Sustainable Development in Darjeeling Hills, India

Ecological and Socio-Economic Aspects for Small-Scale Farmers with Supportive Observations from Kanagawa, Japan

Dissertation
zur Erlangung des Grades
“Doktor der Naturwissenschaften”

Am Fachbereich Geowissenschaften
der Johannes Gutenberg-Universität Mainz

vorgelegt von
Shilpi Saxena

Januar 2005

Eidesstattliche Erklärung

Hiermit versichere ich, Shilpi Saxena, an Eides Statt, daß ich die Arbeit selbständig und ohne fremde Hilfe verfaßt und keine anderen als die angegebenen Hilfsmittel benutzt habe. Diese Erklärung schließt auch alle Zeichnungen, bildlichen Darstellungen und dergleichen mit ein. Diejenigen Stellen der Arbeit, die dem Wortlaut oder dem Sinn nach anderen Werken entnommen sind, sind in jedem Fall unter Angabe der Quelle der Entlehnung kenntlich gemacht. Gleichzeitig versichere ich, daß die Arbeit noch nicht veröffentlicht oder in einem anderen Prüfungsverfahren als Prüfungsleistung vorgelegt worden ist.

Mainz, im Januar 2005	
Ort/Datum	Unterschrift

View of Margaret's Hope Tea Estate and Hills of Darjeeling District
Photo by SHILPI SAXENA, 2002

Table of Contents

Foreword

This research is the continuance of a work (internship) which the author had conducted in Darjeeling District, India in 1998. The study was based on the homestead gardens within the tea estates of Darjeeling District. Those homesteads belong to the tea labourers and serve as an additional income to their work on the tea plantations. As the author noticed a discrepancy between these farmers and the subsistence farmers outside# of the tea estate system in terms of food productivity, nourishment and income, this aroused the curiosity to base my research on crop diversification and income generation for subsistence farmers through organic farming in Darjeeling District, which is located in the NE-Indian Himalayas.

Japan, an industrialised nation, faces landform difficulties such as steep slopes and very limited arable land for production of crops and a declining food self-sufficiency rate. Therefore, it was chosen to study how Japanese organic farmers can sustain high crop diversity, yields, and income by cultivating organic crops on marginal landholdings, on a sustainable basis and in harmony with the environment. The data collected there will serve as supportive observational information, which can be helpful for the subsistence farmers in Darjeeling District, based on simple practical applications. As contacts with organic farmers in Kanagawa Prefecture had been established during an internship in 2001, this prefecture was chosen as the research area. Furthermore, as the prefecture is situated close to Tokyo, the marketing channels and strategies of the organic farmers were able to be studied as well.

The field study, conducted on sustainable development with organic farming in hilly areas, took place in India and Japan from May 2002-March 2003, with a duration of four and six months respectively.

CHAPTER 1

Rice Terraces in Kalimpong Hills, Darjeeling District
Photo by SHILPI SAXENA, 2002

1. Introduction: Importance of Sustainability, Mountain Ecosystem and Small-Scale Farmers

The key words for Developing Countries in the recent years are *Sustainability and Sustainable Development*. They are a means of expressing the importance and necessity of a livelihood with a decent income, good health and safe environment in the (near) future and for future generations (DOMRÖS, 2003a; EARLES, 2002). As the Brundtland Report puts it: *"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs"* (WCED: WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT which made the report "Our common future" 1987, p. 43, (UNEPTIE, 2001)).

There are many aspects of sustainability for rural and urban areas: food self-sufficiency, environment-friendly crop growth, clean water access, healthy nourishment, renewable energy resources, environment and forest management, to name just a few (UNITED KINGDOM SECRETARIES OF STATE FOR THE ENVIRONMENT, 1994; US CONGRESS 1990, in: NORMAN *et al.*, 1997). This means that not only environmental sustainability, but also economic and social sustainability are a part and must be considered as well. But improving the quality of life in context of sustainable development does not mean that natural resources should be used beyond environments' capacity to supply the people for an indefinite time (DOMRÖS, 2003a; WILLARD, 2000).

Though sustainable development has a different meaning to different people and societies, the above mentioned aspects are necessary for many developing countries, since sustainability lacks even in their basic requirements (WILLARD, 2000). Achieving sustainability has also become important for industrialized countries, such as Germany, for example concerning environment-friendly farming practices like organic farming. Furthermore, the quest for renewable energy resources to meet future demands is an increasing and necessary issue for developed countries (LANCASTER UNIVERSITY, 2001). *"The idea of sustainable development is not new, since many cultures have realized the need for harmony between environment, economy and society; what is new is its articulation in the context of a global industrial and information society"* (WILLARD, 2000). On a global level, sustainable development means the necessity to eliminate trade barriers put against developing countries by industrialized nations for so-called protective measures; this shows that sustainable development needs not only to be practiced at the farm-level, but should equally be effective at community, national and international level (RICHARDSON, 1995).

Before explaining the relevance of *sustainable mountain ecosystems*, it is important to define a mountain: *"The most common classification used to define* *mountains is highlands and elevated ice shields above 2,500 meters, along with hilly areas below this altitude. In a recent publication scientists used altitude, slope and local elevation to define 24.3 per cent of the earth's land and ice surface as mountain areas. This includes areas above 2,500 meters, gently sloping older mountain ranges such as the Appalachia in the US and hilly areas at lower elevations such as the Scottish Highlands"* (PAYNE *et al*. 2002, p. 5).

The earlier mentioned aspects of sustainability are even more significant when considering mountain agriculture, ecosystem and life, with fragile mountain systems being threatened by lost forest cover. Latter is often caused by illegal felling, slash and burn to create more fields on the already limited area, causing higher surface water runoff by lack of water retention from trees (MOUNTAIN FORUM, 2001a; CARROLL-FOSTER & LI-PUN, 1995). Other problems such as soil degradation, cultivation of marginal land, soil erosion leading to further disruption of this ecosystem, excessive livestock grazing and mining are being faced by the farmers as well (MOUNTAIN FORUM, 2001a; CARROLL-FOSTER & LI-PUN, 1995; DOMRÖS, 1977). Even at the Earth Summit in Rio de Janeiro 1992, the Agenda 21 adopted this pressing issue in its chapter 13 "Managing Fragile Ecosystems: Sustainable Mountain Development" (MOUNTAIN FORUM, 2001b).

A United Nations report on sustainable agriculture and rural development states that the main problem for sustainable development and food security in developing countries is due to *"degradation of agricultural land and a decline in soil fertility"* (UN 2000, p. 9). These problems are also leading to poverty of farmers, lack of healthy nourishment and income (CARROLL-FOSTER & LI-PUN, 1995).

Additional hazards occur due to landslides and floods, which are caused by heavy monsoon rains falling on bare land and surface area, resulting even more devastatingly in the loss of human and animal life, agricultural fields and houses, as is the case in Darjeeling District. Now more than ever, sustainability and sustainable development are necessary to preserve and secure the environment and the people dependant on it, especially for the future. Besides landslides, the mountain areas are prone to natural problems such as earthquakes and volcanic eruptions (PANOS, 2002). Environmental damage or man-made problems include air pollution, deforestation, large hydropower projects and dams especially in seismic prone areas, and lastly (non-eco-) tourism (PANOS, 2002; UNU, 2002). The systems' sensitivity to climate change also reflects its vulnerability resulting in negative consequences for the people (CARROLL-FOSTER & LI-PUN, 1995).

Furthermore, the degradation of this valuable environment equally affects other people and countries who are also dependant on mountain resources such as fresh-water supply for irrigation, for home-use as drinking water and for cooking, industry, transportation and hydropower, because mountain regions exist in all continents: offering a housing to 10 % of the world's people and supplying the above mentioned necessities to about 40 % of people who live in the adjacent medium as well as in the lower watershed areas (UNU, 2002; PANOS, 2002). More than 50 % of the world's population is affected by the degradation of watersheds and mountain ecosystems (CARROLL-FOSTER & LI-PUN, 1995). In context of environmental resources the mountains provide fuel, wood, (genetic) biodiversity, medicinal plants, minerals, timber and hydropower; for recreation it offers abundance to tourism and even for those seeking spirituality it has many pilgrimage and religious sites (PAYNE *et al.*, 2002). Their vertical dimension makes them all the more special compared to lowland areas: different and rare species of flora and fauna, climatic zones in different altitudes, and the difference in soil and landforms (PAYNE *et al.*, 2002).

Nevertheless, in the developing world the Himalaya-Karakorum-Hindukusch area is classified as a mountain region under greatest stress, in context of a threatened mountain ecosystem (UNU, 2002). Even the European Alps and the American Rocky Mountains, to name just two from the developed or industrialised countries, are among the most threatened mountain areas (PAYNE *et al.* 2002, p. 5).

Hence, it is most necessary to preserve the environment and help especially the *small-scale farmers* who are directly dependant on the mountain ecosystem and its resources and most likely to be affected by the aforesaid problems. Therefore, smallholder farmers are the main focus of this research in context of organic and sustainable farming in hilly and mountainous areas. Due to the specific nature of the research in Darjeeling District, as well as Kanagawa Prefecture, which are hilly and have limited arable land, the most viable farming practice is small-scale, organic farming compared to large-scale, commercial agricultural practice. The latter is simply not feasible on these landforms. Furthermore, the mountain farmers and *"mountain/hill areas (uplands) of Asia"* are among the poorest (JODHA 1993, p. 7); small farmers (commonly having a holding less than 2 ha) are considered to be among the economically weakest, which makes it even more important to focus on these farmers in context of sustainable agriculture (AGRAWAL, 2000; MOUNTAIN FORUM, 2001c). Otherwise, if the self-sufficiency of the farmers declines further, then one day the government has to help out and feed the farmers, as is the case in India in the state of Tamil Nadu at present (SHARMA, 2003). Some farmers in India are so indebted that many even commit suicide due to economic distress (BAKSHI, 2001).

A small farm is defined as having a small size of land, dependant on farm and/or non-farm income, which concludes that the farmer can be a part-time farmer; farm labour comprises mostly of the family and hired (part-time) labourers (EBODAGHE, 1996;

WIMBERLEY, 1996). Though farmers provide food primarily for the non-farming community, it is still necessary for these farmers to achieve their self-sufficiency in food, a viable income, maintaining a quality of life and keeping the environment intact with his or her agricultural practice.

Finally, implementing sustainable agriculture is ultimately the decision of the farmer with his or her family (NORMAN *et al.*, 1997). In order for them to do so and not to be subjected to state or national agricultural policies, the role of the small farmer, especially in hilly and mountainous areas, has to be strengthened. These policies are often issued for the plains and, therefore, cannot properly be implemented in the hills or simply do not help hill farmers. Mostly, hill farmers are overlooked or not considered when decisions are made at state or national level (KATSAROS, 2002). One step would be by letting the farmer be part in the decision-making process at local and village level, via farmers' groups and local NGOs. This would at least ensure that the necessary issues are discussed and solutions sought for the specific landform and environment, which these farmers know best.

1.1. Background for Sustainable Development with Organic Farming

Organic farming is an approach to sustainable development (RATANAWARAKA, 2002). Hence, sustainable agriculture *"is a goal rather than a distinct set of practices; it is a system of food and fibre production that produces safe, wholesome, nutritious food, improves productivity of natural resources and cropping systems and ensures adequate net farm income to support an acceptable standard of living for the farmer"* [1] (CORSELIUS *et al.* 2001, p. 4).

The importance of sustainable development in context of a hill and mountain agriculture, especially for smallholder farmers, can be summarised as follows: *"scarcity of basic facilities, terrain inaccessibility, soil infertility, and transport unavailability"* which have made hill people very nature-oriented since they are most dependant on their environment; furthermore, such man-environment issues are relevant to geography (CHAKRABORTY 1989, p. 132). Therefore, this research is to be regarded from a geographical point of view and not from an agricultural science aspect.

Thus, organic farming started in Darjeeling District in the late-1990s and was initiated by local NGOs. The main aim of NGO projects is the reduction of poverty through increasing local and household food security and incomes (MAHALE, 2002). The farmers who took up this farming practice are basically traditional farmers, which

[1] This definition is based on "the National Research Council's statements in the 1991 'Sustainable Agriculture Research and Education in the Field: A Proceedings'" (CORSELIUS *et al.* 2001, p. 4).

implies a very low chemical input (for practical reasons, the term *conventional* will be used). Organic farming is practiced by *"small family farms involved in subsistence and local market-oriented production. Most of these farmers are poorly endowed with land and capital, have at best smallholdings (less than 2 hectares) and are located mostly in marginal areas (hillsides, rainfed or semi-arid areas)"* (ALTIERTI, 2002). However, the adoption of organic agriculture remains limited to those farmers who receive direct technical and financial support. Hence, it is not very widespread, though NGOs try to promote it (ALTIERTI, 2002). The NGOs have also introduced organic cash crops (cardamom, organge, ginger and small-scale tea cultivation).

In order to understand the meaning of organic agriculture for this research, the basic question of 'What is organic farming or organic agriculture?' needs to be answered. According to the "Vignola Declaration" by IUCN, IFOAM and AIAB from 1999[2], organic agriculture *"puts the concept of multi-functionality into practice, including biodiversity, animal welfare, food safety, market-oriented production, rural development and social and fair trade aspects. Organic farming is fundamental to sustainable rural development and crucial for the future development of agriculture and global food security"* (STOLTON *et al*. 2000, p. 1). In order *"to sustain and enhance the natural recycling in agriculture, the productivity of the farmland derived from the soil properties"*, the refrain from using any chemical input, such as fertilizers, pesticides or herbicides is essential (MAFF 2000, p. 1). The above definition shows the importance of organic farming and also explains the difference to conventional (synthetic chemical) farming: Since it does not use any chemicals for agriculture, it is environmental-friendly. The natural ecosystems are preserved on the one hand, and the consumer receives a healthy basis of nourishment on the other. In short, organic farming can integrate food production, generate income and protect the environment by using to full extent the local knowledge, biodiversity, resources from the farm, integrated pest management and the avoidance of using synthetic chemicals (UN 2000, p. 12). Further definitions and terminologies are given in chapter 3.

Although people mostly associate the Darjeeling District with tea cultivation, this research is not looking at tea plantations in terms of organic tea, but at the farmers who practice agriculture for a living, as subsistence farmers. These villages and fields are situated beyond/outside the tea estate and have nothing to do with the estates. One problem though, is on the rise: the closure of tea estates, which at present is rendering thousands of workers jobless. Many of them are malnourished and starvation deaths

[2] The IUCN (World Conservation Union), IFOAM (International Federation of Organic Agriculture Movements), and AIAB (Associazione Italiana per Agricoltura Biologica) met on May 23rd, 1999 in Vignola, Italy.

have taken place as well (MANDAL, 2004). This situation will give additional economic problems and burdens to the region, if appropriate measures like supplementary activities are not taken soon (LAMA, 2004).

Though sustainable development has been researched in the Indian Himalayas, when dealing with the Himalayas or North-Eastern Himalayas, the study region of Darjeeling District is hardly included. Latter mostly appears in context of tea, monsoon and landslides. Except for a few local NGOs and very little literature, often the focus is on other regions facing sustainability problems, like Meghalya, Uttaranchal, Himachal Pradesh, Arunachal Pradesh, Mizoram and even Sikkim, a state located just north of the district. These are just a few within India, besides the classic examples of Nepal and the Karakorum in Pakistan. Only few have researched rural development and environmental degradation, but not with small-scale farmers as a main focus. Hence, this study contributes to research on sustainable development in the NE-Himalayas, emphasizing on small-scale farmers in Darjeeling District.

Since there are of course huge differences between India, a developing country and Japan, an industrialized nation, such as in economy, wages, social security and many more, the research does not aim to have an economic comparison of the two countries. Organic farming in modern terms is still in its beginnings in India (GARIBAY & JYOTI, 2003) as well as in Japan, and is not – as in Europe – relatively advanced. It will look at how the Japanese organic farmers can sustain with crop diversity, yields, and income by cultivating organic crops and on a sustainable basis in harmony with the environment given their landform conditions and difficulties. As *"Japan is a mountainous country, where arable land is restricted to narrow coastal plains and small intermountain basins"*, farming is difficult (YAGASAKI & NAKAMURA 2003, p. 1) and farmland sizes are less than 0.5 ha (VROLIJK & MAY, 2001).

Kanagawa Prefecture was chosen, because initial contacts with organic farmers had already been established, furthermore, for its proximity to Tokyo in terms of marketing channels used by these farmers. As not only farmers in this prefecture were surveyed, because a sufficient sample data needed to be reached, the surrounding prefectures of the region called Kanto, to which Kanagawa Prefecture belongs to, was included in the survey region (see chapter 4.1. and 4.2. for details). Furthermore, many supportive observations for soil management and natural pest management also include Kanto, next to the main survey and observation area of Kanagawa Prefecture. The supportive observations underline the sustainable agriculture practiced by the organic farmers. These observations will provide suggestions and possibilities for simple sustainable farming methods practiced there by the organic farmers, but which are applicable for the small-scale farmers in Darjeeling District, as they are mostly of low cost and require simple resources. In Japan, reasons for conversion to organic arose from health-related problems, which occurred in the family due to chemicals, being conscious about the negative effects conventional farming has on the environment or simply convinced that chemical inputs are not the right way[3]. Many have become health conscious and want to cultivate and supply fresh vegetables as well as other products directly to the community. In comparison, the surveyed organic farmers in Darjeeling District use organic agriculture mainly to improve their income situation, but there is not necessarily a conviction behind the organic practice.

As there has been an increased interest in organic farming among non-governmental organizations, who work on marginal areas as well as tribal areas, (UN-ESCAP, 2002) the final research, especially the supportive observations from Kanagawa Prefecture, can be used as a kind of guideline for the small-scale farmer. He or she can decide what seems most suitable for the field and the family. The ideas would have to be promoted by local NGOs and be further developed by the farmers themselves, as the farmer knows his land best and that application of certain practices can vary according to site (PARTAP, 1998).

1.2. Problem Statement

The farmers in Darjeeling District are subsistence farmers with fields of less than 1 ha in size. The farmer and his family cultivate the fields. They mostly do monocropping in Darjeeling District. The fields are rain fed and, if needed irrigated. Compost, consisting of grass and cow manure, is applied to the field, as well as a little chemical input. The conventional farming practiced there, is a low input farming practice. Unfortunately, it leads to low yield and low income. The average annual family income in Darjeeling District is below Euro 250 (or Rupees 11,800)[4] (KAUKLER, 1998), whereas the poverty line used by the Government of West Bengal, which Darjeeling District belongs to, is at Rupees 15,000 (US$ 700, at exchange rates in 1997) per household annually (LITTLEMORE, 1997).

Darjeeling District, being an upland area with steep slopes, offers only marginal land for cultivation. Upland areas are characterised by decline in per capita availability of cropland, declining soil fertility and deforestation, which are also the main resources of the mountain populations. With increasing population pressure, also induced by seasonal and permanent migrants from neighbouring countries like Nepal, pressure on food demand, housing area and fuel wood is on the rise (PARTAP, 1998). Livelihood and

[3] These were the main reasons stated by the surveyed organic farmers (see chapter 4.3.; for additional information see chapters 3 and 5.3.).
[4] As no official figure was available, this value is based on a part of Darjeeling District, where a smallholder cooperative has been started (see bibliography for details).

food security become difficult for the farmers, as the areas are already *"productivity constrained areas"* (PARTAP 1998, p. 39). Additionally, due to unsustainable farming practices the farmer has to meet his subsistence needs, which include food, fuel and fodder. As PARTAP (1998, p. 39) points out *"inadequate food production by farm families in several poor areas in the uplands shows that the production of adequate amounts of food crops on small land holdings, with ever declining farm productivity, is impossible. Food shortages in these areas have set in motion a chain reaction towards a process of poverty – resource degradation – scarcity – poverty"*.

In Darjeeling District, farmers with not very high crop diversity and declining yields, sell their crops to the middle-man, as they have no alternative sales channels. Thus, they do not achieve the real value prices, because he is the only direct buyer. This enables him to purchase the products at a very low price. He re-sells the commodities at double or four times the price to the wholesaler or retailer. Besides a few self-grown crops, the farmers often buy food from the market, which is grown in the plains and sold cheap on hill markets. The hill crops and those from the plains are generally not organic. The farming and sale practice indicate a low self-sufficiency, low food security and a low income of the farmers.

Furthermore, many farmers in the Darjeeling Hills[5] resort to illegal felling of surrounding forests for heating and cooking purposes. The side-effect of logging by farmers is especially felt during the summer monsoon, when torrents of rain wash away the topsoil, and soil erosion as well as landslides occur (DOMRÖS, 1977). The deforestation in turn affects water runoff and water storage capacity of the soil. These problems undermine the farmers' immediate environment and endanger them and their land. Due to the felling, the forest depletion is increasing and the hill or mountain ecosystem is being destroyed. Practising sustainable farming has to be conducted together with forest management, but as this is an intensive process, an alternative fuel wood source needs to be provided for the small-scale farmer.

The organic farmers in Kanagawa Prefecture and Kanto farm on marginal landholdings less than 1 ha (averaging 0.5 ha) and try to sustain their livelihood without chemical fertilization (heavily used by conventional farmers), and still try to achieve sustainable yields and income by farming organically, even though many have become part-time farmers, because income is not sufficient from farming itself. The results of the empirical evaluation shows how these farmers are able to sustain with their farming practice.

[5] The Darjeeling District can still be classified as mountain area (see mountain definition given in chapter 1) but literature refers to it as Darjeeling Hills. Mainly because Darjeeling District is regarded as the foothills of the Himalaya; Kanagawa Prefecture too, is in the hilly region (see chapter 2.2.).

1.3. Research Objective and Hypotheses

As the term sustainable development includes a wide array of aspects, the focus of this research is as follows:

(a) The study compares the strategy and achievements of organic farming in terms of crop cultivation, yield, income and marketing, as the main hypotheses, in comparison to the conventional farming system, which is practiced by the majority of subsistence farmers in Darjeeling District and Kanagawa Prefecture/Kanto[6].

(b) The focal question is whether organic farming has brought any significant changes in the quality of life of the farmer in Darjeeling District and Kanagawa Prefecture/Kanto. That is, to assess the benefits of organic farming for the farmer in terms of ecological (e.g. increased crop diversity), economic (e.g. sustainable yield and sufficient income) and social aspects (e.g. food safety, independence from old marketing system, sales prices) since they are interlinked and indicators of sustainability (Fig. 1.1).

As no quantification or comparison between organic and conventional farming and its benefits that have incurred for the farmer has been done in the study region, the research objective does focus on this aspect.

Constraints on ecological (environmental) sustainability could increase external input, dependency on fuel wood use and low crop diversity. In terms of economic constraints, these would be decreasing or low yields, low income level and low sales prices; social constraints could be health problems, decreasing food security in terms of production and food safety which refers to the quality and diversity of food (MATHIJS & WAUTERS, 2004; STOCKLE *et al.*, 1994).

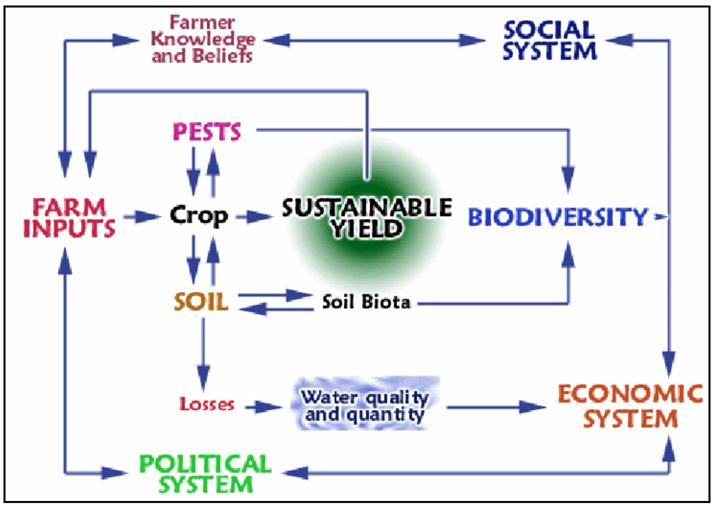
Using sustainable farming practices, i.e. organic agriculture, with locally available resources is important to help establish ecological and socio-economic sustainability in the Darjeeling Hills. Use of locally available resources *"minimises losses of nutrients, biomass and energy and avoids pollution; the emphasis lies on the use of renewable resources"* (REIJNTJES *et al.* 1993, p. 2).

As organic farming has a holistic point of view, its intentions are aimed at long-term benefits for the small-scale farmer, as shown in the logical framework (Fig. 1.1). Basically, it tries to alleviate poverty of the smallholder farmer, by establishing food self-sufficiency and crop diversity with organic farming and creating income generating means in order not to be dependent wholly on (vegetable) crops (PARTAP, 1998). *"Organic farming is fundamental to sustainable rural development and crucial for the future development of agriculture and global food security"* (STOLTON *et al.* 2000, p. 1).

[6] As explained in chapter 1.1., the survey and supportive observations in Japan were additionally conducted in the region called Kanto, to which Kanagawa Prefecture belongs to, in order to obtain sufficient sampling and observation data (for details see chapter 4.1. and 4.2.).

Hence, ecological sustainability includes conservation of natural resources, increase of agricultural diversity, reduction of and refrain from chemical input (STOCKLE *et al.*, 1994). Economic viability means to grow enough for food self-sufficiency, generating sufficient income, as well as having a sustainable yield; labour/input costs should be covered by the returns (REIJNTJES *et al.*, 1993). Social sustainability refers to *"equity, participation, empowerment and institutional development"* (BOHLE 1999, p. 56) but also food safety and security are also important aspects (Fig. 1.2).

Fig. 1.1: Logical framework: holistic view of sustainable agriculture, important for the farm level
(Source: UNESCO 2001, p. 10)



The research hypotheses are as follows:

- The organic crop diversity differs from conventional crop diversity

The assumption is that organic farmers cultivate more crops instead of specialising on one or few like conventional farmers. *"Crop diversification through organic agriculture provided increased household food security, and increased biodiversity was reflected in the health of the farm family and the environment"* (UN-ESCAP 2002, p. 7). The use of diversification is furthermore necessary to pursue optimum production (INDIAAGRONET 2003, p. 10). Organic farming can be used in different ways, such as for vegetables, fruits and livestock, but the main focus here is on vegetables. They are the richest and cheapest supply of minerals, vitamins, proteins and edible fibres (OHYAMA 1989, p. 37; OPĔNA 1989, p. 181). To produce different kinds of local leafy vegetables is not only commercially beneficial for farmers but also more healthy for consumers (BAKSHI, 2001).

- The amount in yield differs between organic and conventional farming

Once farms have completed conversion, they are able to reach equal or higher yields than conventional farming, as experience in India has shown (UN-ESCAP, 2002). *"In several regions of India agriculture is not very intensive as regards the use of agro-chemicals. Especially in mountain areas and tribal areas, use of agrochemicals is rather low, which facilitates conversion to organic production. On these marginal soils, organic production techniques have proved to achieve comparable or in some cases (especially in the humid tropics) even higher yields than conventional farming"* (GARIBAY & JYOTI, 2003, p. 9). Organic farming is helpful to achieve an increase or to stabilize yields, where cheap labour is available in comparison to input costs (GARIBAY & JYOTI, 2003). Therefore, a conversion to labour-intensive production systems is favourable, given that sufficient yields are achieved (GARIBAY & JYOTI, 2003).

- The amount of output (Darjeeling District) differs between organic and conventional farming / The amount of income (Kanagawa Prefecture/Kanto) differs between organic and conventional farming

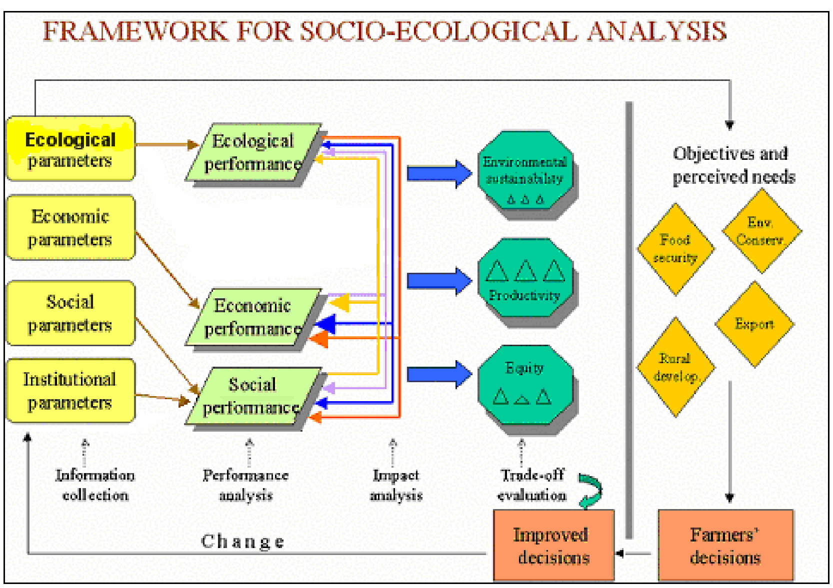
The Darjeeling District farmers were unable to state an income, therefore, only the output could be calculated; whereas the Kanto farmers had no difficulties in giving an income value (for details see chapter 4.3.). The economic aspect is in a way already achieved through the growth and cultivation of diverse (organic) crops and other goods, which in turn provides income generation, as well as producing enough for self-sufficiency (REIJNTJES *et al.*, 1993). Since most of the surveyed farmers in both study areas cultivate vegetables, most of their output or income is derived from there. Vegetable crops provide an income source for small-scale farmers (OPẼNA, 1989) and organic vegetable planting as well as its cultivation also creates jobs, since it is labour-intensive (HAU & JOARIS, 1999). And as BAKSHI (2001) states, for income generation, farmers' increase of income is due to organic vegetables. In order for the farmer to increase product value, higher prices compared to the conventional market need to be achieved for the product. This can be an important way to stabilize or even increase incomes in the trend of decreasing prices for agricultural products (GARIBAY & JYOTI 2003, p. 6).

- The price for organic certified crops differs from conventional crop prices in Darjeeling District

By direct sale of the goods to consumers and avoiding the middle-man, more adequate prices can be reached with this form of marketing. Therefore, *"small farmers urgently need alternative marketing strategies if they are to achieve the goals of a more sustainable agriculture"* (TUBENE & HANSON 2002, p. 1). Here institutional factors, such as policy-makers, NGOs and consumers also play a vital role, to help in achieving social sustainability, which empowers farmers and makes them independent from old structures, such as the middle-man.

The diagram in fig. 1.1 shows the more holistic approach of sustainable agriculture relevant for and benefiting the farmer in the long-term, whereas the aspects as given in the research questions can be seen in the operational framework (Fig. 1.2), which focuses more on the immediate farm level. Therefore, the framework or model of this research is based on fig. 1.1 in terms of sustainability and in terms of the parameters at farm level on fig. 1.2, as described in the research objective and questions. The ecological, economic and social parameters are analysed empirically. Their effect or outcome leads to improved decisions at farm-level, its implementation being a decision of the farmer, contributing to rural development, food security and environmental conservation (Fig. 1.2). The institutional parameters refer to NGOs and policymakers, latter making policies that affect small-scale farmers, as these policies are mostly unsuitable for mountain farmers being issued in the plains. Hence, institutional parameters are equally necessary in the sustainability concept, because changes in laws need to be issued by the governments, so that smallholder farmers can benefit from new policies, which are better adapted to their situation. Such changes though can only be issued if the farmers and NGOs emphasize their situation and bring changes from the bottom down approach.

Fig. 1.2: Operational framework incorporating ecological, economic and social aspects (Source: SCIALABBA, 2000; *abridged*)



1.4. Methodology

The field work had been conducted in Darjeeling District (India) and Kanagawa Prefecture/Kanto (Japan)[7] by using surveys at farm-level and observing their farming practices. The surveys are analysed empirically with a statistical program. The aspects of this study include suggestions on income-generating means, soil and integrated pest management, as well as cropping systems like intercropping. In Darjeeling District, soil management and integrated pest management are practiced at organic and biodynamic tea estates. These methods were explored too, as they can be of use for the fields of the small-scale farmers, especially since the expertise and the resources are locally available and do not have to be imported into the region.

Methodology and research data for Darjeeling District included primary and secondary sources. The primary data consisted of household surveys, observation and interviews as research tools. Survey interviews, i.e. semi-structured household surveys by interviewing the farmers, were conducted in most cases with a prior schedule, while interviews with officials and public leaders were done with and without prior appointment. Soil samples were taken from two research sites at different elevations, and where experimental plots for growing organic vegetables with natural resources were conducted. Secondary sources included literature, census reports, district gazetteers, and the different agricultural as well as forestry offices in Darjeeling District.

Data for Kanagawa Prefecture includes primary and secondary sources. Semi-structured surveys were conducted at farm-level in Kanagawa Prefecture and in Kanto, because organic farmers are located in different prefectures and not only in Kanagawa Prefecture. Kanto is the term for a region that includes prefectures around Tokyo (see chapter 4.1. and 4.2. for details). Furthermore, interviews were conducted with officials and farmer-consumer cooperatives. Secondary sources include literature, brochures and census data. The detailed methodology is given in chapter 4.3.; the questionnaires are listed in the appendix.

A comparison of the two farming systems (organic and conventional) is chosen for this study, as research within the organic farming system is only possible if such systems are already in existence for a longer period of time (LAMPKIN, 1994). This is not the case for Darjeeling District. Conventional systems normally do not use a comparison to organic farming to prove their viability, but for organic farming, it seems to be the opposite (LAMPKIN, 1994).

[7] The explanation for Japan, Kanagawa Prefecture and Kanto is given in chapter 1.1., furthermore, concerning the latter two, in chapters 4.1. and 4.2.

Chapter 2 looks into the location and geographical facts of the two regions: As the focus of this research is on Darjeeling District, Kanagawa Prefecture will only be looked into briefly in terms of geographical facts. The marketing, distribution and certification system of organic crops is shown for India and Japan in chapter 3. The emphasis in chapter 4 is on the empirical evaluation of the surveys. The criteria for choosing the area and the farmers, methodology and analysis of the household surveys are explained. Chapter 5 shows organic (vegetable) cultivation and other sustainable farming practices (small income generating means), such as mushroom cultivation, floriculture, honeybee cultivation (apiary), and small-scale organic tea growth. It furthermore includes many supportive observations from Kanagawa Prefecture and Kanto, including intercropping and natural insect repelling methods practiced by Japanese organic smallholder farmers, which are also applicable for the organic small-scale farmers of Darjeeling District. Furthermore, observations from organic and biodynamic tea estates in Darjeeling District also using soil management methods are shown. Chapter 6 shows the results and discusses these.

CHAPTER 2

Landslides at a Tea Estate, Darjeeling District
Photo by Shilpi Saxena, 2002

2. Geography

2.1. Darjeeling District, India

2.1.1. Location

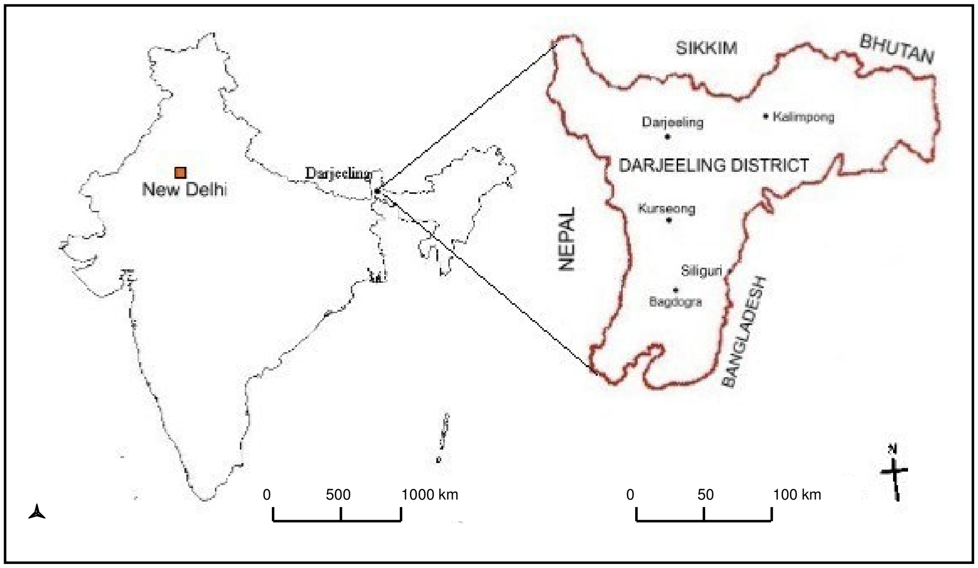
Darjeeling District is located in North-East India, in the Eastern Himalayas[8] and belongs to the State of West Bengal, occupying its northern corner. Darjeeling District comprises of four sub-districts, namely Darjeeling, Kurseong, Kalimpong and Siliguri[9]. Since the latter is mainly situated in the Terai (common term for the plains), it is not included in the study area. Darjeeling District includes parts of the lower Himalaya and along its base it has Terai areas; the latter has an altitude of 91 m above sea-level while other areas of the district, such as Tiger Hill, reach up to 2,560 m, and Sandakphu even reaches 3,639 m (KHAWAS, 2002; STARKEL 2000a, p. 22). The research area within Darjeeling District is situated between 1,010 and 2,200 m above sea level.

The total area of Darjeeling District is 3,149 km^2 while the hill area alone is 1,721 km^2 (BHUJEL, 1993). The main rivers are the Tista, Balasan and Mahananda (STARKEL, 2000b); there are also many natural water streams, called *jhoras*, which exist in Darjeeling District (O'MALLEY, 1999). As the location map of Darjeeling District shows (Fig. 2.1), the area is surrounded by Nepal to the West, the Indian State of Sikkim to the North, Bhutan to the East and Bangladesh to the South-East.

[8] The Himalayas stretch over an area of 2,500 km in length, whereas in the Northwest they are about 280 km broad and in the East about 150 km in width, covering fully or partly several Asian countries, such as Afghanistan, Pakistan, China, India, Nepal, Bhutan and Myanmar (DOMRÖS, 1981; KHAWAS, 2002). The Indian Himalaya covers the NW-, Sikkim- and Assam-Himalaya, which is about half of the total 2,500 km mountain range (DOMRÖS, 1981).

[9] The names of places often vary in maps and literature, therefore, the author is using the first indicated spellings: Terai = Tarai; Tista = Teesta; Siliguri = Shiliguri; Kalimpong = Kalimpang; Kurseong = Karseang; Darjeeling = Darjiling.

Fig. 2.1: Location of Darjeeling District within India
(Source: Author)



2.1.2. Climate

The climate in Darjeeling District is commonly considered as temperate and winter-dry. According to the Köppen classification, Darjeeling District has a humid, subtropical “Cwa“ climate with 'C' standing for temperate with the coldest month having a temperature between +18°C and -3°C; 'w' means a dry season in winter and 'a' stands for the temperature of the warmest month above 22°C (DIERCKE 1996, p. 222). Climate is also governed by the monsoons. In general terms, four seasons can be differentiated on the Indian subcontinent (DOMRÖS 1981, p. 124, 135, 136):

- January – March: NE- or Winter-Monsoon, cool and dry conditions
- April – May: Pre-Monsoon, hot and dry
- June – September: SW- or Summer-Monsoon, cooler but very humid
- October – December: Post-Monsoon or Retreating Monsoon, dry

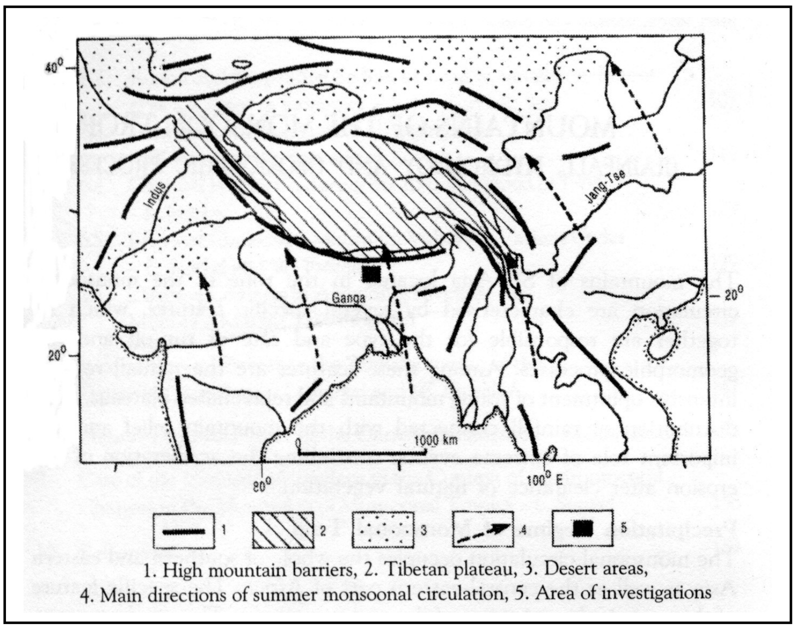
Since the southern slopes of the Himalayas are in the range of a high pressure belt, precipitation and weather change with the seasonally shifting wind systems (STARKEL & SOJA 2000, p. 26). This causes a dry winter season, whereas summer is very humid (STARKEL & SOJA 2000, p. 26). According to DOMRÖS (1981, p. 136), three thermic seasons can be differentiated:

- November - February: cool, but mainly dry *Winter* season
- March - May: hot and dry *Spring* season
- June - September/October: cooler, but very humid *Summer* season

Such three seasons are an important factor for crop growth and cultivation for Darjeeling District, especially concerning the agricultural practice of small farmers as well as for the tea estates (DOMRÖS 1989, p. 87; DOMRÖS 1981, p. 123; see chapter 2.1.8. about the agro-climatic conditions).

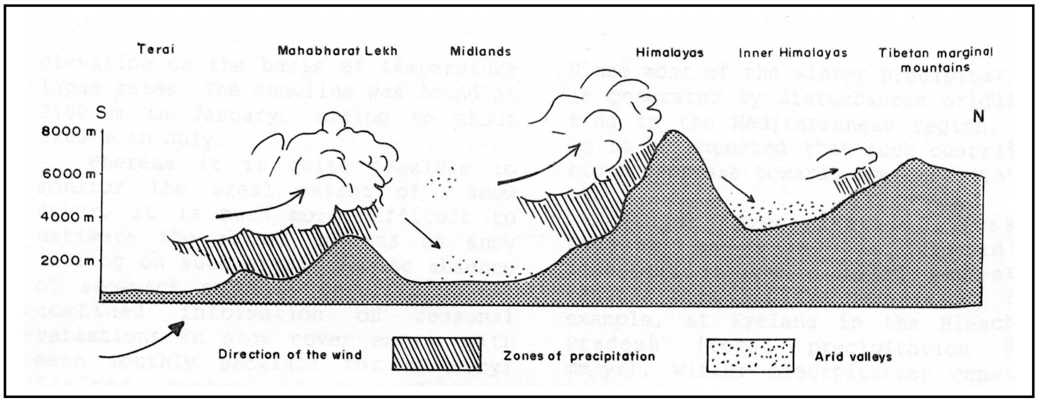
The Himalayas act as a strong orographic barrier for precipitation, thus influencing precipitation distribution in the windward and leeward sides of the mountains (Fig. 2.2), causing strong, sometimes torrential rains on the windward side, but dry conditions on the leeward slopes (DOMRÖS 1989, p. 88; DOMRÖS 1981, p. 135).

Fig. 2.2: Orographic barrier: Darjeeling Himalaya under the influence of the monsoon (Source: STARKEL 2000b, p. 2)



KLEINERT (1973, in: DOMRÖS 1977, p. 69) gave a good example of the precipitation variation in terms of the windward and leeward effect of mountains for two stations in the Nepal Himalaya expressed by the annual amount of precipitation: Pokhara, located at 850 m a.s.l. on the southern flank of the High Himalaya, receives 3,500 mm precipitation, whereas Jomosom with an altitude of 2,750 m a.s.l. and situated on the northern flank of the High Himalaya only gets 270 mm (Fig. 2.3).

Fig. 2.3: Orographic barrier showing precipitation and arid areas, an example from the Nepal Himalaya (Source: BRUIJNZEEL & BREMMER 1989, p. 24)



Temperatures too, experience a decrease with rising altitude, underlined by comparing Dhubri (in the Darjeeling plains at 35 m) and Darjeeling Town (at 2,256 m) experiencing 24.0°C and 11.8°C respectively (STARKEL & SOJA 2000, p. 26-27; DOMRÖS 1981, p. 136). Due to the higher elevation, temperatures in Darjeeling Town are about 12°C cooler and therefore rather pleasant compared to the hot lowland areas.

Humidity in the Darjeeling Hills is all around rather high, with 80 % in winter and 95 % in summer, while for Dhubri in the plains it varies: 58 % vs. 87 % (STARKEL & SOJA 2000, p. 27-28). *"Even though Darjeeling receives an unbalanced distribution of rainfall as 71 % of the annual precipitation is during June–August, the mean relative humidity will not drop below 60 % even in the driest months of March and April"* (HAJRA 2001, p. 96). Another typical climatic phenomenon in Darjeeling District is fog, recording over 100 fog days during the year (RAO 1981, p. 98). Especially during the summer monsoon, the months of June, July and August already record on average 20 fog days per month; the winter months are quite rarely affected by fog, ranging from 3-5 days/month (RAO 1981, p. 98).

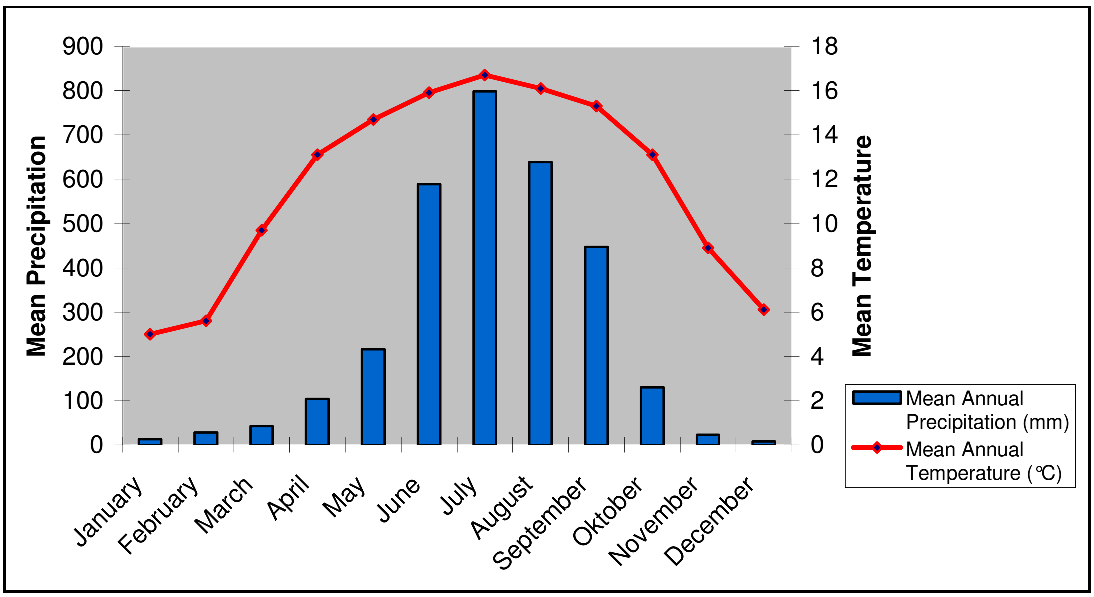
The climate of Darjeeling Town is displayed in table 2.1 in more detail; data refer to the Meteorological Observatory Station at 2,127 m above sea level (MÜLLER 1996, p. 181).

Table 2.1: Climate chart of Darjeeling
(Source: MÜLLER 1996, p. 181; *abridged*)

27°03' N / 88°16' E	Temperature (°C)			Relative Humidity (%)	Precipitation (mm)		
Month	Ave. Max.	Average	Ave. Min.	Average	Max.	Average	Min.
January	8.3	5.0	1.7	83	117	13	0
February	8.9	5.6	2.2	82	97	28	0
March	13.9	9.7	5.6	73	156	43	0
April	16.7	13.1	9.4	78	286	104	11
May	17.8	14.7	11.7	88	498	216	75
June	18.3	15.9	13.3	93	1402	589	217
July	18.9	16.7	14.4	95	1480	798	206
August	18.3	16.1	13.9	95	1022	638	338
September	17.8	15.3	12.8	93	1190	447	143
October	16.1	13.1	10.0	87	913	130	0
November	12.2	8.9	5.6	79	373	23	0
December	9.4	6.1	2.8	78	64	8	0
Year	**15.0**	**11.7**	**8.3**	85	4024	**3037**	2271

The intra-annual variation of precipitation and temperature is given in fig. 2.4.

Fig. 2.4: Mean annual temperature and precipitation in Darjeeling Town
(Source: own projection *based on* MÜLLER 1996, p. 181; *abridged)*



Generally, the term “monsoon” means alternating winds between summer and winter, where the direction varies more than 120° (DOMRÖS & PENG 1988, p. 41). The Indian Monsoon is part of the general circulation of the atmosphere resulting from shift of the Inner Tropical Convergence Zone (ITCZ). The summer monsoon originates from the SE trade crossing the equator, the Southeasterlies turn towards Southwesterlies (BUSCH & KUTTLER, 1990; DOMRÖS, 1989; see fig. 2.5). These winds are laden with lot of moisture as they cross the ocean; upon reaching the dry and heated landmasses of India, strong rains are the result (KATIYAR 1990, p 33). The North-East Monsoon blowing in winter and bringing dry air masses and being rather cool, corresponds with the north-eastern trade winds (DOMRÖS 1981, p. 124). Since it originates from the Asian continent, it carries dry air masses (DOMRÖS, 1981; see fig. 2.6). The Indian summer monsoon reaches a mightiness of 6-7 km, whereas the winter monsoon just reaches a height of 1-2 km (FUCHS 2000, p. 33; DOMRÖS 1989, p. 84-85).

Due to the direction of the surface winds, the summer monsoon for India is termed as “South-West Monsoon”, while the winter monsoon is called “North-East Monsoon” (DOMRÖS & PENG 1988, p. 41). The common understanding is however, that the monsoon(s) just mean “rain”; therefore, these rain-bearing winds are urgently waited for, bringing an end to the long dry winter period caused by the winter monsoon (FUCHS, 2000; KATIYAR, 1990).

Monsoon air masses affect the whole Indian subcontinent; its northernmost extension reaches 30° north at the southern flank of the Himalayas (DOMRÖS 1981, p. 124). Heavy rains associated with the summer monsoon are also the reason for landslides and floods, with devastating effects for the people in Darjeeling District (BASU & SARKAR 2000).

Fig. 2.5: Distribution of air pressure and winds over India and Japan during summer monsoon

(Source: DIERCKE 1996, p. 219; *abridged*)

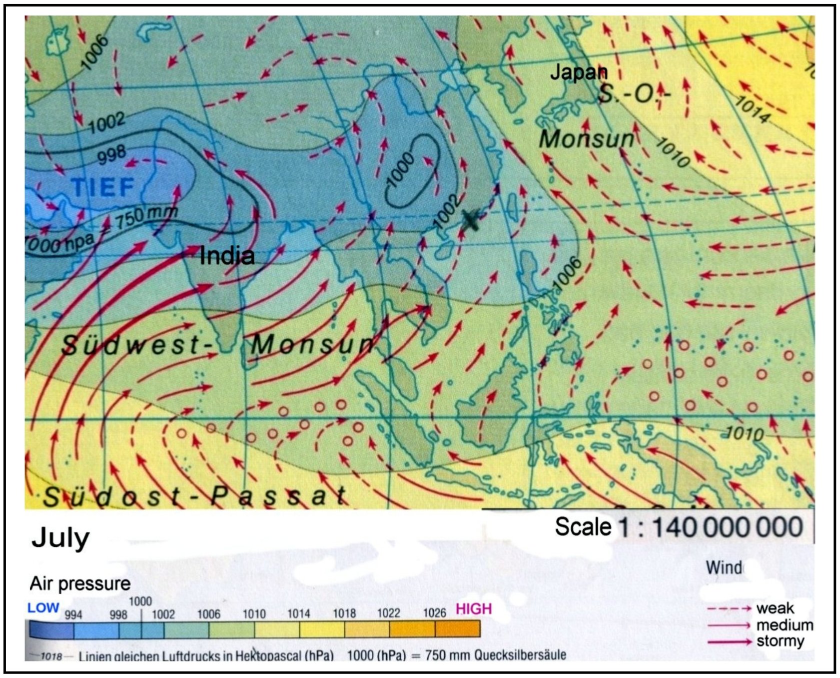
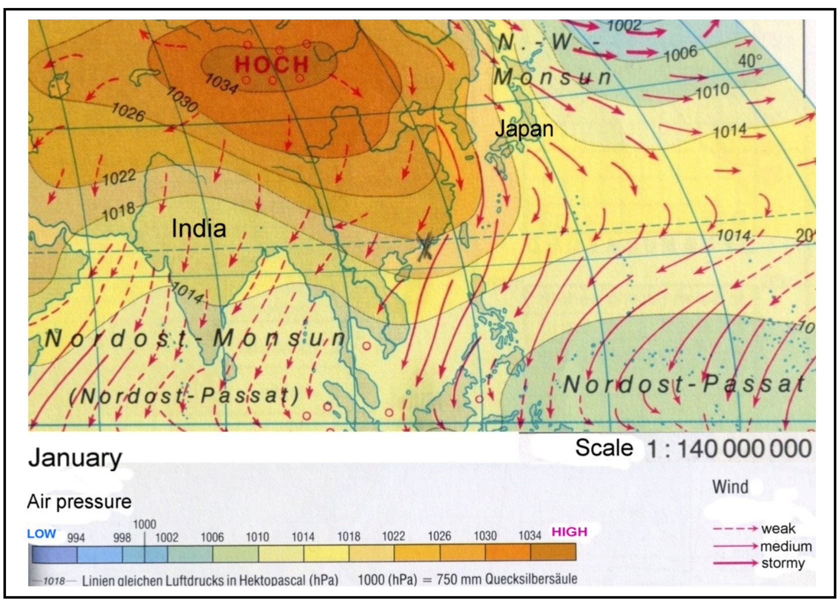


Fig. 2.6: Distribution of air pressure and winds over India and Japan during winter monsoon

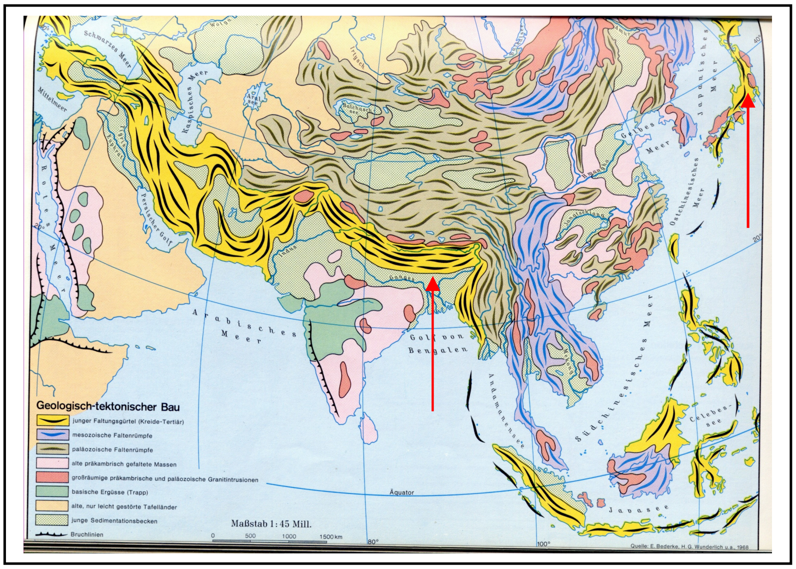
(Source: DIERCKE 1996, p. 219; *abridged*)



2.1.3. Geology

The Himalayas are considered among the youngest mountains on earth (Fig. 2.7), originated from the collision of the Indian continent with Eurasia about 40-60 million years ago; India still continues to migrate with a speed of 5 cm/a; whereas the uplift of the Himalayas moves at a rate of about 5 mm/a (STARKEL, 2000b; PRESS & SIEVER 1995, p. 489-490; KAWOSA, 1988).

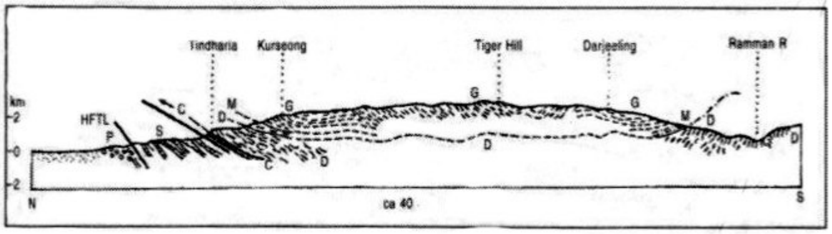
Fig. 2.7: Geology of Himalaya
(Source: GRÖTZBACH 1981, Tafel I)



Though there is a classification of the Himalayan range from West to East according to DOMRÖS (1981, p. 120) only the Sikkim Himalaya, which lies in the catchment area of the Tista river, is of interest, as the Darjeeling Hills belong to them.

Furthermore, *"the Darjeeling Himalaya is separated from the foredeep of the Ganga-Brahmaputra Plains by two active tectonic lines: the Main Boundary Fault and Himalaya Front Tectonic Line"* (BASU 2000a, p. 12; see fig. 2.8). Darjeeling Hills comprise of three belts: 1. *"An outer belt of Siwalik frontal range on the northern border of the young Quaternary alluvial plains; 2. a middle narrow belt of the Damuda (lower element of Gondwana) range, and 3. an inner range of metamorphites belonging to Daling and Darjeeling groups"* (CHATTOPADHYAY 1987, p. 199).

Fig. 2.8: Geological cross section of Darjeeling District, schematic
(Source: BASU 2000a, p. 14)



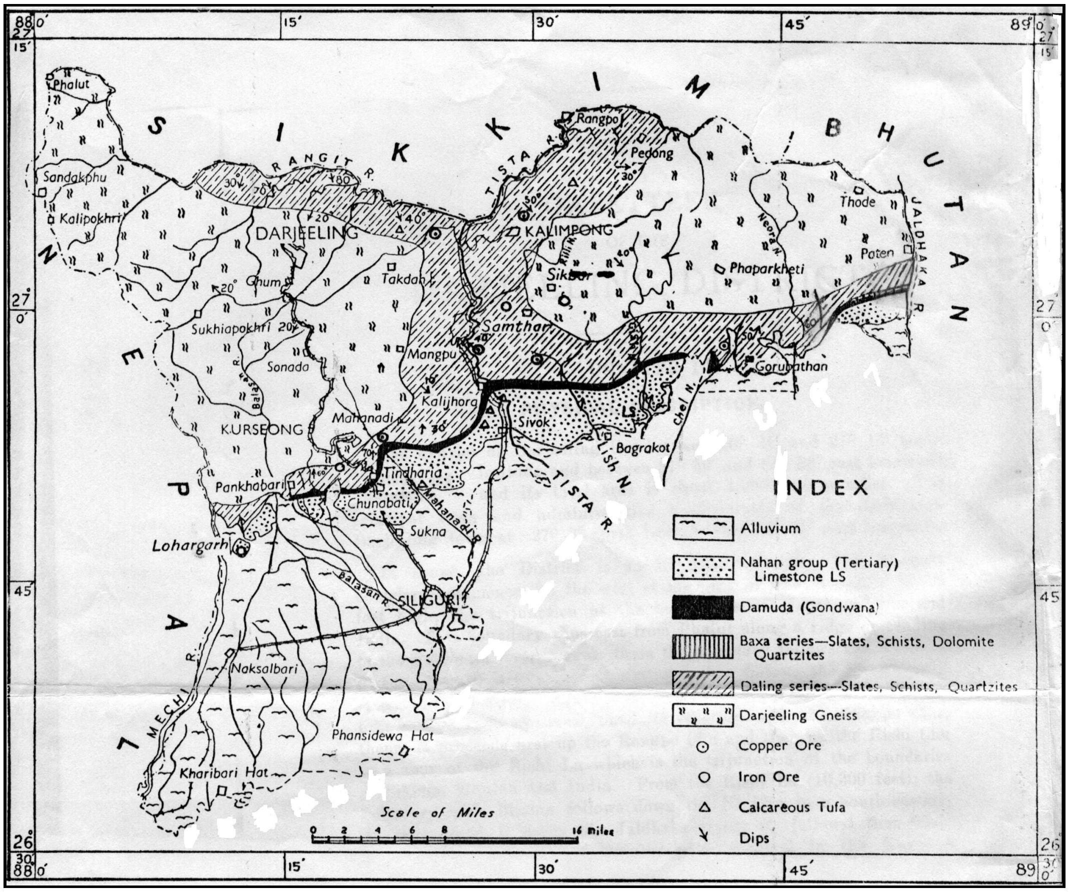
A–Alluvium, P–Pleistocene boulders, S–Siwaliks, C–Damuda series, D–Daling phyllites and slates, M–Mica schists, G–Darjeeling gneisses, MBF–Main Boundary Fault, HFTL –Himalayan Front Tectonic Line

According to BASU (2000a, p. 12-16), the different belts can be characterised as follows: The Siwalik series being a narrow thrust comprises of soft sandstones, mudstones, shales and conglomerates, comprising the foothills of outer Himalaya rising to a height of 1,200 m; the thickness of the sandstones reaches around 3,000 m (KAWOSA 1988, p. 20). The Siwalik is separated from the Damuda series by the Main Boundary Fault, built of Tertiary molassic deposits. The Damuda series consists of coarse-grained hard sandstone, quartzite, carbonaceous shales and slates, being equivalent to the Gondwanas of Peninsular India. The thickness here is about 1,000 m.

"The Daling series comprises of phyllites and schists associated with quartzite rest over the Damuda series. When reaching higher areas of the hills, the Dalings gradually grade into more metamorphosed rocks, the Darjeeling Gneisses, which begin at around 1,000 m above sea level" (BASU 2000a, p. 15-16). This series consists of mica schists and coarse grained gneisses. The geology (Fig. 2.9) clearly shows the formations of Darjeeling District, as explained above. One can see that the Daling and Darjeeling series are prevailing in the Kalimpong hill area, the Darjeeling series mostly covers the area around Darjeeling subdivision.

Fig. 2.9: Geology of Darjeeling District

(Source: DASH 1947, p. *front of volume*)



2.1.4. Landforms

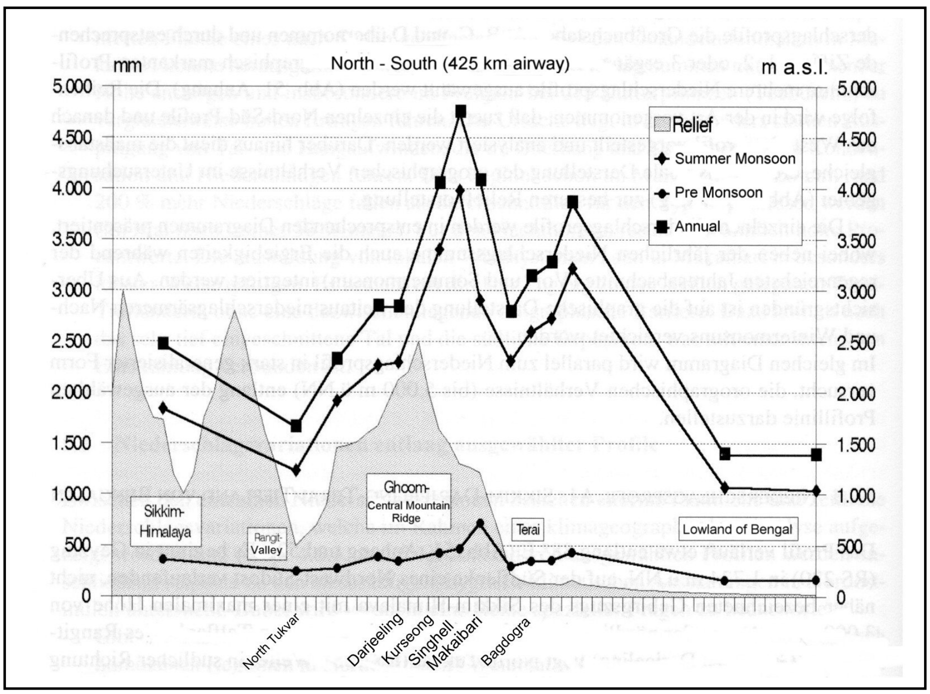
The Darjeeling Hills can be characterised by ridges and narrow valleys, consequently with many precipices, whereas open valleys and plains, beside the Terai, lack (DE & BERA, 1990). The ridges stretch from North to South, while others range from SW to NE. Some slopes are still covered with forest, others have been converted into tea gardens. The main perennial rivers are Balasan, Mahananda, Tista and Gish, which flow southwards following the main ridge. The main elevations of Darjeeling District comprise in the NW for example of Sandakphu (3,639 m), Phalut (3,597 m) and in the E of Tiger Hill (2,560 m), Sukhia Pokri (2,170 m) and Mirik (1,697 m) (STARKEL, 2000a; DE & BERA, 1990).

The dissection and rising of the hills is as follows (STARKEL 2000, p. 22; see fig. 2.10): At a distance of 2 km the Hills rise from the plain to 600 m above sea level. At 6 km distance the higher ridges are elevated to 1,200 m a.s.l.; at 12 km to 2,000 m a.s.l.; the ridge reaching above 2,000 m a.s.l. is about 25-30 km from the plains, ending in Tiger Hill (2,560 m a.s.l.). The relative heights of the Darjeeling Hills vary between

1,000–2,000 m. STARKEL (2000a, p. 22) states that the Darjeeling Hills *“rise directly above the plains called Terai, and are composed by systems of alluvial fans”* (Fig. 2.11).

As mentioned earlier, landslides and land erosion are common. The former takes place mostly during summer monsoon, occurring in and around Darjeeling Town, on Hill Cart Road which connects Siliguri (plains) with Darjeeling, as well as on the lower hills facing Tista River. Fig. 2.10 shows the relief in context of precipitation, which greatly influences and reacts with the parent material in terms of geology and triggers weathering, landslides as well as - based on the parent material - the soil formation (DE & BERA, 1990).

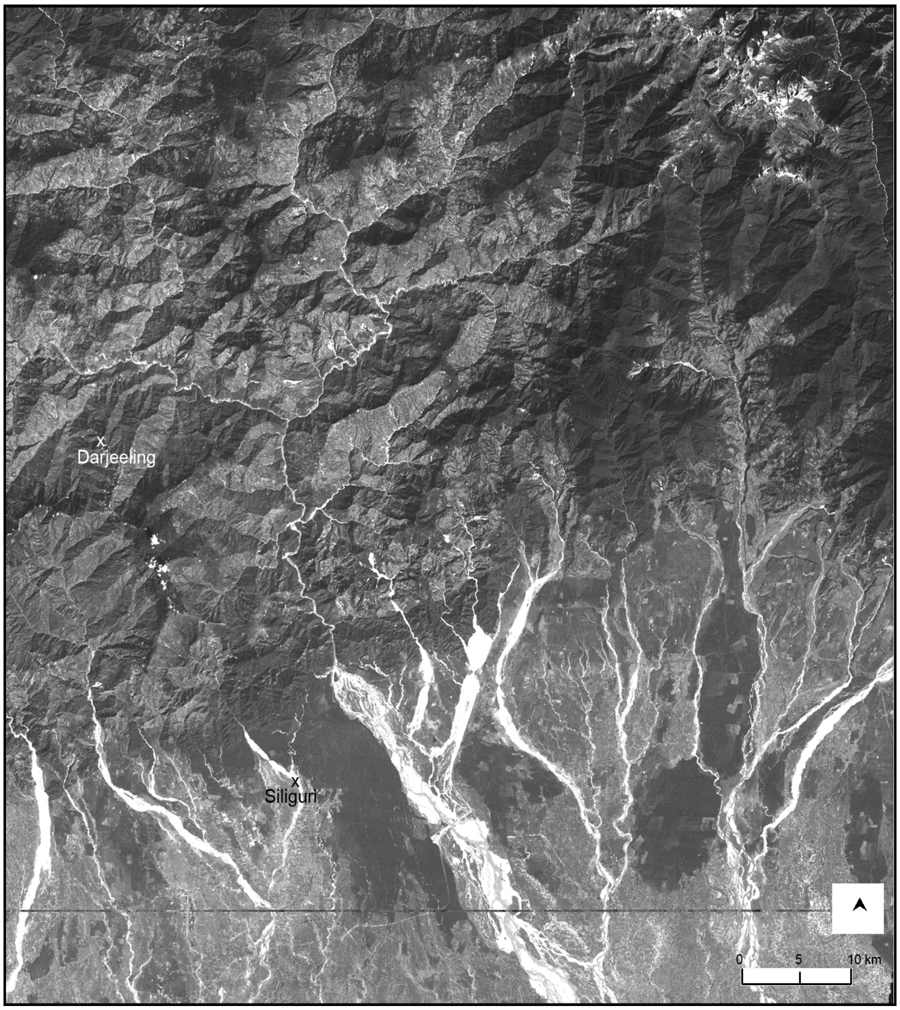
Fig. 2.10: N-S Profile of Sikkim-Darjeeling-Terai
(Source: FUCHS 2000, p. 150, *abridged*)



Another feature is the very low density of dissection by deep valleys, but the Darjeeling Hills are deeply dissected by the rivers: to the west by Mahananda River with its branch Balasan, and to the east by Lish and Gish which flow into the Tista River in the Terai. Furthermore, the slopes that dissect the edge of the Hills are inclined to 30-40°.

The slopes in Darjeeling District can generally be characterised as young convex slopes, of which its concave base is not strongly developed (STARKEL, 2000a). They are about 1-2 km long, have a steepness ranging from 20-48°, their altitudinal difference varying from several hundred meters to 1,500 m (STARKEL & GIL 2000, p. 48). The steepness on certain areas reaches an inclination of about 30-45° and are mainly of rocky origin, whereas the gentler parts of the slopes are inclined at about 15-30°; the latter are covered by regoliths (STARKEL, 2000a).

Fig. 2.11: Satellite image of Darjeeling District rising above Terai
(Source: http://glef.umiacs.umd.edu/data/, Landsat TM 5, November 1990; *abridged*; for details see chapter 4.2.)

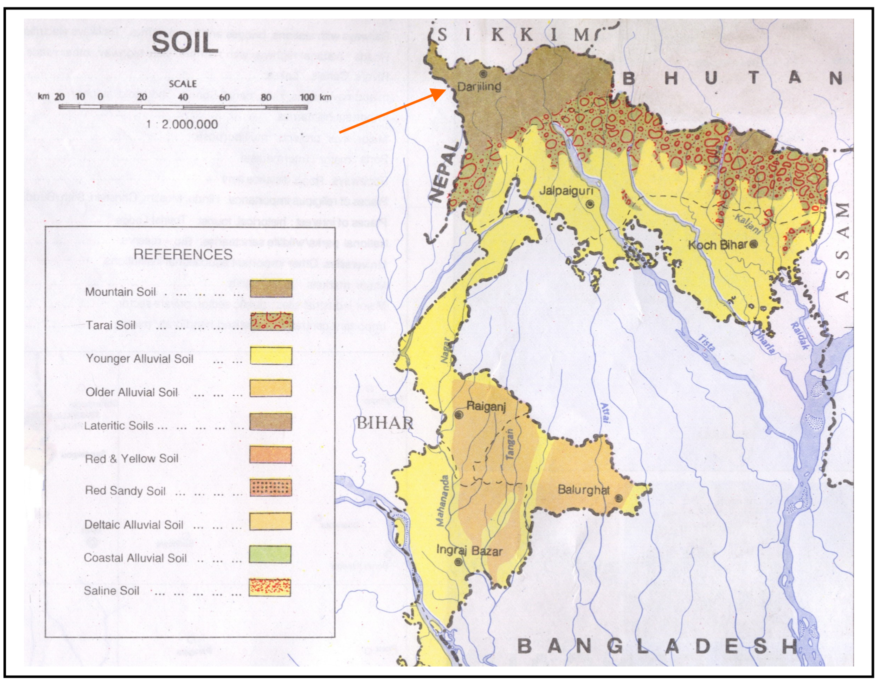


2.1.5. Soils

Soil types in the Darjeeling District which have developed on rock material are basically acidic; the colour is yellow and red-brown (FROEHLICH & SARKAR, 2000; DE & BERA, 1990). Soils are generally poor in calcium, magnesium, potassium and phosphate and contain a low content of organic matter (DE & BERA, 1990). According to TALWAR (1988), soil texture varies from silty loam to sandy loam, whereas the sub-soils are rather compact of grey and dark brown clay. The following soils have developed on top of the rock formations, which are explained in the chapters 2.1.3. and 2.1.4. (FROEHLICH & SARKAR, 2000): Coarse pale yellow to red brown soils on the Siwaliks; mainly sandy soils over the Damuda series, compared to clayey dark grey soils on the Daling; red to brown silty and sandy soils dominate on the Darjeeling Gneisses and are poor in lime, magnesium, iron oxides, phosphorus and nitrogen, but have a *"high content of potassium, derived from feldspar and muscovite"* (FROEHLICH & SARKAR 2000, p.19). Grain composition of soils on Darjeeling Gneiss, Daling and Damuda series contains about 50-80 % sandy and coarse particles. Coarser debris can be found on steeper slopes.

Soils classification of Darjeeling District can be further differentiated into the following soil types: mountain and glacial soil, brown hill soil, forest soil, brown forest soil, tea soil, cinchona soil and terai soil (DE & BERA 1990, p. 161; see fig. 2.12). A basic overview of the soil types and soil properties in Darjeeling District according to altitude is given in fig. 2.13.

Fig. 2.12: Soil features of Darjeeling District
(Source: NATMO, 2000)



Brown hill soil, located at 600-700 m with precipitation reaching 80-200 cm, varies from loam to silty clay loam. The pH value ranges from 6-7.6 while organic matter is between 7.05-22.30 %, and nitrogen ranges from 0.31-1.14 %. In general, the amount of nutrients, such as magnesium, calcium, phosphate and potassium is, however, poor (KAWOSA, 1988; TALWAR, 1988).

Tea soil is located in the tea gardens proving its suitability for tea cultivation. Tea soils have developed on metamorphic rocks, and are acidic with a pH value ranging from 4.6–5.4 (HAJRA, 2001; DTRDC, 2003a). Soil colour is grey; texture is of sandy loam. Though the soil contains high levels in lime[10] (which is used as a main fertilizer in the tea gardens), magnesia and phosphoric acid as well as organic matter and nitrogen are rather low (FROEHLICH & SARKAR, 2000; DE & BERA, 1990). In recent years, organic tea gardens have started using organic manure.

Forest soil in Darjeeling District has a very thin surface layer of organic matter, describing an A_0 horizon of less than 5 cm, a pH value between 5–6.5 indicating an acidic soil, and in texture it is sandy loam to loam (FROEHLICH & SARKAR, 2000; DE & BERA, 1990).

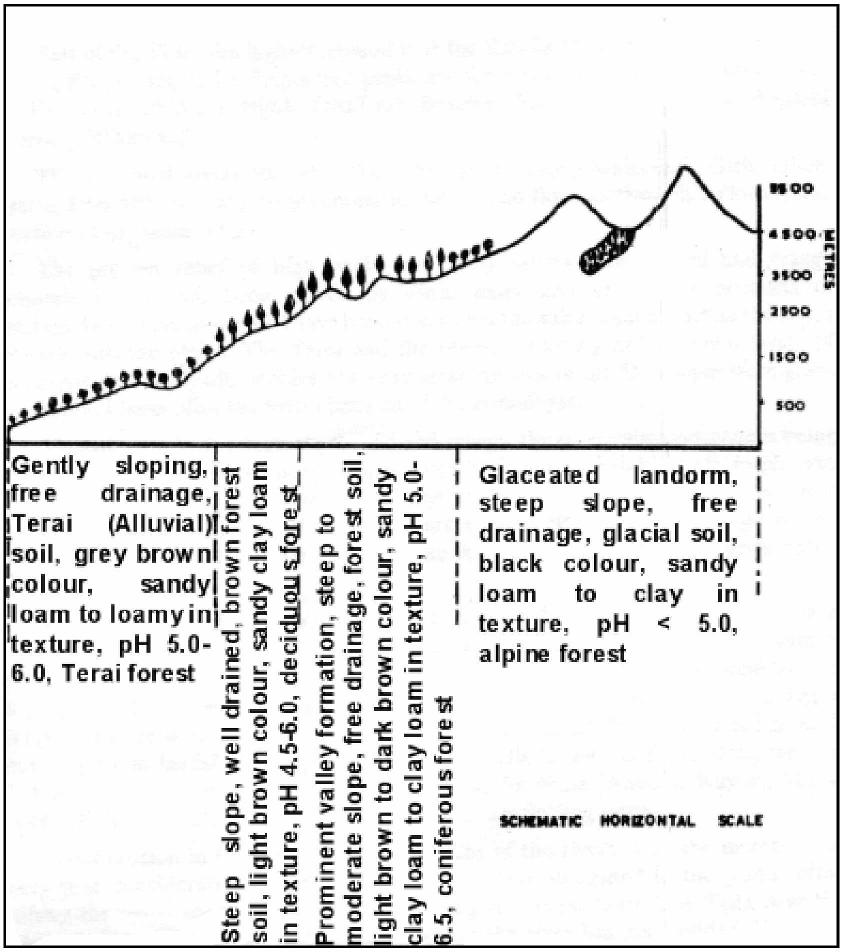
Brown forest soil is of brown or reddish colour to be attributed to iron compounds in the soil. Temperature varies from 10°-20°C with precipitation varying from 210-325 cm. This soil type is found on the lower slopes with prevailing deciduous vegetation. Though these soils are generally rich in organic matter, they are poor in lime having a pH value of 4.5–6 (DE & BERA 1990, p. 161). At higher elevations, where conifers dominate, podzolic soils are a common feature, as the leaves of coniferous trees are more acidic compared to hardwoods and thus produce acid soils (DE & BERA, 1990).

Cinchona soil is clayey in nature, but high in nitrogen and acidic; its pH value ranges from 4.25–5.50, therefore quite acidic. Precipitation varies from 2,000-3,000 mm (DE & BERA, 1990).

[10] Lime improves movement of water in the soil, stimulates microbial activity and hastens decomposition of organic matter (HAJRA 2001, p. 123-124).

Fig. 2.13: Broad classification of soils in Darjeeling District

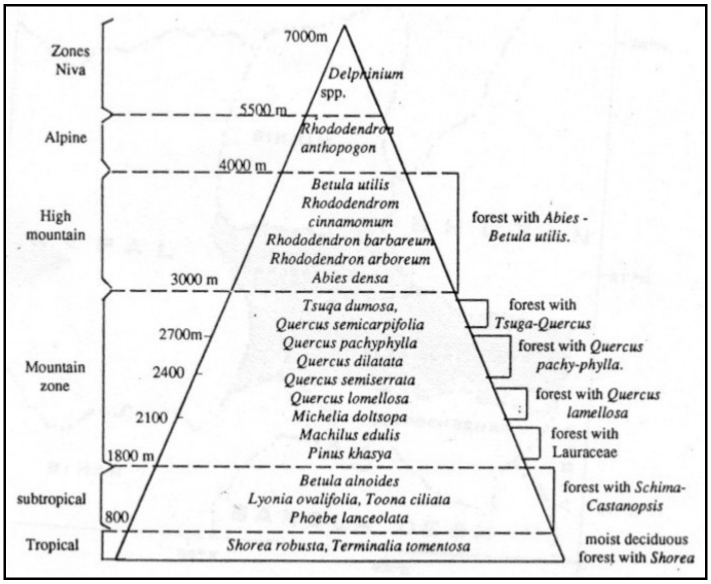
(Source: DE & BERA 1990, p. 152)



2.1.6. Vegetation

Eastern Himalayan vegetation differs from the Western Himalayan in terms of geology and climate, such as *"higher monsoon rainfall, high humidity, milder temperature and less snowfall"* (CHAUDHURI 1992, p. 29; KAWOSA, 1988). The three sub-divisions of West Bengal namely Darjeeling Hills, Jalpaiguri and Cooch Bihar are included the regions of the Eastern Himalaya, next to seven other eastern Indian states. Broad-leaved species such as oaks, maples, and rhododendrons are representative, as well as orchids and ferns (Fig. 2.14).

Fig. 2.14: Altitudinal distribution of vegetation in Eastern Himalaya
(Source: CHAUDHURI 1992, p. 32)



Vegetation in the Darjeeling Himalaya depends on climate, geology, soil and altitude. The hill forests can therefore be differentiated into *"five altitudinal zones of forests"* according to BASU (2000b, p. 31), of which most of them are reserved or protected forests (Table 2.2). Here, the forest belts at 1,000 and 3,000 m is of greatest interest, because the study area is located within that altitude. The monsoons are mostly influencing the altitudinal distribution of vegetation and their different types.

Table 2.2: Forests in Darjeeling District in altitudinal belts
(BASU 2000b, p. 31)

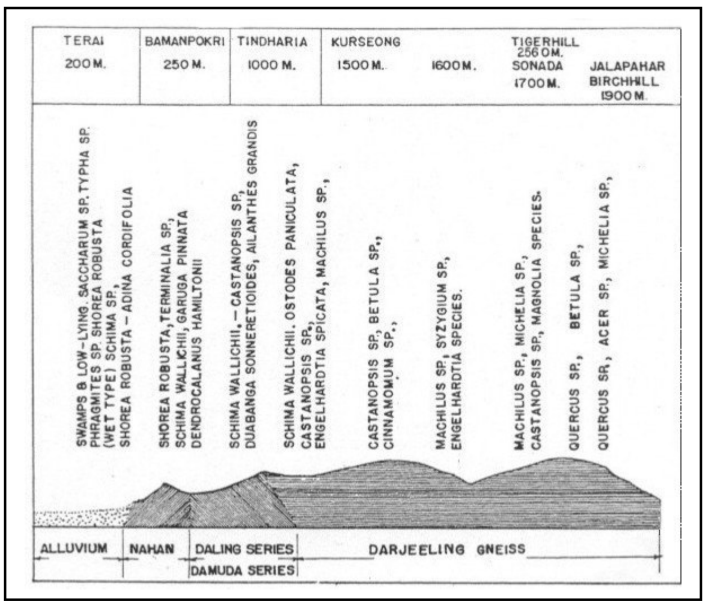
Forest Types of Darjeeling Himalaya	**Altitude (m)**
1. Tropical moist deciduous	300-1,000
2. Tropical evergreen lower montane	1,000-2,000
3. Tropical evergreen upper montane	2,000-3,000
4. Temperate coniferous	3,000-3,500
5. Sub-alpine forest	> 3,500

The Tropical Evergreen Lower Montane Forest is characterised by high humidity and precipitation varying between 1,500-5,000 mm; in winter dew and dense fog occur more strongly than precipitation. As a result, steep slopes are covered with such montane forests, if good drainage is available. The height of the trees is about 20-30 m; a well-developed under-storey and tree ferns are present as well. Species that dominate are *Quercus* and *Castanopsis*. When *Castanopsis* appears above sal *(Shorea robusta)*, it is a clear indication of a montane forest. Furthermore, *Alnus nepalensis* (Nepal Alder) occurs on water courses, but on plantation areas *Cryptomeria japonica* is prevalent. Furthermore noticeable are tea and cinchona plantations of man-made origin. Secondary vegetation has grown on abandoned sites including *Alnus nepalensis*, *Schima walichii*, *Maesa chisia* and *Rhus semialata* (BASU, 2000b).

The trees in the Tropical Evergreen Upper Montane Forest have a dense canopy and reach a height of 30 m. Undergrowth has bamboo, ferns, nettles and raspberries. These forests are often affected by fog and high humidity, hence not much direct sunshine can penetrate. Heavy rainfall occurs in summer, especially in June and August compared to heavy dew which prevails from November till March. Though the forests are mixed, certain species dominate: *Quercus* and *Lauraceae* (from 1,800-2,000 m high up), while Rhododendron is almost entirely in the range of 2,500-2,800 m. Steep ridges are dominated by bamboo undergrowth and Rhododendron, but forest plantations by *Cryptomeria japonica* (BASU, 2000b). Vegetation of Darjeeling District is displayed in fig. 2.15 showing a cross section from the Terai (200 m) via Tiger Hill (2,560 m). Some trees with their local names are given in chapter 5.2.

Fig. 2.15: Cross section of vegetation in Darjeeling District

(Source: CHAUDHURI 1992, p. 585)



2.1.7. Land Use, Crops and Population

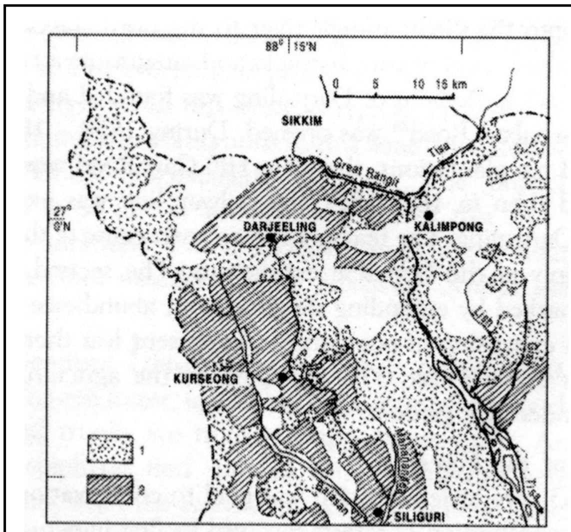
Darjeeling District was chosen to be a British Hill Station[11] in 1835, mainly as a retreat to cooler climates for British civil servants (DOMRÖS, 2003b; HUNTER 1984, p. 18). Soon afterwards, experimental phases of agricultural land-use had begun with tea and cinchona; such experiments resulted in large-scale tea plantations (starting in 1856)

[11] DOMRÖS (2003b) furthermore states that Hill Stations were established as sanatoriums to cure sufferings like malaria in an environment and climate reminiscent of the home country.

and cinchona plantations since 1864 (O'MALLEY 1999, p. 122; DASH 1947, p. 113). At present, there are 86 tea gardens, compared to 177 in 1891 (DTRDC, 2003b).

Agricultural lands totally account for 37 % of the whole District, while less than 38 % are under forest, and about 14 % under tea and cinchona (STARKEL & BASU 2000, p. 33). Fig 2.16 shows the areas covered by tea and forests. The main tea growing areas are located in Darjeeling and Kurseong sub-divisions. Forest areas, which had been cleared for tea cultivation and areas that have been cultivated into agricultural plots, have experienced a change in their soil properties such as a decline in water storage capacity and in organic content, as well as changes in thickness of the soil profile. Due to the different soil covers, soil erosion and runoff have accelerated (FROEHLICH & SARKAR, 2000) showing the necessity of implementing sustainable farming practices, for example using mulching. The rugged landform of Darjeeling District - with steep slopes, landslides and soil erosion - makes it rather difficult for cultivating crops.

Fig. 2.16: Darjeeling District under forest and tea plantations
(Source: STARKEL & BASU 2000, p. 34)



1. Main Forest Areas
2. Tea Gardens (in about 50-70 % under Tea Plantations)

Tea seeds (*Camellia sinensis*) had originally been imported from China and then cultivated in Darjeeling District (BANERJI 1980, p. 230). The most widespread of the many *Camellia* varieties are the China-type *Camellia sinensis* and the Assam-type *C. assamica* (DOMRÖS, 1993, p. 644; see chapter 4.3. and 5.1.1.). The majority of the tea gardens in Darjeeling District are operated by private enterprises with offices located in

Calcutta[12], the other estates are state run. Generally, the government leases tea land to companies. The tea production in Darjeeling District is a large-scale industry, as the following data will show: According to the Darjeeling Tea Research & Development Centre (DTRDC, 2003b) the area covered by tea estates is about 19,000 ha, while 52,000 people are employed permanently. In the plucking season, which lasts from March–September, an additional 15,000 labourers are hired. This high labour force results from the fast growing tea bush, where the leaves need to be plucked every 5-8 days throughout the year, except during the winter dormancy period of three months (DOMRÖS 1993, p. 646). Women constitute the largest workforce with 60 % and employment is done on a family basis. This means that out of one family the wife and husband are employed. Though the annual yield is 10-11 Million kg, it is just a third of the yield achieved in the plains. One Darjeeling tea bush yields only 100 g of made tea and each ha an average of 500 kg of dry tea. Thus, *"each kg of fine tea comprises of more than 20,000 individually handpicked shoots"* (DTRDC, 2003a). Hence, the Darjeeling tea is truly labour intensive, since on this landform no machinery is used[13].

Cinchona, being planted for medicinal purposes (as the quinine from the bark is useful against malaria fever) (BANERJI *et al.*, 1980) grows well at 1,000-2,000 m. (KHAWAS, 2002). Preferred species are *Cinchona ledgeriana, C. officinalis, C. robusta and C. succirubra*. The first one is a yellow bark, rich in quinine; the last one is a red bark, which is poor in quinine but rich in alkaloids related to quinine. The purpose of extracting quinine from the bark was to supply hospitals with cheap medicine against malaria (O'MALLEY, 1999). Cinchona is cultivated on elevations between 1,000-2,000 m covering an area of 26,000 ha where more than 5,000 people[14] are employed (CHHETRI, 2003). It grows well at temperatures of around 20°C, with a relative humidity of 85 % (INDIAAGRONET, 2000). The evergreen tree can reach 10-12 m in height. These plantations are mainly located in Kalimpong and Kurseong sub-divisions. Though originally meant to be used for *"its anti-malarial, anti-pyretic and oxytonic actions, no clinical use is currently made of these properties. In addition to their use in pharmacy, quinine and quinidine and their derivatives are utilized in insecticide compositions for the preservation of fur, feathers, wool and textiles"* (INDIAAGRONET, 2000).

[12] In Calcutta, tea auctions take place every week to sell the commodity; tea auctions in India exist since 1861. Direct sales between international importers and plantation owners have emerged recently (DPA 1999, p. 11-12).

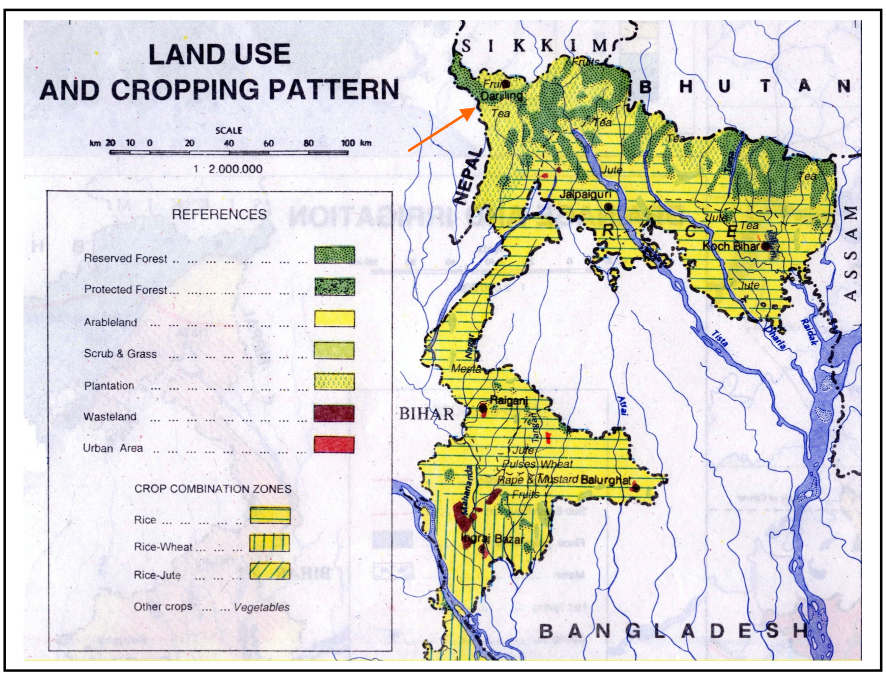
[13] Whereas the Cameron Highlands, situated at an elevation between 1,000-1,500 m, and where tea cultivation dominates the scenery (DOMRÖS 2003b, p. 51-52), use tea machinery.

[14] Besides the 5,000 labourers, 1,000 comprise of staff and 52 of officers (CHHETRI, 2003).

Agricultural crops can be grouped into two categories, (i) as plantation crops like tea and cinchona and (ii) non-plantation crops like maize, potato, barley, rice, ginger, cardamom, as well as vegetables such as radish, squash, peas, beans, cabbage (STARKEL & BASU, 2000; CHAKRABORTY, 1989). Though the villagers consume most products, rising population has increased the pressure to grow more crops and sell them on the markets. Fig. 2.17 shows the distribution of land-use in Darjeeling District.

Fruits are cultivated at a lower elevation with higher temperatures, for example at villages around 1,000-1,400 m a.s.l. (own field survey, 2002). Fruits include oranges, peaches, guava and mango. Animal husbandry is also an integral part of the farmers, with grazing taking place in valley areas. Chapter 4.3. gives further data on vegetables, fruits, tea and cultivation of the fields. Table 2.3 lists the crops grown according to area, production and yield in Darjeeling District.

Fig. 2.17: Distribution of land-use in Darjeeling District
(Source: NATMO, 2000)



Food crops (such as maize, potato, radish and squash) and cash crops (such as ginger) are grown on small terraced fields. The farming system of Darjeeling District can be classified as a mixed crop system or dominated by food crops (ICIMOD, 2004). Land was initially cleared by slashing and burning, under shifting cultivation also known as 'jhum' (ARUNACHALAM *et al.*, 2002). This practice is a very *"low sustainable form of agriculture and is often carried out in the (sub) tropical zones of the eastern half of the mountains; it is locally known in East Nepal as 'Khorea', in North-East India as 'Jhum', and in Bhutan 'Tsheri'"* (BRUIJNZEEL & BREMMER 1989, p. 38). According to O'MALLEY

(1999), shifting cultivation was used by the *Lepchas*, the natives of Darjeeling District. After tea gardens and government reserved forests were opened the *Lepchas* learned from Nepalese immigrants to terrace the fields; immigrants had come to work on tea plantations.

It should be noted that Darjeeling District comprises of three distinct ethnic groups, who live at different elevations. The native *Lepchas* prefer to cultivate on lower elevation. Although the *Lepchas* originally owned all hill areas of Darjeeling and Sikkim, they were pushed to lower valleys, when Tibetans had invaded around 250 years ago (O'MALLEY, 1999). The *Nepali* are the largest group and are called *Chhettri*, *Gurung*, *Rai*, *Tamang* and *Thapa*, which are their family names as well. Originally, they had migrated into Darjeeling District as tea plantation workers. The *Nepali* in general prefer to live and cultivate in the fertile lowlands. The *Bhutias*, who had originally come from Bhutan, Nepal, Sikkim and Tibet, prefer to cultivate at higher elevations and let their livestock graze at higher ridges (O'MALLEY, 1999).

Another important feature of the different groups are their different cultivation practices: *Nepali* cultivate all parts of their land and work with a plough; *Lepcha* keep a small part of land as a set-aside, and prefer using a spade to cultivate a part of the land manually; *Bhutia* also keep a portion of land uncultivated, though a larger piece of land than a *Lepcha* (O'MALLEY, 1999).

Table 2.3: Crops in Darjeeling District, West Bengal according to area, production and yield (A: Area in 100 ha; P: Production in 100 tonnes; Y: Yield in kg per ha) *Area / Production is zero either during current year or during previous year and consequently the Yield Rate / Growth Rate is indeterminate* (Source: MINISTRY OF AGRICULTURE, GOVT. OF INDIA 2000, p. 21, 33, 69, 74, 79, 114, 122, 150, 164, 169, 176, 183, 191, 195, 197, 198, 204)

Darjeeling District		1997 / 98			1998 / 99		
Crop	**Season**	**A**	**P**	**Y**	**A**	**P**	**Y**
Maize	-	226	871	3,854	215	776	3,609
Small Millets	-	5	7	1,400	5	7	1,400
Urad Dhal	Kharif*	1	8	8,000	-	-	-
	Rabi**	1	1	1,000	-	-	-
Moong Dhal	Rabi	1	0	0	-	-	-
	Summer	1	0	0	-	-	-
Wheat	Rabi	44	64	1,455	38	30	789
Sesamun	-	0	0	-	2	1	500
	-	3	2	667	0	0	-
Ragi	Autumn	113	135	1,195	0	0	-
Linseed	-	8	3	375	1	0	0
Coconut	-	1	6	6,000	1	6	6,100
Soybean	Kharif	5	3	600	0	0	-
	-	0	0	-	5	3	600
Jute (Kapas)	Kharif	22	200	9,091	24	214	8,917
Dry Chillies	-	4	3	750	4	3	750
Arecanut	-	2	1	500	2	1	500
Turmeric	-	2	1	500	1	1	1,000
Cardamom	-	27	0	0	29	7	241
Potato	-	69	986	14,290	69	882	12,783
Rice	Autumn	65	42	646	62	55	887
	Winter	289	350	1,211	299	325	1,087
	Summer	1	4	4,000	4	14	3,500

* Kharif refers to the main cultivation period, which is the summer monsoon period, basically from May-September

** Rabi is the cultivation period in winter from November-March, and therefore secondary (Source: DOMRÖS 1989, p. 153; GARIBAY & JYOTI 2003, p. 9)

In terms of population, Darjeeling District is confronted with many serious problems: with a population of more than 1 million and a population density of 510 persons/km^2, rising numbers of Nepali immigrate as well as people from the plains of Bengal (CENSUS OF INDIA MAPS, 2001). Hence, the limited area available is further reduced for hill agriculture and housing in Darjeeling District (STARKEL & BASU, 2000). Further details on the population are given in table 2.4.

Table 2.4: Population of Darjeeling District and West Bengal State
(Source: Census of India Maps, 2001)

2001		Total	Rural	Urban
Darjeeling	Persons	1,605,900	1,085,023	520,877
	Males	826,334	554,609	271,725
	Females	779,566	530,414	249,152
West Bengal	Persons	80,221,171	57,734,690	22,486,481
	Males	41,487,694	29,606,028	11,881,666
	Females	38,733,477	28,128,662	10,604,815

In 1991, the total population of the district was at 1,249,919 while the total rural population was 903,859 (around 70 %) and the total urban population was 396,060 (around 30 %); the density of population was at 396 persons/km^2 (GoWB 1993, p. 1). Concerning workers in agricultural and non-agricultural sectors, their portions are 25 % against 75 % (Table 2.5). The decadal growth in 2001 was at 23.5 % for the total population, 20.0 % for the rural and 31.5 % for the urban population (Census of India Maps, 2001).

Table 2.5: Distribution of population for different categories, Darjeeling District
(Source: Census of India Maps, 2001)

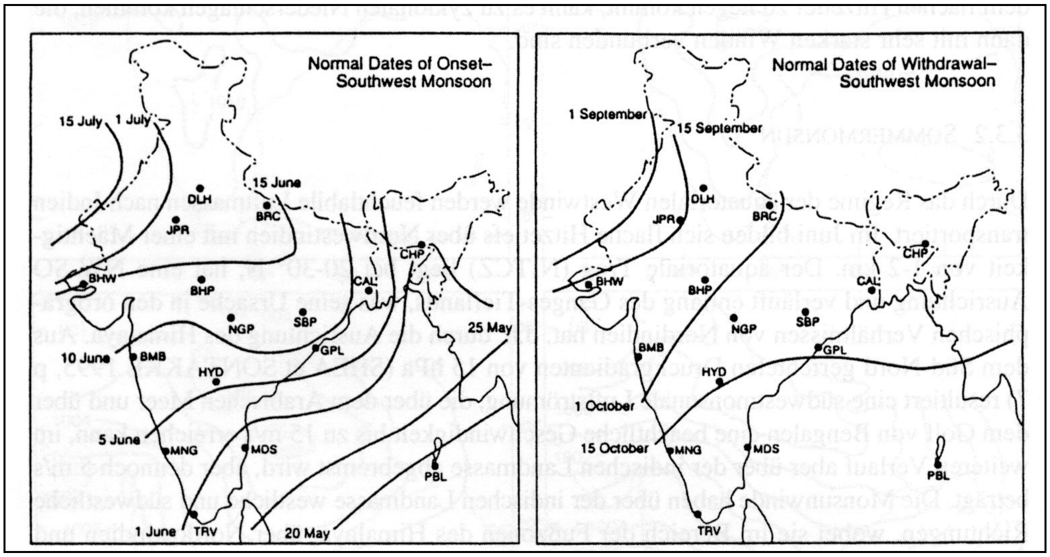
Darjeeling District (2001)	Total	Rural	Urban
Cultivators (%)	14.6	20.6	0.1
Agricultural Labourers (%)	10.2	14.4	0.2
Total Agricultural Sector (%)	24.8	35.0	0.3
Non-Agricultural Sector (%)	75.2	65.0	99.7

2.1.8. Effect of Weather and Landslides on Hill Agriculture

The onset and retreat of the monsoon (Fig. 2.18) is very important for agriculture, as farmers can plan accordingly the sowing and planting of crops. Furthermore, the punctual onset and duration of the monsoonal rains determine the success or failure of the harvest (Domrös, 1981). A late onset can be rather devastating for agriculture, because it results in a shorter rainy season, which implies less water supply for rain-fed cultivation, as well as a shortening of the vegetation period for certain crops (Domrös, 1989).

Furthermore, landslides that occur during or after the monsoon season, such as debris flow and rotational slip, are most frequent, especially during extreme rainfall. The former takes place when after a long dry period sudden rain showers occur. The dryness has developed cracks in the soil, which gets saturated with water, and penetrates into the debris, thus, under pressure it flows downhill.

Fig. 2.18: Dates of onset and retreat of monsoon, important for agriculture (Source: FUCHS 2000, p. 38)



Rotational slip occurs when it rains several days in a row, which creates instability. Thus, *"the slide creates its own sliding plane and moves down the slope along this"* (CHATTOPADHYAY 1987, p. 203). Steeper slopes are prone to landslips and erosion. Landslips take place every year, especially on unstable geological rock formations (DE & BERA, 1990). CHAKRABORTY (1989) states that the geological instability is due to isostatic adjustments, which are still continuing.

Deforestation, agricultural practice and expansion of agricultural land are also factors for landslips and erosion (SEUFFERT, 1989). When areas for plantations were needed due to the expansion of settlements, agriculture and roads, the forests were simply felled (CHADHA, 1989). About *"40 % of the total area of the Darjeeling-gneissic part of the Lish*[15] *basin have been deforested"* (BASU & GHATOWAR 2000, p. 83). The forests used to *"maintain the stability of slopes by repelling the direct rainfall of absorbing a part of the groundwater through its root-system; but they remain exposed to heavy rain and are vulnerable to erosion"* (BASU & GHATOWAR 2000, p. 83).

Landslides and erosion in the Daling series are caused due to agricultural practice on deforested land. The terraces seldom have any contours with protective walls. The fields are cultivated with crops that are uprooted in September-October; these crops are ginger, potato and onions. Due to the uprooting, the cohesiveness of the soil has been changed and therefore has made it more susceptible to erosion (BASU & GHATOWAR, 2000). When steep hill slopes are bare without any vegetative cover and result in landslides, then these cause problems to the hill economy (CHADHA, 1989).

[15] The Lish is a tributary of the Tista river.

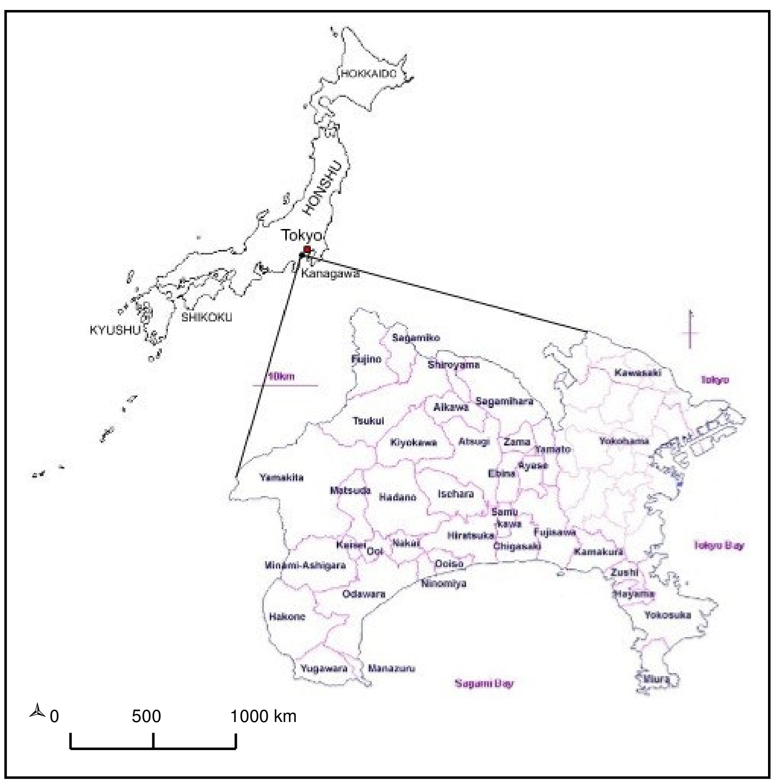
The Geological Survey of India has identified about 200 sites of slope failure, especially in slope areas between 30° and 40°; many of these are accelerated due to anthropogenic activities such as large-scale deforestation, unplanned construction and blocking of the natural water streams (*jhoras*) (GoWB, 1998).

2.2. Kanagawa Prefecture, Japan

2.2.1. Location

Kanagawa Prefecture in Japan is located on Honshu island with Tokyo bordering to the North. Kanagawa Prefecture has altitudes up to 400 m and is therefore regarded as a hilly area, whereas some mountains, like the Hakone range, reach an altitude of 1,500 m (KANAGAWA PREFECTURAL GOVERNMENT, 2002). Therefore, the general range is between 20–1,500 m (KANAGAWA PREFECTURAL GOVERNMENT, 2002). The research area in Kanagawa Prefecture is at 150-450 m and was mainly conducted in Shiroyama, Fujino, Odawara and Yugawara (see fig. 2.19). The total area of the prefecture is 2,415 km^2 (KANAGAWA PREFECTURAL GOVERNMENT, 2002).

Fig. 2.19: Locational context of Kanagawa Prefecture
(Source: KANAGAWA ENVIRONMENTAL RESEARCH CENTER, 1996; *abridged*)



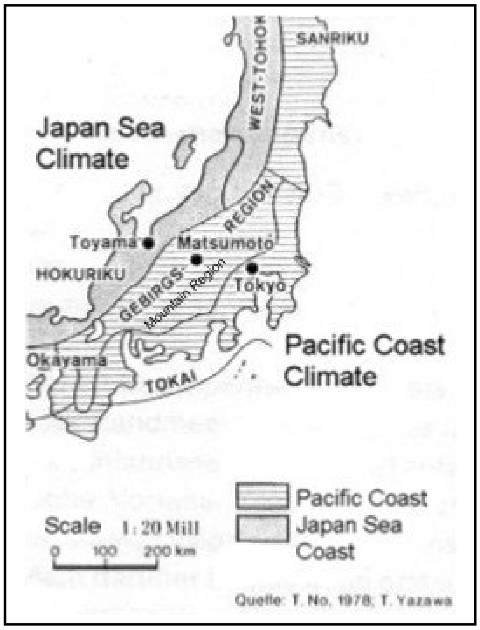
2.2.2. Climate

In terms of climate, Kanagawa Prefecture can be characterised as humid, subtropical “Cfa” climate according to the Köppen classification (MÜLLER, 1996; SCHWIND, 1990). 'C' stands for temperate with the coldest month between +18°C and -3°C; 'f' means that all months have sufficient precipitation and 'a' stands the warmest month above 22°C (DIERCKE 1996, p. 222). In Japan commonly four seasons are differentiated: Winter, Spring, Summer and Autumn (FUKUI, 1977). The climate is yet influenced by certain factors causing many climatic variations mainly as being under the regime of the extra-tropical monsoon, as well as the relief of this island nation causing distinct windward and leeward sides (NOH & KIMURA, 1989; FLÜCHTER, 1982). General seasonal characteristics are: winter monsoon, rainy season in early summer, followed by typhoons and another rainy season in autumn, the latter three being the main rain bringers (YOSHINO 1977a, p. 85).

The rainy season in early summer is called 'bai-u' (or 'mei-yu'): Among the Japanese (and Chinese) these rains are called “plum rains” and the season “plum season”, respectively (FUKUI 1977, p. 85; DOMRÖS & PENG 1988, p. 62; HARPER & STOREY 1999, p. 22). The bai-u season in the pre-typhoon period leads to heavy rainfall in early summer in Japan, occasionally causing landslides and floods (NOH & KIMURA, 1989). The onset is in early June while its end is in mid-July, followed by a humid August, the peak summer month with hardly any rain (YOSHINO, 1977a; FLÜCHTER, 1982). This is because the summer monsoon results from Northwest Pacific Subtropical High, representing a stable pressure pattern, contributing to a hot and fine weather (TAKAHASHI 1977, p 113). In autumn the shûrin (early autumn rain) commences, which constitutes the second rainy season (FLÜCHTER, 1982). The autumn rains lasting from early September until early October originate *“from the southward migration of the Polar front”* (NOH & KIMURA 1989, p. 8; TAKAHASHI, 1977). With the onset of fall, the typhoon season starts, accompanying the early autumn rains (NOH & KIMURA, 1989; TAKAHASHI, 1977).

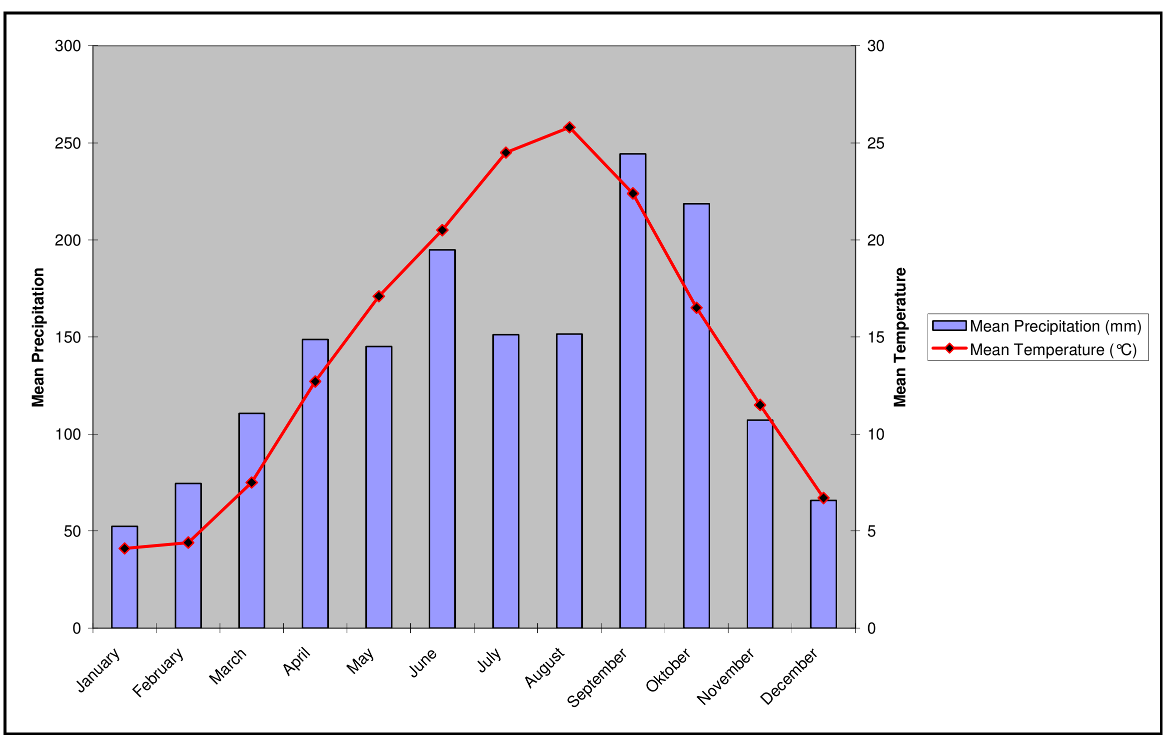
Japan’s central mountains on Honshu island act as an orographic barrier dividing the precipitation pattern in a Japan Sea side and a Pacific Sea side: During winter, when the cold winter monsoon drifts from the inland over the Japan Sea, it takes on moisture and when ascending on Honshu island facing the windward Japan Sea side, heavy snowfall descends on the area (SCHWIND, 1990; FLÜCHTER, 1982). After crossing the mountain ridges, the cold airmasses get warmer and blow as a dry cold wind on the leeward side (Pacific Sea coast), due to which a cool, but dry winter is experienced (SCHWIND, 1990; FLÜCHTER, 1982); the climatic division is shown in fig. 2.20.

Fig. 2.20: Climatic regions and orographic barrier of Honshu, Japan
(Source: FLÜCHTER 1982, p. 209; *abridged*)



The intra-annual variation of precipitation and temperature is given in fig. 2.21 for the city of Yokohama in Kanagawa Prefecture (35°26' N, 139°39' E; 34.5 m) based on data from the World Meteorological Observatory. Mean annual temperature is 14.5°C, mean annual precipitation 1,665 mm.

Fig. 2.21: Mean annual temperature and precipitation in Yokohama
(Source: own projection *based on* ARAKAWA & TAGA 1969, p. 158; *abridged)*



The monsoon system of East Asia, can be called an “extra-tropical” monsoon system, which is different from the inner-tropical monsoon that prevails in South and Southeast Asia (Busch & Kuttler 1990, p. 45; Domrös & Peng 1988, p. 41). What differentiates the tropical monsoon, for which India is the classic example, from the East-Asian Monsoon, is the vertical mightiness: the East-Asian summer monsoon only reaches a vertical height of 400-700 m (Busch & Kuttler, 1990), compared to several km of the Indian summer monsoon (see chapter 2.1.2.).

The East Asian Monsoon governs climate of Kanagawa Prefecture: in summer by a South-East Monsoon and in winter by a North-West Monsoon. According to Domrös & Peng (1988, p. 43), the winter monsoon is characterized by cold and dry air masses. They originate from mid-Siberia and Mongolia, but weaken as they travel from North to South. The wind direction of the winter monsoon in Central Japan is northwest, hence the North-West Monsoon (Yoshino, 1977b). In summer the air masses change their direction from West to East, therefore it is called the South-East Monsoon; these drift, combined with tropical air, from the sea to the continent bringing rain to Japan, Korea and China (Grötzbach 1981, p. 28), as shown in fig. 2.3 and 2.4. The main rainy season is distributed on the bai-u (plum rain) and the shûrin (autumn rain) (Fig. 2.22), even though *“the wind and air masses (of the summer monsoon) originate from the southwestern North Pacific Ocean”*, they mainly contribute to high temperatures as well as high humidity in the main summer month of August, i.e. after the bai-u and before the shûrin (Noh & Kimura 1989, p. 8; Flüchter 1982, p. 208).

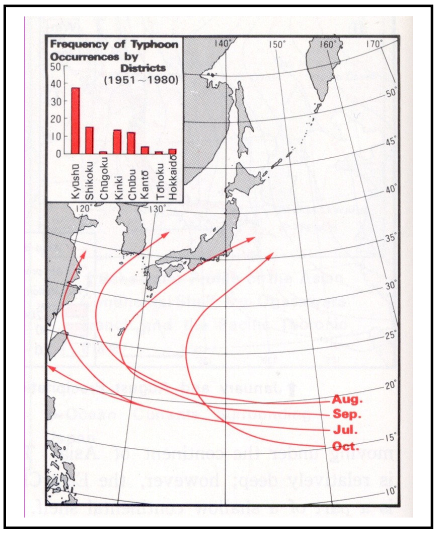
Fig. 2.22: General overview of the seasonal characteristics in Kanagawa Prefecture (Source: own projection *based on* Witherick & Carr, 1993)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Winter Monsoon →		←	*Spring*	→	← *Bai-u* →	← *Midsummer*	→	← *Shûrin & Typhoons* →	← *late*	*Autumn* →	← *Winter Monsoon*
y											

The typhoon season that mostly affects the Pacific Coast side, experiences strong winds and large amount of rainfall, often associated with heavy devastation. Besides being harmful to the people, their houses and buildings as well as to the land, typhoons often result in landslides and mudflows in unstable regions, such as on Okinawa (Noh & Kimura 1989, p. 8; Grötzbach 1981, p. 28). Kanagawa Prefecture, located on the Pacific Coast side, is also prone to typhoons, causing mudslides (The Japan Times, 2004; fig. 2.23). The typhoon season in Japan takes place in August, but mostly in September, sometimes even in July, but it should be noted that the typhoons hitting the Tokyo area are *“about one every 2-3 years”*, whereas Okinawa in the South of Japan receives nearly one each year (Takahashi 1977, p. 120 and 123).

Typhoons have a positive effect, namely their water bringing capacity: Strong winds, as well as heavy rainfalls accompany typhoons, mostly when a typhoon approaches, due to fronts; the following *"duration of heavy rainfall is long"* and causes floods (TAKAHASHI 1977, p. 131). Especially farmers look forward to these events, because *"one typhoon brings 150-500 billion tons of water to the Japanese Islands, which roughly equals 2-8 % of water resources due to the total annual precipitation"* (TAKAHASHI 1977, p. 133).

Fig. 2.23: Typical typhoon tracks towards Japan and Kanagawa Prefecture
(Source: NOH & KIMURA 1989, p. 8)



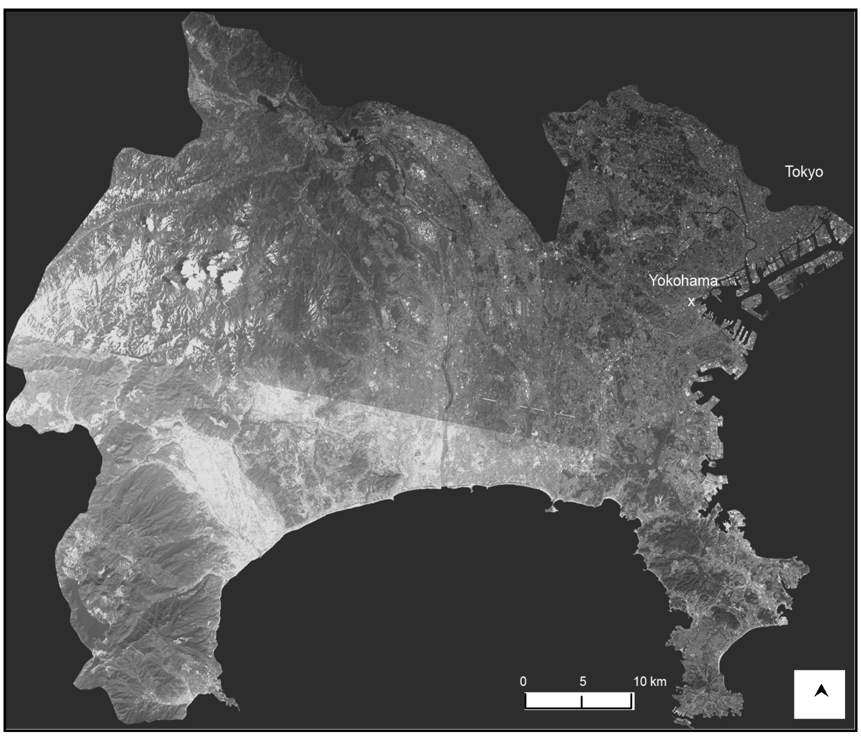
2.2.3. Vegetation

Kanagawa Prefecture mainly belongs to the sub-tropical vegetation type which includes evergreen hardwoods, such as evergreen oak, camphor, myrtle, hemlock and Japanese cedar (*Cryptomeria japonica*) (WITHERICK & CARR 1993, p. 35). Wood, for example in Kanagawa Prefecture, is used for charcoal, wood pulp and as furniture as well as construction material (NOH & KIMURA, 1989). On the main island of Honshu, including Kanagawa Prefecture, *"natural forests have been largely replaced through reforestation by such trees as Japanese cypress and cedar"* (NOH & KIMURA, 1989) and reforestations continue with these trees. According to SCHWIND (1990), the coastal area on central Honshu has a *Castanopsis* forest, followed in vertically direction by *Fagatea crenatae*.

2.2.4. Landforms

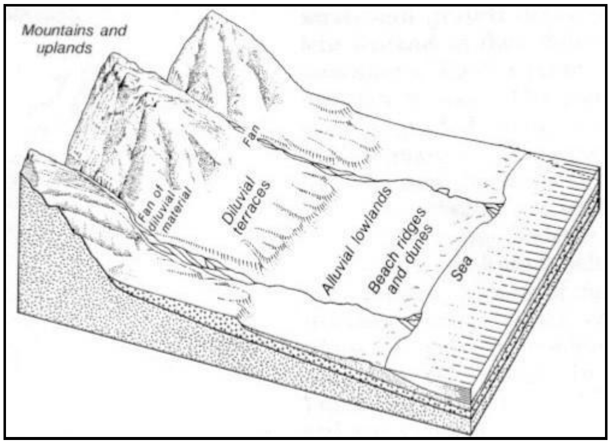
Kanagawa Prefecture can be divided into roughly three regions by topographic features: the mountainous region in the west, the plain and plateau in the central part, and the hilly and coastal area in the east (Fig. 2.24) (KANAGAWA PREFECTURAL GOVERNMENT, 2002). The mountainous area of Kanagawa Prefecture is 37 % of the total country (VISUAL HUMAN LIFE, 1986). Though in administrative terms Kanagawa Prefecture belongs to the Kanto Plain, the plain is divided into alluvial areas near sea level, followed by 20-200 m high uplands, with adjacent hills and mountainous areas, which connect to the bordering mountains (Fig. 2.25) (FLÜCHTER, 1994). The largest plain area is the Kanto Plain located on the main island of Honshu with around 7,000 km^2 and includes seven prefectures (WITHERICK & CARR, 1993).

Fig. 2.24: Satellite image of the landform in Kanagawa Prefecture
(Source: http://glef.umiacs.umd.edu/data/,
Landsat 7, November 2000 and Landsat TM 5, May 1987; *abridged*;
for details see chapter 4.2.)



The diluvial terraces *"mark the transition between the steep upland slopes and the alluvial lowlands"* (WITHERICK & CARR 1993, p. 23). These diluvial terraces are made up of sand and gravel which are deposited by streams. Because the mountains intersect the coastal lowlands in form of steep rocky cliffs, the lowlands are discontinuous.

Fig. 2.25: Uplands and diluvial terraces as in Kanagawa Prefecture
(Source: WITHERICK & CARR 1993, p. 23)



It is worth to note that the Himalayan geological mountain system of young (alpine) orogenic belt reappears in Southeast- and East-Asia; regarding the latter, notably in Japan (STARKEL, 2000b; GRÖTZBACH, 1981; fig. 2.7). In East-Asia (and Southeast-Asia), this mountain system builds the major parts of some of the islands and then sinks between them below the surface of the sea (GRÖTZBACH, 1981).

2.2.5. Land Use, Crops, Soils and Population

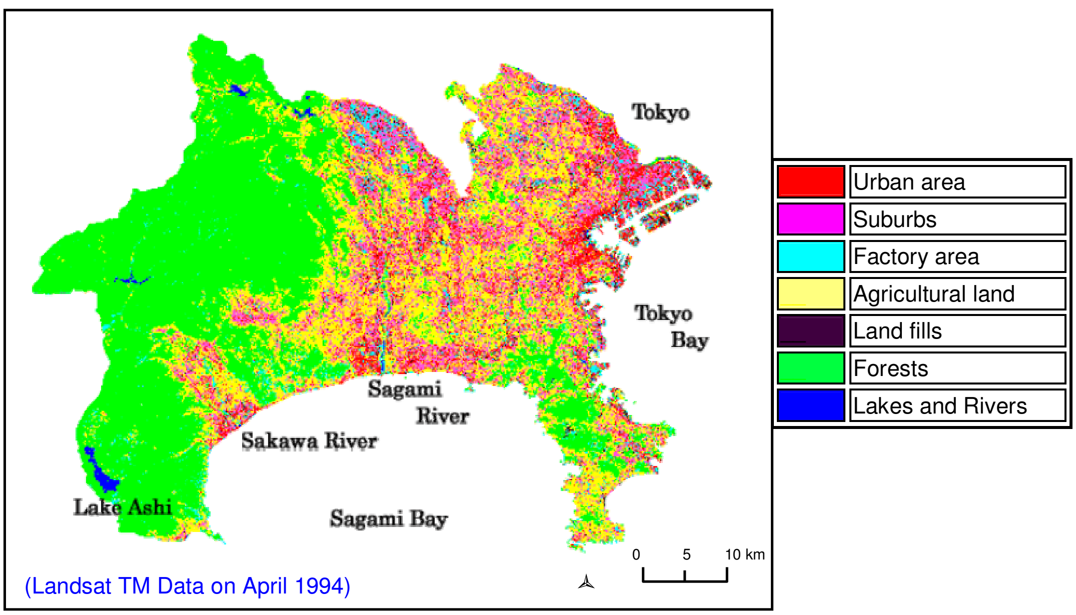
Land-use in Kanagawa Prefecture (Fig. 2.26) shows a high level of forest and urbanised area, whereas agricultural land seems to lose out. In the northern areas of the prefecture, vegetable cultivation dominates more strongly in the higher regions at around 400 m. Land-use, as shown in Fig. 2.27, is very representative of the agriculture practiced in Kanagawa Prefecture on the alluvial lowlands of the coastal areas, on the diluvial terraces and in the hilly area, such as citrus and tea. The region from Kanto up to South Kyushu, including Kanagawa Prefecture, is known for its rice fields being used twice and is also the main citrus growing area (FLÜCHTER, 1994).

Crops grown on the upland fields of Kanagawa Prefecture and Kanto are mainly barley, wheat, beans, potatoes, tea, tobacco and the declining sericulture (NOH & KIMURA, 1989). Though wheat and barley are important second crops after rice cultivation, their production is nevertheless declining (NOH & KIMURA, 1989). Farmers especially in upland fields, have to switch to more profitable crops such as fruits and vegetables, due to the *"low production and small monetary return in proportion to expended labour"* (NOH & KIMURA 1989, p. 17). However, more than 15 % of arable land in Kanagawa Prefecture has been abandoned in the mountainous regions, due to depopulation, migration and ageing of the farmers (FUJITA, 1989). The population of Kanagawa Prefecture is around 8,747,356 with a population density of about 3,621 persons/km^2 (Kanagawa Prefectural Government, 2004). From the total population, male population of 4,420,903 (50.5 %) is higher than the female population of 4,326,453 (49.5 %) (Kanagawa Prefectural Government, 2004). The amount of core persons engaged in farming is 26,000 (male: 15,000 and female 11,000) (Ministry of Internal Affairs and Communication, 2003). The population growth rate for Kanagawa Prefecture was at 3.0 % in 2000 (Ministry of Internal Affairs and Communication, 2000).

As most farmers in Japan can be classified as small farmers, their per capita income is low and even *"smaller than that of other advanced countries"* (Noh & Kimura 1989, p. 17). The agricultural income per household in 2001 was around ¥ 11 million (around € 84,000) (Ministry of Internal Affairs and Communication, 2002). Therefore, farmers deem it necessary either to leave farming or to become part-time farmers in order to sustain their living. Hence, in 2002 there were only 3,790 full-time farmers, while 14,400 were part-time farmers (Ministry of Internal Affairs and Communication, 2003).

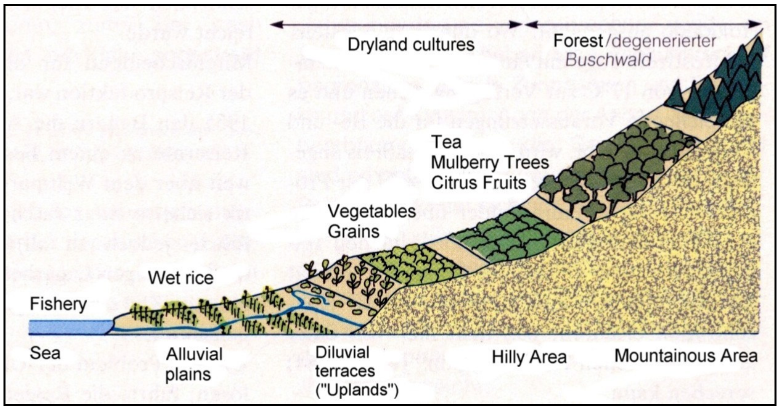
Fig. 2.26: Land-use in Kanagawa Prefecture

(Source: Kanagawa Environmental Research Center, 1994)



Alluvial lowlands are used more and more as urban area and leading to a decrease in farmland, especially of rice fields. The diluvial terraces are traditionally used for tea, rice and mulberry; the latter serving as feed for the silk worm (sericulture). Mulberry was quite commonly practiced in Kanagawa Prefecture, but in many places it made way for orchards, like citrus and oranges (Flüchter, 1994; Witherick & Carr, 1993). The soils of the alluvial lands have become degraded due to intensive agricultural use, as mainly rice, crop rotational practices of rice-vegetable or rice and a winter cereal have been cultivated (WITHERICK & CARR, 1993).

Fig. 2.27: Example of land use on the coastal area according to altitude, as in Kanagawa Prefecture
(Source: FLÜCHTER 1994, p. 101)



A large-scale and plentiful agriculture in Kanagawa Prefecture is rather difficult, as can be seen in table 2.6. Only 12 % of the total area of 377,800 km^2 in Japan can be used for agriculture (THE WORLD BANK GROUP, 2003a; GREIN, 1997). Agricultural land in Kanagawa Prefecture is 21,700 ha (9 % of the total prefectures' area) (NGA, 2002). The basic figures provided by the Ministry of Internal Affairs and Communication (2004) in table 2.23 are based on data provided by the Research and Management on Land Numerical Information from 1982, since no newer data was available by the Ministry. The total area of Kanagawa Prefecture in 1982 was 2,391 km^2, in 2004 it is 2,415 km^2 and the total area of Japan in 1982 was 377,334 km^2.

Table 2.6: Distribution of area according to gradient, Kanagawa Prefecture
(Source: own calculation *based on* MINISTRY OF INTERNAL AFFAIRS AND COMMUNICATION, 2004)

Slope	**0°-3°**	**3°-8°**	**8°-15°**	**15°-20°**	**20°-30°**	**> 30°**
Area by gradient (%) Excluding areas of lakes, marsh and rivers	23.5	24.5	11.3	8.6	15.9	6.4

Soils that have developed on the volcanic deposits are largely too porous; furthermore, they are deficient in necessary mineral nutrients, which makes the soils of low agricultural value (WITHERICK & CARR, 1993). The soils of Japan are generally poor in nutrients and only rich in Magnesium (SCHEIDL, 1937). The reason is that the volcanic ash from eruptions of the Japanese volcanoes is rather acidic (NOH & KIMURA 1989, p. 11). The mountainous soils can be characterised as lithosols, which are unsuitable for cultivation. The soils on the diluvium terraces are of loamy character (SCHEIDL, 1937); furthermore, these soils are easily leached (WITHERICK & CARR, 1993). In both cases, i.e. mountain areas and diluvial terraces, soil erosion is a problem because of steep slopes, earthquakes and heavy rainfall (WITHERICK & CARR, 1993).

As mentioned earlier, Kanagawa Prefecture belongs to the Kanto Plain, not only in administrative terms but also in context of soil development in this region. The majority of this plain consists of diluvial uplands, its surface consisting mainly of red volcanic ash (NOH & KIMURA, 1989). This was caused by frequent volcanic eruptions, especially by Mt. Fuji, which also spread light and porous materials like pumice stone over large distances. Due to upper atmospheric westerly winds the ash is distributed towards the east, affecting mainly the Kanto Plain (SCHEIDL, 1937). Hence, the soil is termed Kanto loam (NOH & KIMURA, 1989).

The diluvial terraces consist of a dry and gravel base, covered by loams, which often includes gravel; these terraces contain no loess (SCHEIDL, 1937). The lowlands of Kanto contain Pleistocene sediments consisting in its essence of brown loam, followed by yellowish brown tuffacious clay, brown sand, brown clay, bluish grey clay, sand and gravel (SCHEIDL, 1937).

The parent material, i.e. the acidic volcanic ash, coupled with abundant precipitation causes leaching. As the soil tends to be infertile, agriculture is preferably practiced on fertile alluvial soils, which are mainly located on deltas, alluvial fans and in basins (NOH & KIMURA, 1989). Nevertheless, “heavy chemical use, i.e. fertilizers, is applied to achieve high crop yields” (NOH & KIMURA 1989, p. 11). Sandy soils are located in flat coastal areas and only constitute a small area, whereas loamy soils are mainly distributed on alluvial plains and lowlands of the Kanto. Though mostly volcanic ash loams are acidic and not suitable for agriculture, the loams of Kanto are of medium productivity (SCHEIDL, 1937). For cultivation of dry crops, sand or sandy loam soils are suited, containing some humus and a porous base, enabling a better drainage of lower soil layers (SCHEIDL, 1937). Such conditions exist on many of the diluvial terraces, including the volcanic ash loam of the Kanto (SCHEIDL, 1937).

CHAPTER 3

Typical Hill Market in Kurseong Town, Darjeeling District
Photo by SHILPI SAXENA, 2002

3. Background Information on Organic Farming in India and Japan

Organic Farming is not completely new to **India**, as ancient knowledge of farming in a sustainable manner dates back to the Later Vedic Period of 1000-600 BC (MAHALE, 2002). The ancient scriptures or Vedas describe a nature-friendly farming system placing partnership with nature, agricultural practices and technologies as well as animal husbandry. Hence, agriculture was not merely a production system but an integral part of Indian culture (MAHALE, 2002). The Indian traditional farming practices applying organic principles such as crop rotation with legumes and mixed cropping were thoroughly studied in the beginning of the 19th century by a pioneer in organic farming, Sir Albert Howard (GARIBAY & JYOTI, 2003). He specialised in soil-plant interactions and developed composting methods, based on his studies there. Since India's Independence, traditional knowledge has made way for conventional agricultural practices, though organic principles are still applied in major areas of the country (MAHALE, 2002). Mountainous areas and hill tribes are largely speared from the introduction of the Green Revolution in the 1960s (GARIBAY & JYOTI, 2003; see table 3.1). Therefore, such places did not adopt agro-chemicals as strongly as in the plains.

As there is a global trend and interest in organic farming, a revival of interest in organic agriculture in the modern sense has come about in India as well (MAHALE, 2002). Reasons for conversion to organic farming can be stated as follows: *"(a) to reach self-sufficiency in food; (b) to improve soil fertility; and (c) to engage in export trade"* (UN-ESCAP 2002, p. 6). Furthermore, the increasingly alarming rate of environmental degradation has given additional impetus for nature-friendly farming (UN-ESCAP, 2002).

Currently, three types of organic practices in India can be differentiated according to their farmers (MAHALE 2002, p. 1-2):

1. Tribal people, hill-farmers and farmers in rain-fed lowlands. They use farming practices based on indigenous knowledge and technology, which has been developed over the past thousands of years. Furthermore, they are encouraged by local NGOs to use organic farming practices, because many NGOs believe that for sustainable development this type of farming is necessary. Cooperation between NGOs and farmers can take the form of small-scale export opportunities and/or fair trade schemes. Furthermore, *"projects that aim at reducing poverty by increasing local and household food security and incomes are supported by local and foreign NGOs"* (MAHALE 2002, p. 1).

2. Farmers with holdings of small (up to 2 ha) to medium size. *"These can be divided into two groups: those working to revive the Vedic practices, coupled with Ayurvedic tradition of health system with scientific exposition; and others who follow modern*

organic agriculture systems" (MAHALE 2002, p. 1), like: biodynamic agriculture propagated by Steiner, Fukuoka's 'natural farming', Mollison's 'permaculture' and Howard's composting methods.

3. Private companies, who believe in organic principles and those who see organic as a business opportunity. This is largely the result of the market demand in industrialised countries. Such companies believe that *"more economic value can be added to the crops which are already cultivated in a manner similar to organic systems. Companies like Tata Tea, LT Overseas, and Maikaal have promoted large-scale conversions of plantations growing tea, coffee, pepper and cardamoms, and of cotton and rice fields. They organise 'contract farmers', and also act as traders. They pay certification costs, get the organic certificate in the company's name and provide the farmers a 'buy back' guarantee"* (MAHALE 2002, p. 2).

The first group of (traditional) farmers are subsistence farmers who grow crops for their own consumption and only have little surplus. The second group farms for market surplus, sometimes connected with export. The third group targets the promotion of organic farming for export.

In order to understand how the organic agriculture movement started in **Japan**, it is necessary to look at the time after World War II. According to KAVANAGH (1997) Japan being occupied by America, the US was looking for an export market of their surplus in wheat and other products. As a result, a redistribution of farm land took place – from the landlords to the hands of small farmers. For this, farmers have presently only an average size of 1.5 ha of agricultural land (JOAA, 1993). The pressure on the Japanese farmers to increase their productivity and to keep up with rapid economic growth led to the use of chemicals and antibiotics in farming (JOAA, 1993; see table 3.1). In the 1980s more than 10 kg/ha of undiluted agrochemicals were applied in Japan, one of the highest applications in the world (YONEYAMA, 1996). Soon, the dietary habits of the Japanese changed and an increase in health problems arose, e.g. heart disease and cancer resulted in *"the first and second highest causes in death"* in 1986 (ARAKAWA 1995, p. 32). The fear of chemical residues and additives in food and the uncertainty of the quality concerning imported food, rose (ARAKAWA, 1995). Pollution related diseases – most notably the milk poisoning, Minamata and Itai-Itai – led to the creation of TEIKEI, a distribution system from farmer to consumer (KAVANAGH, 1997). The two incidents were related to high mercury and cadmium levels in fish, whereas the milk was manufactured with industrial grade soda, which also contained arsenic and caused several deaths in 1955 (KAVANAGH, 1997; ARAKAWA 1995, p. 14). Additionally, chemical residue was also found in mothers' milk (KAVANAGH, 1997; ARAKAWA 1995, p. 14). All of these events resulted in a modification of the Japanese dietary habits based more on vegetables and to a strong awareness and demand for food safety without the use of chemicals; urban mothers formed a group and primarily led this movement towards organic products (ARAKAWA 1995, p. 26 and 28; KAVANAGH, 1997). Additionally, with the self-sufficiency rate of Japan on caloric base declining since 1998 (on caloric base: 40 %, Germany: 97 %), Japanese organic farmers are convinced they have taken the right path with their farming practice, though many fear a stronger dependency of their country on imports due to globalization (TANIGUCHI 2002, p. 2; JIN, 2000).

Prior to the final guidelines and certification system adopted by the Japanese government for labelling organic products, there was a lot of confusion about the certification “organic” (VROLIJK & MAY, 2001). As the translation of the term “organic food” into Japanese is 'yuki shokuhin', its meaning can be *“a food product that contains low or no chemicals added in the growing or production process”* (VROLIJK & MAY 2001, p. 119). Therefore, the categories of 'yuki' are: (a) “organic”: no chemicals have been applied for more than three years; (b) “organic in transition”: no chemicals have been applied for a period between six months and three years; (c) “no pesticides”: no chemical pesticides have been applied; (d) "reduced pesticides”: application of chemical pesticides is reduced more than 50 % of the average pesticide application; (e) “no chemical fertilizer grown”: products grown without chemical fertilizer, and (f) “reduced fertilizer grown”: products where application of chemical fertilizers is reduced to less than 50 % of the average fertilizer application (VROLIJK & MAY 2001, p. 119). For further details on the current regulation on organic certification, see chapter 3.3.

Table 3.1: Fertilizer use in India and Japan
(Source: own compilation *adapted from* FAO STATISTICAL DATABASE, 2001)

Fertilizer (Mt)		1969	1979	1989	1999
Nitrogen	India	1,356,000	3,498,100	7,150,900	11,886,000
	Japan	739,800	777,000	641,000	479,500
Phosphate	India	416,000	1,168,400	3,052,900	4,753,000
	Japan	702,100	831,000	728,000	568,600
Potash	India	210,000	606,400	1,171,700	1,733,000
	Japan	668,300	736 000	569,000	388,800
Urea	India	n.a.	n.a.	5,685,000	9,600,000
	Japan	n.a.	144,000	113,000	99,400

Organic farming in Japan is rather difficult due to the wet and hot climates and scarcity of arable land (VROLIJK & MAY, 2001). Furthermore, Japanese consumers are slowly getting used to natural looking food. Up till now, Japanese consumers have been very conscious about the food shape and colour of vegetables and fruits, which made it difficult to sell anything different-looking: *“In the land of straight cucumbers, perfect round melons, and nearly identical tomatoes, imperfect food has been* *previously hard to sell"* (Brucklacher 2000, p. 244). With the economic recession in the 1990s, farmers had to look for alternatives to reduce the high costs involved in growing products and have started to grow more natural-looking foods and also using less chemical input or going totally organic (Brucklacher, 2000). Farmers converted to organic farming because of family related health problems; others were convinced that conventional farming is not the correct way to farm in terms of environment and health[16]. The main differences between organic and conventional farming, are given in table 3.2.

Table 3.2: Characteristics of conventional and organic farming
(Source: Ratanawaraka 2002, p. 1)

Conventional	Organic
Reductionism approach; it separates all components in the farming system to be treated individually	Holistic approach with emphasis on the ecological aspect; takes farming system as one whole unit
Emphasis on mono-cultural practice	Emphasis on integrated, diversified farm
Accepts the use of genetically modified organisms (GMO) and synthetic chemical inputs	Refuses the use of GMO and synthetic chemical inputs
Emphasis on high yield and high income	Emphasis on health product with sustainable environment
Emphasis on the use of external input to increase productivity	Emphasis on recycling of natural resources within the farm system

The number of organic producers in Japan is estimated at 3,500 (Vrolijk & May, 2001). *"The land sizes are generally small around 0.5 ha, whether conventional or organic and 85 % of the farmers are part-time farmers with an average age of 65 years"* (Vrolijk & May 2001, p. 120). Conventional farming is on the decline, but there is an expectation for an increase in certified organic products in terms of area, production and market (Vrolijk & May, 2001). Table 3.3 below shows the extent of organic area and farms in India and Japan.

Table 3.3: Farms and land under organic management
(Source: Kung Wai 2004, p. 76; JETRO 2004, p. 83; Yussefi 2003, p. 61; Willer & Richter 2004, p. 119; FAO 2000, p. 1; FAO, 1998; Swiss Federal Office for Agriculture 2000, p. 1; *abridged*)

Country	Reference Year	Organic Farms	Organic Area (ha)	% of Agricultural Area	Total Agricultural Area (ha)
India	2002	5,147	37,050	0.03	169,500,000
Japan	2004	n.a.	5,300 (est.)	0.11 (estimate)	4,830,000
Switzerland*	2002	6,466	107,000	10.00	1,072,492

*Note: Switzerland is used for comparison reasons only, being an industrialized, hilly and mountainous country in Europe. Total area of Japan: 377,800 km^2 (Source: The World Bank Group, 2003a); India: 3,300,000 km^2 (Source: The World Bank Group, 2003b) and Switzerland: 41,290 km^2 (Source: The World Bank Group, 2003c)

[16] Based on information given by organic farmers during the field survey conducted by author.

Many different sustainable farming concepts are being practiced in the world. Notably, the most well-known ones are Rudolf Steiner's "Biodynamic Farming" and Masanobu Fukuoka's "Natural Farming", followed by "Organic Farming", "Nature Farming", "Agroecological Farming", "Permaculture", and "Vedic Farming", to name just a few. The degree of sustainability for the mentioned farming systems is shown in fig. 3.1. It should be noted that in Europe the term *biological* farming refers to *organic* whereas the term *ecological* refers to organic along with environmental considerations, such as on-farm wildlife management (NORMAN *et al.*, 1997).

Fig. 3.1: Degree of sustainability with different sustainable farming systems (Source: EAP, 1989)

A Spectrum of Schools of Thought in Agriculture Arranged According to an Evolutionary Approach to Conversion

Low Sustainability

School of Thought:	**Characterized by:**
Conventional [Monoculture]	External solutions to internal problems, detachment, compensatory control, unawareness, disempowerment
[Minimum tillage, chemical banding]	**Efficiency**
LISA Lemaire-Boucher* Ecoagriculture*	**Substitution** of benign inputs
Organic* Biological* Regenerative* Biodynamic*	Benign **Design** and management
Permaculture Bioregionalism Natural	Internal solutions to internal problems. Integration, balance, awareness, responsive to feedback; complex, indirect, long-term, bioecological, local approaches to global problems

High Sustainability

* Products are often sold using an organic food label

To refrain from applying chemicals is a main characteristic of alternative farming systems because they restrain biological soil activity; the use of genetically modified crops is also forbidden (EAP, 1989; Soil Association, 2002). Most of the *"sustainable agriculture systems rely on crop rotations, crop residues, animal manures, legumes, green manures, off-farm organic wastes, appropriate mechanical cultivation, and mineral bearing rocks to maximize soil biological activity, maintain soil fertility and productivity. Natural, biological, and cultural controls are used to manage pests, weeds and diseases"* (EAP, 1989)[17]. Furthermore, organic farming or any of the following farming practices are methods to reach sustainability; as the term itself implies, it is a long-term benefit for the farmer and the environment (Norman *et al*., 1997).

The concept of **Biodynamic Farming** was initiated by the Austrian Dr. Rudolph Steiner (1861-1925) (Gold, 1999), known as the founder of anthroposophy, who tries to explain all areas of life and science in a holistic perspective and in context of the cosmic forces of the earth (Schaarschmidt, 1995). According to Schaumberger, the Executive Officer of Demeter Germany, *"Biodynamic Agriculture is based on the knowledge of that the soil, plants, animals and man work together in one agricultural cycle. In practice, the method is not only to farm organically, but also to include the use of his [Steiner's] preparations described and to take into account the cosmic influences"* (Schaarschmidt 1995, p. 1). Dynamic means that the *"earth forces have an effect on plant growth"* (Schaarschmidt 1995, p. 2). Therefore, many biodynamical farms and tea plantations use the moon calendar and special biodynamic preparations such as horn dung, yarrow, camomile and oak bark:

For horn dung, which is used for spraying, a cow's horn is filled with fresh cow dung and buried in the soil during the winter months till mid-Spring. Other preparations include a bladder of a male deer filled with yarrow (*Achillea millefolium, Compositae*); camomile (*Matricaria chamomilla, Compositae*) filled into the intestine of a cow; or a skull of an animal filled with oak bark (*Quercus robur, Fagaceae*). The moon calendar will indicate when to take these out of the soil and apply them on the crops and the field (Koepf, 1989; Schaarschmidt, 1995; Wistinghausen *et al*., 2000). As these special preparations are imported from Germany by biodynamic tea estates in Darjeeling District, it remains questionable if a low-income farmer is able to afford these preparations or even parts of the ingredients. Additionally, cows are regarded as holy animals in India, which makes it difficult to obtain an intestine or a horn.

The concept of **Natural Farming** was started by the Japanese farmer and agricultural scientist Masanobu Fukuoka (born 1914) (Fukuoka, 1985). His principles

[17] Many citations in this chapter are from websites; therefore, in some cases no page number for the citation can be given.

are: no pruning, no weeding, no tilling/ploughing, no fertilizers, no pesticides; furthermore, not even compost is added (FUKUOKA, 1985). These are the goals to be reached, not the methods (FUKUOKA, 1985; ROJANALAK, 2002). The method is also called *'do-nothing farming: do nothing, but do it intelligently'* (VARUGHESE, 1997; EDOLS, 2002). Basically, nature is the best guide; instead of working more on the soil he thought of *not* doing this or that, since in his opinion natural farming is based on a nature without human interference (FUKUOKA, 1985). He achieved high yields by initially choosing the correct planting timings and the proper combination of crops (GOLD, 1999; VARUGHESE, 1997; FUKUOKA, 1985). Fukuoka's widely distributed books 'One Straw Revolution' and 'Natural Way of Farming', published in many languages, made him and his concept of natural farming popular (FUKUOKA, 1985; VARUGHESE, 1997; EDOLS, 2002). His focal invention is the so-called 'seed ball' or 'seed pellet' in which seeds are covered in clay and then simply scattered onto the ground, without ploughing the soil, sowing seeds or planting seedlings. The method became most effective in semi-arid areas (EDOLS, 2002; FUKUOKA, 1978).

The concept of **Nature Farming** was also developed by an eminent Japanese personality: the philosopher Mokichi Okada (1882-1955) (GOLD, 1999; MOA INTERNATIONAL, 1995). *"The theory of Nature Farming, as Okada expounded it, rests on a belief in the universal life-giving powers that the elements of fire, water, and earth confer on the soil. The planet's soil, created over a span of eons, has acquired life-sustaining properties, in accordance with the principle of the indivisibility of the spiritual and the physical realms, which in turn provide the life-force that enables plants to grow. To utilize the inherent power of the soil, is the underlying principle of Nature Farming"* (MOA INTERNATIONAL 1995, p. 1). Nature Farming analyses the soil and uses organic materials for the enrichment of the soil instead of applying chemical fertilizers or pesticides. These include composting, green manure and mulch. Other practices involve tillage of the soil and crop rotation (MOA INTERNATIONAL, 1995). According to GOLD (1999), this concept of farming, being quite similar to organic farming, is practiced in countries on the Pacific Rim of Asia and North America.

The concept of **Organic Farming** has a holistic view of the environment and human, striving to secure long-term gains, not short-term profits in respect to soil, health and animals, by recycling and using renewable resources (FAO, 1999; FAO, 1998, in: EAP, 2003). It largely refrains from using any synthetic fertilizers, pesticides, growth regulators and livestock feed additives (USDA, 1980, in: GOLD, 1999). Organic farming is defined as follows: *"To the maximum extent feasible, organic farming systems rely upon crop rotations, crop residues, animal manures, legumes, green manures, off-farm organic wastes, mechanical cultivation, mineral-bearing rocks, and* *aspects of biological pest control to maintain soil productivity and tilth, to supply plant nutrients, and to control insects, weeds and other pests"* (USDA, 1980, in: GOLD, 1999).

The concept of **Organic-biological Farming** was introduced by the Swiss Dr. H. Müller in the 1930s, with the theoretical basis delivered by H. P. Rusch (DIERCKS 1983, p. 288). Rusch focused on the microorganisms as an important part of the soil activity; central part of the concept is the treatment and care of the soil fertility by providing the microorganisms nourishment and activating them (DIERCKS 1983, p. 289).

The concept of **Agroecological Farming** focuses on the development and maximization of local/indigenous knowledge and locally available natural resources to maintain soil fertility, and to prevent pests and diseases (PARROT & MARSDEN, 2002; SCHOCH, 2001). Therefore, this concept is based mainly on developing countries in the South, notably in Latin America. It incorporates strongly social equity, and focuses on resource-poor farmers, which means it has a bottom-up approach (PARROT & MARSDEN, 2002; SCHOCH, 2001). The term agroecology itself refers to ecosystems, which are natural and man-made agricultural systems and tries to create integrated farming systems, focussing on natural crop protection, stable yields and soil fertility (ALTIERI, 1983).

The concept of **Permaculture**, which stands synonymously for "permanent agriculture" and founded by the Australian Bill Mollison in 1972 (STEINFELD, 1995), integrates human, plant, i.e. perennials, trees, shrubs, and vines as well as animal in a permanent farming system (BEETZ & KUSTUDIA, 2004): for humans to have a viable living through the use of animals for manure, fur, meat; certain trees for windbreaking purposes, fuel and material; and mulching, composting, recycling and existing natural resources (STEINFELD, 1995; ATTRA, 2002). Permaculture is designed for small-scale systems, which are labour-efficient; it is practicable from the home-garden level up to the farm level (GOLD, 1999).

The concept of **LEISA** (Low-External Input Sustainable Agriculture) aims at small-holding farmers to farm in an ecological manner preferably with natural and local resources (ILEIA, 2002). This means that *"most of the inputs used, originate from the own farm, village, region or country"* (REIJNTJES *et al.* 1993, p. 214) and are called low external inputs. Therefore, it is helpful for small-scale farmers and holdings to generate income and productivity for rural livelihoods using agroecology and indigenous knowledge (ILEIA, 2002; GOLD, 1999; MSS SEVA, 2003).

The concept of **Vedic Farming**, practiced in India, is based on the Indian Vedas (MAHALE, 2002). Vedas are prayers, hymns and mantras in Sanskrit, reflecting the *"cosmic order envisioned by the rishis or seers"* (MAHALE & SOREE 2002, p. 1). Some parts in the Vedas have ancient texts related to the agricultural science, such as seed collection, germination, treatment, soil testing and preparation, methods of cultivating plants, crop rotation, pest control and animal husbandry (MAHALE & SOREE, 2002). Particularly, the balance of cosmic forces and living in harmony with nature are important points in Vedic (Agri-)culture (MAHALE, 2002). The modern term and agricultural practice of 'organic', which were introduced to Europe and the US, originally stem from India: Rudolph Steiner from Austria, founder of the Biodynamic Agriculture in 1924, was influenced by Indian Philosophy of Life; Sir Albert Howard from England, whose theories are the basis for Organic Agriculture and are written in his Agricultural Testament from 1940, were based on his observations in India; J. I. Rodale the well-known farmer and publisher from the USA, who made the word 'organic' popular in 1946, *"was influenced by Sir Albert Howard's work on composting in India"* (MAHALE 2002, p. 5; GOLD, 1999). Interestingly, the major theories on organic farming coincidentally originated from India and spread to the western hemisphere as various types of nature-friendly farming. They are partly finding their way back to India e.g. in Darjeeling District, where some of the tea estates farm biodynamically.

3.1. Marketing of Organic Products in India and Japan

India, having 21 agro-ecological zones, has an advantage to cultivate organic crops, because a variety of primary products can be grown (GARIBAY & JYOTI, 2003; table 3.4). Processed foods are limited, while organic animal husbandry, poultry and fisheries are completely lacking (MAHALE, 2002). Vegetables and fruits can be produced all over India at various locations; this means that their organic cultivation is also beneficial for small-scale farmers in Darjeeling District.

Table 3.4: Indian organic products of various agro-climatic zones
(Source: MAHALE 2002, p. 2; GARIBAY & JYOTI, 2003, p. 7)

Crop Type	**Crop Example**
Vegetables	**Eggplant, garlic, onion, tomato, cabbage, potato, carrot* and okra
Fruits	**Orange, mango, banana, pineapple, peach, pear,* apple, sugar cane and apricot
Tea	
Coffee	Arabica and Robusta
Spices	**Cardamom, ginger, coriander, fenugreek, mustard, chilli,* tamarind, pepper, cloves, nutmeg and mace, turmeric, fennel, cumin, and sesame
Cereals	**Rice, maize, wheat,* sorghum and oilseeds
Pulses	Black Gram, red gram
Dry goods	Chestnut, cashew nut
**Honey*, coconuts and cotton	

*Note: The items indicated in italics are also grown, among other crops in Darjeeling District by small-scale farmers. Therefore, they have potential for organic production (Source: own field survey, 2002).

Due to cheap labour availability in India in comparison to input costs, a conversion to labour-intensive production systems are favourable, given that sufficient yields are achieved (GARIBAY & JYOTI, 2003).

Total domestic production of organic products, which include tea, coffee, rice, fruits and vegetables, wheat, cotton, spices, pulses, and cashew nuts for the whole of India was 14,000 t (2002), while domestic sales of organic products (excluding spices and cashew nuts) only made 1,050 t in 2002 (GARIBAY & JYOTI, 2003). Out of this, organic vegetable and fruit sales on the Indian domestic market accounted for 400 t and organic tea accounts for 100 t (GARIBAY & JYOTI, 2003). Export sales of Indian organic products accounted for 11,925 t (2002), the remaining 1,025 t (2002) were unsold stock, resulting from *"high price and lack of marketing initiative"* (GARIBAY & JYOTI 2003, p. 32). This stock remains with wholesalers and supermarkets.

"IMO-Control, a European-based certification body with an Indian office in Bangalore, calculates that the total area of certified organic tea is 4,020 hectares, yielding 3,880 tons" (MAHALE 2002, p. 2). By February 2002, there were around 1,426 farms certified organic and with an area of 2,775 ha, a value also confirmed by SOEL (Foundation Ecology and Agriculture). *"Indian agriculture as a whole amounts for about 170 million ha, the total land under certified organic production is barely 0.0015 %"* (GARIBAY & JYOTI 2003, p. 7). According to APEDA (AGRICULTURAL AND PROCESSED FOOD PRODUCTS EXPORT DEVELOPMENT AUTHORITY) though, there were 12,000 farms certified and above 200,000 ha of certified organic area in 2003 (EYHORN, 2004), while the Ministry of Agriculture from India stated 41,000 ha (WYNEN & VANZETTI, 2002).

The total value of certified organic goods produced in India is estimated to be around US$ 18.5 million (2000/2001), whereas the figure for non-certified organic crops is around US$ 3.5 million (UN-ESCAP 2002, p. 6). India accounts in the world market for 11 % in organic products (SINGH, 2004). It does not import any organic products (YUSSEFI, 2003), because India is a producer of primary (non-processed) organic goods (UN-ESCAP, 2002). Major export markets for Indian organic goods are Europe (Netherlands, UK, Germany, Switzerland, France, Italy, and Spain), followed by North America (USA, Canada), the Middle East (Saudi Arabia, UAE), Asia (Japan, Singapore), Australia and South Africa (GARIBAY & JYOTI, 2003). Exports to Japan though, are difficult, as the certified Indian products have to be re-certified by a Japanese certifier and therefore make the Japanese organic market less attractive (MAHALE, 2002).

Organic export commodities are rice, wheat, tea, spices, coffee, pulses, fruits and vegetables, cashew nuts, cotton, oil seeds and medicinal herbs; all are sold through export companies, except organic tea (GARIBAY & JYOTI, 2003). Organic tea from

Darjeeling District, for example, is sold directly through the respective tea estate or via auctions (GARIBAY & JYOTI, 2003). Price premiums for the export market vary from country to country for different organic products, but on average about 30-50 % on trader level can be achieved, whereby organic tea fetches a premium of 47 % and spices 30 % (GARIBAY & JYOTI 2003, p. 28). Price premiums for domestic products of 20-30 % over conventional products can be reached (YUSSEFI 2003, p. 57; see table 3.5).

Table 3.5: Price premiums paid in Mumbai for organic goods
(Source: ORG-MARG 2002, in: GARIBAY & JYOTI 2003, p. 17)

Product	Organic (Price Rs./kg)	Conventional (Price Rs./kg)
Rice	32 – 110 (€ 0.64-2.2)	15 – 60 (€ 0.3-1.2)
Wheat	35 – 40 (€ 0.7-0.8)	15 – 25 (€ 0.3-0.5)
Coffee	475 – 1000 (€ 9.5-20)	350 – 500 (€ 7.0-10.0)
Tea	450 – 1300 (€ 9.0-26)	250 – 500 (€ 5.0-10.0)
Spices	400 – 1500 (€ 8.0-30.0)	250 – 800 (€ 5.0-16.0)
Pulses	50 – 75 (€ 1.0-1.5)	25 – 40 (€ 0.5-0.8)
Fruits	80 – 100 (€ 1.6-2.0)	20 – 100 (€ 0.4-2.0)

Organic vegetable production in **Japan** comprises of *"rice, green tea, green vegetables, sweet potato, taro, pumpkin, potatoes, citrus and many other fruits"* (VROLIJK & MAY 2001, p. 120). Organic goods under sale are mainly rice, soybeans and many processed foods, such as pickles, jams and juices, while fresh and frozen vegetables and fruits barely make *"less than five percent of the total certified organic trade"* (VROLIJK & MAY 2001, p. 122). Of the fresh organic products, vegetables are mostly onions, carrots, potatoes, bell peppers, salad vegetables, broccoli, cabbage, asparagus, pumpkins, sweet potatoes, green beans, ginger and taro; fresh organic fruits are mandarins, kiwis, strawberries, oranges, bananas and other tropical fruits (VROLIJK & MAY 2001, p. 122). By 2001/2002, certified organic farmland in Japan was 4,000 ha (ORGANIC MONITOR, 2002). The amount of certified organic fresh vegetables for 2001 was estimated at 2,750 t, whereas fruits were estimated at a level of 13,795 t (VROLIJK & MAY 2001, p. 127). The import volume of organic goods was estimated around US$ 90 million in 1999 (VROLIJK & MAY 2001, p. 126), while the market value for domestic certified organic products was about US$ 250 million (2000) (KORTBECH-OLESEN 2003).

The following chart (Table 3.6) gives an idea of the total volume of certified organic products, comprising of organic farming products as well as organic agricultural processed foods, which are certified in Japan and imported (IMAI, 2003).

Table 3.6: Domestic and imported organic certified products for Japan
(Source: IMAI, 2003)

	Certified Volume (in tons)			
	Japan		Imported	
	2001	2002	2001	2002
Organic Farming Products	34,000	47,000	155,000	118,000
Organic Agricultural Processed Foods	94,000	97,000	97,000	40,000
Total	128,000	144,000	252,000	158,000

As can be seen, there was an increase from 2001 to 2002 for the domestically certified products, i.e. farming and processed, whereas the imported goods show a decline for the same period. Types of certified organic farming products include vegetables, fruits, soybean, raw tea, rice and wheat. Examples for organically processed agricultural products are frozen and canned vegetables, drinks, green tea, soy sauce and tofu (IMAI, 2003).

Price premiums for Japanese organic products range between 20-30 % over conventional products, but they can also be at 100 % (VROLIJK & MAY 2001, p. 122) as the following example from a supermarket selling fresh ginger shows, the price varied between imported organic ginger (¥ 198; € 1.8), domestically grown organic (¥ 178; € 1.6) and imported non-organic (¥ 100; € 0.9) (VROLIJK & MAY 2001, p. 122). Organic products are sold with higher prices than conventional ones in supermarkets and specialized stores (Table 3.7).

Table 3.7: General indicator of price premiums for organic goods, Tokyo
(Source: KUHLMANN 2004, p. 17)

Product name	**Unit**	**Conventional product price in Yen**	**Organic product price in Yen**
Rice	2 kg	1,134 (€ 8.43)	1,554 (€ 11.55)
Tea	32 g	380 (€ 2.83)	557 (€ 4.14)
Coffee	500 g	924 (€ 6.87)	1,449 (€ 10.77)
Bananas	6 pieces	278 (€ 2.07)	350 (€ 2.60)
Lemon	3 pieces	230 (€ 1.71)	345 (€ 2.53)
Kiwi	3 pieces	270 (€ 2.01)	315 (€ 2.34)

A forecast on retail sales on organic food and beverages in Japan for the years 2003 and 2005 and for 2010 is given in table 3.8. No estimates for India are available concerning retails sales for 2003. Switzerland has been added for comparison only, being an industrialized, hilly and mountainous country in Europe (for details see *Note* below table 3.3).

Table 3.8: Market forecast for organic food and beverages
(Source: KORTBECH-OLESEN 2003, p. 24; *abridged*; WYNEN & VANZETTI 2002, p. 83)

Markets	**Retail Sales 2003 (million US$)**	**% of total Food Sales (estimates)**	**Annual growth 2003-2005 in %**	**Retail Sales 2005 (million US$)**
Japan	350-450	< 0.5	- (10-15 in 2010)	- (US$ 32,364-49,534 mill. in 2010)
Switzerland	725-775	3.2-3.7	5-15 (15-20 in 2010)	- (US$ 1,719-2,631 mill. in 2010)

Note: Official Trade Statistics are not available. Compilations are based on rough estimates. (KORTBECH-OLESEN, 2003).

In India, conventional vegetables mostly produced are leaf and root vegetables, such as cabbage and radish, as well as fruit vegetables, e.g. tomato and eggplant (KOBAYASHI, 1989). The dietary habit in Japan focuses more on leaf and root vegetables, which include Chinese cabbage, bamboo shoots and radish (KOBAYASHI, 1989). Detailed information on the vegetable consumption in India and Japan is given in table 3.9. Data are based on a survey that was conducted by the Asian Productivity Organization (APO) in 1989 to its member countries concerning economic importance of vegetable production[18]. Hence, the data is older, as the survey was conducted in 1989.

Conventional vegetable and fruit production for India was at 59 million t and 45 million t (2003), respectively (KIPE, 2004; VENKATRAMAN, 2003). Japan's figures (for 2002) were 13 million t for vegetable and 3 million t for fruit production (MAFF, 2004). The values for Japan are far below the production values of India, because of a much smaller agricultural area (see table 3.3). Marketing and sales for conventional products in India is conducted via wholesale markets of which 7,062 (2000) are traders, supermarkets, or is the own stall of the producer (DHANKAR 2002, p. 26) and in Japan through wholesalers, agricultural extension centres, supermarkets and convenient stores (SETO, 2002).

[18]There are 17 member countries of the APO, but 12 responded to the survey, among them India and Japan. The 11 member countries of the APO that responded were: Republic of China, India, Indonesia, Iran, Japan, Republic of Korea, Nepal, Pakistan, Philippines, Sri Lanka and Thailand. The survey was conducted due to the importance of vegetables and to collect statistical data, to use for further reference; therefore, all tropical and temperate-zone vegetables of economic importance of the member countries were regarded and those that are essential to diet were chosen as well (KOBAYASHI 1989, p. 19).

Table 3.9: Vegetables of economic importance for India and Japan, as APO member countries
(KOBAYASHI 1989, p. 30-32; *abridged*);
*** = Most important; ** = Second most important; * = Third most important

English or Commercial Name	Botanical Name	India	Japan
Beans (kidney bean)	*Phaseolus vulgaris*	✓	
Bell Pepper	*Capsicum annum*		✓
Bitter Gourd/Bitter Cucumber	*Nomordica charantia*	✓	
Bottle Gourd	*Lageneria siceraria*	✓	
Eggplant	*Solanum melongena*	✓ (**)	✓
Cabbage	*Brassica oleraceae*		✓
Carrot	*Daucus carota*		✓
Chilli Pepper	*Capsicum annuum*	✓	
Chinese Cabbage	*Brassica pekinensis*		✓ (***)
Cucumber	*Cucumis sativus*		✓ (*)
Edible Burdock	*Arctium lappa*		✓
Garden Beet	*Beta vulgaris*	✓	
Garlic	*Allium sativum*	✓	
Green/Welsh/Bunching Onion	*Allium fistulosum*		✓
Lettuce	*Lactuca sativa*		✓
Melon	*Cucumis melo*		✓
Onion	*Allium cepa*	✓ (*)	✓
Pumpkin and Squash	*Cucurbita spp.*		✓
Radish	*Raphanus sativus*	✓	✓ (**)
Spinach	*Spinacia oleracea*		✓
Strawberry	*Fragania ananassa*		✓
Taro	*Colocasia esculenta*		✓
Tomato	*Lycopersicum Esculentum*	✓ (***)	✓
Watermelon	*Citrullus vulgaris*		✓

3.2. Distribution Systems for Organic Products in India and Japan

The following sales channels for organic products are used:

- special stores and supermarkets (Japan)
- direct purchase from the organic farmer (India, Japan)
- food delivery systems to the consumer (Japan)

In **India**, a direct sales system for organic products on the domestic market has developed recently: *"Thus in most Indian cities there are now small groups which attempt to forge direct linkages between organic farmers and urban consumers. For example, the Green Bazaar in Mysore is a direct-marketing initiative whose members are committed to an alternative marketing system where producers themselves market their own products. This fortnightly market founded in December 1997 aims to serve the needs of organic producers and consumers"* (BAKSHI, 2001). Next to Mysore (Karnataka), a weekly organic market has developed in another hilly region, namely in Marappanmoola of the Wayanad District (Kerala) (SURENDRANATH, 2003). But as this organic market remains limited to the elite, due to their higher purchasing power for premium prices, it is necessary to promote farmer-consumer ties, which ultimately lead to achieve better prices for the farmers and still *"not make the produce as expensive as it becomes in boutique-like health food stores"* (BAKSHI, 2001).

Organic goods like rice, wheat, coffee, pulses, fruits and vegetables are mainly distributed through wholesalers, supermarkets and small stalls of the producer. The products stem in majority from small farmers, whereas wholesalers/traders account for at least 60 % of the distribution (GARIBAY & JYOTI, 2003). Supermarkets and restaurants are further marketing channels. The main markets in India are big cities like Mumbai, Delhi, Kolkata, Chennai, Bangalore and Hyderabad (GARIBAY & JYOTI, 2003).

For the **Japan**ese consumer, different means of purchasing organic products exist: postal system, retail outlets and the TEIKEI system. TEIKEI describes a system of close farmer-consumer cooperation or *"direct co-partnerships between producers and consumers"* (MIURA, 1993, cited in: ARAKAWA 1995, p. 17; AHMED, 1994). Thus, this system operates outside of the conventional sales channels (NÜRNBERG GLOBAL FAIRS, 2002). The TEIKEI system was started in 1971 by the Nihon Yuki Nogyo Kenkyukai (Japan Organic Agriculture Association – JOAA), and the term "Organic Farming" (Yuki Nogyo) was introduced to Japan in the same year as the association formed (ARAKAWA, 1995). The uniqueness of TEIKEI is represented by the way it operates: Not only do the consumers buy all the grown crops regardless of any fluctuation in harvest, which leads to the motto of TEIKEI to 'eat from root to leaf' (JOAA, 1993), the consumers can also help the farmer on the field for harvest in peak seasons. This is a means to deepen the understanding for agricultural farming and help the farmer financially by sharing production and delivery costs (ARAKAWA, 1995). In return, the farmer is obliged to produce safe, healthy and nutritional food, without any chemicals to be applied (AHMED, 1994). The farmers' main priority though is to feed his own family (self-sufficiency) and to sell the surplus to consumers (JOAA, 1993; KAVANAGH, 1997). Most importantly, the co-operation between farmer and consumer is based on a creative and friendly relationship – not on profit-making (KAVANAGH, 1997; ARAKAWA, 1995). There are several co-partnerships possible. According to ARAKAWA (1995), either one consumer group has a contract with one or more farmers *or* several consumer groups can be working together with one farmer or farmer groups (e.g. rice farmer, vegetable farmer, dairy farmer). There are certain problems facing the continuation of TEIKEI, such as the ageing of the farmers, and furthermore, the children of the older farming generation are not tempted to keep on working in agriculture, they much rather want to move to the cities in search for better job opportunities (JOAA, 1993; KAVANAGH, 1997). To underline the special system of TEIKEI, a summary of the 'Ten Principles of TEIKEI' is listed below (JOAA, 1993; KAVANAGH, 1997):

1. To establish a partnership based on friendship, not on business
2. Planned production in mutual assent between the producer (farmer) and consumer
3. Acceptance by the consumer of all products from farmer
4. Mutual agreement on prices
5. Exchange of information and communication to solidify respect and trust
6. Self-distribution of crops either by producers or consumers
7. Democratic group activities
8. To take interest in organic agriculture related issues (self-education programs)
9. Maintenance of small groups to ensure face-to-face work
10. Consistent progress towards the realization of the aims: organic agriculture and ecologically sound life

Two studies were carried out to estimate the number of households that are engaged in TEIKEI, one in 1991 by Kokumin Seikatsu Senta, who determined about 150,000 households (1990); the other by JOAA, in 1989, who calculated about 10,000 households (ARAKAWA 1995, p. 21). This discrepancy is due to the fact, that the TEIKEI meaning is more strictly defined by JOAA as a “co-partnership”, with *“a mutual relationship between producers and consumers”* (ARAKAWA 1995, p. 21). The former study though emphasizes mainly the *“direct purchase of organic crops from organic farmers”* (ARAKAWA 1995, p. 22).

The postal system in Japan uses distributors who collect organic products from a warehouse or directly from the farmer and deliver it to the house of the contract customer/consumer, or to a designated pick-up point. This facilitates the situation especially for women, who work and do not have the time to pick up the products from the farmer (AHMED, 1994; ARAKAWA, 1995). On average, about three to 20 households are part of the postal service, but some have expanded from 10,000–35,000 households, which are being supplied weekly (AHMED, 1994).

In recent years, natural food stores have picked up the trend of selling organic products; roughly about 150 retail outlets are located in Greater Tokyo (AHMED, 1994; JOAA, 1993). There are also big companies like Kirin, interested in expanding into the organic market (YUSSEFI, 2003). Wholesalers and greengrocers, however, had slowly started selling organic products in the second half of the 1970s (JOAA, 1993).

According to VROLIJK & MAY (2001), the distribution of organic goods breaks down as follows: 55 % or more through TEIKEI systems; 25 % through distribution organizations that specialize in organic food; 10 % by food processing and manufacturers, and 5 % each for the two groups of food brokers/traders and wholesale/warehouse organizations.

Personal talks were held with a TEIKEI consumer group and companies engaged in a larger scale TEIKEI distribution system, which will give a better insight into the marketing and distribution system operating in Japan:

A personal communication with a TEIKEI consumer group in Fujisawa City of Kanagawa Prefecture was held on 25th November 2002. The group leader is Mrs. Mariko Asai; the talk was conducted with her and Mr. Kawakami, a member who served as a translator. The group was founded in 1971. The shop at its present location in Fujisawa City was established in 1992. Mrs. Asai got the idea of creating a TEIKEI consumer group, when her daughter developed an allergy related to agrochemical residues in food in the late 1960s. Mrs. Asai, a mother and housewife at the time, started to collect data and information from doctors and farmers about allergies and its connection to agrochemicals. She then printed a pamphlet at her home, warning about chemical residues in food as well as the importance of food safety and distributed these to other housewives and mothers. It attracted about 40 members at first. Since at the time Mrs. Asai had a job and a little daughter, only weekly meetings were held over a period of three months (i.e. 12 meetings). After the meetings were over, nearly all of the members wanted to continue. Therefore, for the next 3-4 years, she with the other members studied the current situation of chemical residues in food, healthy nourishment, food safety and direct supply possibilities from farmer to consumer. This lead to the establishment of their TEIKEI group and shop in 1971 in Fujisawa City. Their aim is to support the organic farmer and educate the consumer to support the organic farmer.

At present, there are ten members working in the shop, including Mrs. Asai. The rest of the members (consumers) are 120 plus ten farmers. Mrs. Asai prefers to keep a small consumer group (*"Small is beautiful, it enables a better help for and better interaction/relationship with the farmer; too many members make the organisation incoherent"*). The farmers do not have to be members of the group but mainly supply the food, whereas the consumers have to be members. It is more important to have a face-to-face relationship with the farmer (then him being a member). New consumers, who want to become a member, are selected by Mrs. Asai by informing them about the aim and purpose of the group and asking them why they want to a become member. Some only want to join because of the discount they receive on the products as a member (these people are rejected). Members pay a fee of ¥ 3,600 (€ 30) per year or ¥ 300 (€ 2.5) per month, which includes a discount. Only some customers pay twice a year (an instalment), but most of them pay the entire amount in one time. The amount spent for the products is about ¥ 2,000 (€ 17) per month. Most of the members buy all their food requirement from the shop, which not only contains fresh vegetables, but equally many finished products, i.e. cookies, natural soap, shampoo made from seaweed extract, cooking oil and even a pan for cooking brown rice. Overall around 300 different items are available in the shop. Though not all products in the TEIKEI shop are certified organic, some do carry the official JAS logo. For the consumers the organic certification is not so important, rather their trust and confidence towards Mrs. Asai, her judgement and her personal friendship with the organic producers and their organic products is sufficient. The areas from where the organic products reach the shop come from all over Japan: beans from Aomori (near Hokkaido) and Sado Island, green tea from Shizuoka, black tea from Kyushuu and vegetables from Kanagawa Prefecture.

Besides having families as members, some singles or young people are part of the group as well. The members do not have to buy a fixed amount of goods and they are also not bound to only buy from the TEIKEI shop; they are free to buy from supermarkets as well as directly from the farmer. The shop delivers the following areas with organic produce: Fujisawa, Kamakura, Ebina, Yokohama, Zushi and Odawara, all located in Kanagawa Prefecture. Whereas people from nearby Kamakura (ca. 6-7 km), Zushi (ca. 10 km), Ebina (ca. 14 km) and Yokohama (ca. 14 km) mostly come themselves to the shop, further away situated Odawara (ca. 30 km) is supplied by post. The latter is a box with the requested items that is packed at the shop and sent by postal service. The shop is open five days a week, which gives the consumers enough time and opportunity to buy the required organic goods. The home delivery service is called 'Takuhai-Bin' and is used for the personal members, where the box comes to one family individually delivered at the doorstep. The pick-up point is called 'Post', where the customers have to go every week. Every post has a post chief who takes care of the members. When there is a price or quality problem, they hold a meeting to resolve that.

Every personal member has to buy Co-operation goods 'Kyoryoku-hin', about three times a year; the average price is about ¥ 5,000 (€ 42) per box. The post members too have to buy the Kyoryoku-hin every month, with an average price of the items costing about ¥ 2,000 (€ 17).

Besides vegetables, these boxes include tea and fruits, as well as special products during a certain season.

Over this long period of time, when the consumer group was first established, Mrs. Asai has come to know all the producers (i.e. farmers) personally, who supply the shop, as well as their families and their way of life. Not all the farmers were organic from the beginning, and thinking of 1971, there were hardly any organic farmers. As no actual survey was done at/for that time on organic farmers by the government, there are unfortunately no figures available.

It took Mrs. Asai long time to convince the farmers to convert to organic production methods, but she succeeded. For example, the green tea supplier from Shizuoka turned into an organic green tea grower after Mrs. Asai convinced him of the positive aspect and necessity to grow organically. In later years, some conventional farmers asked Mrs. Asai on how to become an organic farmer. Every prefecture has its Prefectural Agricultural Extension Center ('Noogyo Fukyu Centre'), which are subject to their prefecture and not to the Ministry of Agriculture, Forestry and Fisheries (MAFF), they advise the farmers on farming and agricultural practice. Mostly these centres advise on conventional farming practices even if the farmer is organic. Therefore, Mrs. Asai has also organised many meetings with the centre to discuss organic farming practices. Additionally, a newsletter is published about four times a year in January, March, July and October. The consumer group used to hold regular meetings, but due to the lack of time from the customers, meetings are only held if there is a problem.

To the question, if she sees any changes in the family life of her customers, she states that the wives who have changed the family diet by cooking brown rice instead of white rice, their husband’s blood pressure has become lower. It is important for her shop workers to be healthy as well. As for her husband, she says he has seen the positive difference in their daughter’s condition by the change from conventional to organic food.

Asai's TEIKEI consumer group is not the only one in the Tokyo area. There also is 'Daichi-O-Mamoru-Kai' a large consumer group based in Tokyo, with warehouses in the metropolitan area. The main difference between these two groups and Asai's group is the size.

On January 06th, 2003 a personal communication was done with “Daichi-wo-Mamoru-Kai” (The Association to Preserve the Earth, hereafter Mamoru-Kai) that is an NGO promoting organic agriculture. Talks were conducted in Tokyo with Mr. Noda, the Director and Mr. Toyoshima from the International Department. The word 'Daichi' stands for “the earth” and “the soil”. Daichi was founded as an NGO on August 19th, 1975 with the aim of promoting organic products. In November 1977, Daichi Co., Ltd (hereafter Daichi Co.) was established as a food distribution company for organic products. Mamoru-Kai established the company or the corporate organization and called it “Daichi Co., Ltd” in order to increase the number of organic farmers through selling their products. Both Mamoru-Kai and Daichi Co. host events, where the (city) customer can experience harvesting on the field of the Daichi Co.’s contracted farmers (they are also members of Mamoru-Kai) and therefore enabling a direct interaction between these as is done in the TEIKEI system.

The founders of Daichi Co., who themselves were in their 20's, started selling the products at open markets in apartment complexes in Tokyo (DAICHI, 2002a). Their principles and beliefs are as follows: to promote domestic agriculture, fishery, livestock industry and forestry in a sustainable organic way since self-sufficiency of food in Japan is less than 40 % (caloric basis). In order to put this into practice: to pay fair prices to the farmers to ensure that they can continue their living, to encourage farmers to keep up farming. They basically deal with domestic products except some imported goods such as coffee, which is not produced domestically in Japan. And these goods would only be imported on fair-trade basis. Mamoru-Kai has established partnerships or friendships with agricultural organisations overseas like South Korea, China, Mongolia, Thailand, Vietnam, Nepal, Germany and Spain to promote organic farming.

Daichi Co. offers a training “school”, called the Asian Farmers Hot College, which means the school is on the farmers' field in Japan, where people from other countries can come and learn about organic farming and its marketing. The farmers are contracted Daichi Co.’s farmers as well as members of Mamoru-Kai. Furthermore, Daichi Co. and Mamoru-Kai define their role between Citizen’s Movement and Business Activities, as follows (DAICHI 2002b, p. 5): Citizen’s Movement deals mainly with food and agricultural problems; they promote the communication between farmers and consumers, with agricultural organisations and NGO's overseas, as well as promoting the exchange of farming techniques between farmers.

In the Daichi Co. group, there are less than 200 full-time and about 200 part-time workers. With around 2,500 producers (farmers, fishermen etc.), the company provides goods for nearly 60,000 consumers, as of October 1, 2002. All of them are also members of Mamoru-Kai. The targets are mainly young couples in their late 20's till 40's. Some of them are long-membership customers, others stop buying from Daichi Co. once their child has (or children have) grown up. Some consumers are also senior citizens, who are another main focal point in the future.

The company offers a wide range of organic products, both in the food and non-food category. Food items would include milk, vegetables, fruits, seafood, wheat products, in other words, nearly everything which is also available conventionally. In the non-food category, carefully chosen products such as shampoo, soap, clothes, bed covers and pillows are offered. A total of 3,500 items can be purchased. Some carry the JAS "organic" logo. The membership fee is ¥ 1,000 (€ 8) annually. The average amount that is spent by the consumers is about ¥ 7,000-9,000 (€ 58-75) per week. People of lesser income such as seniors and students can also just order a bottle of milk.

The main supply areas for the products are the prefectures in Kanto: Tokyo, Chiba, Saitama, Kanagawa and Yamanashi. The collection of the products and the packing is done at Daichi Co. As a retailer, delivery systems include home delivery to each household individually by truck and courier; there is also group-buying delivery, which means delivery to pick-up points, where the consumer will pick up his or her supply. Both are on a once-a-week basis. If an order comes in today, then by next week it will reach the customer. The customer cannot buy directly from a contracted Daichi farmer. As a wholesaler, items are supplied to natural food shops, co-operatives, supermarkets and to school canteens.

When Daichi Co. contracts a farmer each season, they discuss about the quantity they will buy and the price, which does not change all year round. This is to ensure a steady purchase, even if harvest is lower in a certain year. The farmer also will receive the Daichi Basic Standards Guidelines and is asked if he or she can produce accordingly and asked to keep records in prepared documents. Furthermore, the credibility is checked as well, by frequently visiting the farms and farmers. These visits enable Daichi Co. to establish a friendship-relationship with the farmers, because, as Mr. Toyoshima put it *"a friend is less likely to cheat you"*. The checking includes the composition of soil, the growth and the residues (soil analysis). Soil analysis is carried out either at the company laboratory or at a professional testing lab. The domestic certification agency for Daichi Co. is AFAS, which certifies according to standards, applying ISO 14001 methods. When the farmer follows JAS organic standards, they will check if the farming is done according to it. When the farmer follows Daichi Co.'s standard, they will check it accordingly. Though Daichi Co.'s standard is comparatively lower than JAS organic standard, Mr. Toyoshima explains that their standards were made for promoting organic agriculture in overall Japan where there are many variations of climate pattern and soil conditions and that they spent a few years for discussions with many member farmers about what they have been doing in an organic way. And he also explains that JAS organic standard conforms to foreign standard such as Codex and IFOAM basic standard that has been developed in European climate, not in Asia or in Japan. Furthermore, detailed recordings by the farmer e.g. on planting, crop rotation, and manure with many detailed questions from Daichi Co. are a necessity for the farmer and Daichi Co. to keep track (traceability) of the farming practice and harvested products.

Daichi Co. and Mamoru-Kai host events for their customers (or its members) mostly on weekends all year round, so that the members can go for a day to one of the contracted farmers to experience harvesting vegetables or fruits. They might go to the nearby fishing towns such as Izu Peninsula to experience fishing using fisherman's net etc (the Peninsula is located next to Shizuoka Prefecture, the tea growing area); the children also attend the autumn harvest of vegetables. Furthermore, Daichi Co. and Mamoru-Kai offer two to three day trips to Aomori (North part of the biggest island Honshu) to experience harvesting apples, to Iwate Prefecture for livestock farming or to Tokunoshima or Tokuno Island (North of Okinawa Island) for experiencing the harvest of vegetables and fruits such as potato and mango. In Chiba, Mamoru-Kai has rented a plot of paddy field, where consumers plant the rice seedlings in April and harvest it in October, weeding is done once a month. The seedlings have been prepared, i.e. grown by the farmer who owns and maintains the plot.

On February 25th, 2003 a talk with Mr. Toshiki Imai, President of POLAN-HIROBA, which is the organic products distribution network in Tokyo took place. The name POLAN comes from the English word "pollen", which means that the distribution system and availability for organic products should grow and spread as fast as pollen do. Prior to founding POLAN, Mr. Imai was part of the Japan Agriculture Community (JAC), which was a movement for organic products at first, and then it became a distribution company. But the members rather wanted to continue the movement. Therefore, POLAN was established by those people who had a previous connection with JAC, from Hokkaido, Osaka, Nagoya and Kyushu. POLAN, which started in 1982 is not a company as such, but rather an organic network of groups called "POLAN Organic Farming

Association" (POFA). POFA was established in 1997. POLAN groups are located in Hokkaido (North), Saitama, Tokyo (both in the Centre of Japan), and for the South in Nagoya and Osaka. The latter two offices provide the Kansai Region with organic products; the Saitama office covers the Kanto Prefectures of Chiba, Tochigi and Gunma; whereas the Tokyo office covers Saitama Prefecture, Tokyo Metropolitan Area and Kanagawa Prefecture. Each region has distribution/delivery centres as well as many outlet shops, e.g. organic vegetable shops. All of these retailers are individual companies that are therefore part of the network. These shops buy from wholesalers and then sell to their own customers; therefore, they are individual companies. The concept of the shops is to have a local production and local consumption; but due to seasonality, there is an exchange of products e.g. between the Kyushu and the Hokkaido shops.

The Saitama office has a staff of 35 and 60 part-time workers. That office wholesales to Polan Delivery Company and retailers. Each customer receives the delivery personally by Polan cars. According to the delivery company, delivery to the consumers is done once per week, their expenditure on organic products ranges between ¥ 6,000-8,000 (€ 50-67). The vegetable pack of ¥ 1,000 (€ 8) for members is fixed, which every member is expected to buy. Since the delivery fee itself is ¥ 300 (€ 2.5) students or people with smaller incomes can rather buy the products at the POLAN shops. The membership fee is ¥ 5,000 (€ 42) on entering, and annually it has the same fee. There are about 3,500 consumers in the Tokyo area, in Saitama 1,800 and in the Kansai region 10,000 consumers. The target age group is 30 years and younger with a little child. POLAN provides and sells all products on vegetables, fruits, seafood, dairy products, pickles, oils, vinegar, coffee, tea and clothing. Most products are domestic, but some products are imported, for example, organic banana, and coffee, some kinds of tea, which are impossible to produce within the country (coffee is imported from Brazil, Mexico and Ecuador). Of the products range, approximately 40 % are farming products, 30 % processed foods and about 28 % are bread, fish and meat. Just 2 % are others, like toothpaste, blankets, skincare goods and others. Of all products 45 % are organic. Now the JAS organic standards cover just organic farming products and organic processed foods based on organic farming.

When a new farmer is contracted, POLAN will visit the farm but not conduct any soil testing. They rather ask the organic farmer to get a certification. Since these are expensive, a group certification is conducted to reduce the costs, which are ¥ 40,000 (€ 335) per year. In addition, POLAN adds 1 % on the price. This means, if an organic farmer produces at a value of ¥ 4,000,000-7,000,000 (€ 33,300-58,300) then POLAN puts 1 % on the price for the certification fees. Up till 2003, POLAN had been buying the products from the farmer at a fixed price, but since 2003 they want to make the price dependable mainly on the quality and then on yield. There is a kind of trust between the farmer, wholesaler/retailer and consumer on which the 'Sakutsuke' is based: this is a style of contract e.g. between a retailer and the farmer or wholesaler and farmer for organic products, which is not a written contract but rather an understanding. On a visit to organic farmers in Tochigi Prefecture with POLAN staff, which the author accompanied, the talks between POLAN and their contracted farmers evolved around the planned production for the year 2003, the quality and other issue, but in a simple manner, casual and based on mutual understanding.

Furthermore, consumers, who are members of POLAN, can have face-to-face contact with the farmers at live events in autumn. The consumer can help out on the farm if he or she wants to, but it is not compulsory. Meetings are also held between POLAN and the farmer once or more per month, depending on the vegetables to be produced; General Assembly is held twice a year. If a new farmer wants to be part of POLAN, they will ask one farmer to find other farmers and form a farmers group.

The POFA company structure is as follows: the General Assembly allows the farmers to discuss their production planning, such as product, variety, price and amount. Even the wholesalers and retailers discuss their sales plans. The category Crop Producers / Livestock Producers Group and Processors Group, gives the producers the opportunity to exchange technology, skills and information on organic farming. The producers group has the most members. The Wholesalers and Retailers Group hold monthly meetings for discussion of sales plans. The members of these two groups do operate as individuals, but they work together on such activities as catalogue publication, sales promotion, or seminars for the public. The Consumer Group helps the customer with cooking classes in which the organic food can be utilised suitably. The secretariat is involved in five categories, namely providing (I) Information on organic production, certification, agriculture, funding; (II) Consulting on organic production and certification, problems, compatibility to POFA and JAS standards; (III) Publication of newsletters and brochures: a weekly catalogue with available products listings; (IV) Monitoring activities such as random sampling of products and testing chemical residues; (V) Public

Relations by working together with other organic groups regionally, nationally and internationally.

Finally, an interview with 'Tabe Ken', a TEIKEI delivery company was held on February 26, 2003. Tabe-ken is located in Kokubunji, Tokyo Metropolitan Area. The name is put together from the words: "Taberu" (to eat) and "Kenkyu" (research). This company was founded in 1976 by Mr. Kimura first in Kunitachi. In 1994, the company moved to Kokubunji. Mr. Kimura had set off the 'Jimoto no Nogyo wo Kangaeru Kai' ("Conference to think Local Agriculture" action of Mrs. Asai, who had founded the TEIKEI shop in Fujisawa). The staff comprises of five members. Sales reach about ¥ 70 million (€ 580,300) per year. Since the past ten years, membership has been declining, but in the past two years there has been an increase. They have about 200 families who are members, mostly in the age group of 30-65 years.

The membership fee is ¥ 2,000 (€ 17) upon subscribing, the annual fee is ¥ 1,200 (€ 10). The average expenditure by consumers per week is about ¥ 7,000-8,000 (€ 58-67). Delivery is done through trucks and cars once per week. The delivery area is mainly the western part of Greater Tokyo Metropolis: Kokubunji, Kunitachi, Tachikawa, Akishima, Kodaira, Higashi Yamato, Higashi Murayama, Koganei, Fuchu, Hino, Inagi, Tama and Hachioji. Some farmers do the packing themselves and bring the products to the warehouse, in other cases, the products are packed directly at the warehouse. The products come from nearby local farmers, but some products come from all over Japan. Green tea (organic) for example, comes from Shizuoka Prefecture; rice (organic) from Yamagata Prefecture, soy sauce and miso, a paste made out of soybean, also both organic come from Saitama Prefecture; milk (not organic) from Gunma Prefecture; tangerine, renkon, a lotus root and oil (organic) from Kyushu and organic banana from Okinawa. About 90 % of the vegetables and fruits are organic. Furthermore, products such as bread, vinegar, toothpaste and shampoo which are not organic are sold as well.

The members can do voluntary work on the organic farm if they want to, mostly in spring (March-June), for example on Suzuki-san's farm in Hachioji. Every year in winter there is an event called 'Ochiba Haki' where the members collect fallen leaves to make compost on the organic farm, for example on Shimizu-san's farm near Mizuho. Afterwards there is a celebration. Twice a year a general assembly is held for the farmers, members and staff. Publications include a monthly pamphlet with information on events and news and a monthly newsletter lists the available products.

3.3. Organic Standards and Certification in India and Japan

"An important development was the approval of the joint FAO/WHO food standards programme of the Codex Alimentarius Commission, of guidelines for the production, processing, labelling and marketing of organically produced foods. These standards are essential to promote the development of national legislation, encourage international trade and provide consumer confidence in certified organic products" (UN 2000, p. 12). The Food and Agricultural Organization (FAO) and the World Health Organization (WHO) created the Codex Alimentarius Commission in 1963 to create guidelines as quoted above (SINGH, 2004). These guidelines enable countries to develop standards or regulations based on the Codex, but it is not necessarily meant for the certification of products (SCHMID, 2002). It aims at protection of consumer health and making sure that fair trade practices take place concerning food trade (SINGH, 2004). As most countries base their own standards and regulations concerning organic products not only on the Codex but also on the EU Regulations and IFOAM Basic Standards, it is necessary to understand the differences between these three. The following explanation will give a short overview of the latter two (SCHMID 2002, p. 12): *"The EU text acts as direct production standards with the aim to equalise market in the*

EU. It has the status of a law", whereas IFOAM has made *"world-wide standards for standards, which also act as a guide to others, e.g. what accredited certifiers have to fulfil."* Therefore, Codex and IFOAM rather outline principles and criteria that need to be accomplished, but are more general in content and less in detail than the EU standards (SCHMID, 2002).

"Use of the label 'certified organic' developed as a way to assure consumers that the food they are eating is, in fast, grown according to the practices that are commonly associated with the word 'organic' " (EAP, 1989). The International Federation of Organic Agriculture Movements (IFOAM) introduced certification on an international level in 1992, to establish global guidelines for products from organic agriculture (YUSSEFI & WILLER, 2002). Though certification existed in a few countries, they differed greatly from each other in their standards. Hence, the IFOAM Accreditation Program (IAP) was set up *"to provide international equivalency of organic quality claims"* (HERRMANN 2003, p. 31). There are two types of standards applied for inspection and certification of organic goods worldwide: one is based on voluntary/civil certification norms, the other on statutory certification norms (SINGH, 2004). The prior is conducted by voluntary international agencies such as Codex, IFOAM, Naturland, Demeter and the Soil Association; their guidelines are stricter than statutory norms (SINGH, 2004). Governments issue the latter, for example regarding import and certification of organic goods, but there is a lot of overlapping of the two norms (SINGH, 2004). By the end of 2001, India and Japan were among the very few countries within Asia to have a fully implemented certification regulation in place, next to China, Korea and Taiwan (THE ORGANIC STANDARD, 2002).

Although external inspection and certification agencies had initiated programmes in **India** as early as 1987, there was no government regulation in effect (YUSSEFI, 2003). In April of 2000, the Indian Ministry of Commerce (MoC) appointed the National Steering Committee (NSC), which in turn set the regulations for organic certification, termed 'National Programme for Organic Production (NPOP)' (THE ORGANIC STANDARD, 2002); these are based on European/US/Japanese and Codex standards (SINGH, 2004). The NSC has appointed licensed agencies, which accredit [19] individual inspection and certification agencies. The regulations upon which accreditation agencies can operate were established in May 2001 and the implementation of the rules and standards has been in effect since October 2001 (THE ORGANIC STANDARD, 2002).

[19] Accreditation means "*the inspection of certifiers*" (HERMANN 2003, p. 27).

The agencies comprise of the following boards: Agricultural and Processed Food Products Export Development Authority (APEDA), Tea Board, Coffee Board, Spices Board, Coconut Development Board and the Directorate of Cashew and Cocoa Board under the Ministry of Commerce and Industry (The Hindu Business Line, 2002; Singh, 2004).

Inspection and certification bodies are, as already mentioned above, accredited by Indian accreditation agencies. These permit the former to carry out inspection and certification physically for organic products in India, by visiting the farms and conducting on-site inspections (The Hindu Business Line, 2002). By December 2002, the inspection and certification agencies are as follows (Garibay & Jyoti 2003, p. 13):

- ECOCERT International (based in France and Germany, branch office in Aurangabad)
- IMO India Pvt. Ltd. – Institute of Marketology (based in Switzerland, office in Bangalore)
- INDOCERT (based in India, office in Aluva, Kerala)
- LACON GmbH (based in Germany, office in Aluva, Kerala)
- SGS India Pvt. Ltd. (based in Switzerland, offices in Delhi and other cities)
- SKAL International (based in the Netherlands, branch office in Mumbai)

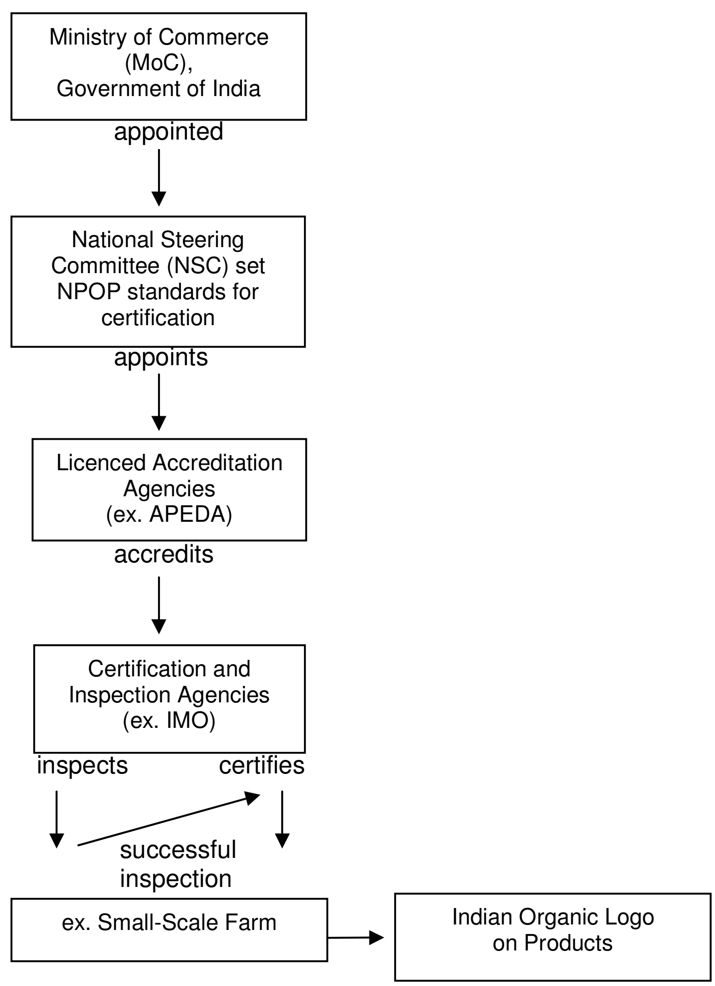
In July 2002, the Ministry of Commerce launched the 'Indian Organic Logo' (Fig. 3.2) in New Delhi (The Hindu Business Line, 2002). This enables India to participate on the international market for organic products. One should be aware that this measure for authentication is only meant in regard to the manufacturers and exporters of Indian organic products such as organic tea from Darjeeling District or spices, and not geared at domestic organic crops or creating awareness for the inland consumers (Singh, 2004; Parrot & Marsden, 2002; The Hindu Business Line, 2002).

Fig. 3.2: Indian organic logo used on certified products
(Source: APEDA, 2003)

Inspection is necessary for a farmer who wants to sell his items as 'organic', especially on the international market. If the applicant fails to comply with the standards set by the government, then certification is denied. After further improvements, and another inspection (or several inspections), the certification is given, if the farmer is able to fulfil all criteria of the standards. Certification means that a third party verifies a product or process; these have to comply with particular requirements (MACLAREN, 2002). Only then will the producer obtain the licence to use the organic logo on the products and packing material (THE HINDU BUSINESS LINE, 2002).

The simplified diagram below (Fig. 3.3) is intended to give an overview of the certification chain in India, as described above.

Fig. 3.3: Inspection and certification chain in India for organic products
(Source: own projection *based on* THE HINDU BUSINESS LINE, 2002;
SINGH, 2004)



The cost of inspection and certification, especially for small-scale farmers is quite high: just the travel and inspection fee per day would cost a farmer Rs. 12,000 (€ 240) (GARIBAY & JYOTI 2003, p. 13). This makes it difficult for them to afford this measure. Table 3.10 below gives an indication of the fees necessary to be paid to a certifying agency in India, which differentiates its fees between small farmers and estate manufacturers. Whether individual certification or certification in general is really beneficial to small-scale farmers, that aspect is discussed in chapter 5.1.5., as well as alternatives to certification.

Table 3.10: Cost of inspection and certification in India (in Rupees)
(Source: ORG-MARG 2002, in: GARIBAY & JYOTI 2003, p. 13)

Category	Details	Fees (Rs)	(€)
Small farmers and co-operatives	Travel and inspection	12000/day	(240)
	Report preparation	5000 flat fee	(100)
	Certification	5000/certificate	(100)
Estate manufacturers and exporters	Travel and inspection	19200/day	(384)
	Report preparation	5000 flat fee	(100)
	Certification	5000/certificate	(100)
Large and medium-sized processors	Travel and inspection	16800/day	(336)
	Report preparation	5000 flat fee	(100)
	Certification	5000/certificate	(100)

In 1992, **Japan**'s Ministry of Agriculture, Forestry and Fishery (MAFF) issued guidelines for different farming practices. These guidelines were supposed to help farmers and consumers alike by labelling their products as organic, no pesticides, or as reduced pesticides and/or chemical fertilizers used. Many consumers were dissatisfied with this system, because no enforcement tools were used. Therefore, the Codex Committee issued "Guidelines for the production, processing, labelling and marketing of organically produced foods" in July of 1999. These were still no national legal standards. The MAFF came under pressure to revise the Japanese Agricultural Standards, also know as JAS and established an accreditation and inspection scheme, which was issued in June 2000 (YUSSEFI & WILLER, 2002). Furthermore, *"the Ministry launched standards for organic agricultural products and organic agricultural processed products, following guidelines adopted by the Codex Committee"* (YOKOI, 2002). When the JAS Organic Mark and certification regulations were officially implemented in April of 2001, many other farmers who sold their products as 'Specially Cultivated Crops' or 'Green Vegetables'[20] suddenly could not market them anymore since they could not comply to the revised law (YOKOI, 2002; KORTBECH-OLESEN, 2003). This was the reason

[20] The term 'green vegetables' refers to vegetables cultivated with reduced pesticides, which was also used by the producers to sell the crops as environment-friendly prior to the implementation of the organic law (YOKOI, 2002).

why prior to the revised law in 2000, the market for green products including organic, was estimated to be about US$ 2-2.5 billion; after the new law took effect, the Japanese market value for organic certified products in 2000 was re-estimated at around US$ 250 million (Kortbech-Olesen 2003, p. 23).

Once a JAS certificate is given to an organisation, as it is not given to a product, land or processing plant (Sakuyoshi, 2001), the organic logo can be used on the product. An organisation is categorised into production, sub-divider, manufacturer and importer (Sakuyoshi, 2001).

There are three ways for obtaining the Organic JAS mark (Nürnberg Global Fairs, 2002; The Organic Standard, 2002). It should be noted that the labelling regulations only cover crops and processed foods, excluding marine and livestock products (Sakuyoshi, 2001): a producer or supplier from overseas could get the JAS certification from a foreign agency, which is certified by the Japanese government. This type of foreign agency is named Registered Foreign Certification Agency (RFCO) of which there are 20 by 2004 (Kuhlmann, 2004). In this case though, *"the foreign organisation must have its business establishment in a country that is deemed to have a system equivalent to that of Japan by MAFF"* and be approved by MAFF (The Organic Standard 2002, p. 8).

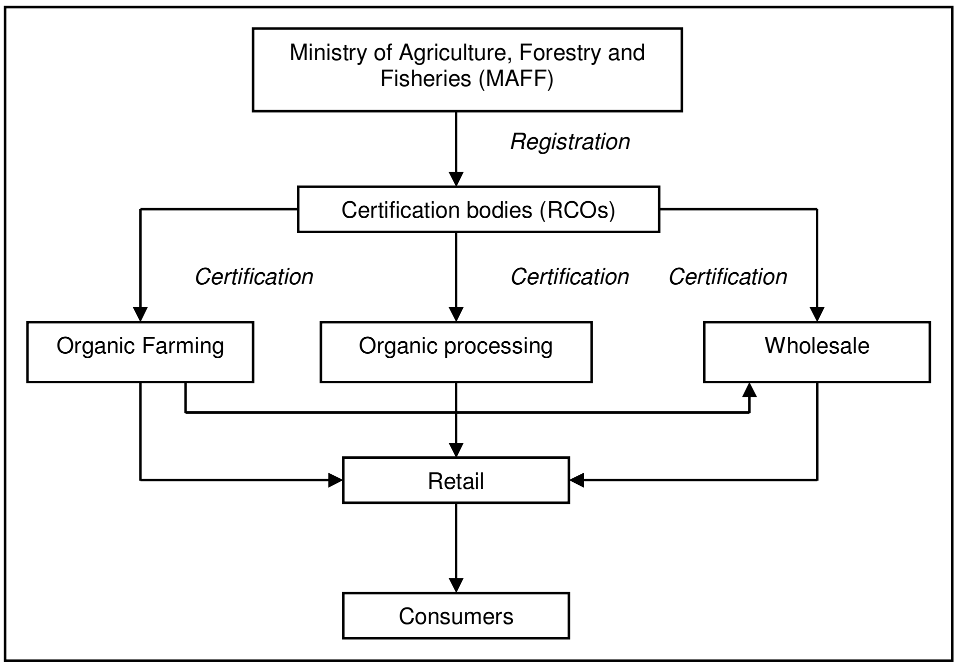
Furthermore, Japan accepts the EU-certification of organic products, because the MAFF has reached an agreement with the EU about recognizing the equivalent of the EU Regulation 2092/91 with the organic regulation procedure operating in Japan (The Organic Standard 2002, p. 8). Another option is the certification of the products from a domestic, i.e. Japanese certifier, termed as Registered Certification Agency (RCO). By 2004, there exist 67 RCOs in Japan, out of which 13 also work and certify products in other countries, such as Asia, Central and South America (Kuhlmann, 2004). On the labelled product, the RCO name and JAS Organic have to be shown (see photo 3.1).

Photo 3.1: JAS organic logo on organic product
(Source: Sakuyoshi 2001, p. 5)

Organic spinach greens showing the JAS logo and the RCO's name on the packaging.

In these first two described options, the organic label is affixed for export to Japan in the foreign country. The last possibility enables a Japanese company to import, whereby he is certified by an RCO in Japan. If the imported product is a processed food, then the raw materials have to be certified as organic. The importer can attach the organic mark on the goods. Table 3.4 gives an overview of the certification procedure in Japan.

Fig. 3.4: Organic inspection and certification system in Japan
(Source: www.embargentina.or.jp, in: VROLIJK & MAY 2001, p. 121)



The following example is for the second option of obtaining the JAS Organic label, as described above: At the BioFach Japan 2002, which was held in Tokyo, a personal communication was held with Mr. Yoshi Kihata from the "Association for Sustainable Agricultural Certification" (ASAC) about their certification system for domestic and foreign companies. If a foreign company wants to export organic products to Japan, they can directly contact certifying agents in Japan, such as Japan Organic Agriculture Association (JOAA), Japan Organic & Natural Foods Association (JONA) or ASAC, which has 18 sub-agents like the Nippon Organic Agricultural Products Association (NOAPA). The foreign company/producer must obtain a JAS certification and JAS Logo from one of the above agents. ASAC, for example, provides information to the foreign company/producer in the applicants country. If a Japanese trader or company is interested in importing organic products, then the same procedure applies (see above for details). In case no agent is known to the applicant, the Ministry of Agriculture, Forestry and Fisheries (MAFF) can be contacted. MAFF will then provide a list of three to four Japanese agencies, but the applicant has to try to obtain information like fees and procedure of these agencies by himself, since the MAFF does not give any further data. This is rather time consuming and tedious.

The export to Japan is more expensive and bureaucratic for an Indian organic producer or company, because he first has to obtain the Indian Organic certification and logo (since July 2002), then he can apply to a Japanese certifying agent for the JAS logo and export procedure.

The certification costs vary from region and country, but one can say that the *"average certification costs at farm level are 3 % of business turnover"* (THE ORGANIC STANDARD 2001, p. 7-8). Some inspection and certification agencies charge fees for the initial application, for the inspection or certification on a fixed basis, whereas others charge inspection or certification fees for the actual working hours spent and costs that occurred, others even charge fees for carrying out an inspection at random[21]. Some fees per hour range from US$ 7 to US$ 52, the higher rates stemming from European certifiers (THE ORGANIC STANDARD 2001, p. 9). Charges can also be related to sales. This means that fees are calculated based upon staggered sales, ranging from 0.5-1 % for a normal farm, but much higher for a small farm (THE ORGANIC STANDARD 2001, p. 9): a North American certification body will charge a small farm up to 10 % of the sales value, but only 0.1 % to the largest farm; for an Asian certifier, the sales fee for a small farm is 0.3 % of the turnover, and 0.8 % for a larger farm (THE ORGANIC STANDARD 2001, p. 9).

[21] Data was collected from a survey carried out by THE ORGANIC STANDARD (2001). They sent out 80 questionnaires to certification agencies, out of which 18 responded from North America, South America, Europe, Australasia and Asia.

CHAPTER 4

Preparation of Radish for Sale, Chimney Village (SE of Kurseong Town), Darjeeling District
Photo by SHILPI SAXENA, 2002

4. Empirical Evaluation: Hill Farming in Darjeeling District

4.1. Criteria for Choosing Areas and Farmers

In Darjeeling District, initial contact to a local NGO, the St. Alphonsus Social and Agricultural Centre (SASAC) in Kurseong subdivision was established during an earlier visit in 1998. This facilitated the research by having contact to farmers for survey purposes. This NGO works on organic farming among other activities. The author furthermore, established contacts to other local NGOs for their surveying project villages with the questionnaire.

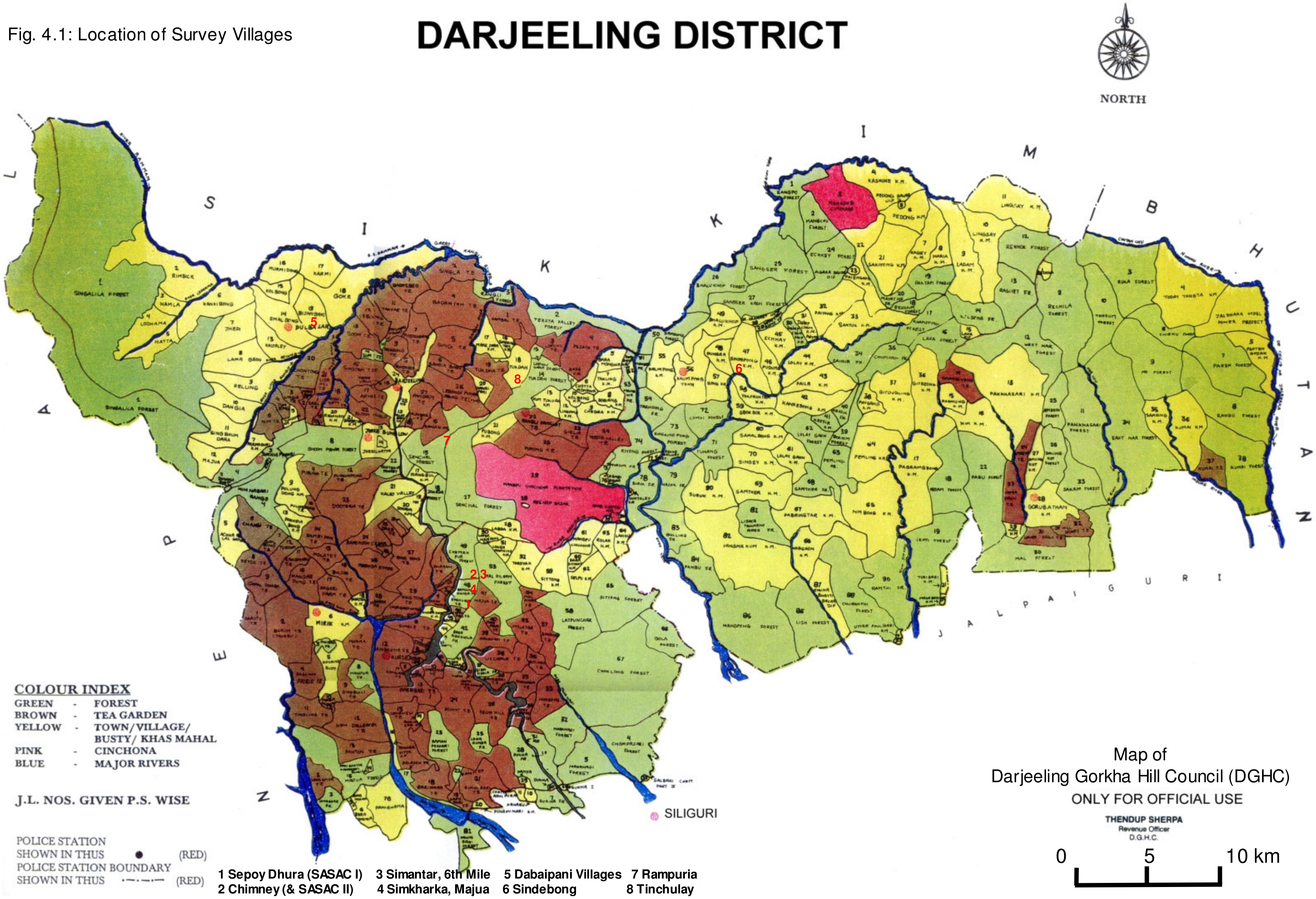
Although the main cash crop of Darjeeling District is tea, this research does not include tea labourers, even though they practice farming, but in villages within the tea estate area, where they live. They are granted free accommodation with a homestead for farming purposes. Furthermore, these (farmers) tea labourers receive an income from the tea estate plus free rations of rice and wheat, medical care for all family members, insurance, gratuity (retirement money) as well as paid holiday and festival days ('pooja') (DPA, 1999; O'MALLEY, 1999). In other words, they are better off than the subsistence farmers. The homestead gardens are located in little villages scattered within the tea estate, where these part-time farmers can grow their own vegetables on small plots and fruits for personal consumption. Cows milk is for personal use and also sold in the village or market ('bazaar'), chicken's eggs are also for personal use as well as the meat of chicken, goat or pig depending on which type of animals husbandry is practiced. These farmers are therefore self-sufficient and their homestead products are not necessarily a primary source of income (SAXENA, 1998; DPA, 1999). Unfortunately, many tea estates are closing down due to mismanagement, leaving the labourers on their own (RCDC, 2002). Several cases of malnutrition and even deaths have been reported (MANDAL, 2004).

The location of the surveyed villages is given in the specific map (Fig. 4.1 [22]). It furthermore shows village areas, tea estates, cinchona plantations and designated forests. The tea area is predominantly located in Kurseong and Darjeeling subdivision and can be used as a reference for the areas, where the survey took place (details are given in chapter 4.3., in the paragraph on altitude).

For Kanagawa Prefecture, there were already existing contacts to an organic farmer, Mr. Yoshinori Hayatoh, in the town of Yugawara, Kanagawa Prefecture through an earlier internship in Japan in 2001. From here on, the author conducted visits to most farmers for Kanagawa Prefecture.

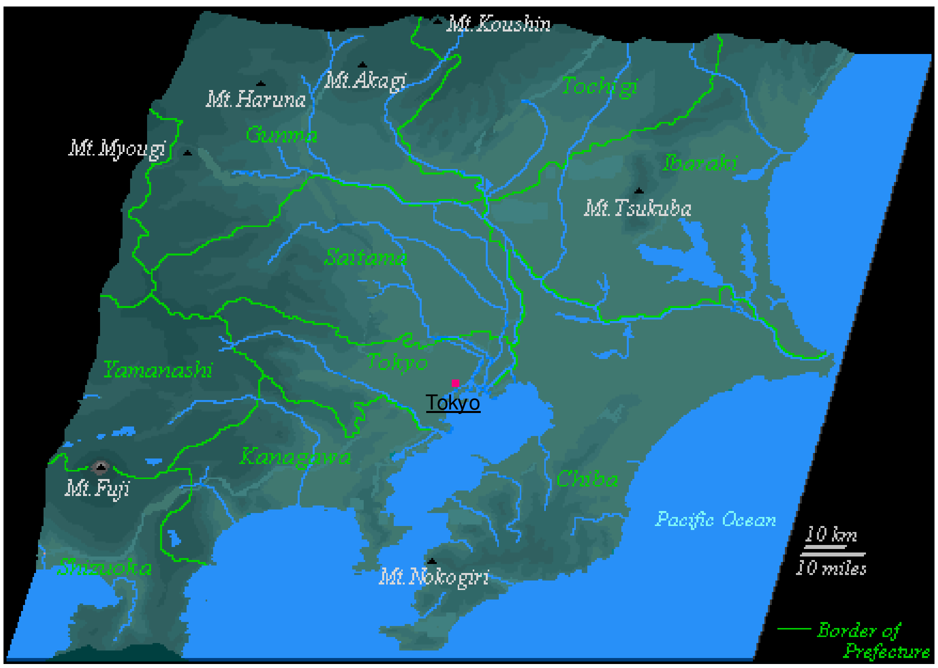
[22] The scaling is based on the original location map, therefore, there are variations in the distances on the map and actual distances.

Fig. 4.1: Location of Survey Villages



Since not so many organic farmers are located in Kanagawa Prefecture only, therefore the data collection, field visits and survey were carried out in some prefectures of the Kanto. This region includes Tokyo Metropolis and six prefectures around Tokyo: Kanagawa, Saitama, Gunma, Tochigi, Ibaraki and Chiba; surveys were conducted in the prefectures of Kanagawa, Saitama, Chiba and Tokyo Metropolis (Fig. 4.2; for details on survey areas, see chapter 4.2. and table A1 in the appendix). The observations/field displayed in chapter 5, visits stem mainly from Kanagawa Prefecture, added by observations from Shizuoka Prefecture, as well as Tokyo Metropolis, Saitama and Chiba prefectures.

Fig. 4.2: Field visits conducted in the Kanto region
(Source: SONOBE, 2001; *abridged*)



4.2. Methodology and Materials

Cultivation of land in Darjeeling District faces difficulties due to hilly and steep landform, acidic soil and limited arable land, since the majority is under tea cultivation. Options are either to increase the yield per unit area or to increase land itself. The latter is not possible, as forestland is under government regulation (reserved forests), Darjeeling District can either try to increase productivity or rather diversify its crop production and seek different income means. Other problems like population pressure and increased deforestation add even more to the burden, which need to be dealt with in a sustainable manner.

The study focuses on subsistence farmers in Darjeeling District and Kanagawa Prefecture/Kanto (hereafter: Kanto). The hypotheses compares the strategy and achievements of organic farming concerning crop cultivation, yield, income and marketing in comparison with conventional farming practice; to assess the benefits of organic farming in terms of ecological and socio-economic factors for Darjeeling District and Kanagawa Prefecture/Kanto. As the farmers of Darjeeling District are basically traditional farmers as described in chapter 3, the term 'conventional' is used for differentiation purposes in comparison to the term 'organic'. Some of the organic farmers are certified, others are non-certified organic.

The following hypotheses are evaluated in both study areas (for details see chapter 4.3.):

- The organic crop diversity differs from conventional crop diversity
- The amount in yield differs between organic and conventional farming
- The amount of output (Darjeeling District) differs between organic and conventional farming / The amount of income (Kanto) differs between organic and conventional farming
- The price for organic certified crops differs from conventional crop prices in Darjeeling District

Surveys, the primary data sources for Darjeeling District, have been used at farm-level, concerning those farmers, who practice organic and conventional farming. There, surveys took place from June-August 2002. These are household surveys with semi-structured questions of qualitative and quantitative nature (HOLM 1975, p. 52). Mostly the survey interviews were conducted personally, some were distributed in villages. The household sample size for Darjeeling District were 100. Due to an injury suffered by the author some surveys had to be distributed via an NGO in some of the Darjeeling District villages. Therefore, author could not visit those areas with difficult landform and thus, no personal interviews were carried out there. Furthermore, strikes and road landslides sometimes hindered going into towns or villages in Darjeeling District. Interviews with officials of agricultural and forestry offices were also conducted.

Farmers from Darjeeling District are of Nepali background, but they speak and understand Hindi, which the author is able to speak as well. This facilitated the asking of questions and receiving useful answers. Here, the previously prepared English questionnaire was translated into Nepali, with the help of Mr. Sudhir Dorji, Supervisor of St. Alphonsus Social and Agricultural Centre (SASAC). Suggestions were also included from another NGO, the Darjeeling Ladenla Road Prerna (RCDC), which has some project villages in the subdivisions of Darjeeling and Kalimpong. To make sure that the initial questions were adequately translated into Nepali, the questionnaire was later re-translated verbally by Mr. Dorji into English. Many inadequacies were eliminated through the double-checking and the final Nepali questionnaire was used on the field. In Darjeeling District, an NGO representative mostly accompanied the author during the surveys, introducing the author and helping in translations where necessary, except in Kalimpong subdivision, where the author had gone by herself.

In Kanto, the surveys conducted at farm-level, contained semi-structured questions (qualitative and quantitative), and took place from November 2002-March 2003. The household sample size for Kanagawa Prefecture/Kanto region was 70. As there are not so many organic farmers per prefecture, sufficient questionnaire data needed to be gathered for the statistical evaluation, by visiting several prefectures, next to Kanagawa Prefecture. The surveys were mostly conducted personally in Kanagawa Prefecture and the surrounding prefectures, which include Saitama, Tokyo and Chiba. They all belong to Kanto and are climatically very similar. Postal survey was used as well, partly out of time-constraint, as it was somewhat difficult contacting a farmer through another via introduction only, which is customary and very time-consuming. Meeting Japanese farmers required an appointment and in some cases, farmers declined to be visited. Some of the distributed and posted questionnaires were answered contradictorily, were half-filled or not answered at all; hence, these were rejected for the final data set. For details on the areas and prefectures, where personal and postal surveys were carried out, see table A1 in the appendix. Though Tochigi Prefecture was used for postal survey as well, the questionnaires had to be rejected due to above-mentioned reasons. By mid-December 2002, the author was able to get hold of the "Japan Organic Agriculture Association" (JOAA) members book, containing addresses and information on organic farmers, which enabled a more precise and direct contact with visits and postal surveys to farmers of interest. The disadvantages of a postal survey were taken into account (WILK 1975, p. 187-188), as listed above.

The author is aware that language is a main problem, mainly because the authors' basic knowledge of Japanese did not suffice for fluent communication. Hence, it is important that specific vocabulary is used in the preparation of the Japanese survey (CHIAVACCI, 2002). However, due to the outsider position of a foreign scientist, he or she can have insight into Japanese society through qualitative research methods, which are unattainable to Japanese colleagues (CHIAVACCI, 2002). The survey was not written in Japanese characters (Kanji) but in Latin alphabet (Romaji), so that the author could read out the Japanese questions and thus ensure the correct answering of the questionnaire*. It contains suggestions and aspects as suggested by scientists and organic farmers, which makes it more detailed than the Nepali questionnaire.

* It was first translated from English into Japanese with the help of another Geographer as well as the Scientific Assistant of Prof. Dr. Mizushima, Geographical Institute of the Nihon University, Tokyo A copy of the English questionnaire was sent to Dr. Carolin Funck, Department of Geography, Hiroshima University, for further suggestions and aspects, which should be included. Additionally, a meeting with Dr. Sawanobori, Horticulture Department, Keisen University, Tokyo, who teaches organic farming; Mr. Hayatoh, an organic farmer from Kanagawa Prefecture, also gave ideas of relevant points to be included.

The Japanese questionnaire was verbally re-translated into English by the organic farmer Mr. Hayatoh, in order to ensure that the Japanese version was understood correctly concerning its content. After necessary corrections, the final Japanese questionnaire was implemented in the field. Here, the author conducted the interviews either alone, or was accompanied by an organic farmer, who introduced and translated where necessary. Interviews with distribution companies and cooperatives of organic products were also conducted.

After checking all questionnaires of Darjeeling District and Kanto region, those of use for the statistical evaluation were in total 100 complete data sets of properly answered questionnaires, i.e. 50 for Darjeeling District and 50 for Kanto. The detailed questionnaires are listed in the appendix.

Statistical evaluation: The author is aware that the inference-statistic methods, if at all, are only limitedly applicable. Therefore, the following p-values or significance levels are calculated to make a comparison possible to other existing studies and to weight the explorative statements. The current study can be classified as an explorative study (TUKEY, 1977) and therefore is mainly used for the generation of hypotheses. The data in chapter 4.3. is based on the author's own field survey, except where indicated. There are furthermore variables, which have been derived from the surveyed data, such as 'rating of yield' and 'rating of home consumption' or a variable has been generated from the context of the answered questions, such as the 'purpose of crops' in terms of 'sale' or 'home consumption'.

For choosing the tests and their pre-conditions, the newer statistical literature is followed, which means that parametrical tests as ANOVA (*An*alysis *o*f *Va*riances) are robust against departures from normality or homoscedasticity (equality of the standard deviation of groups) (see MOORE & MCCABE, 1999). A pre-test on the equality of variances, e.g. Levene's Test, should even be avoided according to newer literature. For comparison reasons to older literature though, these pre-tests will be conducted. Furthermore, also for comparison reasons with older literature, the non-parametric tests in many cases will be given as well, next to the parametric tests.

Notation: As exact p-values for the tests have been stated in the text, they have the following meaning: a p-value <0.05 indicates "significant", p-value >=0.05 means "not significant" (KÄHLER, 1998). Furthermore, to keep the statistical procedure simple, all hypotheses were formulated "two sided", so that all later statistical hypotheses (H_0) assume equality and consequently, all p-values shown are also "two sided".

The method used for the survey is called Quota-sampling: the interviewees are chosen according to certain criteria, in this case conventional and organic farmers (HOLM 1975, p. 160). As sample size is small (n=50 each for Darjeeling District and

Kanto), the evaluation cannot be seen as representative for the broad-scale, as the number of surveyed people is low. Therefore, the amount of interviewees necessary to reduce the sampling error could not be fulfilled; a minimum of 100 persons for each data set would have been necessary to have an error range of maximum 5 % (KAPLITZA 1975, p.138). The structure of the questions is of ordinal and nominal nature, but the Darjeeling District farmers often gave the answer for their crop yields and prices as ratio data (HOLM 1975, p. 46).

Before evaluating the hypotheses, general statistical information is given about the farmers (land size, farming practice, age, gender), location and altitude in form of simple frequency tables and cross tables. The latter show a relationship between two variables; the strength of such correlation is expressed through symmetric measures such as the Spearman Correlations Coefficient for two ordinal variables. Normality Tests have been conducted to test whether interval (ratio) data is normally distributed and having equal variances, which are seen as a precondition to use T-Tests or ANOVA (LEHNERT, 2000). Since data in most cases point at large deviations to the assumption of normal distribution, Non-Parametric Tests were used: on two unrelated samples (Mann-Whitney = U-Test) and on n unrelated samples (Kruskal-Wallis = H-Test) (JANSSEN & LAATZ, 2003). Sample size could be a reason for a weak detection of non-normal distribution. The analysis of the empirical data was performed with SPSS ("Superior Performing Software Systems") (BAMBERGER, 2002). SPSS tables for Darjeeling District and Kanto are given in chapter 4.3.; additional SPSS tables for Kanto are listed in the appendix (Table A2-A9). All SPSS tables, except for tables A5 and A8 in the appendix, have been modified in Excel.

Secondary sources for Darjeeling District include data from various agricultural and forestry offices. Data from agricultural marketing offices were collected concerning marketing channels, crops and market prices, i.e. retail and wholesale. The different forestry offices (state, local and NGO) provided data on the afforested areas, size of these areas and tree species used for afforestation, such as indigenous and exotic species. The census reports contain statistical data, while the Darjeeling District gazetteers gave information on the historical development. There were general problems when collecting data on census, agriculture and forestry, as these were mostly only available locally and for official purposes. Many gazetteers were out of print, because they are very old. Offices mostly had hand-written data, as often no computers were being used. Furthermore, the officials were in general reluctant to give out data, due to mistrust ('for which purpose is the data needed') and there were conflicts between local and state offices in Darjeeling District concerning data and jurisdictions. Experimental plots for growing organic vegetables with natural resources and soil samples were conducted at two elevation sites.

In Kanto, secondary sources consisted from statistical data issued by the Ministry of Agriculture, Forestry and Fisheries (MAFF), secondary data (brochures, pamphlets, books) provided by the surveyed farmers and literature given by the personal contacts at universities, which the author had established.

Maps of Darjeeling District were obtained from different offices in the district itself, as well as from Calcutta. Obtaining such maps was not always easy, as the officials had to be convinced of the purpose of use, since most maps are for official purposes only. Many of the Indian maps had to be modified, i.e. scales were added.

The satellite image in chapter 2.1.4. is used from a Landsat TM 5 image (05.11.2000) from which an excerpt of Darjeeling District has been made with Remote Sensing Software Erdas Imagine 8.6. The satellite image in chapter 2.2.4. is generated from two satellite images (Landsat 7, 08.11.2000 and Landsat TM 5, 21.05.1987). These have been mosaic-ed together and image matched with the Remote Sensing Software Erdas Imagine 8.6., and manually digitalizing the boundaries of the prefecture. Due to the two different years of the images, Kanagawa Prefecture has a different shading/colouring in the final image. Scales and locations were added to the images.

Photos were made with an Agfa APS camera (Advanced Photo System, 27 mm) and supplemented with photos taken with a Vivitar RL 3000 (35 mm) to document and support the observations visually.

4.3. Survey Data of Darjeeling District and Kanagawa Prefecture/Kanto

Age

For Darjeeling District the main age of the surveyed farmers lies between 40-60 years, followed by the age group of 20-39 years (Table 4.1). The eldest and youngest were not strongly represented. Whereas in Kanto, older farmers are more frequent, while the percentage successively declines with the younger age. The ageing of Japanese farmers is an additional problem, because younger ones are leaving the family farms to seek jobs in the cities.

Table 4.1: Age structure of interviewees in both study areas

	< 20	20-39	40-60	> 60	Total No.
Darjeeling (%)	2.0	34.0	54.0	10.0	50
Kanto (%)	0.0	26.0	34.0	40.0	50

Gender

The gender in Darjeeling District was predominantly male (62 %) compared to female interviewees (38 %). One should be aware though, that the husbands run the farms and the wife only responded if the husband was not available. In Kanto, the male farmers were represented with 88 % compared to 12 % women farmers. In this case though, the surveyed women were mainly farming on their own.

Professions

It should be noted that six farmers in Darjeeling District mentioned other or previous professions such as army, working at a local NGO or at a local forestry office, and these farmers were organic or conventional. Often though, the husbands take up a short-time wage labour, such as road construction, as it is better paid. In Kanto, about 70 % from the 36 organic farmers are full-time farmers; 50 % out of 14 conventional farmers are full-time. The days of part-time farming (i.e. days engaged in farming) for conventional farmers are spread between 35 and 300, for organic farmers between 10 and 360 days. The part-time professions include forestry, real estate agent, part-time labourer or trainee on another farm, running a fruit and vegetable shop or an organic café.

Altitude

Out of the 50 villagers under study in Darjeeling District, nearly half of the interviewees lived at lower altitude, between 1,000-<1,400 m, while the rest are located up to 2,200 m. The villages in Darjeeling District, where the interviews took place, have been grouped according to the subdivision and proximity of each other: Chimney, Simantar and 6th Mile Village lie above 1,800 m and belong to Kurseong subdivision. Simkharka (1,800 m) and Majua Village (1,400 m), both located on the same hillside above Majua Tea Estate, also belong to Kurseong subdivision (see Fig. 4.1). All of the above mentioned villages are located about 10 km northeast of Kurseong Town. The two villages Tinchulay and Rampuria (1,500 m and 1,400 m respectively) belong to Darjeeling subdivision and are located on the road towards Kalimpong subdivision, 32 and 20 km southeast from Darjeeling Town respectively. The villages of Dabaipani, which are Aapbotay, Godown Dhura, Saila Dhura and School Dhura (1,000-1,400 m) belong to Darjeeling subdivision and are located about 15 km northwest from Darjeeling Town. Lastly, the village of Sindebong (1,100 m) belonging to Kalimpong subdivision, is situated 5 km east from Kalimpong Town. The study villages in Kanto are mostly below 100 m (68 %), whereas 26 % were located up to 300 m and the rest up to 700 m (see appendix table A2). For the different locations where surveys took place, see table A1 in the appendix.

Number of people working on the farmland

In Darjeeling District and Kanto was mostly below five persons (Table 4.2). The help on the farmland is largely constituted of family labour, which causes no extra expenditure for the farmer.

Hire Labour

The organic certified farmers, in the case of Darjeeling District, hire labour (six out of 17, 35 %). In Kanto, from the 36 organic farmers, 19 % hire external labour and have trainees, whom they teach organic farming. Out of the 14 conventional farmers, 29 % hire labour (Table 4.3).

Table 4.2: Persons working on farmland

Darj. Dist.	No.	%	Kanto	No.	%
< 5	45	90.0	< 5	47	94.0
5 - < 10	5	10.0	5 - < 10	2	4.0
-----	-----	-----	10 - < 15	1	2.0
Total	50		Total	50	

Table 4.3: External labour hired

Darj. Dist.	No.	%	Kanto	No.	%
No	44	88.0	No	39	78.0
Yes	6	12.0	Yes	8	16.0
-----	-----	-----	Trainees	3	6.0
Total	50		Total	50	

Years of Farming

In Darjeeling District, the number of farmers increase with the years of farming: the majority of persons have more than 20 years of farming experience, compared to those who have less than five years experience (Table 4.4). Furthermore, there is also a corresponding increase with age, which means the correlation is strong and significant (Spearman=0,824, p=0.000). This measure is used for ordinal variables to express a monotonous correlation between two variables. Here it indicates, the older the farmer, the more years of farming he has. In Kanto, 40 % of the farmers are above 60, the next largest group are the 40-60 year old with 34 %. Here too, correlation of age with the years of farming is strong and significant (Spearman=0,754, p=0.000; table 4.5).

Table 4.4 - 4.5: Years of farming * age of farmers, Darjeeling District and Kanto

	< 20	20-39	40-60	> 60	Total No.
< 5	-----	4	-----	-----	4
5 - < 10	1	7	-----	-----	8
10 - < 20	-----	6	6	-----	12
> =20	-----	-----	21	5	26
Total No.	1	17	27	5	50

	20-39	40-60	> 60	Total No.
< 5	6	2	-----	8
5 - < 10	4	2	-----	6
10 - < 20	3	5	2	10
> =20	-----	8	18	26
Total No.	13	17	20	50

Farming practice

This refers to the type of farming carried out, such as conventional or organic. The organic farming practice in Darjeeling District needs to be explained: NGO project villages farm organically or promote organic agriculture. In the case of Kurseong subdivision, the NGO St. Alphonsus Social and Agricultural Centre (SASAC) took up a practice termed as Square Meter Farming (SMF), based on "Square Foot Gardening" by BARTHOLOMEW (1981). It has been modified to the area, so that the farmers can practice it by using one square meter and grow locally available crops. This practice is done in so-called one square meter beds that are situated on terraced fields, with plastic frames, a polyethylene cover and about 80 cm high (Photo 4.1). These fields were earlier used for conventional cultivation. Each bed contains a different vegetable crop, so that a disease does not spread directly to the neighbouring crop. If cauliflower and cabbage are grown next to each other, both would be affected. These beds are protected with a polyethylene cover; therefore, too heavy monsoon rains, hale or wild boars do not harm the crops. Farmers of Kurseong subdivision faced these problems at altitudes between 1,400 and 2,200 m.

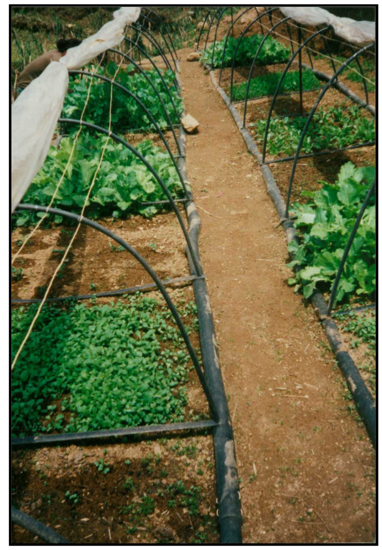


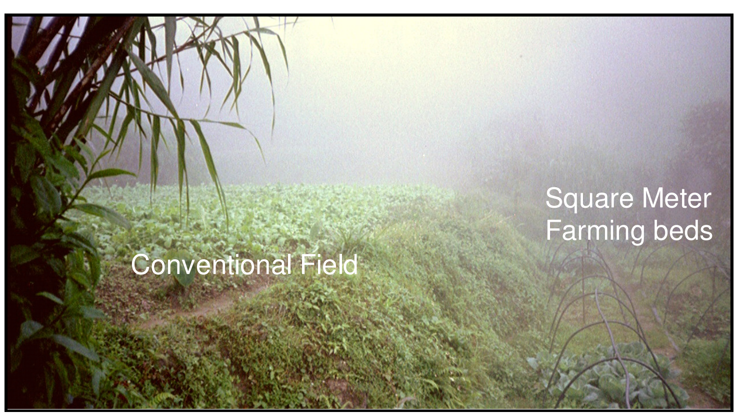
Photo 4.1: SMF-beds with polyethylene cover and different crops, Darjeeling District (Photo by SHILPI SAXENA, 1998)

The cover acts as a small greenhouse system. These one square meter beds have the purpose of growing a sufficient amount of crops on small area (e.g. 350 carrots in one m^2; 16 cabbages, cauliflowers or broccoli; 49 beetroots and lettuces) and a different crop per square (see table A11 in the appendix for details). Once a crop is harvested, the bed is prepared for the next crop. The crops are then sold via the NGO directly to the local market or in the village. Most SMF-farmers make between 50 and 150 m^2 beds and also continue farming on their other terraced fields, because they pursue both. The idea of the SMF was to increase the crop diversity and the amount of income for the farmer by buying directly from the farmers and selling at the buying price, without any commission, as most of these farmers have very low income. This method is a supplement to their conventional farming practice, as many of them do not want to give up their previous cultivation style on terraced fields. Furthermore, the marketing system cuts off the middle-man and thus saves provision as well as transportation costs for the farmer.

The NGOs pursue different on- and off-farm activities next to crop organic cultivation, such as animal-husbandry, vermicompost, nursery, alternative energy sources, floriculture and apiary as well as eco-tourism. Like this, the NGOs try to achieve income diversification and alleviate dependence on agricultural crops. SASAC took up its work with the square meter beds in 1997 at their two experimental farms in Kurseong subdivision, where SMF, composting, nursery, floriculture and animal husbandry are taught to farmers. ATREE, the Ashoka Trust for Research in Ecology and the Environment, started its work in Rampuria since 1999, the same year as Project SERVE (Save the Environment & Regenerate Vital Employment) in Tinchulay. These two also incorporated the SMF-beds like SASAC. Darjeeling Ladenla Road Prerna (RCDC) and the Sanjukta Vikas Cooperative (SVC) started with organic farming in 1996 and 1997 respectively in the Dabaipani villages. The SVC was set up by the Dabaipani villagers and all organic farmers have to be registered with the SVC, after paying a fee of Rs. 21 (€ 0.42); currently, there are 483 member families with SVC (DOWN TO EARTH, 2004). Though RCDC too works in Kalimpong subdivision in more remote areas like Pringtam-Kankebong, Sindebong is not part of the project villages. A village affiliated with an NGO, does not mean that the entire village is a project village, but NGOs always work with a few farmers within one or several villages.

In Darjeeling District the categories of farming practice are conventional, the largest group, certified organic, the second largest and non-certified organic (Fig. 4.3). Furthermore, there are farmers who practice both conventional and non-certified organic (Photo 4.2). The certified organic farmers are located in the Dabaipani villages and have received certification since 2002/2003 from the Institute of Marketology (IMO) with the help of the NGO RCDC. Those who practice conventional with non-certified organic agriculture (SMF) are distributed on the Kurseong and Darjeeling subdivision and haven taken up the practice in 1998 (Kurseong subdivision), 1999 and 2002 (Darjeeling subdivision). The surveyed conventional farmers are located in all areas, except for Dabaipani. Basically, all three farming types are practiced on terraced fields, while non-certified organic uses m^2-beds, placed on terraced fields.

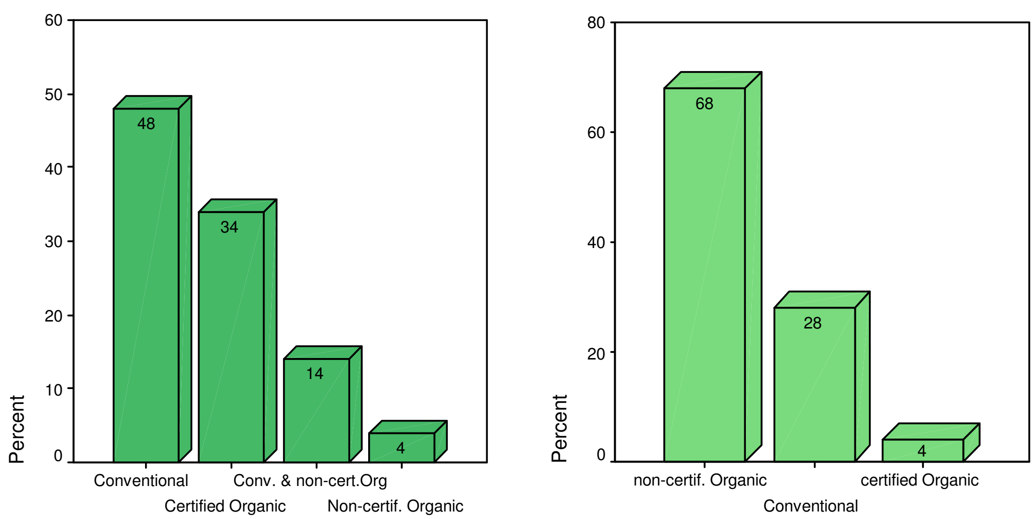
Photo 4.2: Field of a farmer practicing conventional and m^2-farming, Darjeeling District (Photo by SHILPI SAXENA, 2002)



The surveyed organic Kanto farmers decided themselves to convert from chemical to environment-friendly farming. During informal talks with them, they stated that the decision to convert included health reasons in their family related to chemicals or that they simply became aware of the harmful effects of such inputs to nature and humans. Many of the farmers are convinced they made the correct choice by converting. Few cases stated they wanted to earn a higher income through premium prices. The surveyed organic farmers were farming on small plots, but not necessarily on terraces.

The Kanto farmers that were surveyed were largely organic (Fig. 4.4). Those with certification (6 %) obtained the organic JAS mark since 2001 (see chapter 3.3.). The non-certified farmers stated that they did not see any point in certification mainly because they regard it is a government intervention and regulation into their farming practice. For them a relationship directly with the consumer based on trust is far more important than an official stamp on their products. Of the organic farmers, 58 % have already been fully organically converted since more than 10 years, followed by 17 % who have converted below five years (see table A3 in the appendix). The organic regulation says, to be counted as organic, three years have to pass without any synthetic input, therefore the years are counted from the point of full organic conversion; one farmer was still in conversion period. There were some farmers, who were practicing conventional or certified organic agriculture and had answered by postal survey, but did not specify what and how much they grow organically or conventionally. Therefore, they were not taken into the database.

Fig. 4.3 - 4.4: Farming practice in Darjeeling District and Kanto



Chemicals

Photo 4.3: Blitox fungicide at a non-certified organic NGO village, Darjeeling District (Photo by SHILPI SAXENA, 2002)

Although the majority (96 %) of the non-certified organic and conventional farmers declined using chemicals, a fungicide application was found in one of the NGO project villages, where (non-certified) organic farming is promoted in Darjeeling District (Photo 4.3). The majority, who do not apply chemicals, includes certified organic farmers; they do not apply chemicals. Only two (4 %) conventional farmers in Kalimpong subdivision stated they use chemicals: pesticide (Metacid) for floriculture, as well as fertilizers such as urea, DAP (di-ammonium phosphate) and potash for the rice terraces and vegetables. As most farmers did not really admit using any synthetic chemicals when surveyed, a local NGO was asked: common agrochemicals are easily available from the market or government department. For the cultivation of crops, urea is most commonly used and widely available. It is utilized for rice, potatoes and vegetables. Copper fungicides are applied for tomato and insecticides for oranges. The Kanto farmers use organic and/or chemical inputs (see table A4 in the appendix). These are organic fertilizers (68 %), like compost, charcoal, wood ash or common agrochemicals (26 %) which are N, P, K, insecticide, herbicide, fungicide, or they use organic and chemical fertilizers/insecticides (6 %). Organic fertilizers are made from wood or rice vinegar; organic insecticides include mixtures from alcohol, chilli and water or onion applied as spray on crops. Wood vinegar is mixed with water and then sprayed on the crops. The frequency of spraying varies from 1-10 x per year, depending on the need. Out of the 36 organic farmers, the two certified organic farmers use only organic inputs, just as the majority of non-certified farmers (94 %); only 6 % use chemical and organic fertilizers. From the 14 conventional farmers, 93 % apply common agrochemicals and one (7 %) applies next to chemical fertilizer, an organic insecticide (wood vinegar). The amount of chemicals applied by conventional farmers per 10 a (1,000 m^2) annually varies on their need: 36 % (from 13 farmers, one case missing) apply 100-150 kg; 22 % apply 200 kg, 7 % apply 400 kg, and 28 % apply between 5-40 kg.

Compost

As an organic input, it is used by the Darjeeling District farmers in the study area, and is mostly farmyard manure (FYM). Latter consists of animal manure and straw or grass. Of the 26 organic and mixed farmers, 96 % prepare it themselves, 4 % do not make or buy any. From the 24 conventional farmers (here the seven mixed farmers were not included, as they use the same compost for both purposes), 58 % make themselves, 25 % do not make any and only 17 % buy locally, with a price range between Rupees 20-60 per 100 kg (€ 0.5-1.50) for the villages in the Kurseong and Kalimpong subdivision respectively. The compost ingredients for organic and conventional farmers alike are mainly cow dung and grass; few organic farmers add some cow urine, woodchips or wood ash, though conventional farmers preferably use pure cow dung. Some of the Square Meter Farmers use compost as suggested and practiced by the NGO SASAC: cow dung, eggshells, kitchen waste (i.e. vegetable peels), soil and grass. The certified organic Dabaipani farmers are also using kitchen waste, crop residue and animal manure. Often a local grass is used in the compost, called 'Banmara' (*Eupatorium adenophorum* Spreng.) which grows *"wild and rampant"* (RAI & SHARMA 1994, p. 39). Banmara (mugwort) belongs to the family of *Asteraceae* and grows on sunny slopes; it is rarely found in dense forests. Being an erect herb it can grow up to one meter and has a habitat range of 1,000–2,000 m, on average at of 1,600 m (RAI & SHARMA 1994, p. 39). The collecting of this grass takes about 2-3 h time. The duration till the compost is ready to be used varies from two to six months, as it depends on altitude and season.

All 36 organic farmers in Kanto use compost; out of these, 78 % make their own, only 6 % buy locally, the rest make and buy. From the 14 conventional farmers, 29 % do not use any, six farmers (43 %) buy, and only 22 % make their own, the rest makes and buys. Components for conventional compost are mostly manure from cow, pig or chicken, or leaves collected by the farmer. Organic compost used by the surveyed farmers is very diverse and can include rice husk, soybean husk, kitchen waste, fishmeal, leaves, grass, straw, rice straw, eggshells, twigs, woodchips and manures from cow, pig or chicken. Prices for the conventional compost ranged from ¥ 500-1,000/100 kg (€ 5-8); organic compost between ¥ 150-2,500/100 kg (€ 1.25-21), depending on whether it is only manure or contains more components.

Furthermore, 11 % of the organic farmers additionally use 'bokashi', an organic fertilizer, translated by the surveyed farmers as 'fermented organic material', which is supposed to help the soil nutrient level. The ingredients used, vary between the farmers: rice husk, rice shell and tofu residue, or including kitchen waste (vegetable peels), or fishmeal and shell powder.

Livestock

Animals are owned by all 26 organic and mixed farmers, compared to 92 % of 24 conventional farmers (here too, the seven mixed farmers are only included once in the organic count) in Darjeeling District. Animals are most commonly chicken: 80 % out of

26 organic and mixed farmers, compared to 50 % from 24 conventional farmers own chicken. Some also own a goat, pig or cow (Table 4.6).

Table 4.6: Livestock owned by organic & mixed and conventional farmers, Darj. Dist.

	Goat		**Pig**		**Cow**		**Goat**		**Pig**		**Cow**	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0	20	77.0	14	53.8	2	7.7	18	75.0	19	79.1	7	29.2
1- 2	3	11.5	11	42.4	12	46.2	4	16.7	4	16.7	12	50.0
> = 3	3	11.5	1	3.8	12	46.2	2	8.3	1	4.2	5	20.8
Total	26		26		26		24		24		24	

Animals are often kept in a barn (Photo 4.4), because the landform and terraced fields do not give many opportunities for grazing; only where a farmer has easy access to grazing area, it is utilized, though those areas are government owned. It should be noted that the farming practice (organic or conventional) does not have an effect on the livestock rearing, as is practiced e.g. in Europe. Nevertheless, it is still shown separately for both categories, because it is of interest for the next paragraph on biogas. The animals are fed with crop residues and grass collected by the farmers (Photo 4.5). Milk from the cows is used at home, but also sold to the middle-man or in the village. When a calf is born, the farmer uses a part of the milk for own consumption and a part remains for the calf. During these periods, which last about six months, milk is not sold. Only 20 farmers gave data on milk yield and selling price, 20 could not, as sometimes, they did not know about yield or price, or the surveyed wife could not render the information, as the husband took care of this aspect. One farmer uses milk only for home consumption. Depending on the amount of cows a farmer has, milk yield ranges between 1 and 10 l per day. Prices vary, as milk is sold to the middle-man (Rs. 6-8/l; € 0.12-0.16), to an NGO (Rs. 10/l; € 0.2) and to a milk cooperative (Rs. 5.50-8/l; € 0.11-0.16), mostly depending on whether the village or farmers are affiliated with an NGO or cooperative.

Photo 4.4 – 4.5: Cow barn and fodder collection, Darjeeling District
(Photo by SHILPI SAXENA, 2002)

Most of the organic farmers in Kanto own chicken (45 %), which includes sale and home consumption of eggs and somewhat of chicken meat, sometimes manufactured into chicken sausage. Concerning other livestock, each one farmer only owned one of the following: ducks for the paddy field and home consumption, sheep for wool and meat, pig for meat, goat and cow for milk. None of the surveyed conventional farmers owns livestock.

Considered using biogas

This was done by nearly half of the farmers in Darjeeling District (Table 4.7), who are organic or conventional, but only one mixed farmer uses biogas in one of the project villages. Here too, the seven mixed farmers were only counted once in the category organic. The farmer stated that the slurry is used as fertilizer on the crops; around 20-30 kg/day of cow manure is used as input and around 1 m^3 of gas is produced. It is mainly used for cooking and heating water. Though one farm in Kalimpong subdivision was seen using biogas as well, no further inquiries could be made as the farmer was not available that day. Most farmers were interested in using this technology, but when asked why the farmers were not doing so, some answered that they had no material to construct a biogas unit, did not have the know-how, would need (more) cows as input material for the system to be efficient, and that they had no money. Upon the suggestion to use it as a community at village level, they said that its maintenance would be difficult due the hilly as well as steep landform and distances between houses are too far. Furthermore, they asked how to guarantee that those who provide the input material would be the ones benefiting from the output (biogas)?

In Kanto, more than half of the organic farmers had considered using biogas, but most of the conventional farmers had not (Table 4.7). Only three organic farmers (8 %) out of 36 are using the system, but none of the conventional farmers in both study areas are using biogas. One of the three uses chicken manure, the remaining two use cow manure. All stated that less than 500 l/month is used as input, and around 60 m^3 results in biogas. All is used for cooking purposes and the slurry is applied as fertilizer on the field.

Table 4.7: Considered using biogas for cooking and heating in both study areas

	Darjeeling District				**Kanto**			
	Organic		Conventional		Organic		Conventional	
	No.	%	No.	%	No.	%	No.	%
No	13	50.0	9	37.5	14	38.9	11	78.7
Yes	12	46.2	13	54.2	22	61.1	1	7.1
Never heard of	1	3.8	2	8.3			2	14.2
Total	26		24		36		14	

Farmland ownership

The percentage in Darjeeling District was unfortunately was not established (see questionnaire), but through informal talks with local municipality offices, it was established that farmland mostly belongs to the farmers, whereas pastures and forestland are government owned. The certified organic farmers in Dabaipani are living and partly farming on land of a former tea estate and on homesteads, as latter and houses are provided to tea labourers by the management. Farming is practiced on marginal land holdings averaging less than 0.5 ha. Often the fields are located near the house, but sometimes they are situated a few hundred metres away. Boundaries between fields are made of bamboo fences or natural vegetation, such as trees (Photo 4.6) in the case of Chimney. In Kanto, the survey data showed that around 40 % of organic farmers have inherited land from their family; the rest has either bought or leased land, sometimes in addition to the inherited land (see table A5 in the appendix). Nearly 85 % of conventional farmers have also inherited the land, but hardly have bought or leased any. According to the interviewed farmers, the farmland ownership within the family dates back between 50 to 500 years. Some farmers still have their own forest grove with the farmland, from where they use their fuel wood supply (see paragraph on fuel wood use).

Photo 4.6: Conventional radish field in Chimney with natural vegetation as boundaries (Photo by SHILPI SAXENA, 2002)

Cultivation area

Here, marginal landholding means less than one ha, small ranges from 1-2 ha. Farm sizes were indicated in *decimals* or *acre* (= 100 decimals). In the case of the surveyed organic cultivation land in Darjeeling District, in total about 70 % have less than 0.5 ha for cultivation, compared to about 90 % of conventional farmland. Below table on conventional area includes the seven farmers that cultivate combined (conventional and SMF), as well as two farmers who only practice SMF but still own normal land, though at time of the study, those were not in use for conventional cultivation. The organic farmland also includes the seven combined farmers (SMF and conventional), as well as the Dabaipani farmers and the two farmers only practicing SMF (Table 4.8). These nine non-certified organic farmers have up to 150 m^2-beds.

Of the surveyed organic farmers in the Kanto region, farmers indicated sizes in *ares* (= 100 m^2) or *tan* (= 1,000 m^2). More than 70 % have less than 1 ha out of which 40 % are already below 0.75 ha for agriculture; 11 % have between 1 and 2 ha for cultivation, the rest up to 7 ha (see table A6 in the appendix). From the conventional farmers, 43 % have less than 0.5 ha, while 29 % have below 1 ha. This shows that in both surveyed regions, the majority of farmers have marginal landholdings.

Table 4.8: Size of organic and conventional cultivation farmland, Darjeeling District

Landholding	m^2 (ha)	Organic		Conventional	
		No.	%	No.	%
	< 1,000 (<0.1)	10	38.5	6	19.4
	1,000 - < 5,000 (0.1-<0.5)	8	30.7	22	70.9
Marginal	5,000 - < 10,000 (0.5-<1.0)	2	7.6	3	9.7
Small	10,000 - < 15,000 (1.0-<1.5)	6	23.2	-----	-----
Total		26		31	

Total farmland

This variable includes cow shed/animal shed and house. Here, the majority of conventional and organic farmers have less than 1 ha (84 % and 58 % respectively) in Darjeeling District. Though one case in the conventional farmers is missing, less than 1 ha would still be the highest value. Both farming types only have up to 3 ha, out of which 27 % of total organic farmland is distributed between 1-<2 ha compared to 10 % conventional of same size. For Kanto, total farmland additionally includes greenhouse area: here, 57 % of conventional farmers have less than 1 ha compared to 53 % total organic farmland. Though cases are missing in both, nevertheless, the size mentioned above would still be the highest. Concerning other sizes, no reliable statement can be made due to the missing cases (see table A7 in the appendix).

Cultivated crops

In Darjeeling District these are leafy, stem and root vegetables (e.g. radish, cabbage, broccoli, spinach and onion), fruit vegetables (e.g. cucumber, tomato and eggplant), tuber crops (e.g. potato) and seed crops (wheat). The majority of conventional and combined farmers grow vegetables (64 % and 27 % respectively) but only 9 % of non-certified organic farmers cultivate vegetables. Of the 17 certified organic farmers, 47 % practice vegetable cultivation in combination with tea, fruits and cardamom; each 6 % are into vegetables, fruits and cardamom as well as vegetables and tea, while 41 % are cultivating vegetables, fruits and tea. Of the 24 conventional farmers, 58 % are growing vegetables, 21 % vegetables and fruits, 17 % vegetables and cardamom, and 4 % vegetables, fruits and cardamom. From the 7 combined farmers (conventional and non-certified organic), 86 % raise vegetables, and 14 % vegetables and cardamom. In Kanto, 61 % of the non-certified organic farmers cultivate vegetables compared to 33 % of conventional farmers and 6 % of certified organic. Vegetables and fruits are cultivated by 40 % of non-certified organic farmers, compared to 60 % of conventional farmers. Vegetables and rice are grown by 78 % of non-certified organic, and each 11

% by certified organic as well as conventional farmers. For a detailed view on the crops cultivated, see table A8 in the appendix.

Basically, farmers in Darjeeling District are subsistence farmers, but have also started growing cash crops, such as ginger, tea, cardamom or orange. The farming system is a food crops dominated system, with somewhat livestock integrated with the growing of crops. On the higher elevations, only vegetables are cultivated, whereas at lower altitudes fruits, tea and cardamom are grown too. The fields are terraced and rain-fed as well as irrigated from nearby water streams ('jhoras'). With the commencement of the rainy season from beginning of June till the end of August, which is the main cultivation period of summer crops ('kharif' crops), the conventional farmers of Chimney at 2,200 m grow radish as a monocrop, whereas Majua farmers at 1,400 m grow maize during the same time period. Farmers stated that due to the lower altitude it becomes too warm and humid at Majua, which makes it difficult to grow radish in summer. Conventional crops grown by Chimney, Majua and Sindebong farmers are listed in table 4.9.

Table 4.9: Planting pattern of conventional farmers at different altitudes, Darj. Dist. (Source: own field survey, 2002)

Village	Planting Pattern
Chimney (2,200 m), Kurseong subdivision	Raia Saag, Coriander (January/February) Peas, Beans (March/April) Potato (March/April) Radish (May-August) leftover Radish (September/October) Raia Saag (October) Raia Saag, Coriander (November/December)
Majua (1,400 m), Kurseong subdivision	Raia Saag (January/February) Beans (March/April) Potato (March/April) Maize, Ginger (May-August) Cardamom (sowing November-January; harvest August-November) Raia Saag (October) Raia Saag (November/December)
Sindebong (1,100 m), Kalimpong subdivision	Rice (sowing June/July; harvest October/November) Cardamom (sowing November-January; harvest August-November) Vegetables on same field (November/December-May): Radish, Maize, Potato, Ginger, Bean, Squash, Lentil, Wheat

Conventional and certified organic farmers grow seasonally dependent crops, whereas the SMF farmers grow year around mainly the following: cauliflower, cabbage, broccoli, lettuce, spinach, carrots, beetroot, fenugreek, coriander, onion and spring onion (see table A11 in the appendix for a detailed SMF crop listing). But farmers find it difficult to cultivate leafy vegetables in summer, due to the humid weather leading to wilting crops and insect infestation in the m^2-beds. Hence, these vegetables are preferably grown in the post-monsoon/pre-monsoon period. As these farmers also own conventional land, they cultivate the same crops as their colleagues (see table 4.10). Chimney farmers (conventional, SMF and both combined) are located on the hilltop, which is exposed to very strong winds and direct sun. Here, the poly-cover of the square meter beds protects the crops from the winds. The farmers in Tinchulay and Rampuria practice SMF only seasonally, as crops like cabbage and cauliflower do not grow well in summer at lower altitude (at 1,500 m and 1,400 m respectively).

The certified organic farmers of Dabaipani primarily grow radish, pea, bean, maize, tomato, tree tomato, potato, ginger, cardamom and tea. Furthermore, they grow pumpkin, eggplant, squash, hill chilli (a special chilli grown in the hills), bitter gourd and cucumber. One certified organic farmer also grows carrot, cabbage and cauliflower. The Kalimpong farmers are more rice-based in summer and grow vegetables as well as wheat in the winter season. Popular local leafy vegetables grown by conventional and organic farmers alike include raia and lali saag (*Amarantaceae*). Fruits cultivated by conventional and organic farmers include orange, guava, peach, pear, mango, pineapple, plum and banana at elevations between 1,010 and 1,400 m. Table 4.10 includes the botanical names for above-mentioned crops and differentiates between primary, secondary and cash crops. The choice of crops shows that the farmers equally grow leguminous crops, which add nitrogen to the soil. These crops in this case are peas and beans. Fruits are not mentioned for the Kurseong subdivision, because the surveyed farmers did not cultivate any, which does not mean that neighbouring farmers might be growing fruits, for example in Majua village, with its lower altitude than Chimney. Products like rice, lentil and wheat flour are purchased from the market, which are grown in the plains. Only Kalimpong subdivision is a traditional rice cultivating area in the Darjeeling Hills.

Ginger seed retention is another practice done by surveyed certified organic Dabaipani and conventional Kalimpong farmers: depending on the yield, they keep about one quarter in store to use as seeds for the following year. In Sikkim, the state north of Darjeeling District, ginger retention by farmers is not practiced due to less space and soft rot during storage; hence, the farmers buy the rhizomes from the market at planting time (SHARMA & SUNDRIYAL, 1998).

Table 4.10: General overview of crops cultivated by the surveyed farmers, Darjeeling District (* primary/most frequent; ** secondary; *** cash crop) (Source: own field survey, 2002; SHARMA, 2001; TRIVEDI, 1987; ICAR, 1980; BURNS, 1918)

Farm Practice	Crop cultivated	Nepali/Hindi Name	Botanical Name
Non-Certified Organic Farmers (SMF)	Cabbage*	Bandh Gobi	*Brassica oleracea* var. *capitata*
	Caulifower*	Ful Ghobi	*Brassica oleracea* var. *botrytis*
	Broccoli*	Broccoli	*Brassica oleracea* var. *italica*
	Carrot*	Gajar	*Daucus carota*
	Table Radish**	Mula	*Raphanus sativus*
	Beetroot*	Chukandar	*Beta vulgaris*
	Lettuce*	Salad/Lettuce	*Lactuca sativa*
	Spinach*	Paalak	*Spinacea oleracea*
	---------	Lali Saag*	*Amaranthus gangeticus*
	---------	Raia Saag*	*Amaranthus oleraceus*
	Onion*; Spring Onion*	Piyaz	*Allium cepa*
	Fenugreek**	Methi	*Trigonella foenum-graecum*
	Coriander**	Dhania	*Coriandrum sativum*
	Mushroom**	Mushroom	*Agaricus campestris*
Certified Organic Farmers	Radish*	Mula	*Raphanus sativus*
	Pea*	Mattar	*Pisum sativum*
	Bean*	Semi	*Lalab purpureus*
	Pumpkin*	Farsi	*Cucurbita moschata*
	Eggplant**	Brinjal/Baigan	*Solanum melongena*
	Squash**	Sqush	*Cucurbita pepo*
	Cucumber*	Kakra	*Cucumis sativus*
	Tomato**	Rambera/Tamatar	*Lycopersicon lycopersicum*
	Bitter Gourd**	Karela	*Momordica charantia*
	Potato*	Aloo	*Solanum tuberosum*
	Maize*	Bhutta	*Zea mays*
	Hill Chilli*	Dalle Khorsani	*Capsicum annnuum* var. *acumminatum*
	Ginger***	Adhuva	*Zingiber officinale*
	Cardamom***	Elaichi	*Amomum subulatum*
	Tea***	Chai	*Camellia sinensis*
	Orange***	Suntala	*Citrus aurantium*
	Guava*	Ambak	*Psidium guava*
	Pineapple**	Ananas	*Ananassa sativa*
	Pear**	Naspati	*Pyrus communis*
	Peach**	Aroo	*Amygdalus persica*
	Plum**	Aloocha	*Prunus domestica*
	Banana**	Kera	*Musa paradisiaca*
	Mango**	Am	*Mangifera indica*
Conventional Farmers Da=Darjeeling subdiv. Ka=Kalimong subdiv. Ku=Kurseong subdiv.	Radish*	Mula	*Raphanus sativus*
	--------	Lali Saag* (Ku); ** (Da, Ka)	*Amaranthus gangeticus*
	--------	Raia Saag* (Ku); ** (Da, Ka)	*Amaranthus oleraceus*
	Pea**	Mattar	*Pisum sativum*
	Bean*	Semi	*Lalab purpureus*
	Pumpkin* (Da, Ka); ** (Ku)	Farsi	*Cucurbita moschata*
	Squash* (Ku); ** (Ka)	Sqush	*Cucurbita pepo*
	Cabbage** (Da, Ka)	Bandh Gobi	*Brassica oleracea* var. *capitata*
	Cucumber* (Da); ** (Ka, Ku)	Kakra	*Cucumis sativus*
	Spinach** (Ku)	Palak	*Spinacea oleracea*
	Carrot** (Da)	Gajar	*Daucus carota*
	Tomato**	Rambera/Tamatar	*Lycopersicon lycopersicum*
	Fenugreek** (Da)	Mehti	*Trigonella foenum-graecum*
	Coriander** (Ku, Da)	Dhania	*Coriandrum sativum*
	Hill Chilli** (Ka)	Dalle Khorsani	*Capsicum annnuum* var.

			acumminatum
	Onion** (Da, Ka)	Piyaz	*Allium cepa*
	Garlic** (Da, Ka)	Lehsoon	*Allium sativum*
	Ginger***	Adowa	*Zingiber officinale*
	Cardamom***	Elaichi	*Amomum subulatum*
	Potato*	Aloo	*Solanum tuberosum*
	Maize*	Bhutta	*Zea mays*
	Wheat** (Ka)	Gahu	*Triticum sativum*
	Rice* (Ka)	Dhan	*Oryza sativa*
	Lentil** (Ka)	Dal	*Lens esculenta*
	Guava* (Ka)	Ambak	*Psidium guava*
	Pear** (Ka)	Naspati	*Pyrus communis*
	Peach** (Ka, Da)	Aru	*Amygdalus persica*
	Plum** (Ka)	Arucha	*Prunus domestica*
	Tree Tomato**	Tree Tamatar	*Cyphomandra betacea*

Note: The table exemplifies the crop variety cultivated by the farmers and is therefore not exhaustive. The spelling of local Nepali words is based on a phonetic estimation to English and is not a direct translation from Nepali to English. The rating (primary, secondary) has been established from the frequency of crops named by the farmer.

The crops mostly cultivated by the surveyed organic farmers in Kanto are (the crops without a Japanese name in brackets are pronounced very similarly to the English name; for botanical names not listed below, see table 4.11): radish ('daikon'), cucumber ('kyuri'), capsicum ('piman'), pea ('endou'), bean ('ingen mame'), soya bean ('daizu', *Glycine max*), tomato, spinach ('horenso'), lettuce, eggplant ('nasu'), broccoli, cabbage ('kyabetsu'), cauliflower, pumpkin ('kabocha'), carrot ('ninjin'), chilli ('toogarashi'), onion ('tama negi'), spring onion ('negi'), ginger ('shyouga'), garlic ('niniku'), rice ('kome', *Oryza sativa* var. *japonica*) and several potato varieties ('imo'), often sweet potato ('satsuma imo', *Ipomoea batatas*). Few even grow rocket salad ('ruccola', *Eruca sativa*), brussel sprouts ('mekyabetsu', *Brassica oleracea* var. *gammifera*), shiitake mushroom (*Lentinus edodes*), peanuts (*Aracbis hypogaea*), sesame ('goma', *Sesamum indicum*) and herbs like basil (*Ocimum basilicum*), parsley (*Petroselinum crispum*) and rosemary (*Rosmarinus officianlis*) (Fanton & Fanton, 2002). A planting and harvest pattern of an organic farmer from Greater Tokyo is given in the appendix (Table A10).

The conventional Kanto farmers grow basically the same vegetables, only in much lesser variety (see paragraph below on crop diversity). Additionally, there are Japanese and Chinese leafy vegetables preferably cultivated by organic and somewhat by conventional farmers, such as 'komatsuna', 'hakusai' and 'chingensai' (Photo 4.7; table 4.11), which are quite popular in Japanese diet.

Photo 4.7: Three leafy vegetables in Japanese diet; chijimina is cultivated from taasai and chingensai
(Photo by SHILPI SAXENA, 2003)

Fruits cultivated by the organic farmers can include kiwi (*Actinidia chinensis*), Japanese persimmon ('kaki', *Diospyros kaki*), grape ('budo', *Vitis*), blueberry (*Vaccinium spp.*), watermelon ('suica', *Citrullus lanatus*), apple ('ringo', *Malus*), litchi (*Litchi sinensis*), pear ('nashi'), plum ('ume'); the surveyed conventional fruit farmers mostly grow different mandarin ('mikan') and orange ('orenji') varieties (FANTON & FANTON, 2002; KOBAYASHI, 1989; TREML, 2004).

Table 4.11: Popular Japanese and Chinese vegetables mainly cultivated by organic farmers, Kanto
(Source: own field survey, 2002-2003; FANTON & FANTON, 2002; TREML, 2004)

Vegetables	**English Name**	**Botanical name**
Aburana	-----	*Brassica campestris* L. var. *rapa*
Chingensai	-----	*Brassica campestris* L. var. *chinensis*
Daikon	Japanese Radish	*Raphanus sativus*
Hakusai	Chinese Cabbage	*Brassica campestris* L. var. *pekinensis*
Kinrenka	Nasturtium	*Tropaeolum majus*
Komatsuna	Mustard spinach	*Brassica campestris* L. *rapa perviridis*
Mibuna	-------	*Brassica rapa japonica*
Mitsuba	Japanese Parsley	*Cryptotaenia japonica*
Mizuna	Mizuna	*Brassica campestris* L. var. *japonica*
Moroheya	-----	*Corchorus olitorius*
Pakchoy	Chinese Chard/Mustard	*Brassica rapa* var. *chinensis*
Shungiku	Garland Chrysanthemum	*Chrysanthemum coronarium*
Taasai	-----	*Brassica campestris* L. var. *narinosa*

According to DOMRÖS (1974), upland rice or dry rice is grown as a rain fed crop; the wet or lowland rice is irrigated. The latter is more important globally, since it accounts for 75 % of rice cultivation, while upland rice accounts for only 10 % (WILLENBRINK 2003, p. 27). Rice *(Oryza sativa)*, in this case upland rice, grows without extra irrigation and on soils that have good natural water–bearing capacity. Often upland rice is cultivated in crop rotation. In Kalimpong subdivision, where local rice is grown, terraces are rain fed in summer and irrigated in winter for vegetable cultivation and potato being the main grown crop. Upland rice matures in the mountainous regions of the Himalaya in 75 to 80 days at altitudes up to 2,300 m a.s.l. (WILLENBRINK 2003, p. 27). Generally temperatures of minimum 25°C are needed and a high water supply, which is necessary for upland rice. In order for the farming practice on rain-fed land to work properly, terraces need to be flat (Photo 4.8). Some data was provided by RCDC from one of their Kalimpong project villages about the cultivated local rice, called *Basti ko Chamal*: the seed is sown in June/July, transplanted in July/August and harvested in November/December. They use farmyard manure as fertilizer. This local hill rice is dehusked manually and sold directly in the Kalimpong market. It is a brown rice that is only consumed by hill people mainly during festivals, whereas for daily rice consumption the white rice from the plains is bought. In the rice growing area itself, the local rice is consumed along with white rice.

Photo 4.8: Rain-fed rice terraces in Kalimpong subdivision during summer monsoon (Photo by SHILPI SAXENA, 2002)

For irrigated land, the fields must be slightly forward slanting. In most cases the terraces are located near a water stream from where water is diverted through small water channels or half open bamboo pipes (DOZEY 1999, p. 233; O'MALLEY 1999, p. 64-67). The vegetable fields/terraces in the Darjeeling and Kurseong sub-divisions are somewhat sloping and depending on the season, irrigated or rain fed as well. Though villages are connected through pipes to the government-owned water supply system, its supply is often scarce. The SVC-Dabaipani villagers have recently set up their own decentralised water supply system with the help of the NGO RCDC, which runs for 24 h to be independent from government supply (THE TELEGRAPH, 2004; DOWN TO EARTH, 2004). Historically, Kalimpong subdivision is a rice growing area; the terracing style of fields as in Kalimpong subdivision is not found in Kurseong and Darjeeling subdivision, whether conventional (Photo 4.9) or certified organic (Photo 4.10; the non-certified organic farmers use the m^2-beds).

Photo 4.9 - 4.10: Terraced fields of a conventional and a certified organic farmer in Kurseong and Darjeeling subdivision, growing potatoes and beans (Photo by SHILPI SAXENA, 2002)

Tea is cultivated by the surveyed organic farmers in the Daibaipani villages (see chapter 5.1.1.). *Camellia sinensis* and *C. assamica* are grown in Darjeeling District. Darjeeling tea is cultivated in the Terai (plains) and up to 2,100 m, on slopes up to a gradient of 15-20° (DTRDC, 2003c; STARKEL & BASU, 2000). It thrives best at a minimum temperature of 18.3°C and a maximum temperature of 23.5°C, giving the highest yield; relative humidity ranging from 80-90 % is favourable too (HAJRA 2001, 91). If properly cultivated, tea bushes can live well above 100 years. The tea bush can grow up to 2.5 m, but it is kept at 0.60-1 m; this is the optimal plucking height for the women pluckers, as no machinery is used due to the hilly and steep topography of Darjeeling District (O'MALLEY, 1999; DPA, 1999). Tea plantations exist mainly in the Kurseong and Darjeeling sub-divisions of the district, only a very small area in Kalimpong sub-division has tea estates (see chapter 5.1.1. and fig. 4.1).

Large cardamom (*Amomum subulatum*) is cultivated in Darjeeling District and Sikkim (SHARMA, 2001). It is a perennial and non-perishable cash crop (SHARMA & SUNDRIYAL, 1998) with high value in monetary terms. Originally, cardamom cultivation was started by the Lepchas in Sikkim; from there it spread to Darjeeling Hills, Bhutan and eastern Nepal. It prefers shade from tree cover and requires very moist areas with a mean average rainfall between 1,500 and 3,000 mm (SHARMA & SHARMA, 1997). Shade trees are *Alnus nepalensis*, *Schima wallichi*, *Bucklandia populnea*. This crop can be grown on altitudes between 600 and 2,000 m and soils should be acidic.

Crop diversity

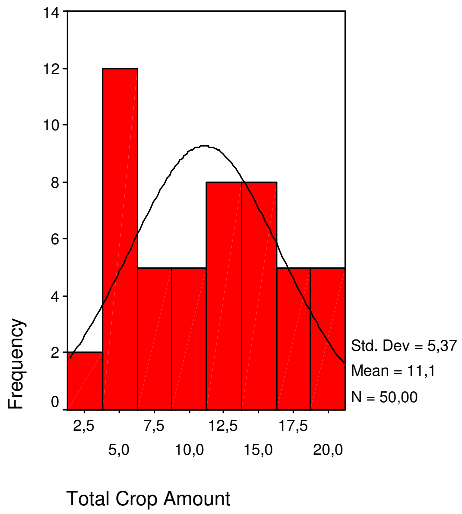
It refers to the amount of crops, including varieties cultivated by the farmers (Table 4.12). In Darjeeling District, the majority of the organic farmers grow a medium amount of crops. The certified organic farmers are mainly in the medium level, compared to the combined and non-certified farmers, who are mainly distributed in the lower crop amount category. Most conventional farmers have low crop diversity. In a study by SINGH *et al.* (1997, p. 30) in the North-Western Himalaya, 17 crops in upland agriculture are stated as high, compared to 5-8 crops in other Himalayan studies (SHARMA, 1991; PANDEY & SINGH, 1984; MISHRA & RAMAKRISHNAN, 1982). In Kanto, organic farmers have a high crop diversity, in this case mostly the non-certified organic, whereas conventional farmers have a rather low diversity level. Often the latter farmers stated that in conventional farming they specialize on a few crops but therefore try to achieve high yields through lot of chemical input. Organic farmers said they strive for quality rather than quantity and offer a wider variety of food for the consumer, taking into account lesser yields. From the surveyed organic farmers, some cultivate between 30 and 60 crop varieties.

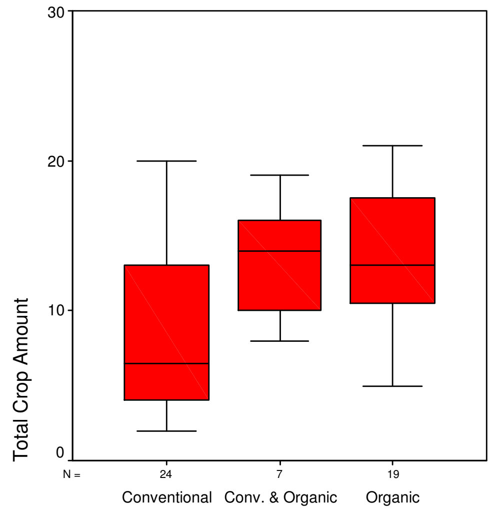
Table 4.12: Crop amount/diversity in both study areas

	Crop Amount	**Darjeeling District**				**Kanto**			
		Organic		Conventional		Organic		Conventional	
		No.	%	No.	%	No.	%	No.	%
low crop diversity	1 - < 10	10	38.5	20	64.5	6	16.6	9	64.3
medium crop diversity	10 - < 20	14	53.8	10	32.3	9	25.0	3	21.4
high crop diversity	>= 20	2	7.7	1	3.2	20	55.6	2	14.3
Total		26		31		35	97.2	14	
Missing						1	2.8		
Total						36			

Darjeeling District: data (Fig. 4.5) shows a (here lightly) right-skewed (positive skewed) distribution of crop amount (Skewness=0.126, Standard error of Skewness (SE)=0.337). The boxplots are also skewed and show differences in crop amount between farming techniques, with a higher crop amount for mixed and organic farmers (Fig. 4.6). Boxplots indicate a smaller median total crop amount for conventional farmers (Median 6.50 vs. 14.00 vs. 13.00).

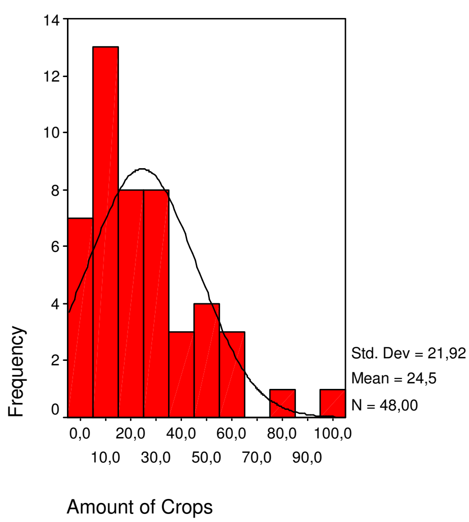
Fig. 4.5 – 4.6: Distribution of total crop amount: histogram and boxplot, Darjeeling Dist.

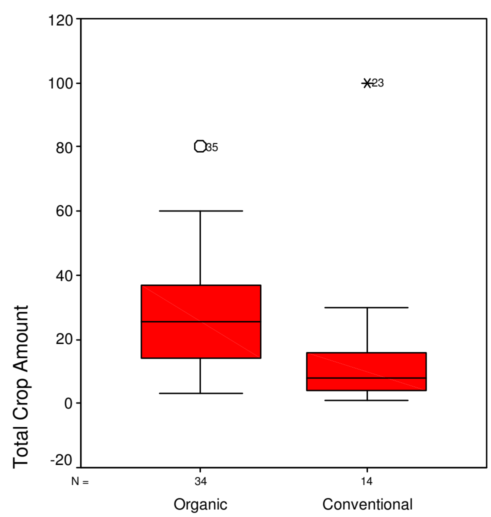




Kanto: As in the former case of Darjeeling District, the histogram shows a (here clearly) right-skewed distribution of total crop amount (Skewness=1.426, SE=0.343; fig. 4.7). The boxplot indicates a difference in crop amount between farming techniques, with a higher crop amount for organic farmers (Median 25.50 vs. 8.00; fig. 4.8). Outliers are expected in lognormal distribution. Remark: The heterogeneity of data do not disturb the modality of the combined distribution because of unequal (representative) sample sizes.

Fig. 4.7 – 4.8: Distribution of crop amount: histogram and boxplot, Kanto





Hypothesis 1: The organic crop diversity differs from conventional crop diversity

Null Hypothesis H_0: No difference in crop diversity of organic farming compared to conventional farming

The groups in Darjeeling District are organic, conventional, as well as organic and conventional. A test on normal distribution of total crop diversity/amount (kg) was conducted. Though there was no rejection of normality of combined data (Lilliefors, p=0.184), groups show a distinct heteroscedasticity (Levene, p=0.026). Therefore, the total crop amount for the three groups were tested with the H-Test. Data shows a significant difference (n=50; Medians: organic: 13.00, conv. and organic: 14.00, conv.: 6.50; H-Test, p=0.008; ANOVA on logdata, p=0.003) for organic crop diversity compared to conventional crop diversity in Darjeeling District.

As the two study areas are tested separately, a test for the organic and conventional Kanto farmers concerning total crop amount was conducted: Normality of data was rejected (Lilliefors, p=0.012), but no objection against homoscedasticity was found (Levene, p=0.808); nevertheless, the within group variance is smaller, therefore, even with small sample size, the test for Kanto was able to detect a significant difference (n= 48; Medians: organic: 25.50 and conventional: 8.00; U-Test: p=0.04; T-Test on logdata: p=0.02) in crop amount. The result shows that crop diversity/amount for organic farmers are different from conventional farmers.

Yield

In Darjeeling District, yield was indicated in *quintals* (≅ 100 kg), *man* (≅ 40 kg), *doko* (a *basket* ≅ 15-20 kg) or *bag*, which can vary between 40-80 kg, depending on the crop. Raia saag was always stated as *bundles* (≅ 500 g). Organic Farmers have a low yield, compared to the conventional farmers, which are ranked at higher yield, narrowly followed by low yield (Table 4.13). The category of low yield includes eight square meter farmers. The majority of organic Kanto farmers though have high yield, as well as the conventional cultivators. Some organic farmers have crop yields between 10 and 100 t per year, compared to 10 to 60 t grown conventionally. The Japanese farmers stated yield in kg or tonnes.

Table 4.13: Yield from crops in the study areas

		Darjeeling District				**Kanto**			
		Organic		Conventional		Organic		Conventional	
	kg/yr	No.	%	No.	%	No.	%	No.	%
low yield	<= 500	13	50.0	12	38.7	9	22.2	3	21.4
medium yield	501-1,000	7	26.9	6	19.4	6	13.9	1	7.1
high yield	> 1,000	6	23.1	13	41.9	19	58.3	9	64.4
Total		26		31		34	94.4	13	92.9
Missing						2	5.6	1	7.1
Total						36		14	

For Darjeeling District the correlation between organic yield and crop amount is strong although not significant (Spearman=0.447, p=0.22), which indicates that the more crop amount cultivated, the higher the yield. For conventional yield and crop amount, the correlation is rather low (weak) and not significant (Spearman=0.032, p=0.865). The correlation for the organic Kanto farmers is high and significant (Spearman=0.632, p=0.000) and for the conventional farmers slightly lower and not significant (Spearman=0.506, p=0.078). As all correlations - significant or not - have the same sign we have a clear indication in both study areas: the higher the crop amount, the higher the yield (Table 4.14-4.15).

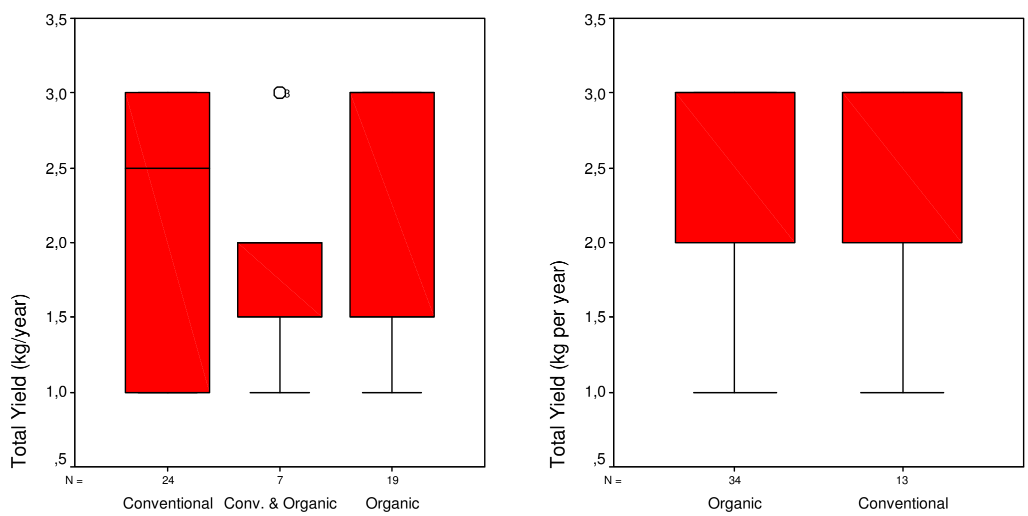
Table 4.14 – 4.15: Cross tabulation between yield and crop amount, Darjeeling District

		Organic Crop Amount			**Total No.**
		1 -< 10	10 -< 20	>= 20	
Total Yield of Organic Crops (kg/year)	<= 500	7	6	-----	13
	501-1,000	3	3	1	7
	> 1,000	-----	5	1	6
Total No.		10	14	2	26

		Conventional Crop Amount			**Total No.**
		1 -< 10	10 -< 20	>= 20	
Total Yield of Conv. Crops (kg/year)	<= 500	8	4	-----	12
	501-1,000	3	3	-----	6
	> 1,000	9	3	1	13
Total No.		20	10	1	31

The data on yield are grouped, because the non-certified farmers only indicated ranges, but no specific values. The boxplot for Darjeeling District (Fig. 4.9) does not show a clear difference in yield (Median: 2.50 vs. 2.00 vs. 3.00), as the boxplots overlap. Distributions for Kanto (Fig. 4.10) also seem to indicate no clear difference in yields (Median: 3.00 vs. 3.00).

Fig. 4.9 – 4.10: Boxplots on total yield, Darjeeling District and Kanto



Hypothesis 2: The amount in yield differs between organic and conventional farming

Nullhypothesis H_0: No difference in the amount of yield between organic and conventional farming

In accordance with literature, the data for Darjeeling District does not indicate a significant difference (n=50, Medians: organic: 3.00; conv. and organic: 2.00; conv.: 2.50; H-Test, p=0.307) between the yields of organic and conventional crops.

Data for Kanto does not indicate a significant difference between organic and conventional crop yield (n=47; Medians: organic: 3.00; conv.: 3.00; U-Test, p=0.717). The tests support the observation from the frequency table and the boxplots.

Clark *et al.* (1999, p. 111) point out that for yield comparisons, temporal variability is an important factor to consider when evaluating alternative and conventional systems *"because of the potential implications for farm-income when adopting non-conventional practices"*. Due to the short time period of the study in Darjeeling District and Kanto, the temporal aspect was simply not feasible for the current research, whereas the study by Clark *et al*. (1999) was done over an eight-year period.

Productivity

Or production in terms of yield on the cultivation area (Scialabba, 2000) is quite different in both places: while the Darjeeling District farmers, organic as well as conventional rather have a low production, the organic and conventional Kanto farmers have a rather high production per ha (Table 4.16). In the Darjeeling District count, the mixed farmers are only counted once, because they stated their conventional yield with a precise value, but not their SMF-yield. Therefore, the production of yield per ha includes the cultivation on terraced fields, of both certified organic and all conventional farmers. The two non-certified farmers, who own terraced land but only use SMF, are indicated as 0 kg/ha.

Table 4.16: Productivity of farmers in both study areas

	Darjeeling District				**Kanto**			
	Organic		Conventional		Organic		Conventional	
kg/ha	No.	%	No.	%	No.	%	No.	%
0	2	10.5	-----	-----	-----	-----	------	------
< 500	10	52.7	25	87.0	12	33.3	5	35.8
500-< 2,000	4	21.0	4	13.0	7	19.4	1	7.1
>= 2,000	3	15.8	-----	------	15	41.7	7	50.0
Total	19		31		34	94.4	13	92.9
Missing					2	5.6	1	7.1
Total					36		14	

Output

It should be noted that the farmers found it difficult to state a general income amount as requested in the questionnaire; they were able to give a detailed account of the per unit crop price sold to the middle-man etc. which means that for Darjeeling District only an output of the products could be calculated.

Even though conventional farmers have a higher yield in Darjeeling District compared to the organic farmers, they and their organic colleagues have an output which is already well below the poverty line. As no official figure was available on Darjeeling District, this value is based on Dabaipani villages where surveys had been conducted by RCDC: the average annual family income there is below Rupees 11,800 (€ 250) (KAUKLER, 1998), whereas the poverty line used by the state, Government of West Bengal, which Darjeeling District belongs to, is at Rupees 15,000 (about € 300) per household annually (LITTLEMORE, 1997). The level of Rs. 15,000 is used as an indicator for the output in table 4.17; accordingly, if an income would have been given, it would be even lower than the official poverty line. The zero income in table 4.17 means, that those farmers supplement their income from sources other than agriculture.

Eight square meter farmers are also below Rupees 15,000 out of which seven are mixed farmers, which means their output is as well from conventional sources. Unfortunately, that income too is in the low output category. They stated that they were as such satisfied with the SMF as an additional money source. Two farmers who had practiced it, had given it up, partly out of personal reasons and partly because they thought, it was too much work.

Table 4.17: Output from crops and non-crop products, Darjeeling District

		Organic		**Conventional**	
	Rs/yr (€/yr)	No.	%	No.	%
Home Consumption only	0	----	----	3	9.7
Poverty Line low output	**<= 15,000 (<= 300)**	21	80.8	21	67.7
medium output	15,001- 45,000 (300-<900)	4	15.4	6	19.4
high output	> 45,000 (> 900)	1	3.8	1	3.2
Total		26		31	

Outputs from other products (non-crop products) include honey from apiary, floriculture, silviculture or making of the Darjeeling broomstick from a local plant, known as 'Amlisoo' (*Thysomaelia agropsis*; photo 4.11). This plant has several other useful purposes, such as soil binding properties, fodder and firewood. Non-crop products are pursued by 15 % out of 26 organic and mixed farmers and 18 % out of 24 conventional farmers. Milk output is not included, as only few farmers gave information on it, as described under the livestock paragraph.

Other farmers make illegal alcohol, locally known as 'raksi' or 'arak' (Photo 4.12) and 'jhar'. In the survey, it is made by 27 % of organic and mixed farmers. Raksi is distilled from rice, wheat, millet, maize, potato or ginger, whereas jhar is a local beer made from wheat, millet or maize. Since this activity is illegal and vehicles into the towns are checked, it is not sure whether the farmer can really sell this commodity. Hence, the output from the alcohol is not included in above table.

Photo 4.11 - 4.12: Broomstick made out of 'Amlisoo' and illegal distilling of 'Raksi' Darjeeling District (Photo by SHILPI SAXENA, 2002)

Income

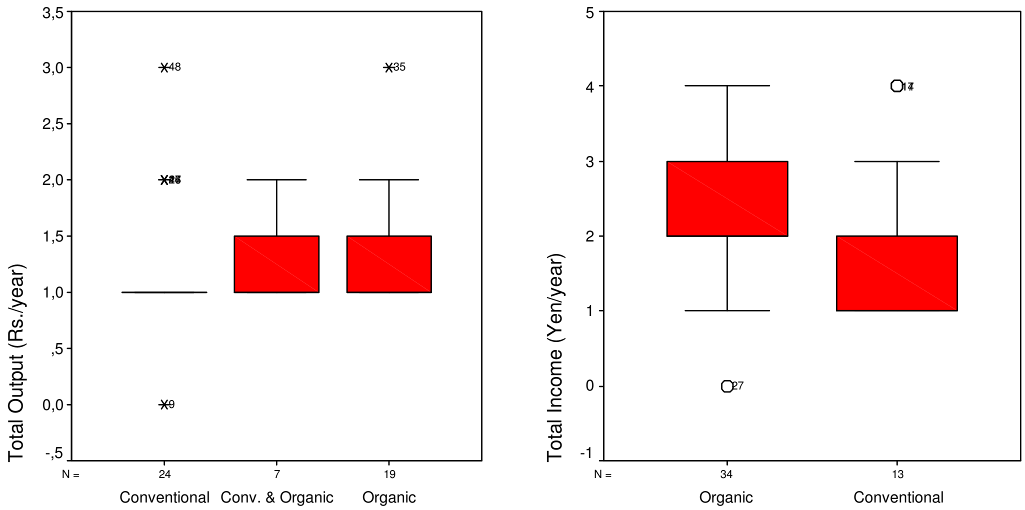
Kanto farmers stated the income amount as requested in the questionnaire, and not simply an output value. They did not have any difficulties to calculate it, compared to the surveyed Darjeeling District farmers. Most of the organic Kanto farmers have a higher income compared to conventional farmers (see table A9 in the appendix): 44 % of organic income is below € 40,000 compared to 50 % conventional income below € 4,000. Only one of the organic farmers has home consumption only, because he has another profession as the main income source. Several of the other surveyed organic farmers stated that they mainly grow crops for self-sufficiency and sell excess to customers. Others sell most of their products and use a part for home consumption.

The agricultural income level per household in Kanagawa Prefecture (2002) is ¥ 11,034,500 (around € 84,000). An average agricultural income value per household (2002) for the prefectures Kanagawa, Saitama, Chiba and Tokyo City is ¥ 9,452,400 (€ 70,500) (MINISTRY OF INTERNAL AFFAIRS AND COMMUNICATION, 2002).

In the Kanto income, non-crop products are included: 34 % out of 36 organic farmers make non-crop products like jam, wine, 'sake', mixed pickles, juice, 'miso', a fermented soybean paste or 'koji', a special rice made with yeast mould (*Aspergillus oryzae*) (IWAMA, 2001). Only 14 % from 14 conventional farmers make jam, juice, 'miso' and mixed pickles.

The boxplots on total output for Darjeeling District (Fig. 4.11) indicates that there is no difference in output for the different farm practices (Median for all three groups: 1.00). For Kanto, the boxplots on income (Fig. 4.12) indicate that there might be a difference in income as boxes do not overlap and the organic median is higher than the conventional one (Median: 2.00 vs. 1.00).

Fig. 4.11 – 4.12: Boxplots on total output, Darjeeling District and total income, Kanto



Hypothesis 3: The amount of output (Darjeeling District) differs between organic farming and conventional farming / The amount of income (Kanto) differs between organic and conventional farming

Nullhypothesis H_0: No difference in the amount for output (Darjeeling District) / No difference in the amount for income (Kanto) between organic and conventional farming

In Darjeeling District, the m^2-farmers stated a range value as requested in the questionnaire. The other organic and conventional farmers gave a price per crop and non-crop, because it was more difficult for them to state a general output value. Hence, the test for output will be for a grouped variable, which means a Non-Parametric Test for n unrelated samples. The data indicates that there is no significant (n=50; Medians: organic: 1.00, conv. and organic: 1.00, conv. 1.00, H-Test, p=0.784) difference between the organic and conventional output.

In the Kanto survey, the income variable is grouped, as farmers did not specify an exact value, but only a range, as stated in the questionnaire. A test shows that there is no significant difference between the organic and conventional income (n=47; Medians: organic: 2.00, conv. 1.00, U-Test, p=0.085). Principally, all hypotheses are tested two-tailed; with a one-tailed test at this point, the obvious result (see boxplot) would be significant (U-Test exact (one-tailed), p=0.043). Furthermore, data from the frequency table of Kanto indicates a difference (Table A9 in the appendix).

It is important though, to look at the sales/marketing channels used for the crops, in order to understand why even the majority of the certified organic farmers are in the low output category (see table 4.17).

Sales channels

Or marketing in Darjeeling District is predominantly conducted through the middle-man. He mostly comes into the villages with people who carry the goods and buys the products directly from the farmer, mostly at low prices and takes a commission. Then he sells them either at the hill market or in the Terai (plains) at wholesale markets with high profit. Siliguri, for example, has a very large wholesale market. Products like rice, lentils, wheat flour and vegetables from the plains are sold in the hills cheaply, as they are grown on large farmland area. Some farmers in Chimney were asked why they do not sell their crops by themselves in Kurseong; they answered that the municipality does not allow the villager from rural areas to maintain a shop at the local market; otherwise they would have to pay taxes. For general crops, the organic and mixed farmers (SMF crops) are displayed in table 4.18, as well as the conventional and mixed farmers (conventional crops). In both cases, the middle-man is the most frequently used sales means. Interestingly, the certified organic farmers also use middle-men, as there are no direct market outlets yet and according to RCDC, consumer awareness for (certified) organic products is still low. The Sanjukta Vikas Cooperative mainly takes care of the tea and milk of their certified organic members. Only two conventional farmers in Kalimpong stated that they sell their crops directly at the Kalimpong Bazaar or in the village. No sale indicates home consumption only.

Table 4.18: Sales Channel for Organic and Conventional Crops, Darjeeling District

	Organic		**Conventional**	
	No.	%	No.	%
Local NGO buys at fixed price	7	26.9	--------	--------
via Middle-man	17	65.4	24	77.5
Himself at Kalimpong Market	------	-------	1	3.2
Himself in Village; via Middle-man at Kalimpong Market	------	-------	1	3.2
No sale	-----	-----	5	16.1
Total	24	92.3	31	
Missing	2	7.7		
Total	26			

The farmers practicing SMF sell their crops to SASAC, which buys and sells these non-certified products at the same price without profit (Table 4.19), which means no commission has to be paid by the farmer, which is normally paid to middle-men. SASAC brings the crops collected at their experimental farm to the SASAC shop outlet in Kurseong Town. The mixed farmers do sell their conventional crop through middle-men, just like their colleagues.

Table 4.19: SASAC buying and selling prices for SMF crops

SMF-Vegetable	Yield per m² (pieces)[23]	Unit (g)	Buying and Selling Rate (Rupees/Unit)
Cauliflower	16	1000	20 (€ 0.4)
Cabbage	16	1000	12 (€ 0.24)
Broccoli	16	200	10 (€ 0.2)
Dwarf Bean	---	500	10 (€ 0.2)
Spinach	400	500	5 (€ 0.1)
Lettuce	49	200	2 (€ 0.04)
Raia Saag	30	500	5 (€ 0.1)
Lali Saag	49	500	5 (€ 0.1)
Carrot	400	500	5 (€ 0.1)
Spring Onion	196	200	5 (€ 0.1)
Table Radish	196	500	5 (€ 0.1)
Beetroot	49	500	4 (€ 0.08)
Fenugreek	250 g (seed packet)	500	5 (€ 0.1)
Coriander	250 g (seed packet)	50	2 (€ 0.04)
Turnip	49	500	5 (€ 0.1)
Mushroom	Bag culture	200	20 (€ 0.4)

The middle-man organization is described more accurately in this excerpt from the Government of West Bengal in a review on agricultural marketing in Darjeeling District (GoWB 1985, p. 18): *"The system of agricultural marketing has some variation in hill areas as compared to the plains. There is no Commission Agent operating in the hills area for the disposal of the products. A class of middle-men ('fariah') who move about in the villages as hawkers usually buy the produces of the cultivators at their farm level at a low price and arrange transport of those collected goods from farm/village to assembling markets and sell them to wholesalers with a good margin of profits. The producers/villagers who come to the assembling markets with their products have to sell these at a price dictated by the traders of the assembling market."* This citation and paragraph show that not much has changed in the sales and delivery system since the review in 1985 and at the time of survey by the author in 2002. Currently, the producer has to pay around Rs. 15-20 (€ 0.30-0.40) as transportation costs for very remote areas.

Radish is the one of the most often cultivated crops, no matter whether organic or conventional farmers grow it. Additionally, some Chimney and Simantar farmers sell it at an auction in Siliguri via the middle-man (Table 4.20). He comes and picks up the crops and takes a paper slip with the initials of the farmer for the auction. Later he pays the farmer the price it was sold for. The auction prices per kg vary between Rs. 2.5-9 (€ 0.05-0.18) therefore, they are not steady. The two farmers from Kalimpong sell radish

[23] It is interesting to note that organic urban gardens in Cuba have yielded 20 kg of vegetables and fruits per m² (HATTAM, 2002).

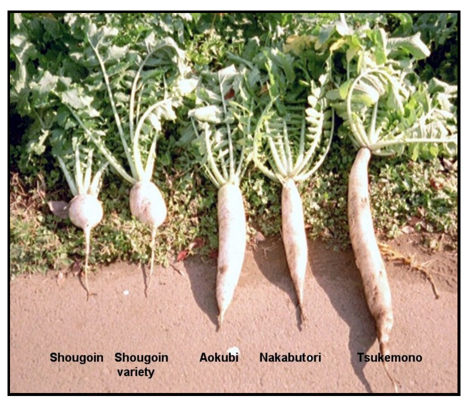
either directly at the market or in the village. The mixed farmers (non-certified organic SMF- and conventional crops) also grow radish. They are therefore included in the conventional count, as the radish grown by them is the large variety (see photo 4.13). SMF table radish sold via SASAC is the small radish. The two non-certified farmers who only grow SMF-vegetables are not included in the organic count. 'No sale' indicates home consumption only, in this case the majority of organic farmers. Prices of the middle-man range between Rs. 2-9 per kg (€ 0.04-0.18).

Table 4.20: Sales channels for radish, Darjeeling District

	Organic		**Conventional**	
	No.	%	No.	%
No sale	15	88.2	7	22.6
Middle-man	1	5.9	15	48.4
Auction in Siliguri through middle-man	----	-----	7	22.6
Himself at Kalimpong Market	----	-----	1	3.2
Himself in village and via Middle-man at Kalimpong Market	----	-----	1	3.2
Total	16	94.1	31	
Missing	1	5.9		
Total	17			

Radish, a favourite crop cultivated by the farmers of Darjeeling District (Photo 4.13) and Kanto (Photo 4.14) alike, is preferably home consumed in both areas; Kanto farmers often make Japanese pickle ('tsukemono') out of it. Though the radish in both study areas looks different from the exterior, its interior is white.

Photo 4.13 – 4.14: Radish cultivated in Darjeeling District and in Kanto
(Photo by Shilpi Saxena, 2002/2003)



Prices

These are stated here for different crops in Darjeeling District, as farmers were able to give a unit price per crop. Tea, as mentioned earlier, is mainly grown by the surveyed Dabaipani farmers. It is sold and marketed through the SVC and processed at

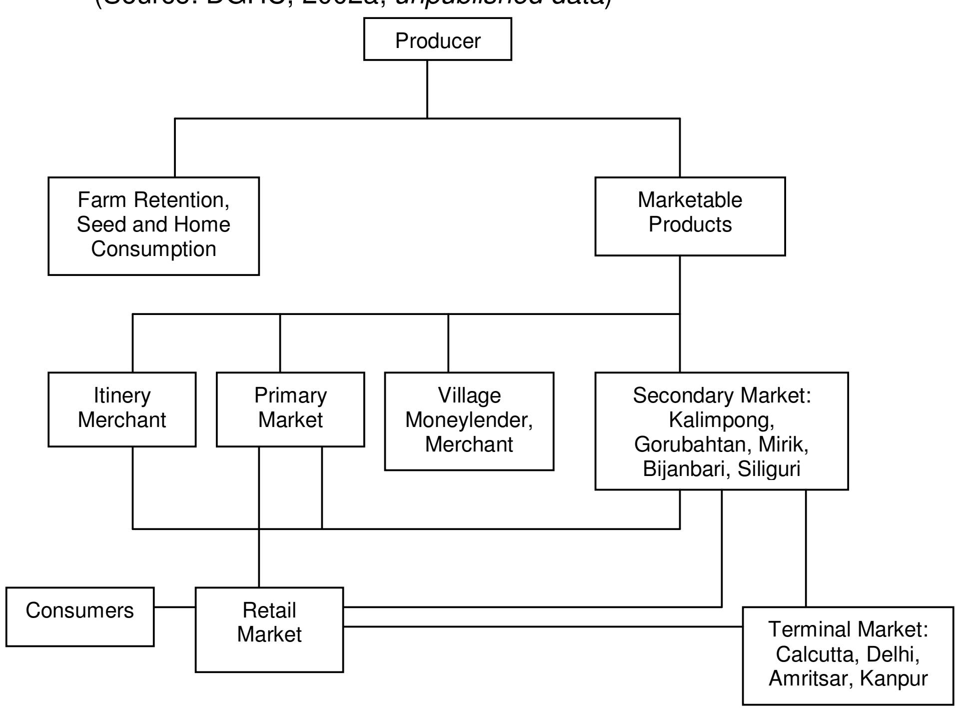
Selimbong Tea Estate, Darjeeling District. Out of the 17 certified organic tea cultivators, 16 grow tea. The buying price per kg of plucked leaves is Rs. 20 (€ 0.4) at the time of the survey in 2002; currently it is Rs. 24/kg (€ 0.5) (RCDC, 2004).

Just recently, the Dabaipani farmers have planned to export certified cash crops like ginger, cardamom and orange (DOWN TO EARTH, 2004) but it is not yet clear if this will be conducted through SVC or any other channel. Certified organic cardamom is sold from Rs. 100 (€ 2) up to Rs. 175 (€ 3.5) per kg, compared to the conventional price of Rs. 125-163 (€ 2.5-3.3) per kg.

Milk, is sold through various channels by the 50 surveyed farmers in Darjeeling District: 32 % of farmers sell the milk to the SVC, which are the organic Dabaipani farmers; in Rampuria, the ATREE village, milk is sold to the Himul Cooperative (8 %) and 16 % of farmers of Chimney village and surrounding villages sell their milk to SASAC. The latter includes those who work with the NGO as well as conventional farmers. This milk is sold to schools and at the Kurseong market. 10 % use the middle-man, 18 % own no cow and only one farmer uses milk for home consumption only. 14 % did not give information on where they sell (see livestock paragraph for details).

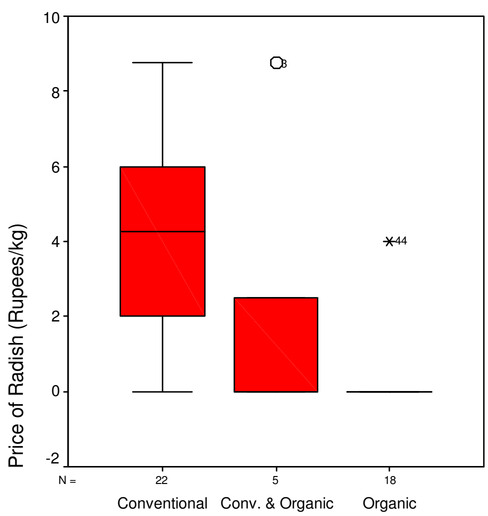
In this survey, mainly the certified organic farmers cultivate ginger. As the middle-man buys it also from these farmers, it has a price range between Rs. 5 and 8 (€ 0.1-0.16) per kg. Fig. 4.13 gives a detailed example for ginger in the supply chain from producer to consumer in Darjeeling District. There are only two of the surveyed conventional and mixed farmers cultivating ginger, and these use it for home consumption.

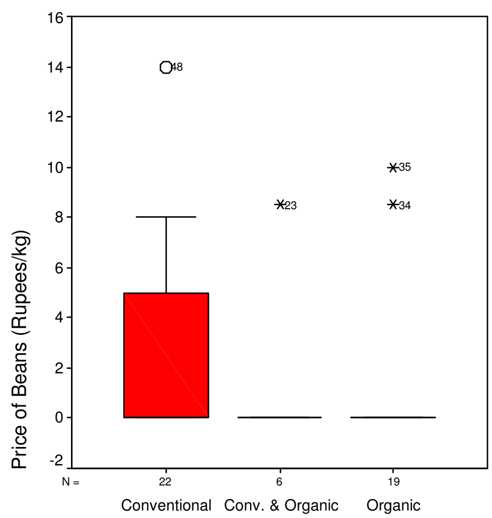
Fig. 4.13: Marketing channel for ginger, Darjeeling District
(Source: DGHC, 2002a; *unpublished data*)



The boxplots for radish (Fig. 4.14) indicate a difference in prices for conventional and mixed farmers, whereas mixed and organic farmer seem to have no difference (Median: 3.75 vs. 0.00 vs. 0.00). The potato boxplots overlap too and indicate no difference in prices (median value for all three: 0.00). The maize boxplots indicates no difference in prices, the medians have the same value (0.00). This is because the mixed farmers do not sell maize at all but consume it, as most of the farmers. The beans boxplots indicate a difference in prices (Median: 2.00 vs. 6.00 vs. 0.00; fig. 4.15). Peas boxplots also indicate no difference in prices and have the same median value for all three farm techniques (Median: 0.00).

Fig. 4.14 – 4.15: Boxplots on radish and beans sales prices to middle-man, Darjeeling District





The Kanto farmers did not state individual prices, therefore, those cannot be tested.
Hypothesis 4: The price for organic certified crops differs from conventional crop prices in Darjeeling District

Nullhypothesis H_0: There is no difference in price between organic certified crops and conventional crops in Darjeeling District

This hypothesis focuses on some of the most frequent crops cultivated by certified organic and conventional farmers in Darjeeling District, which are radish, potato, maize, beans and peas. Since the SMF crops are different from the certified organic crops and sold to SASAC, these are not included. The non-parametric test (Table 4.21) gave following result:

Table 4.21: Result of H-Test for crop prices

	Medians in group			
Crop (combined n)	organic	conventional & organic	conventional	H-Test (p)
Radish (n=45)	0.00	0.00	3.75	0.000
Potato (n=45)	0.00	0.00	0.00	0.661
Maize (n=48)	0.00	0.00	0.00	0.722
Beans (n=47)	0.00	6.00	2.00	0.237
Peas (n=48)	0.00	0.00	0.00	0.481

Except for radish, which is primarily home consumed by certified organic farmers and sold through auction, as well as though middle-men by conventional farmers, no significant difference in price could be detected between groups.

The prices vary for these conventional and organic crops, as the middle-men can demand the prices they find suitable and sell these commodities to wholesalers and retailers for a much higher price. Table 4.22 states prices as given by the Agricultural Marketing Offices of the Darjeeling Gorkha Hill Council for the markets of Kurseong, Sonada and Kalimpong in comparison to the prices bought by the trader from the producer.

Table 4.22: Buying and sales prices of middle-men, Darjeeling District (Source: own field survey, 2002*; DGHC, 2002b**)

Crop	**Price**			
	Conventional* Rs/kg	**Organic* Rs/kg**	**Wholesale** Rs/100 kg**	**Retail** Rs/kg**
Radish	2 - 9 (€ 0.04-0.18)	4 (€ 0.08)	600-1,200 (€ 12-24)	8-16 (€ 0.16-0.32)
Potato	4-10 (€ 0.08-0.2)	3-8 (0.06-0.16)	700-1,600 (€ 14-32)	7.50-20 (€ 0.15-0.4)
Maize	10 (€ 0.2)	10 (€ 0.2)	800-1,020 (€ 16-20.4)	10-12 (€ 0.2-0.24)
Beans	3-14 (€ 0.06-0.28)	8-10 (€ 0.16-0.2)	2,500 (€ 50)	32 (€ 0.64)
Peas	4-20 (€ 0.08-0.42)	7-10 (€ 0.14-0.2)	3,200 (€ 64) Green Pea 800 (€ 16) Cow pea	32-40 (€ 0.32-0.8) GP 10-14 (€ 0.2-0.28) CP

Sales channels

In Kanto, most crops are sold directly to the consumer: 39 % by organic farmers and 29 % by conventional farmers. Furthermore, organic sales channels include delivery to Health Food Stores, by post or through courier service or to school canteens. Most organic farmers have two-three sales channels, which is a combination of the above, making about 53 % next to the direct consumer sale, as seen in table 4.23. Second most frequent channel for conventional farmers is the outlets of the Japan Agriculture Association (JA), an extension service for agricultural goods from the Ministry of Agriculture. One organic farmer, who does not use any marketing channel, consumes the crops. Typical for conventional farmers is the use of less sales channels compared to their organic counterparts.

Tea is sold only by 8 % of the surveyed organic farmers (33 from 36), out of which 6 % sell the leaves to a tea factory for processing and 3 % have its own tea processing. Latter farmer sells the processed tea through post to the consumer. Only two (14 %) from 14 conventional farmers sell tea to JA.

Table 4.23: Sales channels used by farmers in Kanto

	Organic		**Conventional**	
	No.	%	No.	%
Directly to consumer	14	38.7	4	28.8
through JA (Japan Agriculture Association)	1	2.8	3	21.4
Health Food Store	1	2.8	1	7.1
through Postal delivery	1	2.8	------	------
through Organic Delivery Group	3	8.3	------	------
Directly to consumer; Health Food Store	3	8.3	------	------
Directly to consumer; Postal delivery	2	5.6	------	------
Directly to consumer; Courier service	1	2.8	------	------
Directly to consumer; School Canteen	3	8.3	------	------
Directly to consumer; School Canteen; Health Food Store	2	5.6	------	------
Directly to consumer; Health Food Store; Teikei Company	1	2.8	------	------
Directly to consumer; School Canteen; Restaurant	1	2.8	------	------
Directly to consumer; Postal delivery; Health Food Store	1	2.8	------	------
Directly to consumer; JA	------	------	3	21.4
Directly to consumer; JA; Auction Market	------	------	1	7.1
None	1	2.8	1	7.1
Total	35	97.2	13	92.9
Missing	1	2.8	1	7.1
Total	36		14	

Purpose of crops

This variable is generated from the context of different answers (Table 4.24). Most common is the sale and home consumption of the cultivated crops in both study areas. The Kanto farmers, who indicated vegetables for home consumption, are mainly conventional fruit farmers, who cultivate vegetables for home use and one is an organic farmer who is largely into livestock rearing.

Table 4.24: Purpose of cultivated crops

	Darjeeling District				**Kanto**			
	Organic		Conventional		Organic		Conventional	
	No.	%	No.	%	No.	%	No.	%
Sale & Home Consumption	24	92.3	26	83.9	32	88.9	8	57.1
Home Consumption only	-----	----	3	9.7	1	2.8	1	7.1
Home Consumption mainly, sell very less	-----	----	2	6.5	2	5.6	-----	
Sell only	2	7.7	-----	-----	-----	-----	1	7.1
Vegetables Home Consumption	-----	-----	-----	-----	1	2.8	4	28.6
Total	26		31		36		14	

Home consumption

This is completely sufficient for the conventional farmers in Darjeeling District, whereas less than 80 % of conventional farmers in Kanto stated sufficiency (Table 4.25). Only very few farmers in both areas think that the crops are not sufficient or they do not know whether it is enough. One farmer who practices both m^2 and conventional in Darjeeling District stated that he prefers to sell the SMF crops instead of eating them. Of Japanese organic farmers, 14 % out of 95 % for sufficient home consumption stated that they eat 'amaru', which means they eat the leftovers in terms of what they cannot or have not sold. A cross tabulation with yield shows, that those who stated 'not sufficient' have a yield below 500 kg/year. No consumption means that the crops are only sold.

Table 4.25: Crop rating for home consumption

	Darjeeling District				**Kanto**			
	Organic		Conventional		Organic		Conventional	
Rating	No.	%	No.	%	No.	%	No.	%
Sufficient	24	92.4	31	100	34	94.4	11	78.7
Not Sufficient	-----	-----	------	------	1	2.8	1	7.1
No Consumption	2	7.6	------	------	-----	-----	1	7.1
Do not know	-----	-----	------	------	1	2.8	1	7.1
Total	26		31		36		14	

Amount of home consumption

The amount of home consumption as assessed by the farmers for Darjeeling District shows that the majority of organic and conventional farmers rather have low consumption from their own crops (Table 4.26). The medium amount, compared to the few who have high crop consumption, is second. A cross tabulation between yield and amount of home consumption for organic farmers shows correlation that is significant and high (strong) (Spearman=0.541, p=0.05), and a not significant, weak relationship for conventional farmers (Spearman=0.209, p=0.259). A positive correlation means, the higher the yield, the higher the consumption.

It is interesting to note, that the majority of surveyed organic farmers in Kanto, have a low consumption even though they have high yield and high crop diversity. This is followed by medium crop consumption for organic and conventional farmers. Here too, a cross tabulation between yield and amount of home consumption shows a significant and high correlation (Spearman=0.526, p=0.02) for organic farmers, and a weak one for conventional farmers (Spearman=0.200, p=0.533).

Table 4.26: Consumption amount of cultivated crops

Crop consumption	kg/month	Darjeeling District				Kanto			
		Organic		Conventional		Organic		Conventional	
		No.	%	No.	%	No.	%	No.	%
none	0	2	7.7	-----	-----	-----	-----	1	7.1
low	1-< 20	18	69.3	18	58.1	18	50.0	9	64.4
medium	20-< 40	3	11.5	10	32.2	9	25.0	3	21.4
high	>= 40	2	7.7	3	9.7	7	19.4	-----	-----
Total		25	96.2	31		34	94.4	13	92.9
Missing		1	3.8			2	5.6	1	7.1
Total		26				36		14	

Assessment of Organic Farming

The assessment of organic farming in Darjeeling District, in terms of experience, 73 % of organic farmers stated a very positive experience, 27 % a positive experience. One mixed farmer stated 'the money for SMF comes in constant form; there is no waiting time as with conventional agriculture'. In terms of successfulness and helpfulness compared to conventional farming, the same values were stated for very successful and helpful as well as successful and helpful. For the Japanese question, organic farmers in Kanto stated the categories were very good (69 %), good (20 %) and satisfactory (8 %) experience, with one missing case out of 36. Comparing it to conventional farming, some could not answer this, as they had never practiced conventional agriculture (Table 4.27). The majority thought it was very successful and helpful, though in some cases they stated a bit more differentiated.

Table 4.27: Comparison of organic to conventional farming, Kanto

	No.	%
Very successful and helpful	15	41.6
Successful and helpful	7	19.4
No rating, because not practiced conventional farming	7	19.4
Others: good for environment and health, but income not good; wonderful; exciting; tastes good and steady income	5	14.0
Total	34	94.4
Missing	2	5.6
Total	36	

Fuel wood use

The use of energy sources, such as fuel wood were also surveyed. In Darjeeling District, fuel wood ('daura') is collected from forests for cooking, space heating (i.e. room heating), bathing and washing purposes (Table 4.28), though farmers also use cold water for the latter. In winter, farmers use fuel wood to heat the animal feed and water, because it is too cold for the animals to consume. The farmers themselves added the latter aspect, since it was not specifically listed in the questionnaire; hence, only a few gave information about it. The data was not split into organic and conventional, as there was no major difference in the answers; except in heating of animal feed, which only two organic farmers mentioned. A total amount of fuel wood use was also calculated: 68 % use between 20-40 kg/day, 28 % use less than 20 kg/day and the remainder uses > 40 kg/day. A study by MISHRA & RAMAKRISHNAN (1982) calculated an annual fuel wood consumption of 3,060 kg for cooking in an Himalayan village. Other studies estimated an average annual requirement of 1,000 kg and above (PRASAD, 1999). In this context, the annual fuel wood consumption per household in Darjeeling District is very high.

Collection time for fuel wood was stated by six farmers between 2-4 hours or more or they collect in one to three months either for the entire winter season or the entire year. One farmer even buys fuel wood for around Rs. 1.50/kg (€ 0.03). Even in the NGO project villages, fuel wood consumption was nevertheless prevalent. In Rampuria though, a forest village, which is situated in the East Range of Senchal Wildlife sanctuary, the NGO has started planting fast-growing fuel wood species on or around the farmers' fields. This measure and several other income diversifications have lead the farmers to use such means and not to plunder the surrounding forests.

Table 4.28: Fuel wood use by the surveyed Darjeeling District farmers

	Cooking		**Heating**		**Bathing**		**Washing**		**heating Animal Feed**	
kg/day	No.	%	No.	%	No.	%	No.	%	No.	%
0			1	2.0			8	16.0	32	64.0
< 5	22	44.0	22	44.0	21	42.0	19	38.0	10	20.0
5 - 10	23	46.0	23	46.0	23	46.0	18	36.0	4	8.0
> 10	5	10.0	4	8.0	5	10.0	4	8.0	1	2.0
Total	50		50		49	98.0	49	98.0	47	94.0
Missing					1	2.0	1	2.0	3	6.0
Total					50		50		50	

Next to the above mentioned energy source, LPG (Liquefied Petroleum Gas) and twigs ('jhigra') are also used, 28 % and 16 % respectively. The rest does not use anything else. One LPG cylinder lasts for about 1.5 to 2 months; and 2-5 kg of 'jhigra' is used per day. LPG is created as a by-product from petroleum refining and natural gases and is a mixture of propane, butane, propylene and butylenes (SHANNON, 1997). Electricity is used for lighting, but often enough supply is scarce.

Out of the 50 farmers in Kanto, each of the following resources are used: 98 % require LPG gas, 86 % use kerosene oil, 40 % use fuel wood ('maki') and 14 % use solar energy. The majority of farmers was unable to state their fuel wood consumption, only 12 % stated 100-300 kg/month. Oil consumption was only stated by 44 % and ranged between 8-600 l/month. Electricity is mainly used for lighting and the washing machine, whereas fuel wood and kerosene are used for room heating and bathing, solar energy for heating or warm water supply. LPG is applied for cooking; roughly, one cylinder per month is used. The cylinders are delivered to the houses, whereas eight surveyed farmers collect wood from their own forest resources. This dates back to the time, when farming families used to own their own forest area. The traditional farming houses in Japan do not have any central heating systems, but only little stoves that run on kerosene or wood to heat a room.

As explained in chapter 1, the threat for the mountain ecosystem next to natural calamities, is man himself. Due to human activity to secure a basis of income and food, he destroys nature around him, e.g. by felling the forests for fuel purposes (Photo 4.15). But the farmers cannot simply be resettled in order for nature to restore itself. The humans are dependant on the land, forest and environment which nature provides them. The illegal felling in Darjeeling District leads to landslides and soil erosion, as no water retention through trees is available anymore. The water run-off is accelerated. Due to the need of fuel wood by the farmers for cooking and heating, especially during the winter months, the felling will continue. Fuel wood species that are afforested are listed in chapter 5.2.

Photo 4.15: Former forest near Chimney village, Kurseong subdivision
(Photo by SHILPI SAXENA, 1998)

The cut fuel wood is then stored in front of the house or in the kitchen above the traditional 'chulha' (smokeless cooking stove) (Photo 4.16). LPG cylinders for Kurseong are delivered once a week and the farmers have to carry them on their back, as they do not own a car (Photo 4.17). One such cylinder weighs around 14 kg.

Table 4.29: Decrease in forest area in relation to population increase, Darjeeling District (Source: BASU *et al*. 2000, p. 70)

Year	Forest (%)	Built-up area (%)	Population
1800	95	0.0	100
1850	87	3.0	10,000
1901	65	7.5	16,924
1951	40	39.0	33,605
1991	15	52.0	71,479
2001*	10	65.0	85,000

* *Projected*

The decrease in forest area is furthermore correlated to the increase of population and built up-area (Table 4.29). The continued population increase as well as influx of migrants from neighbouring countries up till now has lead to a further exploitation of forest resources. Fuel wood availability is decreasing, this is felt by an increase in collection time and by having to use other sources. Fuel wood is perceived as a 'free' item, compared to LPG, but farmers are not aware of the opportunity costs involved for collecting fuel wood (RIJAL, 1999).

Photo 4.16 – 4.17: Fuel wood use and LPG as an alternative energy source (Photo by SHILPI SAXENA, 2002)

4.4. Nature of Experimental Plots

SASAC had started Square Meter Farming in the Kurseong subdivision, due to problems farmers faced, such as topsoil being washed away by heavy monsoon and wild boars trampling and eating vegetables. Additionally, farmers only earned Rs. 120/month (€ 2.40) from their small land holdings, compelling them to go for other jobs.

Hence, SASAC started with SMF in 1996 with a few families, and by 1998, the number of families being a SMF-member in different villages, was 35. In 2002, the number decreased to around 12 SMF-members. Some stopped, because the work of attending the beds was too hard for them, others had personal problems, which made them unable to take care of their crop and m^2-beds. The polyethylene cover on top of the m^2-bed protects the crops from wild boars and frosts. Every home in those villages SASAC works with and supports, targets Rs. 10 (€ 0.20) per bed per month and furthermore, SASAC calculated that 150 m^2-beds would be beneficial, equalling an income of Rs. 1,500 (€ 30) per month. The figures have been kept easy on purpose, because most farmers, have difficulties with higher numbers, i.e. in thousands, which they have never seen and is difficult for them to remember. A few farmers, who have understood and learnt the way of calculation, have e.g. expanded their beds to 172. They have to keep simple accounts and records of their beds. The villager has a little booklet, where he writes what has been planted and when it has been harvested (e.g. lettuce 30. January sowing date and 21. April harvesting date; see table A11-A12 in the appendix).

The Square Meter Farming system, which is mainly applied by the NGO SASAC in Kurseong subdivision for growing organic vegetables, uses iron rods and polyethylene-pipes, as well as metallic wiring, to tighten the rods (Photo 4.18). The cost for one m^2-bed is Rs. 234 (€ 4.7), while 150 m^2–beds garden cost Rs. 35,000 (€ 700). As such, one person is sufficient to build one m^2-bed. The time required for making one bed is 2.5 h with these materials. 150 m^2-beds were completed by SASAC at a farmers' field in three weeks by four persons needing eight hours a day. Conventional farmers who were questioned during the survey (see chapter 4.3.), were interested in the Square Meter Farming as practiced by the neighbours, but were unwilling to pay such a high price for materials, as listed above.

The natural and environmental friendly alternative to iron and polyethylene-pipes is the use of bamboo and jute as tying material. The author with SASAC staff constructed the latter (Photo 4.19). Bamboo was bought from a neighbouring village for SASAC I and supplied free of cost by Margaret's Hope Tea Estate for SASAC II. One bamboo stick with a length of 3.90 m and a diameter of 0.10 m–0.30 m, costs Rs. 50 (€ 1). Around two bamboo canes are needed for building two m^2-beds, depending on the length and circumference of the bamboo. The time required is 2 h.

Photo 4.18 – 4.19: SMF-beds made from polypipe and bamboo, Darjeeling District (Photo by Shilpi Saxena, 1998/2002)

Therefore, experimental square meter beds have been made at SASAC I and II, as an alternative to the more expensive polypipe material. SASAC I is located at 1,524 m, whereas SASAC II has an altitude of 2,160 m. On each station, four experimental beds have been built with bamboo as the main construction material. First, the area for the beds was cleaned from weeds. Then, according to the available area, it was decided upon the amount of beds needed, e.g. several rows of beds or just 1-2 beds. At SASAC II, the four beds had to be split up into two groups (Fig. 4.16), whereas at SASAC I, the provided space for constructing the beds, allowed four square meter beds to be placed in one row (Fig. 4.17).

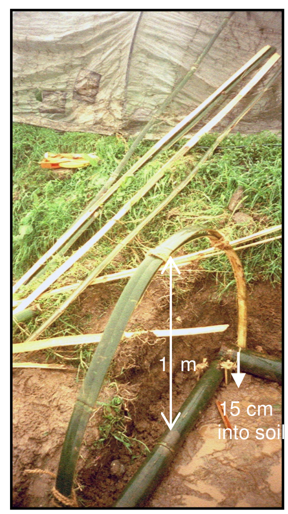


Photo 4.20: Circular bend of m^2-bed (Photo by Shilpi Saxena, 2002)

The bamboo used, had an average diameter of 0.30 m and the pieces were cut into the needed sizes for the beds. For example, the bottom frame used the full bamboo (not split into pieces), whereas the bamboo for the circular bend had to be sliced into lengthy pieces (Photo 4.20). The measurement from the part that goes into the soil as well as the length for bending the piece, all had to be calculated. Nevertheless, the height of such a construction is in the range of the personal preference of the farmer. In this case, the height was calculated as follows: if the height from the bottom square meter frame till the top centre of the circular is supposed to be ca. 3.50 m and on both sides the sliced piece goes into the soil with each side about 15 cm, then the total cut piece will have a length of about 3.80 m. Then, the circular itself will only be 1 m high (Photo 4.20). Construction at SASAC I was completed in May 2002, while at SASAC II, the meds were made in June, due to delay in the delivery of bamboo.

After the construction was completed, compost was placed onto the bed and mixed with the soil. The beds were planted with raia saag (Photo 4.21) and cauliflower (Photo 4.22). Raia saag (*Amarantaceae*) is a leafy vegetable and its leaves are consumed; once it starts flowering, the leaves developed are not large enough for consumption or sale. The two crops are most difficult to grow in summer, because of the warm weather and the plastic cover used; for example, at SASAC I, with open cover at 9 am, min. temperature was 9℃, max. 33℃, while with closed cover at 3 pm, min. temperature was 10℃ with a max. of 36℃. Therefore, wholes were prepared on both ends of the cover for air penetration. These still proved to be unsatisfactory, because the wholes made were too less and proved to be too small. The crops in the four beds at higher altitude however grew very well, whereas insects soon infested the crops at lower altitude (Fig. 4.17).

Fig. 4.16 & Photo 4.21 – 4.22: Four m^2-beds constructed with bamboo at SASAC II and growing vegetables

(Photo by SHILPI SAXENA, 2002)

Raia Saag (6x5) Bed No. 4

30	29	28	27	26	25
24	❋	22	❋	20	19
18	17	16	15	14	13
12	11	10	9	8	7
6	5	4	3	2	1

Raia Saag (6x5) Bed No. 3

30	29	28	27	26	❋
24	23	22	21	20	19
18	17	16	15	14	13
12	11	❋	9	8	7
6	❋	❋	3	2	1

Cauliflower (4x4) Bed No. 2

16	15	14	13
12	11	10	9
8	7	6	5
○	3	○	○

Cauliflower (4x4) Bed No. 1

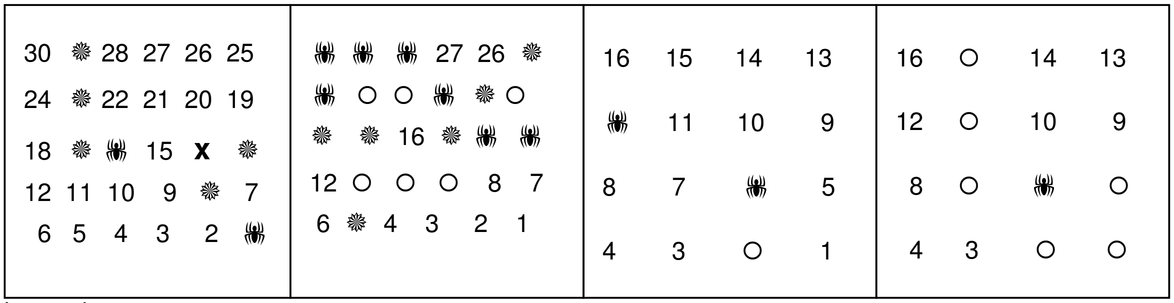
16	15	14	13
12	11	10	9
8	7	6	5
4	3	2	1

Legend:
○ Very small/hardly growing
❋ Flowering, therefore removed

Certain vegetables are first raised as seedlings, before they are transplanted into the m^2-beds. These are broccoli, cabbage, cauliflower, celery, lettuce, spring onion and saag (raia or lali), which is like spinach. Hence, the cauliflower and raia saag planted in the experimental plot were seedlings.

Fig. 4.17: Four m^2-beds in a row constructed with bamboo at SASAC I

Raia Saag (6x6)	Raia Saag (6x6)	Cauliflower (4x4)	Cauliflower (4x4)
Bed No. 4	Bed No. 3	Bed No. 2	Bed No. 1



<u>Legend</u>:

○ Very small/hardly growing
❋ Flowering, therefore removed
🕷 Eaten by insects, therefore removed
x wilting plant, therefore removed

For correct seed planting, sowing plates are used at SASAC (Photo 4.23), but seeding at the experimental bamboo plots was simply done by hand and fingers. A spinach sowing plate has 49 holes, each 7 cm apart (4x in one m^2 yields 196 spinach). A carrot sowing plate has 100 holes, each 3 cm apart (4x in one m^2 yields 400 carrots), though this has proven to be too crowded and not enough nutrients reach the carrots. Therefore, 350 are planted. The plate is positioned on the m^2, and a twig is used to make a hole in the soil through the sowing plate. One to two seeds are planted per hole due to which no seed wastage occurs. Per m^2, 16-25 seedlings are planted, depending on the crop (see table A11 in the appendix). The seeds used at SASAC are Indo-American seeds from Bangalore. The best is to plant in each m^2 a different vegetable; if insects affect spinach, the neighbouring m^2 plot with carrots will not be affected hence, farmers are advised by SASAC not to plant cabbage and cauliflower side by side. Weeding was conducted manually. Watering of the cauliflower and raia saag was not required on rainy days. Otherwise, the water was poured directly near the root beneath the leaves, so that there was no water wastage.

Photo 4.23: Sowing plate used at SASAC experimental farms, Darjeeling District (Photo by Shilpi Saxena, 2002)

Soil analysis has been conducted in Darjeeling District, as only basics have been looked into, the analysis is not very exhaustive, because the soil analysis is not a main feature of this study. It merely gives some idea of the soil at the study site. More information on soils in the district is given in chapter 2.1.5. Soil analysis helps to determine the nutrients in the soil, which is essential for the (vegetable) crops. If nutrients are lacking, they can be compensated by compost. After talking to the NGO SASAC, about taking soil samples, they suggested it would be easier and more sensible to do this from their experimental farms, where organic vegetable cultivation is being practiced. SASAC I is located in Sipeodhura village (1,524 m; cultivation area: 1,800 m^2) and II in Chimney village (2,160 m; cultivation area: 2,000 m^2) rather than from the surrounding villages. The samples were analysed at NITM (Darjeeling Tea Research & Management Association), Bagdogra. For the soil samples, common equipment was not available from the Tea Research Association, as these are only used for samples extracted from tea estate property. Therefore, the TRA Advisory Officer for tea soils, suggested to use a bamboo stem (Fig. 4.18, photo 4.24). The author prepared it from a bamboo cane and outer markings were placed for topsoil (at 15 cm) and subsoil (at 30 cm), as NITM tests the samples according to top/subsoil (≅ one sample set). Furthermore, NITM required that each top- and subsoil sample was supposed to weigh at least 500 g. Six samples each were taken at the sites, as suggested by the Advisory Officer of TRA, for replication sampling (JACKSON, 1958). Though SASAC I and II practice m^2-farming, the samples were taken from fields and terraces surrounding these beds and not inside the beds, as most of them were growing a crop. The ones that were empty were being prepared for the next crop.

Fig. 4.18 & Photo 4.24: Soil sample equipment and taking of soil samples,
Darjeeling District
(Photo by SHILPI SAXENA, 2002)

The NITM used the following methods for the soil analysis: for the pH determination a 1:2.5 Soil Solution Method was used, for nitrogen (N) the Kjeldahl Method, for potash (K) the Flame Photometer using Neutral Ammonium Acetate, for organic carbon (C) the Chromic Acid Digestion Method (Walkley and Black) was applied and for sulphur (S) the Turbidity Method was used. Phosphorus (P) was not tested by NITM for these samples. Though separate values were given for the pH according to top- and subsoil, their average values yielded no difference; therefore, only one value is given here (Table 4.30). The pH value is acidic, the nitrogen content is low, while potash is high. As organic C is less than 20 %, this soil is a mineral soil.

Table 4.30: Soil analysis report for SASAC I & II
(NITM, 2002, p. 1; *unpublished*)

	pH	**N (%)**	**K_2O (ppm)**	**C (%)**	**S (ppm)**
Sipeodhura (1,524 m)	6.85	0.3	282	4.7	50
Chimney (2,160 m)	6.4	0.4	218	3.3	65

Nitrogen (N): ~ 1 % is good; below 1 %, manuring recommended
Carbon (C): < 0.8 % is low; 0.8-1.0 % is good; > 1.0 % is high
Potassium (K): Optimum levels at 90 to 125 ppm for light-colored, coarse-textured soils; for dark-colored heavy-textured soils 125 to 200 ppm
Sulphur (S): < 40 ppm, then deficiency. Soil test levels should be maintained in the optimum range. There are other soil factors that need to be taken into account when interpreting a soil test of sulphur, such as organic matter content, soil texture and drainage.

Soil profiles at SASAC I (10.08.2002) and II (09.08.2002) measured 0.80 m in breadth, and 1 m in length (Photo 4.25-4.26). The following horizons and depths, established at both elevations (Table 4.31), were based on the BUNDESANSTALT FÜR GEOWISSENSCHAFTEN UND ROHSTOFFE UND GEOLOGISCHE LANDESÄMTER (BGRGL, 1996). The description of the soil profiles was conducted during summer monsoon, in August of 2002.

Table 4.31: Soil characterization at two elevations of SASAC I & II
(Source: own field survey, 2002; BGRGL 1996, p. 79)

Horizon	**Depth (cm)**	**Munsell Soil Colour Chart**		**Description**	
		Sipeodhura	Chimney	Sipeodhura	Chimney
Ah	0-5	dark yellowish brown, 10 YR 4/4	dark yellowish brown, 10 YR 3/4	wet loam	wet loam
B	5-60	- do -, 10 YR 4/6	- do -, 10 YR 4/4	crumbly, dry loam	crumbly, dry loam
C	60-90	- do -, 10 YR 4/6	- do -, 10 YR 4/6	crumbly, dry sandy loam	crumbly, dry sandy loam; stones

Photo 4.25 – 4.26: Soil profile at SASAC I and SASAC II, Darjeeling District
(Photo by SHILPI SAXENA, 2002)

In **Kanagawa Prefecture**, soil analysis was conducted at the Kanagawa-ken Nokyo Dojo Shindan Center (Kanagawa Prefectural Agricultural Research Center) in Odawara[24]. The organic farmer, where the samples were taken from, has 10 fields, mostly fruit orchards (orange and mandarin varieties), a tea field and small vegetable fields. Soil samples have been taken by the author from the organic vegetable field no. 1 (130 m a.s.l., size: 39.50 x 19.37 m; five samples) and samples from organic vegetable field no. 2 (10 m a.s.l., size: 16.70 x 10.20 m; three samples). These were submitted to the center. The standard values were tested but no organic carbon and sulphur content. Furthermore, here there was no differentiation of top- and subsoil, as in Darjeeling District, and only 100 g samples were required by the center. The samples for the center had to be dried (room temperature) prior to submitting them. The data from the agricultural center is as follows (Table 4.32):

The methods used by the center for pH (H_20) is the 1:5 Soil Solution Method, for nitrogen (NO_3-N) the Alkali Reduction-diazo Pigment Method, for phosphate (P_2O_5) the Murphy-Riley Method, for potash (K_2O) the Sodium Tetraphenylborate Turbidimetric Method, for calcium (CaO) the Cresolphthalein Complexon Method (OCPC Method), for magnesium (MgO) the Xylidilblue-1 Method and for CEC the Indophenol Method.

[24] Generally, soil analysis for organic farmers is conducted at the Prefectural Agricultural Extension Centers ('Gimotono Noogyo Fukyu Center'), which every prefecture has. These centers have the function of advising the farmers on (conventional) agricultural practice, for example concerning fertilizers and manure.

Table 4.32: Soil analysis data from a vegetable field, Kanagawa Prefecture (Source: KANAGAWA-KEN NOKYO DOJO SHINDAN CENTER, 2003; *unpublished*)

Date: 21. November 2002	Average Values		Best values as suggested by the Prefectural Center
	Field 1	Field 2	
pH (H_20)	5.9	6.1	5.5 ~ 6.0
Nitrogen (NO_3-N) mg/100 g	1.0	1.0	< 3.0
Phosphate (P_2O_5) mg/100 g	66.5	46.7	20 ~ 50
Potash (K_2O) mg/100 g	66	33	19 ~ 38
Calcium (CaO) mg/100 g	257	293	224 ~ 280
Magnesium (MgO) mg/100 g	35	37	40 ~ 60
CEC (meq/100 g)	20.7	20.0	--

Nitrogen content is good in both fields, but phosphate and potash in field 1 are too high. As the farmer was not very willing for soil samples to be taken in the first place, he did not agree for a soil profile to be dug out on his field. Therefore, only the existing soil sample whole was able to be used up to a depth of 30 cm for determining the soil colour (Table 4.33).

Table 4.33: Soil characterization at two elevations of vegetable fields, Kanagawa Prefecture

Horizon	**Depth (cm)**	**Munsell Soil Colour Chart**		**Description**	
		Field 1	Field 2	Field 1	Field 2
Ah	0-5	dark brown, 10 YR 3/3	dark yellowish brown, 10 YR 3/4	loam	loam
Al	5-30	dark brown, 10 YR 3/2	dark brown 10 YR 3/3	loam	loam

CHAPTER 5

Tea Bushes and Orange Orchards, Kanagawa Prefecture
Photo by SHILPI SAXENA, 2001

5. Sustainable Farming in Darjeeling and Supportive Observations from Kanagawa Prefecture

5.1. Ecological and Socio-Economic Aspects

Organic farming or any sustainable farming practice is a sensible way of agriculture for the farmer and the environment, and a means to create a better income in developing countries. The target group of this research are poor and smallholder farmers, with field sizes less than 1 ha. However, one should keep in mind that *"technological change and development policies need to promote strategies, which reduce the inherent risks of agriculture on sloping landscapes"* (PARTAP 1998, p. 76). Furthermore, as the farmers are cultivating crops on marginal lands, the following aspect, needs to be considered as well: *"The strategy, however, should be clear that if fragile sloping lands are or need to be used, it should be only for poverty alleviation of the local farming communities – through adopting income generation and labour intensive production approaches"* (PARTAP 1998, p. 75). Since the Darjeeling District farmers are predominantly into vegetable cultivation on small and sloping terraced fields, additional income sources need to be sought in order not to be too dependent on farming alone. Therefore, next to organic vegetable farming, which some farmers are practicing, the smallholder farmers need to have other income-generating means which can be produced on the farm with simple resources. Methods to achieve these are practices, such as *floriculture, mushroom cultivation, apiary and small-scale organic tea cultivation*. Another socio-economic aspect is *alternative certification* beneficial for smallholder farmers, as they are more flexible than current certification schemes. Furthermore, *sustainable forest management* and alternative energy sources, such as *biogas* are ecological aspects, next to *composting* and *soil management* practices. One should also keep in mind that the farmer knows his land best and furthermore, application of certain practices may vary according to site. Factors like sunlight availability, soil type and moisture regimes can vary within small areas and are characteristics of sloping lands (PARTAP, 1998).

Important factors next to income diversification is linking them directly to local markets and consumers, additionally holding awareness campaigns addressing consumers for the benefits of organic agriculture in terms of health and environment, and improving access to information concerning organic agriculture and market opportunities for farmers (ALTIERI, 2002; UN-ESCAP 2002). Necessary for the adoption of any alternative system in terms of sustainable land management practices, is the security of land tenure. Then a willingness to use different methods is higher. If a farmer does not own the land, he might be unwilling to start anything new (ALTIERI, 2002).

5.1.1. Small Income Generating Means

A way to improve the income situation of the subsistence farmers in Darjeeling District is **mushroom cultivation**. The cultivation of mushrooms has been introduced by the local NGOs in this region next to organic vegetable cultivation and is therefore only carried out in the project villages. Furthermore, mushrooms contain vitamin B, C and D, amino acids, which is a valuable source of protein, and minerals such as potassium, phosphorus, calcium and magnesium (BEETZ & KUSTUDIA, 2004). NGOs should also consider its nutritional aspects, and it would therefore be an addition to the diet of the farmer, next to being an income supplement.

SASAC for example has started mushroom cultivation at their experimental farm quite successfully, growing oyster mushrooms (*Pleurotus ostreatus*). Here, the spawn i.e. the mushroom culture, is spread between layers of straw (e.g. unused cow barn straw or paddy straw) that has been made moist; initially, the straw is placed in a thin polyethylene bag. The first layer of moist straw is filled up to around 1 cm (half an inch), then the spawn is spread on top (spawn is bought at Rs. 2/200 g packet; € 0.04); in total four layers are made. The weight of moist straw (with seeds) reaches around 4-4.5 kg. Afterwards, the entire bundle is placed in a damp and warm area. At SASAC, it is placed in the compost shed on racks (Photo 5.1). This kind of mushroom cultivation is called bag culture. The outside temperature should reach 20-25°C. The mushroom grows through the bag and can be harvested easily. The first harvest is obtainable after 30-35 days; it is possible to have up to three harvests yielding 800 g. This used straw can be utilised for compost making. During summer monsoon, mushroom cultivation is halted due to poisonous fungus growth; hence, the main cultivation and harvest time is between September and May.

Project SERVE and RCDC have also introduced this method, but it has not been very successful. In the case of RCDC, the cultivation was first tried on an experimental basis with one or two farmers; the net and bag cultures were hung in a concrete room. As cultivation was not satisfactory, it was not propagated further by the NGO.

Photo 5.1: Mushroom cultivation at SASAC experimental farm, Darjeeling District (Photo by SHILPI SAXENA, 2002)

In Japan, farmers grow shiitake mushrooms (*Lentinus edodes*) on wood logs (Photo 5.2). The length can be 50 cm (short and thick) or 1.2 m, with a diameter of 8-15 cm (KRÄMER, 2003). Fresh oak, maple or alder log are preferred; all these tree species also grow in Darjeeling District. Wholes then need to be drilled through the bark; these should be around 5 cm (2 inches) deep (KRÄMER, 2003). Then the mycelium bacterium, which is in a wooden peg/plug, is hammered into the wholes. These logs are placed into a forest (Photo 5.3), for the mycelium bacteria to grow. If a forest is not nearby available, then the logs should be placed on top of old logs, which cover the grass or bare ground; stones or concrete bottom is unsuitable. The farmers then covered the pile of logs with black plastic sheeting; the latter need wholes for air circulation. In the forests though, no black cover was put. Frost and temperatures above 30°C are damaging to the mushrooms (KRÄMER, 2003).

After nearly one year (12-15 months), the logs begin producing mushrooms (KRÄMER, 2003). There are more aspects to consider next to producing the culture, such as pest management, harvesting, packing, storing, market requirements and re-use of logs. Other options instead of logs are sawdust, woodchips or straw. Sawdust needs to be sterilized and requires more skill as well as financing than logs, because of the equipment necessary. BEETZ & KUSTUDIA (2004) state that shiitake mushrooms can be grown on a small scale and with moderate initial investment, and thus can be considered as an alternative activity with low-input. For Darjeeling District though, NGOs would have to do the initial financing, if shiitake is considered useful. Since it is labour-intensive, a local niche market needs to be established to sell a high-quality product or a mushroom-based food item (BEETZ & KUSTUDIA, 2004) next to home consumption. Otherwise, it will be difficult for the small-scale farmer to be competitive. Furthermore, it would be advisable to grow a village community forest with above-mentioned species, so that farmers do not illegally fell more trees, as is being done for fuel wood purposes.

Photo 5.2 - 5.3: Drilled logs with mycelium and placement in a forest,
Kanagawa Prefecture
(Photo by Shilpi Saxena, 2003)

Floriculture: Though Kalimpong subdivision is known for its flower cultivation, especially of orchids, NGOs (ATREE, Project SERVE and SASAC) try to promote floriculture in their project villages (Photo 5.4). Floriculture at the SASAC experimental farm includes such plants like bougainvillea, orchids and gladiola. One farmer from Rampuria sells his flowers directly in Darjeeling Town and Takdah via taxi on the roadside. This ATREE project village also receives training how to cultivate seedlings. Project SERVE makes small green houses (height ca. 1.70 m) of wooden frame and a polyethylene cover for the farmers to cultivate flowers (Photo 5.5). Seeds are provided initially and seasonal flowers such as Calendula, Dahlia, Petunia and Marigold are cultivated. Surveyed mixed and conventional farmers at Rampuria cultivate flowers; conventional farmers in Sindebong sell bulbs. Prices range between Rs. 10-15/flower (€ 0.2-0.2).

Photo 5.4: Plant and seedling cultivation at an ATREE project village, Darjeeling Dist. (Photo by SHILPI SAXENA, 2002)

Photo 5.5: Floriculture in a greenhouse at a Project SERVE village, Darjeeling District (Photo by SHILPI SAXENA, 2002)

Apiary (Apiculture): The traditional Himalayan honeybee *Apis cerana* is preferably used by NGOs in the region for honey cultivation, compared to the exotic (European) *Apis mellifera*. The latter is unsuitable for Himalayan regions in terms of adaptation to the environment above 1,500 m, where *A. cerana* is well adapted (VERMA, 1992). Honeybees are an enrichment for the environment, because they increase flora diversity, fruit and vegetable production, especially crops that are cross-pollinated such as pears and plums and seed production for vegetables such as radish, cauliflower, cabbage, carrots etc. (ICIMOD, 1994). Beekeeping is an easy method, with minimal inputs, generates income, improves yield through cross-pollination, produces honey and beeswax, and does not require land, hard labour or much time (ICIMOD, 1994). An indirect benefit of beekeeping is an increase in crop yield by 30-40 % (MASKEY, 1989).

The products also need little space for storage or delivery. If such a beekeeping program is not conducted and maintained properly, it can result in failure.

In one of the model villages of Project SERVE (Photo 5.6), honeybee rearing has been difficult for the farmers. They stated that after a short period the queen bee would die and the colony would fly away. The farmers said they would like to have more training and information on beekeeping from the NGO. It is important that the food, especially diversity in crops for *Apis cerana* is available up to 0.5 km radius from the apiary (PARTAP 1989, p. 93). Important honey plants in terms of pollen or nectar source are necessary for the bee, many of such plants (Table 5.1) are already cultivated by the farmers in Darjeeling District for agricultural purposes. During winter, some honey should remain with the bees for them to feed on, i.e. not all honey should be harvested, otherwise, the bees need to be fed with a solution of sugar-water. Furthermore, the hive needs to be comfortable for the bees to live in.

When extracting honey, farmers should keep in mind that cleanliness and hygiene are essential for a high-quality honey: the product should be kept in metal containers for storage, the extractor needs to be kept clean from rust, flies, dirt and water (BISHOP, 1989). Another problem is early extraction of honey, which does not render a good quality, because it is *"thin, fermented, unsanitary and has a metallic taste"* (BISHOP 1989, p.152).

Photo 5.6: Honey cultivation at Model Village No. 5 (Project SERVE), Singell Tea Estate, Darjeeling District (Photo by SHILPI SAXENA, 2002)

Beehive frames could be made from bamboo, which is cheap and easily available in Darjeeling District; this makes it a low-cost initial investment (BISHOP, 1989) and might even be a job opportunity for the jobless of Darjeeling District youth or the elderly in the villages. The frames can then be sold within the village and the surrounding areas. Furthermore, repairs for such frames could be conducted in the village as well. The Austroproject/ICIMOD Bee Project (2000) for *Apis cerana* beekeeping gives detailed information into beehive construction. Running the apiary is a task, which the farmers can easily operate. ICIMOD (1994) calculated that an initial investment in the Hindu Kush-Himalayan region would be less than US$ 150 for 10 bee colonies; this input can be covered during the next year once the colonies have established themselves. Furthermore, this second year could even reach a production of 20 kg of honey per colony, supplemented by beeswax (five kg) (ICIMOD, 1994). Project SERVE purchases the hives and equipment, such as honey extractor, and distributes these to the farmers in their project villages.

At Rampuria, two of the surveyed farmers cultivate honey selling it for Rs. 150/bottle (€ 3) (glass à 750 ml); at Dabaipani for Rs. 120/bottle (€ 2.4), the amount of bottles ranging from 5-15. One farmer was able to produce 20 bottles from five hives. Some sell all bottles; others retain a few for home consumption. SHAH *et al.* (1984, p. 237) state that in Western Himalaya, 2.5 kg per hive, worth Rs. 50 (€ 1) was produced; RATHORE & VERMA (1989, p. 227) calculated Rs. 60/kg (€ 1.2) for Himachal Pradesh.

Table 5.1: Important nectar and pollen-yielding plants for Apiculture
N= Nectar; P= Pollen; M= Major Source; m= minor source
(Source: MASKEY 1989, p. 124-130; *abridged*)

English Name	Species	Sources	Status	Flowering Months (incl. the latter)
Banana	*Musa paradisiacal*	P/N	M	March - May
Brinjal	*Solanum melongena*	N	m	February – October
Broad Bean	*Vicia faba*	P/N	M	January – March
Capsicum	*Capsicum annum*	P	m	June – August
Carrot	*Daucus carota*	P/N	M	January – April
Cauliflower	*Brassica oleracea*	P/N	M	February – April
Coriander	*Coriandrum sativum*	N	M	March – May
Cucumber	*Cucumis sativus*	P/N	M	March – June
Fenugreek	*Trigonella* sp.	P/N	m	February – May
Garlic	*Allium staivum*	P	M	April – August
Guava	*Psidium guajava*	P/N	M	Mid-May – Mid-July
Indian Mustard	*Brassica juncea*	P/N	M	October – November
Lady’s Finger (Okra)	*Hibiscus esculanta*	P/N	M	February – April
Maize	*Zea mays*	P	M	June – August
Neem tree	*Azadirachta indica*	N	M	April – May
Onion	*Allium cepa*	P	M	April – August
Plum	*Prunus domestica*	P/N	M	Mid-February - March
Pumpkin	*Cucurbita pepo*	P/N	M	February – March
Rhododendron	*Rhododendron arboretum*	N	m	January - April
Radish	*Raphanus sativus*	P/N	M	February – March
Sal tree	*Shorea robusta*	P	m	January – February
Turnip	*Brassica rapa*	P/N	M	February – April
White clover	*Trifolium repens*	N	M	April - July

Photo 5.7: Tea saplings cultivated at Tinchulay, a Project SERVE village, Darjeeling District (Photo by SHILPI SAXENA, 2002)

Small-scale organic tea cultivation is mainly practiced by the surveyed Daibaipani farmers, and even in one project village of Project SERVE (Photo 5.7). Dabapani village used to be Harrington Tea Estate before closing down in 1952. Many farmers of the area, who now belong to the villages of Harsing, Dabaipani and Yankhoo were left without any income source. They started uprooting tea bushes in some areas to use the land as agricultural fields. For many years, the tea bushes were simply left to themselves, as the farmers did not know how to grow the plant. With the help of the local NGO RCDC, farmers started cultivating tea organically at a small-scale since 1997 (RCDC, 2002). The villagers formed the Sanjukta Vikas Cooperative in 1996, which oversees, records and regulates the process of leave collection through a network of elected hamlet collectors, as well as re-weighing and crosschecking (DOWN TO EARTH, 2004). The plucked leaves are sold to and processed at Selimbong Tea Estate, from where it is sold as Mineral Spring Tea. Every week a truck is sent by the tea estate to pick up the organic green tea leaves. The company Tea Promoters India (TPI) and its Selimbong tea garden actively support these farmers by paying the entire certification cost and the annual visit of the auditors. The farmers' tea has also been certified and is exported via the tea estate. For small-scale subsistence farmers, who are not employed at a tea estate, small-scale organic tea is an income generating option, just as the farmers of Dabaipani are doing. For processing, the tea can be sold to the organic tea estates and marketed through the company, as is the case with Mineral Spring Tea. Therefore, in order for this region and the small-scale farmers to grow and develop sustainably, they need support from these estates, in terms of marketing and distribution channels. At present there are more than 80 tea estates in Darjeeling District covering an area of around 19,000 ha while the total organic tea area is around 4,000 ha (DTRDC, 2003d; see chapter 2.1.7. and 4.2.1.). More than 15 estates are organic or under conversion (Table 5.2). All of the fully converted tea estates are also certified organic and/or biodynamic (DTRDC, 2003d), while the rest are conventional (DPA, 1999). An overview of all tea gardens is given in fig. 5.1.

Table 5.2: Organic tea estates in the Darjeeling Hills

(Source: DTRDC, 2003d)

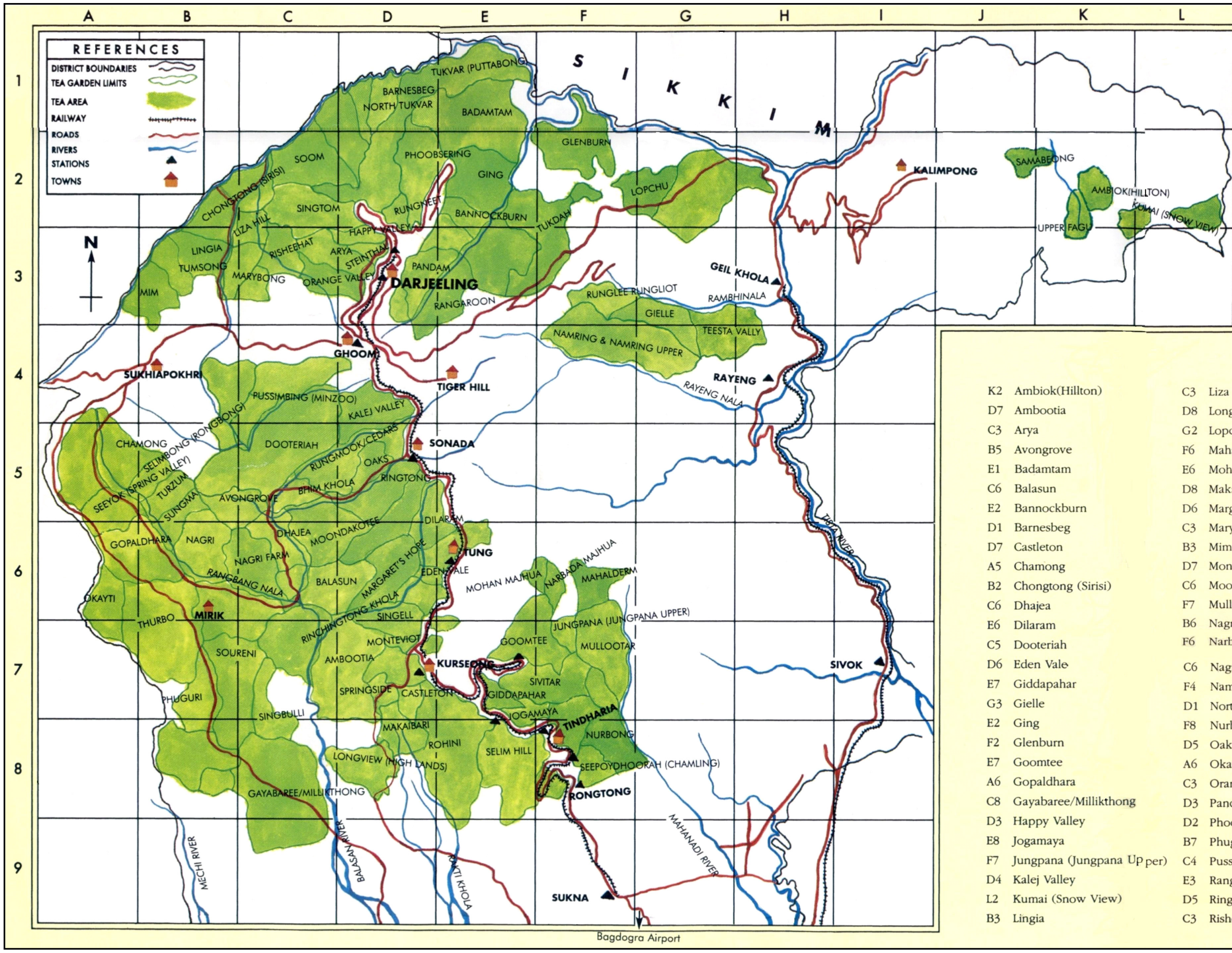
Name	Estates/divisions under conversion
Monteviot, Mullootar, Singell, Dooteriah, Pussimbing, Chamong, Selim Hill, Seeyok, Selimbong*, Ambootia*, Makaibari*, Samabeong and Tumsong	Poobong division of Namring, Mahalderam div. of Jungpana, Mohon Mazua div. of Goomtee, Lingia, Nagrifarm

* Organic and biodynamic farming

Fig. 5.1: Tea plantations in Darjeeling District[25]

(Source: DPA, 1999; *abridged*; see next page)

[25] The scaling is based on the original location map, therefore, there are variations in the distances on the map and actual distances.



GENERAL INFORMATION

DARJEELING TOWN

Altitude	2134 Metres
Population	1,00,000 (approx)
Climate	**Summer:** (April to June) Maximum 15°C/59°F Minimum 9°C/48.2°F **Winter:** (November to March) Maximum 6°C Minimum 0°C/32°F
Rainfall	320 cms (Annually)
Clothing	**Summer:** Light woollens **Winter:** Heavy woollens

K2	Ambiok(Hillton)
D7	Ambootia
C3	Arya
B5	Avongrove
E1	Badamtam
C6	Balasun
E2	Bannockburn
D1	Barnesbeg
D7	Castleton
A5	Chamong
B2	Chongtong (Sirisi)
C6	Dhajea
E6	Dilaram
C5	Dooteriah
D6	Eden Vale
E7	Giddapahar
G3	Gielle
E2	Ging
F2	Glenburn
E7	Goomtee
A6	Gopaldhara
C8	Gayabaree/Millikthong
D3	Happy Valley
E8	Jogamaya
F7	Jungpana (Jungpana Up per)
D4	Kalej Valley
L2	Kumai (Snow View)
B3	Lingia
C3	Liza Hill
D8	Longview (High Lands)
G2	Lopchu
F6	Mahalderm
E6	Mohan Majhua
D8	Makaibari
D6	Margaret's Hope
C3	Marybong
B3	Mim
D7	Monteviot
C6	Moondakotee
F7	Mullootar
B6	Nagri
F6	Narbada Majhua
C6	Nagri Farm
F4	Namring & Namring Upper
D1	North Tukvar
F8	Nurbong
D5	Oaks
A6	Okayti
C3	Orange Valley
D3	Pandam
D2	Phoobsering
B7	Phuguri
C4	Pussimbing (Minzoo)
E3	Rangaroon
D5	Ringtong
C3	Risheehat
E8	Rohini
F3	Runglee Rungliot
C5	Rungmook/Cedars
D2	Rungneet
J2	Samabeong
A5	Seeyok (Spring Valley)
B5	Selimbong (Rongbong)
E8	Selim Hill
F8	Seepoydhoorah (Chamling)
C8	Singbulli
D7	Singell
C2	Singtom
D3	Steinthal
F7	Sivitar
C2	Soom
B7	Soureni
D7	Springside
B5	Sungma
B5	Turzum
G4	Teesta Valley
B7	Thurbo
F8	Tindharia
F2	Tukdah
E1	Tukvar (Puttabong)
D3	Tumsong
K2	Upper Fagu

0 5 10 km

Even though small-scale tea cultivation is a rather rare phenomenon in India, which belongs to the largest tea producing countries in the world (SCHÜTTE, 1998), it is slowly being introduced by NGOs. Kangra District in Himachal Pradesh (NE-India) and the Nilgiris (South-India) are exceptions (SCHÜTTE, 1998), just as Peermade, Kerala, where small-scale organic tea cultivators have also commenced (NATURLAND, 2003). Before turning organic, these farmers were growing tea and spices on land holdings between one to five hectares, using chemicals and selling tea to surrounding factories. The NGO convinced the farmers to farm organically; they received training on organic tea cultivation and went a step further by building their own tea-processing factory. This enabled them to be independent from surrounding tea factories, which were paying low prices and gave no guarantee of purchase (NATURLAND, 2003). With the help of a local and a German NGO, the project succeeded, financed mainly by the European Union. Now, more than 1,000 small-scale tea farmers can process and sell their own organic tea, starting with a production of 600 tonnes per year (NATURLAND, 2003). Some small-scale organic tea farmers in Shizuoka Prefecture, the traditional tea growing area in Japan, have their own tea-processing factory for green and black teas, enabling them to produce, process and sell independently from tea companies. Such machinery is expensive; therefore, it would be sensible for the Dabaipani farmers in Darjeeling District to continue selling their leaves to the organic tea estate for processing and use their marketing channel. It is a sensible option, for other small-scale farmers in the district planning of organic tea at farm-level, because tea estates have the equipment and more important the better marketing channels.

5.1.2. Organic Pest and Soil Management with Further Observations

"Organic agriculture requires informed decision-making about a range of pest management practices which are being developed; this decision-making and field management process, is known as Organic Pest Management" (FAO 2003, p. 1). Organic Pest Management (OPM) is an outcome of Integrated Pest Management (IPM), the latter does allow the use of chemical inputs. Nevertheless, OPM and IPM promote the use of alternative methods. These include, besides crop rotation and crop diversity, *"growing in the appropriate season for the variety, improving soil health to resist soil pathogens and promote plant growth, modifying habitat to encourage pollinators and natural enemies of pests and encouraging natural biological agents for control of disease, insects and weeds"* (FAO 2003, p. 1).

There are methods for crop protection used at the organic and biodynamic tea estates in Darjeeling District, which were observed, as well as other simple applications from Kanagawa Prefecture and Kanto that can serve as alternatives to conventional uses. In both regions, no quantitative data was collected, as most information was based on observations and interviews, except where indicated. The information given on insect control through crops (e.g. ginger and turmeric) are based on practical applications developed in developing countries, which STOLL (2000) has researched. It would then need to be researched whether there is a general acceptance from the farmers' side for such practices; afterwards, the farmers could try out the methods on a small area first. Like this, the farmer can see for him/herself the effect and benefits of natural crop protection and then decide whether to implement it on a larger scale.

In **Darjeeling District**, some farmers in Dabaipani do use traditional methods against crop diseases. According to the NGO RCDC the insects and pests are aphids *(Aphidae)*, fruit borer *(Heliocoverpa armigera)*, diamondback moth *(Plutella xylostella)* (STOLL 2000, p. 95), thrips, grasshopper, leafhopper, white grub, army worm and nematode; tea pest problems for the small-scale organic tea farmers are the same as in the tea estates, which are listed below. Of course, hand weeding and hand picking of large insects are also possible, but are rather labour intensive and unpleasant.

The following applications are used at the organic and biodynamic tea estates[26] in Darjeeling District: Organic methods of repelling insects, the practice of natural soil management such as soil rehabilitation, mulching and stabilization against landslides. Because pests cause severe damage to the tea bush and results in high crop loss, the organic estates need to protect their crop and hence apply natural friendly pest-controlling methods (HAJRA 2001). These aspects were also researched during the field survey with the aim of applying these methods for the fields of the small-scale farmers, where necessary. Since the plants, weeds and grasses described below are applied for their pest-controlling properties on these tea estates, the availability as well as expertise for aiding and supporting local smallholder farmers by the gardens would be viable. Especially the local NGOs could work together with these tea plantations and bridge the gap between local farmers and estates to create a sustainable farming system in Darjeeling District. Concerning small-scale organic tea cultivation as practiced in some of the NGO villages, the data will be helpful.

The data in the following excerpt is partly based on personal communications with the following tea managers and assistant tea managers from Darjeeling District between May 2001 and August 2002: Mr. J. D. Rai, Mr. Abid Rahman, Mr. Parveez Hussain, Mr. B. N. Mudgal and Mr. S. K. Pathak, Advisory Officer, Tea Research Association; other sources are indicated.

Most common tea pests are spider mites *(Oligonychus coffeae, Brevipalpus phoenicis)*, *thrips (Heliothrips haemorroidhalis)*, leaf hoppers *(Empoasca flavescens)*, bunch caterpillars *(Andraca bipuncata)* and mosquito bug *(Helopeltis theivora)* (BARUA 1989, p. 322; STOLL 2000, p.136). Therefore, some of the organic tea estates try to use **natural predators**, such as ladybird beetle. These predators are insects that consume other pest insects but do not harm the ecosystem (DTRDC, 2003d). Other such predators are spiders and lacewings[27]. According to the tea managers, a forest should be planted after every 2 ha on an organic tea estate, (at least 100 trees). in between the tea sections. The trees will serve as a host for birds, these will then serve as predators for eating insects (WIRSIG, 2000). These trees not only provide shade to the tea bushes, which is the primary function, but also affect the microclimatic conditions of the tea bush by protecting from *"over-intense transpiration, over-strong insulation, being directly hit by heavy precipitation, too much cooling at night and finally it offers protection from strong winds"* (DOMRÖS 1974, p.48). For the organic vegetable field, small trees or bushes could be planted on the sides of the fields to attract natural predators (see also chapter 5.2.).

Citronella (*Cymbopogon winterianus*) is another method for repelling insects (BARUA 1989, p. 279). The plant should be situated on the sides of each tea section (Photo 5.8). When the infestation of insects is very high, the citronella leaves are cut by half, so that the aroma or odour penetrates into the air. Of course, it can also be cut as a preventative measure.

Photo 5.8: Citronella planted as an insect repellent, Mahalderam Tea Estate, Darjeeling District (Photo by SHILPI SAXENA, 2002)

Neem *(Azadirachta Indica)* kernels/seeds are for example, very effective to repel insects (GOVINDACHARI *et al.* 1997, p. 78). The seeds have to be crushed, after having been soaked in water overnight (e.g. 5 kg of seeds in 20 litres of water). The solution is mixed with water at 2 litres per 200 litres in a drum, which is then sprayed on the tea bushes for controlling pests and mites. Caterpillars are handpicked. For control of insects on vegetables, Neem might be most effective of the mentioned methods, according to the tea managers' opinion.

Other methods include *"extracts derived from the aerial parts which are leaves and stem of Artemisia vulgaris (Mugwort), Urtica dioica (Nettle), Polygonum runcinatum and Eupatorium glandulosum (Crofton weed) and which grow abundantly in the tea*

[26] A listing of the organic and biodynamic tea gardens is given in chapter 5.1.1.
[27] Other natural predators against thrips, leafhoppers, caterpillars and those listed for vegetables are given by COTTON & COTTON (2004; see bibliography for details).

plantations. They are used for their antifeedant action against some leaf-eating pests. To generate plant extract they are cut to small size and fermented in water tanks for six to seven days in the ratio 1:10. In addition, the extracts of lemongrass Cymbopogon citratus, C. nardus and Tagetes patula (Marigold) are also used as repellents. These botanicals are being used carefully and infrequently. Horsetail (Equisetum arvense)[28] *is used as spray to counter fungal disease"* (DTRDC, 2003d).

In severe infestation, extracts of **Marigold** *(Tagetes)* and diluted cow urine should be made into a solution and then sprayed onto the tea bushes (HAJRA, 2001). Marigold works as a repellent and insect-controller and even grows in areas above 1,600 m. Its pest-controlling properties are located in the flower leaves and roots (Fig. 5.2). STOLL (2000, p. 132) also suggests that Marigold can be used with different combinations, for example as a Marigold-water extract, Marigold-chilli extract, Marigold-tomato extract and even as a Marigold-chilli-garlic-onion extract. The latter is used in this combination in Central America on potatoes to protect against insect pests and plant diseases: they are sprayed every 3-8 days depending on weather (if rainy, then more; if dry, then less); a minimum of 12 sprays over the cropping cycle is necessary (STOLL 2000, p. 132). The Marigold-tomato extract helps against leaf beetles and aphids by using 1 kg of marigold leaves and 1 kg of tomato leaves. These have to be grinded, mixed with water and filtered; afterwards it needs to be diluted to one tank filling of 20 litres with water. Marigold-water extract can be used against aphids and leafhoppers in lettuce and blight in tomatoes: use 2.5 kg of marigold leaves and flowers, pound these and they should be mixed with sufficient water to cover the plant material. On the following day, the solution needs to be filtered and filled up to 18 litres with water (STOLL 2000, p. 132). For the application of chilli extracts and mixtures, the farmers should wear protective gear, as it might irritate the skin (FAO, 2003). Marigold is not only grown by the biodynamic tea estates, but also at the Project SERVE nursery but for floriculture purposes. Hence, a supply for farmers would be available two-fold.

Fig. 5.2: Marigold
(Source: STOLL 2000, p. 131)

Turmeric *(Curcuma domestica)* is another helpful plant, because it acts as a repellent, is insecticidal and antifungal. The insect controlling property is the rhizome. Turmeric, a native to India, grows in elevations up to 2,000 m where precipitation lies between 1,000-2,000 mm, which makes Darjeeling District a beneficial location. If it is used as a spray with diluted cow urine, then it can control pests and diseases: STOLL

[28] This preparation is also referred to as biodynamic preparation 508.

(2000) suggests shredding 1 kg of turmeric rhizome, adding 3-4 litres of cow urine and mixing it well. Dilute the mixture with 15-20 l of water. An emulsifier is added (4 ml/liter). In Thailand vegetable pests are controlled with spraying turmeric. Here, *"500 g of turmeric are chopped and soaked overnight in 2 litres of water. The next day, filter the extract, fill up to 20 litres and spray on the vegetables"* (STOLL 2000, p. 166).

Ginger *(Zingiber officinale)* is a frequent crop grown by local farmers in Darjeeling District. It grows at elevations up to 1,500 m on a wide range of soils that are well-drained (STOLL 2000, p. 120). Its insect-repelling property is also the rhizome; ginger acts as a repellent, insecticidal, nematocidal and fungicidal. As a ginger-water extract it can be sprayed as follows: 2 kg of rhizomes are ground and made into a paste and then mixed with 30 litres of water. Afterwards it should be filtered. An emulsifier like liquid soap is added (4 ml/litre). In order to spray one ha with this extract, 10 kg of ginger is necessary.

For **soil management**, the following practices are suggested, which are used at organic and biodynamic tea estates in Darjeeling District, like growing leguminous crops as shade trees, cover crops and green crops which supply nutrients to the soil (DTRDC, 2003d). Therefore, nitrogen supply for the tea bushes is done by planting grasses such as Guatemala grass *(Tripsacum laxum)* (Photo 5.9), leguminous trees such as Sunn hemp *(Crotalaria juncea)* and *Tephrosia candida* in alternate rows (BARUA 1989, p. 278-279). Guatemala grass needs rich soil but tolerates acidic soils. Additionally, it can also be used as a fodder plant (FAO, 2004a); for green manure or hay purposes, Sunn hemp should be cut in the early flowering stage, when it is 1.5-2.5 months old (FAO, 2004b). Grass cuttings are spaced 30-45 cm apart following the same alignment as the legume (BARUA 1989, p. 279). Furthermore, by using green mulch by cutting leguminous plants 3-4 times a year and putting them as ground application benefits the soil, because mulch protects from *"heavy rainfall and surface runoff, suppresses weed growth, preserves fertile topsoil from erosion, conserves soil moisture, and by multiplying the bacterial population, the better nutrient intake is ensured as well"* (HAJRA 2001, p. 480). Due to its dense canopy, Sunn hemp as a shade tree and cover crop can also suppress weed populations (FAO, 2004b).

Photo 5.9: Guatemala interplanted as leguminous plant between tea bushes, Selimbong Tea Estate, Darjeeling District (Photo by SHILPI SAXENA, 2002)

According to HAJRA (2001), soil rehabilitation means that old tea area, which has been uprooted, contained some toxic (allelopathic) substances, because it had been under tea cultivation for a long period. This has been observed in NE-India as well as in Kenya. If the uprooted land is then planted with crops, these would fail to grow. In general, uprooted land should not be kept bare in any case. Soil rehabilitation not only improves the structure of the soil but equally increases soil fertility (HAJRA, 2001). Therefore, planting weeping love grass *(Eragrostis curvula)* for soil rehabilitation has yielded good results, as well as Guatemala *(Tripsacum laxum)*, being a deep-rooting grass. Weeping love grass is also planted to stabilize soils against landslides at Selimbong Tea Estate, an organic and biodynamic tea estate in Darjeeling District (Photo 5.10-5.11). Another grass which can be used for afforestation to stabilize against landslides and for soil rehabilitation is Napier grass (also known as Elephant grass) *(Pennisetum purpureum)* (HAJRA 2001, p. 128-129).

Photo 5.10 – 5.11: Weeping Love Grass freshly planted and fully grown, Selimbong Tea Estate, Darjeeling District (Photo by SHILPI SAXENA, 2002)

All above-mentioned methods as described are easy to make and applicable on the fields of the small-scale farmer as most ingredients are locally available in Darjeeling District. Lemongrass for example is used in large quantities at organic tea gardens and hence, these are a good supply source for local farmers, which can be sold to the latter at a reasonable price. The same is possible with Marigold or the farmers can simply grow it themselves. They then could cultivate their own grasses and flowers and use them on their fields for soil rehabilitation, stabilization against landslides, insect-repellent and mulching purposes. PARTAP (1998) offers a few examples of higher and lower input practices for sloping lands, as can be seen in table 5.3.

Table 5.3: Sloping land use principles: some examples (Source: PARTAP 1998, p. 51; *abridged*)

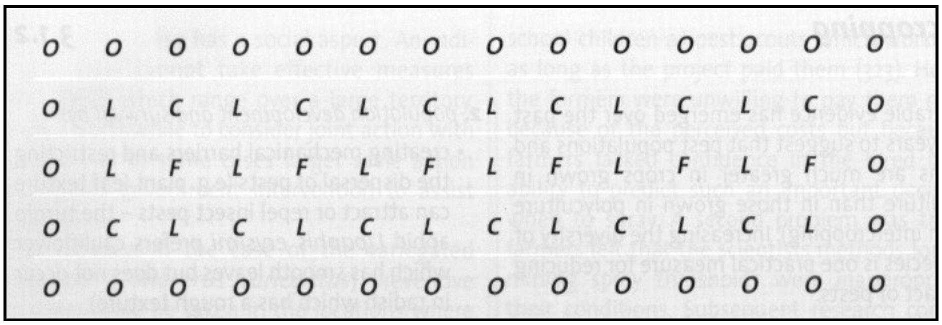
Principle	Objective	Examples of practices	
		Lower input	**Higher input**
• Minimal soil disturbance	• Limit soil disturbance and decrease potential for erosive run-off from exposed soil	• Digging stick • Selective logging	• No-till planting • Enriched forest management
• Replacing organic matter • Soil erosion cultural barrier	• Replenish plant nutrients lost through harvested outputs and ensure nutrient retention	• Increase proportion of nitrogen fixing trees • Green manuring	• Fertilizer application • Composting • Manuring

Crop diversity is an important aspect for sustainable farming. The diversity will equally reduce the impact of pests attacking the polyculture and furthermore, the farmer will be able to generate income from growing and selling different crops compared to only four or five. Another reason is to *"prevent soil erosion and to distribute risks during a bad year"* (ITO *et al.* 1997, p. 74). Japanese organic farmers therefore cultivate crops with high diversity, even on small plots (Photo 5.12). Many of the encountered organic farmers grow up to 60 crops and varieties. For crop production, crop rotation is equally essential for the biological cycle of the farming system, by creating soil fertility, controlling weeds, diseases and pests (NATURLAND, 2000). *"It provides the farm with good yields and economic stability, thus ensuring long-term viability. For this reason, a minimum of one fifth of the crops on the arable land have to be legumes. During crop rotation, winter and summer crops should complement each other in their effects to prevent the negative effects of monoculture. Variety is an essential characteristic of organically cultivated fields. Special attention should be paid to ensuring sufficiently long periods between the cultivation of the same kinds of crops"* (NATURLAND 2000, p. 6).

Photo 5.12: Crop diversity on a total cultivation size of 0.6 ha, Kanagawa Prefecture (Photo by SHILPI SAXENA, 2002)

Growing a diversity of plants, i.e. multiple crop farming, controls insects and enhances yields by the following practices (STOLL 2000, p. 93): **Intercropping**, which means that more than one crop is grown on a field, **trap cropping**, are crops that will divert the attention of certain pests from the main (target) crop and **plant attractants**, are plants, which provide feed or shelter to beneficial insects. In trap cropping, *"once the trap crop is infested with the pest, it can be removed and destroyed"* (GREGORY 1986, p. 10) taking along with it a large part of the pest population. Another method is **companion planting**. Here, the insect pest rejects the companion plant such as fenugreek (*Trigonella foenum-graecum*), coriander (*Coriandrum sativum*), garlic (*Allium* sativum) or onion (*Allium cepa*) when the plant is placed next to the target crop. Garlic for example controls aphids, fruits tree borers and spider mites. A cultivation pattern developed in Nepal combines certain crops with each other to protect them from insect pests. Here, the ultimate protection of the entire field was attained, when cauliflower (*Brassica oleracea* var. *botrytis*), onion, lettuce (*Lactuca sativa*) and fennel (*Foeniculum vulgare*) were planted together (Fig. 5.3), with onion also serving as a companion plant. This method kept aphids, large white cabbage butterfly *(Pieris brassicaceae)* and the diamondback moth *(Plutella xylostella)* under control for three years (STOLL, 2000).

Fig. 5.3: Intercropping and companion planting pattern from Nepal to control insects (Source: STOLL 2000, p. 94)



O = Onion, L = Lettuce, C = Cauliflower, F = Fennel

Table 5.4 lists intercropping patterns for vegetables, especially which are applicable in Darjeeling District, since most of the listed crops and controlling plants are cultivated by the farmers themselves, its application would not require any expensive know-how or input. Basil, which originates from India, is a companion plant for tomatoes and peppers, as it repels insects and diseases; but it is vulnerable to cold weather and therefore needs sun and also rich moist soil and compost (MAYBAUM, 2003).

Table 5.4: Intercropping used in vegetables
(Source: STOLL 2000, p. 95)

Pest	Crop	Controlling plant and principle of control
Aphids (Aphidae)	Tomatoes	Onion
	Lettuce, Brussels sprouts, chilli,cabbage	Basil: Optical effects, repellent
	Chilli	Eggplants are an effective trap crop for those aphids migrating early and transmitting virus diseases such as CVMV.
Cabbage butterfly *(Pieris brassicae)*	Cabbage	Non-green foliage plants as well as strong-odoured plants such as onion, leek, garlic, shallot, mint, coriander, fennel, bitter gourd. This principle gives very good control effects.
Diamondback moth *(Plutella xylostella)*	Cabbage	Tomato, coriander, garlic: act as repellents
Fruit borer *(Helicoverpa armigera)*	Tomato	Marigold (*Tagetes erecta*) as trap crop. Synchronization of flowering of tomato and marigold is crucial. 25 day old tomatoes and 40 day old marigold seedlings resulted in simultaneous flowering. Planting marigold every 10, 12, 14 and 16th row resulted in an infestation of only 6.0, 7.1, 10.3 and 10.4%.
Fruit and shoot borer *(Leucinodes orbonalis)*	Eggplant	*Peucedanum graveolens*: acts as repellent
Loopers *general*	Crucifer	Radish: according to the ayurvedic concept, seeds and main vein of radish are of antiseptic value.
	Onion	Onion: repellent. According to the ayurvedic concept, onions have a killing effect on bacteria and insect larvae.
Aphids (general) Thrips (*Thrips tabaci*) Whitefly (*Bemisia tabaci*)	Chilli	Coriander: acts as attractant for beneficial insects, thus promoting biological control
Whitefly (*Bemisia tabaci*)	Tomato	Onion Cucumber planted in alternating rows 30 days before tomato delays infection of the tomato by the whitefly-vectored tomato yellow leaf curl virus.

Further **observations** from **Kanagawa Prefecture**, Kanto and other prefectures were done, where quantitative data was not collected. As for all of these observations, the decision of implementing any method is the individual farmer's own choice. This research and the NGOs can only provide an idea or suggestion for improvement of crop yield or natural pest control. Organic farmers in Kanagawa Prefecture use different methods for repelling insects. Some farmers grow the vegetables in midst of **weeds** surrounding the crop. This measure is used for the insects to be rather attracted to the weed and not the target crop (Photo 5.13-5.14). The farmers said that they had just recently begun with this method, but it seemed promising. HARPER (1983, in: SANDARS & AUDSLEY, 1996) states that weeds will compete with the crop for its nutrients and space, which in the end effect might decrease yields of the main crop. A farmer might try above method on a small plot and monitor the development. Even the NATURLAND (2000) guidelines for organic agriculture mention that weeds *"are the habitat of fauna, a prerequisite for a varied community of species"* (NATURLAND 2000, p. 5) and should therefore be regulated rather than being eliminated, because weeds are natural companions of plants. A case study in India showed that a farmer, who was mainly influenced by the philosophy of the Japanese farmer Fukuoka and his Natural Farming concept (see chapter 3), started using weeds in crop cultivation. These weeds have saved his vegetables, wheat and pulses from pests and diseases. The farmer had started out on a small plot of 0.1 ha as an experimental basis; after positive results, he extended his plot to 1.2 ha (LECLERQ, 2002). Weeds such as baru (*Sorghum halepense*), doob (*Cynodon dactylon*) and motha (*Cyperus rotundus*) grow well on his field with sugar cane (LECLERQ, 2002).

Photo 5.13 – 5.14: Crops interplanted with weeds and grass, Kanagawa Prefecture
(Photo by SHILPI SAXENA, 2003)

Black polyethylene cover (or black polyfilm): this sheet is placed right on the ground on top of the crops. Organic farmers use this method to increase temperature of soil, maintain moisture, protect from frost and weeds as well as accelerate root growth. According to HANADA (1991), a 90 % weed control and an increase of soil temperatures up to 70°C can be achieved. It has wholes so that the crop can grow accordingly though the cover (Photo 5.15). It is used for example, for onion seedlings during winter, which are transplanted after six months from the cover directly onto the field, and harvested in May or June. Farmers of course also use mulching materials like straw, but the black plastic film (0.014 ± 0.003 mm) is more efficient, as it can promote a faster growth of various crops: according to ICIMOD (1994) by 5-29 days and increase yields by 30-50 %. The farmers visited by the author in Kanto, are quite satisfied with this system, because of its use in winter and good yield results. On the sides of the cover, farmers place either iron rods or bricks, so that strong winds do not remove the cover (Photo 5.16). A study by STOFFELLA *et al.* (1997) shows that polyethylene cover used as mulch in Florida increased vegetable yields more than organic mulch, such as municipal waste and wood chips.

The author had reservations about this cover method for the Darjeeling District due to production costs and material, but as the International Centre for Integrated Mountain Development (ICIMOD) in Kathmandu has started promoting it in the Hindu Kush-Himalayan region, it could be applied in Darjeeling District too. The disposal of such material might pose a problem in the region, if proper planning in terms of waste management is not taken care of before implementation. One organic farmer in Kanagawa Prefecture though, has reused this material several times, but now it is quite damaged from frequent usage. Another organic farmer in Saitama Prefecture only used it for a year or two before disposing of it, because it becomes damaged from the strong winds or heavy rainfall.

Photo 5.15: Onion seedlings under black polyfilm, Saitama Prefecture (Photo by SHILPI SAXENA, 2002)

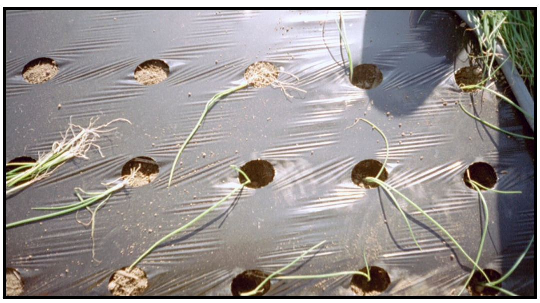


Photo 5.16: Spinach cultivated under black polyfilm, Kanagawa Prefecture (Photo by SHILPI SAXENA, 2003)

Tunnel Farming and the greenhouse system in Japan date back to the beginning of the Edo Period (1600's), which used an oil coated paper and a straw mat ('komo') as covers (TAKEZONO, 1994). When vinyl materials were developed after 1945, the systems were refined and led to modern time greenhouse cultivation with steel frame houses and polyethylene cover (TAKEZONO, 1994). Tunnel Farming also started using white polyethylene covers. Tunnel Farming utilizes frames made either from bamboo (Photo 5.17) or from bendable plastic material (Photo 5.18). Mostly in the summer, a very fine synthetic cloth (white fabric) (Photo 5.18) or nets (Photo 5.19) are used to cover vegetable crops, which are placed on top of the frames and are both water permeable. The nets in summer provide better air

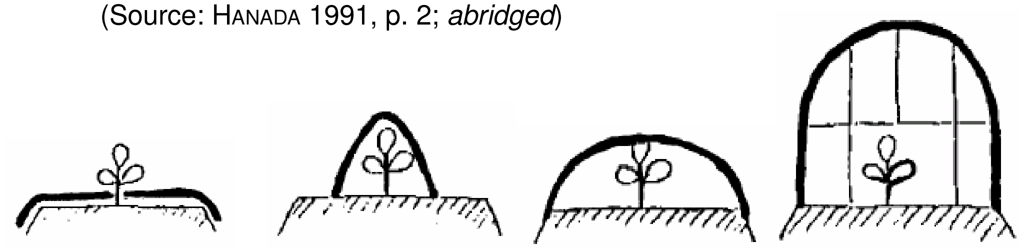
Photo 5.17: Bamboo frames used for tunnel farming, Kanagawa Prefecture (Photo by SHILPI SAXENA, 2003)

circulation than vinyl covers, as it tends to get very humid. Additionally, the net protects the crops from insects and pests. In winter, polyethylene plastic cover or synthetic cloth is used on the Tunnel-Farming to protect the crop from frost and cold. This system can be used throughout the year and for crops such as cabbage, spinach, cauliflower or even seedlings. If sowing is done in February/March, then the crop can already be harvested between May and July, due to the covering and mulch in the Tunnel Farming. Unlike the Square Meter Farming practiced in Darjeeling District by some farmers, the Tunnel Farming in Japan does not use any specific amount of crop per area or row of tunnel. This means there is no m^2-cultivation per crop. Another possibility to protect the crop from frost especially during winter is to use a fine woven cloth/net directly on the crops without frames (see fig. 5.4).

Photo 5.18 - 5.19: Tunnel farming with net covering, Kanagawa Prefecture
(Photo by SHILPI SAXENA, 2003)

HANADA (1991) shows different types of mulch and row covers used in Japan (Fig. 5.4). These have an effect on soil temperature, soil moisture, texture, fertility and control on weeds and diseases and protection from wind (HANADA, 1991). The material placed directly on top of the crop (hot cap), does not leave enough space between the plant and the material, which is a disadvantage for its growth. More practical are the *"low tunnel hoops or low pipe-frames"* used for the Tunnel Farming (HANADA, 1991, p. 14) and which are covered by various types of materials: blue net, polyester sheets or polyethylene. For subtropical and tropical climates, row covers using plastic net or air permeable material, is useful especially for leafy vegetables and for yield increase. Latter results from a combination of factors, such as *"shading, suppression of soil temperature increases, conservation of soil moisture, and protection from wind and pests"* (HANADA, 1991, p. 20). For effective crop protection against pests, the mesh size of the net is equally important. To protect from yellow-striped flea beetles, a mesh size of 1.0 mm is needed; 2.0 mm against diamondback moth and 4.0 mm against army worm and cabbage worm (HANADA, 1991).

Fig. 5.4: Types of covers applied for vegetables in Japan
(Source: HANADA 1991, p. 2; *abridged*)



Seedlings in raised compost bed: Organic farmers in Kanto often use raised compost beds to grow seedlings, before planting these onto the field. The seeds are either placed directly into half-decomposed material (Photo 5.20), which generates heat or in little pots/slates placed on top of a compost bed (Photo 5.21). Temperatures in the compost bed can reach 35-40°C and needs to be regulated according to the crop. Some farmers place straw on the outer side of the compost bed for better insulation. The whole system is then enclosed with a polyethylene cover to protect the crops from insects as well as to contain heat. The compost bed is located in a greenhouse to maintain high temperatures, especially during winter. After the seedlings have grown, they are planted onto the field.

Photo 5.20 – 5.21: Seedlings of different vegetables grown in a raised compost beds,
Greater Tokyo and Kanagawa Prefecture
(Photo by SHILPI SAXENA, 2003)

Effective Microorganisms (EM): These microorganisms are a mixture of several bacteria, mainly lactic acid bacteria, yeasts, smaller numbers of photosynthetic bacteria, actinomycetes, and other types of organisms (HIGA & PARR, 1994). Japanese Professor Higa from Okinawa University has developed this liquid solution (Photo 5.22); the beneficial microorganisms serve as inoculants to increase microbial diversity of soil and plants (HIGA & PARR, 1994). It is applied in order to increase crop growth and yields by enhancing beneficial microbial soil activity (DANIEL, 2004). Furthermore, the germination, flowering, fruition and ripening in plants is enhanced (ICIMOD, 2004) and suppresses insects and pests (HIGA & PARR, 1994). It is applied by only a few of the visited and surveyed farmers, as it is quite expensive. EM is sprayed on the crops or mixed into the animal feed/water. It is not supposed to substitute other organic farming practices such as crop rotation, organic pest management, use of crop residue, but EM is used as an addition to these practices (HIGA & PARR, 1994). This technology has even been applied in the hills of Nepal for selected vegetables, radish and cabbage, showing an increase in yields (YADAV, 2004). The EM sprayed on these crops improved their quality as well, which makes them better for marketing purposes. But not only has it proven helpful in crop cultivation, it has equally been applied in animal husbandry, curing injuries and infections, combating odour and improving milk quality of cattle (THE HINDU, 2001; CORREA, 2001). An important aspect and aim of EM is to make it available in different countries by producing it in that country or region and using local organisms. One reason for this is to keep costs low, if produced within the country of application, the other is to use microorganisms that are not brought in from another country and therefore do not disrupt local soil/microorganisms. ICIMOD too, is testing this method at some of its sites. And local NGOs on Darjeeling District have also shown an interest in applying EM at their project villages.

Photo 5.22: EM-1 solution applied by an organic farmer, Kanagawa Prefecture (Photo by SHILPI SAXENA, 2002)

Clover (*Trifolium spp.*): Some Japanese organic farmers use clover ('rengei') on rice fields before planting rice or after rice harvest (Photo 5.23–5.24). It makes the soil very soft and fixes nitrogen. In spring, the clover covers the rice field and it does not allow other weeds to grow, so it acts as a natural weed control. One month before rice seedlings are transplanted, the clover is tilled into the soil. The soil of the organic rice field with clover (Photo 5.25) was very soft and had a crumbly texture, compared to the conventional rice field, where the soil showed a very hard and lumpy texture. With clover on the rice field, the organic farmer stated of having good results in rice yield and harvest.

Photo 5.23 - 5.25: Harvested rice fields and soil with and without clover,
Shizuoka Prefecture
(Photo by SHILPI SAXENA, 2003)

Furthermore, clover, especially white clover (*Trifolium repens*) can be used as a feed for livestock, because it contains *"higher protein than grass and maintains its digestibility at a higher level with maturity than grass. Due to fewer cell wall constituents than grass, it has higher intake characteristics, leading to more milk yield"* (NEWTON 1995, p. 13). Dutch white clover (*Trifolium repens* L.) grows in the Darjeeling Himalayan region as thick white pasture and is furthermore a source of honey for another Himalayan honeybee, *Apis dorsata* (MAJUMDAR *et al.*, 2004; see apiary paragraph). Kalimpong subdivision, the main rice growing area in Darjeeling District, might benefit of using clover, but this method would need to be tried by the farmers on an experimental basis first, before applying it broadly and most importantly, the Kalimpong farmers need more information on the benefits of clover, to decide whether it suits their purposes.

Duck integrated rice farming system: In Japan, the surveyed organic farmers use ducks as biological control when growing rice. These animals act as natural predators for insects and maintain soil structure, due to movement in the flooded rice field. As the ducks eat insects, weeds and snails while swimming through the rice field, the need for insecticide and herbicide or manual weeding is removed. Furthermore, duck manure serves as optimal organic fertilizer for the growing rice, which also reduces or removes the need for fertilizers. The feeding of ducks is taken care of by them eating insects, weeds, snails or rice grains from the previous harvest. The ducks are placed into the field after rice have been transplanted and removed when the rice starts flowering, i.e. about 2.5 months; otherwise, they will start to feed upon the new rice before harvest and destroy the crop. Around 30 ducks per 10 acres of rice field are suggested (KAZUSHI, 1997). Another benefit is that the ducks stir the water by paddling, preventing sediments to settle at the bottom of the paddies, they loosen the mud with their beak and stir up soil, which increases oxygen supply and stimulates root growth in the seedlings (KAZUSHI, 1997). This muddy water, as well as the paddling prevents weeds to grow anew. A small shelter is provided for the ducks in one corner of the rice field to rest (Photo 5.26). Besides these benefits for the paddy fields, these animals require minimal care, limited space and small shelter and lastly they provide eggs and meat for consumption or sale (PAYER, 2001). In the post-harvest season, the animals can be kept near a rice field with water access but fenced (Photo 5.27). It might be necessary to put a fence around the field to protect the ducks from other animals like dogs and to prevent the ducks to fly away. Whether such a measure is feasible on the rice terraces of Kalimpong subdivision in Darjeeling District, remains questionable (see photo 4.8 in chapter 4.3.).

Photo 5.26 – 5.27: Duck-rice farming system and post-harvest shelter,
Shizuoka Prefecture
(Photo by SHILPI SAXENA, 2003)

Rice husk charcoal ('kuntan'): rice husk surrounds the rice grain and is removed by de-husking, as it is the non-edible part. The rice husk charcoal is applied on the field as fertilizer. Benefits of this charcoal are water retention of soil, reduction of diseases, increase of soil pH and available phosphorus, *"an increase in the level of exchangeable K and Mg"* (FFTC 2001a, p. 1). Components of rice husk charcoal are K and Fe. In order to make the 'kuntan', some burnable materials like wood and cardboard are lighted to make a fire under a chimney ('entotsu'), which is then covered by a tin can containing wholes (Photo 5.28). Then initial rice husk is placed around the base of the chimney (Photo 5.29), but if too much husk were put, the process would not work. Slowly, more rice husk is placed with a shovel and occasionally the husk has to be turned (Photo 5.30) otherwise it starts to burn. The entire process takes a few hours, on average 8 h[29]. FFTC (2001a) suggests applying 10-20 mt/ha as a row application instead of broadcasting it; after applying it onto the soil, it should be mixed into the surface. With the application rate suggested, an increase in yield by 10-40 % can be

[29] Another detailed description is given by FFTC (2001a; see bibliography for details).

achieved for crops like maize, cowpea and soybean (FFTC, 2001a). Small-scale farmers apply this charcoal, suitable to *"sandy, acidic and relatively infertile soils"* (FFTC 2001a, p. 1).

Photo 5.28 – 5.30: Making of charcoal from rice husk, Kanagawa Prefecture
(Photo by Shilpi Saxena, 2002)

Charcoal is also made from bamboo, which additionally provides wood vinegar. This charcoal is applied on the field as fertilizer, when it is nearly a powder, whereas the bamboo charcoal itself can also be used as a coal. Furthermore, it supplies K and Fe to the soil. If the field soil is sticky, then the charcoal powder is mixed into the soil to loosen it up; this means that charcoal keeps the loose structure of the soil. Basically, it improves the soil and once the crumbly soil texture is retained, then it is sustained with compost.

Wood vinegar ('mokusaki') is derived when making charcoal from wood or bamboo. Wood vinegar is used as fertilizer on crops or on the rice field, in a mixture with water, e.g. 1,000 parts of water with one part of wood vinegar. Furthermore, it acts as an insect repellent when sprayed on crops. It takes about one week to eight days until it is ready. The preferred trees used for wood vinegar are Japanese oaks 'kunugi' (*Quercus acutissima*, Sawthorn oak) and 'konara' (*Quercus serrata*) (Cantú Silva & Okumura, 1996; Sakagami, 2003). Konara is a *"typical dominant species in coppice in Japan"* and grows in Kanto (Iwabuchi & Hoshino, 2003), while kunugi is also used to cultivate shiitake (Ogawa, 1995; see mushroom cultivation paragraph). A fire is made with a temperature of 100℃, and then 1,500 kg wood is placed inside the kiln, which is made in traditional style of mud and stones (Photo 5.31). The kiln is closed for eight days with no gas, water or air able to penetrate inside. The outside door is sealed with hot liquefied soil and dry soil in layers. After the eight days are over, the burnt wood (charcoal) is removed from inside. A chimney in a 45° angle is connected to the kiln, from which another rod is placed downward and ends in a bucket to collect the liquid: *"As the smoke slowly meanders up the chimney the moisture in the smoke condenses on the cold chimney wall and runs down the chimney into a bucket"* (Epp 2002, p. 3). This condensate is the wood vinegar and its extraction is a very slow process, because very little of this liquid drips from the rod into the bucket. The yield here will be around

50 l of wood vinegar. The farmer sells wood vinegar and bamboo charcoal ('sumi') to other organic farmers. Another farmer in Saitama Prefecture produces about 150-200 kg of bamboo charcoal and 30-50 l of wood vinegar; the kiln is kept at below 70°C to produce a slightly acidic charcoal. The kiln is used twice a year, in late autumn (November) and late spring (May) (KAZUSHI, 1997).

Photo 5.31: Kiln to make charcoal and wood vinegar, Shizuoka Prefecture
(Photo by SHILPI SAXENA, 2003)

Bamboo stems as **windbreak**: one organic farmer in Chiba Prefecture uses bamboo stems as protection for his crops from wind (Photo 5.32-5.33). He had not tried it before, but thought it might help protect his crops, as bamboo is used, among other purposes, for its windbreak, noise and climate buffer (MERCHAN & NIETO, 2004).

Photo 5.32 – 5.33: Bamboo leaves as wind break for cabbage and beans,
Chiba Prefecture
(Photo by SHILPI SAXENA, 2003)

Water storage: Farmers e.g. in Kanagawa Prefecture, like to retain water for the non-rainy season (Photo 5.34), in order to water their crops. Similarly, this might be a useful system in the Darjeeling Himalayan region, as the post-rainy season does not supply enough water, compared to the monsoon season. The farmers in Darjeeling District do not practice water storage.

Photo 5.34: Water storage for crops in the non-rainy season, Kanagawa Prefecture
(Photo by: SHILPI SAXENA, 2002)

Potato storage: A preferred method of organic farmers in Kanto is to store their potatoes during winter for the next season, by digging a pit and fill their crop into it. For 200 kg of potato, a pit with a depth of 80 cm is prepared (Photo 5.35-5.36). On top of the pile, compost, for example consisting of rice meal and cow manure is filled, followed by soil and sometimes a plastic or canvas sheet. The potato will be taken out in June and planted on the field. Ginger seed retention is also practiced by digging a soil pit of 1 m depth. It is much deeper than for potato, because ginger is much more vulnerable against low temperatures than potato.

Photo 5.35 – 5.36: Organic farmer digging a potato storage pit for winter, Kanagawa Prefecture
(Photo by SHILPI SAXENA, 2002)

5.1.3. Composting and Vermiculture

Compost is an important part of organic agriculture, because it supplies nutrients to the crop and the soil, to increase its fertility (DAHAMA, 1997). During plant growth, crops extract nitrogen, phosphorus or potash from the soil, which need to be replaced either by composting, manure input or by planting leguminous plants like peas and beans, which supply nitrogen (BURNS, 1918). If there is an unbalance in any of them, crop growth is affected. Therefore, composting is a soil management practice that additionally *"decomposes organic wastes, destroys pathogens and abates malodours"* (DAHAMA 1997, p. 107). Other benefits include an *"increase in biological soil activity, minimum additional investment expenses, and minimum external energy requirements with regard to processing and use"* (LAMPKIN 1990, p. 99). Compost in organic farming aims at the long-term improvement of the soil and consequently of its plants, whereas chemical fertilizers aim at the short-term needs of the plant. This leads to further use of chemical fertilizers for the following crop, as the soil has not been provided with any nutrients.

Darjeeling District farmers, conventional and organic, preferably use farmyard manure, which basically consists of animal excreta from chicken, cow or pig and bedding material, like straw. Some organic farmers include cow urine, wood ash or wood chips, while some conventional farmers only use cow dung. Few organic farmers additionally use eggshells, grass clipping and kitchen waste next to cow dung. Often, these compost piles are kept outside and uncovered. Organic and biodynamic tea estates in Darjeeling District also make compost and apply biodynamic preparations. Although wood chip compost increases soil microbial activity, and mulch made of wood chips compost reduces weeds, factors such as availability of wood chips, costs of transportation and shredding machinery need to be taken into account, before usage (FFTC, 2001c). Its application should not lead to an increase in illegal felling, which is an inexpensive way of obtaining the material.

The organic farmers in Kanto preferably use rice husk, soybean stalks and husk, kitchen waste, fishmeal, leaves, grass, straw, rice straw, eggshells, twigs, woodchips and manures from cow, pig or chicken. Of course, not all compost heaps are as diverse as mentioned above, but rather a combination thereof. Most commonly animal manure, rice husk, tofu residue, leaves and grass are used. Some organic farmers even use old tatami mats, which are traditional flooring materials in Japanese houses. These mats are used for their straw, but since they are treated upon manufacture with chemicals (e.g. chemical spray) like fungicides, most organic farmers have refrained from this compost ingredient. The mats are made from a plant called 'igusa' (*Juncus effuses* var. *decipiens*) (FLETCHER, 2001). Organic farmers obtain wood chips either from sawmills, carpenters, woodcuttings of municipal trees in cities or from their family forest resources.

The compost pile should have a well-balanced composition of carbon and nitrogen materials, i.e. a C/N ratio between 25:1 and 35:1; otherwise, the microbial activity will suffer (LAMPKIN, 1990). Farmyard manure has a low C/N ratio (14:1), which means that the nitrogen content is higher (2.2 % dry weight basis) compared to rice straw with a higher C/N ratio (100:1), and consequently a low nitrogen content (0.4 % dry weight basis) (DALZELL *et al.*, 1981). Materials with high N-content are animal manure, oil cake, rice bran, green grass clippings, green weeds, vegetable wastes; carbonaceous materials are rice straw, wheat straw, sawdust, peanut stalks, sweet potato stalks, fallen leaves, chopped cornstalks, corncobs, hay and shredded paper (FFTC, 2001b). It is helpful to know the average nutrient content of different bulky manures, when making a compost pile (Table 5.5). Large components for the heap need to be shredded into smaller pieces, then the decomposition process is accelerated. Furthermore, crop residues or grass treated with pesticides or herbicides should not be placed into the (organic) compost (OPTA, 2000).

Table 5.5: Average nutrient content of bulky manures
(Source: DAHAMA 1997, p. 111; *abridged*)

Manure from	**Percentage content**		
Animal Refuse	**Nitrogen (N)**	**Phosphoric Acid (P_2O_5)**	**Potash (K_2O)**
Cattle dung, fresh	0.3-0.4	0.1-0.2	0.1-0.3
Poultry manure, fresh	1.0-1.8	1.4-1.8	0.8-0.9
Sheep dung, fresh	0.5-0.7	0.4-0.6	0.3-1.0
Cattle urine	0.9-1.2	traces	0.5-1.0
Sheep urine	1.5-1.7	traces	1.8-2.0
Wood Ashes			
Ash, coal	0.73	0.45	0.53
Ash, household	0.5-1.9	1.6-4.2	2.3-12.0
Ash, wood	0.1-0.2	0.8-5.9	1.5-36.0
Farm Waste			
Farmyard manure, dry	0.4-1.5	0.3-0.9	0.3-1.9
Plant Residues			
Rice hulls	0.3-0.5	0.2-0.5	0.3-0.5
Maize	0.42	1.57	1.65
Paddy	0.36	0.08	0.71
Wheat	0.53	0.10	1.10
Green Manures (fresh)			
Cowpea (*Vigna catjang*)	0.71	0.15	0.58
Blackgram (*Vigna mungo*)	0.85	0.18	0.53
Sesbania aculeata	0.62	-	-
Sunnhemp (*Crotalaria juncea*)	0.75	0.12	0.51

The compost pile should not be too wet or have too less oxygen, otherwise anaerobic processes commence, creating bad odours. In the latter case, the pile needs to be turned. When a pile is too wet, then dry materials need to be added. If the compost pile is too dry, the decomposition will slow down and it needs to be made moister. Ideal moisture content lies between *"55-70 % and can be checked easily: if compost is squeezed in the hand and no water emerges, than the pile is too dry; if water trickles out, it is too wet. If water droplets appear between the fingers and when squeezed, the material should retain its form when the hand is opened"* (LAMPKIN, 1990). Generally, carbon materials are dry and nitrogen materials contain water. A broad heap will allow air to circulate into the compost pile, which is necessary for the different microorganisms to work on. These microorganisms include bacteria, actinomycetes and fungi (DALZELL *et al.*, 1981). They work on the pile, and after an initial warming up-phase, the heat inside the compost stack increases and reaches a peak temperature of 70℃, afterwards it cools down and matures (DALZELL *et al.*, 1981). Different organisms work at the temperature levels, e.g. at 60℃, fungi die and actinomycetes take over.

Dalzell *et al.* (1981) recommend a first turning of the pile after 10-14 days, by placing the top layer on another space next to the heap. Then the next layer will be placed and watered. The second turning should take place after another three weeks and the final one after 12 weeks, though during monsoon it might take longer to do so (Dalzell *et al.*, 1981). One more important factor to consider is that compost piles that are not covered by a roof or a shelter, are subject to *"moisture loss due to sun and wind in the hot season and nutrient loss through leaching by rain in the monsoon"* (Dalzell *et al.* 1981, p. 13). Hence, a covering is necessary, but it should allow air permeability (Raupp, 1999).

The compost, as shown in Photo 5.37, consists of woodchips/tree pieces (95 %), rice meal (4 %), chicken manure (1 %), eggshell (very little), vegetable peel (very little) and leaves (a little). The pile is mixed in November. It is kept and turned for 1 year. After maturing, it is applied on the field. The inside temperature of 80℃ is determined by placing a thermometer into the pile.

Photo 5.37: Ready-to-use compost heap, Chiba Prefecture
(Photo by Shilpi Saxena, 2003)

Compost can be tilled into the soil or applied on the surface, which is a mulch application. Mulching protects the soil from raindrop impact, *"reduces soil temperature and water loss caused by evaporation"* (Maglinao 1998, p. 21). Application rates for the field should be in total 20 t/ha (8 t/acre); this means that per m^2 two large hoefuls or a ground cover of 1 cm thickness is applied, which just about covers the field (IIRR, 1998). For erosion control purposes, Maglinao (1998) states that 0.5 kg of straw or 0.8 kg of corn stalk per m^2 is sufficient. Photo 5.38 and Fig. 5.5 show compost applied as mulch on a leek field in Kanagawa Prefecture. The compost consists of leaves, grass and branches.

Photo 5.38 & Fig. 5.5: Compost as surface application on leek, Kanagawa Prefecture (Photo by SHILPI SAXENA, 2002)

Vermiculture is practiced in one NGO project village (Photo 5.39) and at one biodynamic tea estate in Darjeeling District. Interestingly, none of the visited farmers in Kanto use vermiculture. This method uses earthworms to create compost, by simply feeding them green leaves, crop residues and vegetable peels, basically, any organic matter. Care should be taken not feed spicy crops, such as onion or garlic. They are able to eat their body weight, i.e. one kg of worms can eat one kg of organic matter (MISRA & ROY, 2002). The fertilizer used on the crops therefore consists of the worms' excreta or castings ('vermicast'). The Darjeeling Tea Research and Development Centre (DTRDC) has analysed the average nutrient content of this vermicompost: nitrogen (N) 1.6 %, phosphorus (P_2O_5) 2.2 %, potassium (K_2O) 0.67 %, calcium (Ca) 0.99 % and magnesium (Mg) 0.15 % (DTRDC, 2003d). When earthworms are placed into a compost heap, they aerate it, making turning unnecessary, mix the material and accelerate decomposition (MISRA & ROY, 2002).

In order for the worms to work on the material fed to them, a shed needs to be created of 6 x 24 m, containing a vermi-bed or a pit with the size of 0.8 m in height x 1.2 m in width x length as convenient (MISRA & ROY, 2002; DAHAMA, 1997). The shed is built using local resources like bamboo and tree stems; the roof is made from dried grass and bamboo sticks (DAHAMA, 1997). The pit is filled with a layer (2-3 cm) of farm manure, on top a further layer (10-15 cm) of biomass is placed (DAHAMA, 1997). Into this layer, 200-250 worms per square foot (or ideally 1,800 worms/m^2) are placed, *"followed by a 10-15 cm half-digested cow-dung layer"* and leaves should be placed on top (DAHAMA 1997, p. 149). This amount of worms is estimated to feed on 80 t of humus per year (DAHAMA, 1997). Local earthworms can be used or *Lumbricus rubellus* (red worm) or *Eisenia foetida*, both being heat-tolerant (MISRA & ROY, 2002).

Photo 5.39: Vermicompost pit at Tinchulay project village, Darjeeling District
(Photo by SHILPI SAXENA, 2002)

Afterwards, the layers need to be sprinkled with water to keep it constantly moist; otherwise, the earthworms will not be able to work efficiently on the material. To obtain a balanced C/N ratio, carbonaceous and nitrogenous materials should be added. Temperature in the bed should not exceed 28-30°C while moisture content is optimal at 40-45 % and pH of the raw material is best at 6.5-7 (MISRA & ROY, 2002). Direct sunlight or too much heat is destructive to the worms. After one month, compost is ready for application. It has a granular texture, is black in colour, rich in humus and has a pleasant smell. When planning to use the ready compost, watering should be halted for 2-3 days, because the earthworms will move towards the bottom of the bed, where it is still moist. Like this, top layers are easy to remove and applicable on the crops. For the next heap, new feeding material needs to be added (6-7 cm layer), on alternate days.

Selimbong Tea Estate also applies 'vermiwash' (Photo 5.40), the liquid form of vermicast. The shed has sprinklers attached to the roof. There is an outlet valve and a net at one end of the pit, so that only the liquid washes out and not the worms. Watering is done every day, and this yields sufficient extract into a tank that holds 150-200 l. When the liquid is clear (Photo 5.41) and has no smell, it has a good balance. At the estate, the liquid is used as a fertilizer spray on the foliage and ground of tea bushes.

Photo 5.40 – 5.41: Vermiwash from vermiculture, Selimbong Tea Estate, Darjeeling District
(Photo by SHILPI SAXENA, 2002)

5.1.4. Organic Crops: Food Security and Food Safety

"Sustainable agriculture and rural development are essential to the implementation of an integrated approach to increasing food production and enhancing food security and food safety in an environmentally sustainable way" (WSSD Plan of Implementation, para. 40 in: UN-DESA, 2004).

Food security is defined as *"access by all people at all times"* to sufficient and nutritious food, which enables them to live a healthy and active life (THE WORLD BANK 1986, p. 1; ICIMOD, 1997). Food security is equally important for the producers, i.e. the hill farmers, as it means a farmer is able to grow sufficient and/or buy adequate food to sustain the family. The surveyed hill farmers in Darjeeling District seem food secure and hence, self-sufficient, but they have very small cultivable land available (less than 0.5 ha), a low productivity and the majority are nevertheless below the poverty line (see chapter 4.3.). Organic agriculture looks at the aspect of improvement of local food production with low-cost and locally available resources (PRETTY, 2002). Other factors, such as family size and knowledge of nutrition have an influence. Crop diversification is a necessary aspect because more food is available, and thus, increases food security, as several organic projects in developing countries have shown (PRETTY, 2002). Additionally, a risk minimization is achieved because the risk of failure is distributed over wider range of crops and not solely on a monocrop (SCIALABBA & HATTAM, 2002).

Another option for food security is cash security by growing high-value crops, such as cash crops and off-season vegetables. It is important to select proper cash crops, suitable to the local area, and which should neither lead to a dept for the farmers not to a mono-cropping of cash crops, as farmers tend to convert most or all of their land to these cash crops (YA, 2001). An over-supply of these crops would result in throwing excess away, because too many farmers would specialize in the same crops, which are harvested in the same time, as was the case with oranges in many parts of

China (Ya, 2001). Hill farmers have a comparative advantage over farmers in the plains, as the former can grow off-season vegetables: during summer, when it is too hot or humid in the Terai, certain crops cannot be cultivated; but off-season vegetables are only limited to a season or a specific period (ICIMOD, 1997). Vegetables like peas, beans, cabbage and tomatoes can achieve higher prices in Terai markets during this period (ICIMOD, 1997). Nevertheless, without market linkages, direct sale and infrastructure, it will be difficult to secure food through farm income. If these factors are not given, then food insecurity is the consequence, even for high-value cash crops and off-season vegetable cultivation (Nagpal, 1999). Additionally, Nagpal (1999) argues that such practices increase risk and vulnerability of local farming communities, as most of these introduced policies are planned and executed by governments in the Terai, as well as by NGOs.

Food safety refers to chemical residues or any gene-manipulated contaminations in the crops, as both are not permitted in organic agriculture (see chapter 3). Chemical residues have been found in conventional cultivation which has lead organic producers to believe that there is a long-term hazardous effect on human health and the environment, hence, they refrain applying such practices (Soil Association, 2001; Das, 2004). Organic products are reported to have higher mineral and vitamin C content than conventional products, an increase in phytonutrients (naturally occurring compounds) enables the crop to withstand pest and diseases and these phytonutrients have health benefits for the humans as well (Soil Association, 2001). Taste is another positive effect, although *"it does not have a direct influence on nutritional quality"*, nevertheless, consumers buy organic also for taste reasons (Soil Association 2001, p. 50). Many of the surveyed organic farmers in Kanagawa Prefecture and Kanto stated that they felt more secure concerning their health, due to refrain from chemical input and appreciated the taste of their organically cultivated products, e.g. as carrots were perceived sweeter. A reason of taste difference in the conventional and organic system is the higher water content in conventional crops, thus possibly diluting its flavour (Soil Association, 2001).

Organic products have zero tolerance of genetically modified organisms (GMOs); once contaminated through *"seed impurities, cross pollination or harvesting/storage practices, i.e. mixing of crops after harvest, the certified organic product would lose market value and its entire organic viability"* (Wynen & Vanzetti 2002, p. 95). Hence, spatial distances of fields and post harvest handling between organic, conventional and GMO are necessary for producers in order to maintain organic safety standards and for consumers to have a *"freedom of choice between different foods and farming systems"* (Wynen & Vanzetti 2002, p. 95).

5.1.5. Alternatives to (Individual) Certification

One option to lower the inspection and certification costs for a small farmer is a **group certification** or to establish local certification schemes (UN-ESCAP, 2002; see chapter 3.3.). Furthermore, government support in covering at least a part of certification costs for small-scale farmers would be helpful in the process. If a smallholder group certification is carried out, then the following characteristics are of importance (ELZAKKER & SCHOENMAKERS 2001, p. 8):

- Smallholders mainly use family labour
- Similarities in geographical location, production and marketing system should be there
- Costs for individual certification are much higher than the sales value of the sold product

There should be at least an internal quality assurance system, also known as Internal Control System (ICS), if no annual certification is carried out by an external body. According to ELZAKKER & SCHOENMAKERS (2001, p. 8) an ICS is a *“documented quality assurance system that allows the external certification body to delegate the annual inspection of individual group members to an identified body or unit within the certified operator.”* This means that the external body does not have to carry out the primary inspections themselves, but if there is no ICS, then an inspection on annual basis has to be carried out. There are more than 25 certification bodies dealing with smallholder group certification, out of which 10 are accredited by IFOAM and comply to IFOAM regulations (ELZAKKER & SCHOENMAKERS, 2001). Of course, there are also non-IFOAM certifiers, which are accredited and deal with the same issue, using their own system.

Nevertheless, it should be clear that if an ICS is applied, the internal regulation needs to be in a local and easy understandable language; rules and procedures have to be documented; qualified personnel and a specific contact person are necessary as well (ELZAKKER & SCHOENMAKERS 2001, p. 9). Mapping of the farmers fields is essential to localize them and field records should be kept. An external evaluation, which is a checking system for the functioning of the ICS and therefore not an inspection, is carried out by certification bodies. Often they work with domestic evaluators, which also need specific training. In an evaluation, the documentation on quality assessment needs to be reviewed, the staff of the ICS needs to be interviewed and a risk assessment to determine internal and external risks is useful. Furthermore, the farmers' understanding of the implemented organic standards, his or her yield and its estimate are essential, and the objectivity of the internal inspectors of an ICS (ELZAKKER & SCHOENMAKERS 2001, p. 9). The risk assessment should consist of the following (Table 5.6):

Table 5.6: Criteria for risk assessment

(Source: ELZAKKER & SCHOENMAKERS 2001, p. 10)

Internal Risk Assessment:	**External Risk Assessment:**
• Farmer's expectations and understanding of standards • Awareness of the risks to farmers and personnel • Conflicts of interest among staff	• Production system and systems in surrounding areas • Availability of agrochemicals in the area • Likelihood of buying of products from conventional neighbours • Price paid by alternative buyers

In **Darjeeling District**, an ICS is carried out in some villages, which supply small-scale organic tea to an organic and biodynamic tea estate. This tea is certified, but as costs for individual certification are too high, smallholder group certification has been introduced. However, even a smallholder group certification, though cheaper than an individual one, still involves many steps, procedures and costs, and in both cases a lot of bureaucracy and data collection are involved.

Furthermore, the question remains, whether there really is a need for the smallholder farmer to certify his or her products, unless it is meant for export. Especially, for crops like vegetables and fruits in the case of Darjeeling District that are mainly geared at the local hill market in the first place and not aimed export. As is the case in Thailand, where smallholder farmers grow organic vegetables for home consumption and the local market. These vegetables are not certified because local market does not require any certification seal as the farming complies with the standards of Organic Agriculture Certification Thailand (ACT) (RUENGLERTPANYAKUL, 2002). *“Although economic viability is important to all farmers, non-certified organic farmers, who are not market driven, tend to establish more diversified systems that are managed following the ecosystem approach”* (ALTIERI, 2002).

Therefore, a local certification scheme for Darjeeling District farmers, developed by local NGOs seems to be more suitable, as local standards and regulations can be defined and promoted. This scheme is sensible if the hill farmers want to sell their crops at the local hill markets, or to hotels and restaurants, where the target group for the latter two are (western) tourists. Such a system is termed 'participatory certification', as it has emerged in Brazil (FONSECA, 2003). *“This is operated by informal networks, based on the work of NGOs (farmers' association, co-operatives, extension services, consumers' association, etc.) with rural and urban communities in low income counties. They are usually associated with local and regional markets, selling a diverse range of farm products directly from the farm, public fairs and through home delivery services”* (FONSECA 2003, p. 6). Nevertheless, it is still a certification; therefore, the NGOs in Brazil offer next to the certification process, also education and project development, while only charging a small monthly fee of around € 3 to their members, i.e. the farmers

(FONSECA, 2003). Participatory certification especially aims at the inclusion of small farmers and consumers with low income.

Another option to certification is the system practiced by small-scale organic farmers in **Japan**, as the following quote shows: *“The Japanese sustainable agriculture movement has instead focussed on bringing consumers and producers closer together by creating consumer-producer cooperatives and buying groups, thereby reducing the need for certification”* (EAP, 1989). For Japanese small-scale organic farmers, certification is not important, since a direct sale and marketing exists between producers, i.e. the farmer and consumers (see TEIKEI system in chapter 3.2.). During the field surveys of organic farmers conducted by the author in Kanagawa Prefecture and Kanto, this was the general opinion of the organic farmers concerning certification. This system is based upon trust and confidence, which is more important for the two groups involved than a stamp or certification document. The crops, basically non-certified organic, are for example sold to the consumer either directly off the farm (Photo 5.42), is home-delivered by the farmer to the consumer, or sold at a TEIKEI shop (Photo 5.43), where farmers deliver their freshly harvested products. Here too, consumers and producers can interact directly. Concerning home-delivery or personal customer pick-up of the box, the empty box from the previous delivery is returned to the farmer; this enables a recycling/re-usage of material. Although the Japanese government has also produced its own organic certification system in order to be competitive with the EU and US, many of the local organic farmers simply do not see any necessity of a certification for their products. They rather perceive the system as interference by the government into their farming practice and think that it is not sensible to pay a high cost simply for a certificate.

Photo 5.42: Consumer picks up basket directly at the farm, Tokyo (Photo by SHILPI SAXENA, 2003)

Photo 5.43: Farmers and consumers interact at a TEIKEI shop, Chiba Prefect. (Photo by SHILPI SAXENA, 2003)

5.2. Sustainable Forest Management

Illegal felling is a big problem in the Darjeeling Hills, as explained in chapter 4.3. But deforestation without replanting will have serious environmental effects. The forestry department has started afforestation programs in Darjeeling District. Several authorities take care of the afforestation activities. Rather, there are three independent offices in charge of Kurseong, such as the Divisional Forest Office Kurseong (DFO) of the Government of West Bengal, the Forest Department of the Darjeeling Gorkha Hill Council (DGHC)[30] and the Forest Department of the Kurseong Soil Conservation. Additionally, Project SERVE-WWF India (Projektwerkstatt Teekampagne Germany) also does afforestation efforts in some areas between Kurseong and Darjeeling subdivision.

"In the afforestation programmes and social forestry, stress should be laid on fuel trees, fodder trees and preferably fuel-cum-fodder trees" (GOSWAMI *et al.* 1993, p. 36). Simply telling the farmer to refrain from felling wood is not a solution. Therefore, creating **community forests** as a means of sustainable forest management is an aspect, which the villages, with the support of the local and state forest offices, need to implement in Darjeeling District. Fuel and fodder trees should be available to rural people, preferably as a village or community forest. Only when a village is responsible for its own forest in terms of growth, felling, harvest and replanting, will it be able to use only selective trees as fuel wood, thus not harming the entire forest. It is therefore crucial that the farmers' awareness is raised for such type of forest management and agriculture, since their livelihood is dependant on it. Therefore, viable and long-term farming practices in these hilly regions should include long-term forest management and by using alternative fuel wood sources such as biogas. Then afforestation efforts can continue on the protected and unclassed forest area, while the farmers still can use a source for cooking and heating. The by-product of biogas, the slurry, is a good fertilizer for the crops and excess can be sold to the organic and biodynamic tea estates, which can use these inputs for their tea bushes. Since the main input for biogas is animal dung and most farmers/villages have cows, the basic ingredient is already available. Furthermore, the farmer does not have to walk to the forest, cut and carry wood, which takes several hours, as biogas is a time saving measure, being an on-farm activity. However, the financial aspect and the concerns voiced by the farmers,

[30] The DGHC was a movement initiated in Darjeeling District in the mid-1980s after a violent uprising by its residents to become independent from the State of West Bengal and have their own "Gorkhaland". As latter was not achieved, the Government of West Bengal compromised by creating the DGHC, a local municipality of the district, to take care of matters of the hill people (WANGYAL, 2002).

as explained in chapter 4.3. in the biogas paragraph, need to be considered thoroughly before implementing any such measure.

Hill farmers used to have village forests, but these and surrounding forests were decimated due to increased population pressure and need for cash (KHOSLA, 1998). NGOs and the government need to offer an alternative, as ATREE had done for their project village Rampuria: this forest village is located below the East Range of the Senchal Wildlife Sanctuary. Facing problems of wild boars destroying their crops and fields, these villagers started felling trees and selling fuel wood to generate income. ATREE started a project to protect the forest and give the farmers other means of income through floriculture, apiary, animal husbandry, cardamom and medicinal plant cultivation (RAI, 2002). Furthermore, the NGO gave the villagers saplings of fuel wood, fodder and fruit trees to plant near or on their own field. These saplings were cultivated in the Project SERVE nurseries, Chattackpur (Table 5.7); a total of 2,360 trees were supplied in 2002. Trees or community forests additionally benefit the villagers with building material, shade and raw materials (MUKHERJEE, 1997). Illegal felling will probably not be terminated immediately; therefore, SAIKIA (1995) suggests a simple method for preventing soil erosion is to keep the tree trunk at about 0.5-1 m height, i.e. not to fell the entire tree, a method, which is practiced in a district of Nagaland, in NE-India.

Table 5.7: Trees used for afforestation at village level, Rampuria, Darjeeling District (Source: PROJECT SERVE, 2002; *unpublished data*)

Local name	**Botanical Name**	**Purposes**
Utis	*Alnus nepalensis*	Fuel wood, Timber
Katus	*Castanopsis* spp.	Fuel wood, Fruit*
Sinkauli	*Cinnamomum* sp.	Aromatic, medicinal
Bhadrase	*Elaeocarpus sikkimensis*	Fuel wood, Fruit, Fodder
Maya	*Eriobotrya bengalensis*	Fodder
Nevara	*Ficus roxburghi*	Fodder
Amboke	*Jambosa formosa*	Fuel wood, Fruit, Fodder
Okhar	*Juglans regia*	Fuel wood, Fruit, Timber,
Lapche kauloo	*Machilus edulis*	Fuel wood, Fruit, Timber, Fodder
Ghogen champ	*Magnolia campbelii*	Fuel wood
Champ	*Michelia* spp.	Timber
Kaphal	*Myrica* sp.	Fruit, Fodder
Panyun	*Prunus cerosoides*	Fruit, Fodder, Timber
Arupatey	*Prunus* sp.	Fuel wood, Fruit, Fodder
Gagun	*Saurania nepalensis*	Fodder
Kyamuna	*Syzygium tetragonum*	Fruit, Fodder

* Fruit means, that these are edible

The area, which the DFO takes care of, is divided into territorial divisions: the Terai (the plains), lower hill forests and middle hill forests, located between 60-1,980 m and covering about 277.13 km^2 (O'MALLEY 1999, p. 91). The work of the DFO includes protecting the forest from illegal activities (e.g. felling) by patrolling and policing the area. Furthermore, they plant trees, i.e. saplings, in degraded, unbalanced forests for regeneration. Next to the DFO, there is an office or branch called the Kurseong Soil Conservation Division, with its own jurisdiction and duties. They also did planting and regeneration of forests in highly vulnerable areas. Prior to 1986, some of these areas, called "resumed forest land", were left or abandoned by tea estates. In other words, the areas belonged to the tea estates, but were managed by the Soil Conservation Division. After 1986, these areas were handed over to the DGHC and therefore do not belong to the tea estates anymore. This council is also doing planting in these resumed forestland areas, with the help of officers employed from the Kurseong Territorial Forest Division.

The DGHC Forest Department provided the following data on afforestation by the DGHC: The resumed forestland (including the plains) covers an area of 6,952.76 ha. This includes *Protected Forest* (1,712.30 ha) and *Unclassed State Forest* (5,240.46 ha). Protected forest refers to non-commercial use of timber, whereas unclassed forest area allows a very restricted use, e.g. the collection of wild fruits, medicinal plants and dead wood, but settlements are prohibited. No other forestland is under the care of DGHC. About 2,500 seedlings/saplings are planted per hectare plus 20 % casualties' replacement, i.e. about 3,000 seedlings per hectare.

The saplings are planted with a spacing of 2 x 2 m. The planting season is normally in the month of May and latest by June each year during the onset of monsoon. This means July is used for seedling and April/May for stump planting[31], but only hard wood for example teak.

The Kurseong Soil Conservation supplied their data on the planting of trees by location area, year and ha from 1991–2001. The plantation efforts are year wise all over the division area. Sometimes planting is done twice at the same block but at a different location (for afforestation conducted under the Kurseong Soil Conservation see table A13 in the appendix). The hectares replanted by DGHC and DFO in the hills and plains are listed in table 5.8 as well as afforestation conducted in the hills by DFO (1997-2002): these areas include Bamanpothra, Bagora, Chimney and Kurseong.

[31] Stump planting means to plant the main root of a plant, which is at least 1–1.5 years old: uprooting of a plant of 15-18 cm length, again planting same root ca. 10 cm below ground, keeping 5 cm as soot above ground.

Table 5.8: Area of afforested land by local and state forestry offices, Darjeeling District (Source: DGHC, 2002c; DFO, 2002; *unpublished data*)

Year	Total Area (ha) incl. Plains		Hill Area (ha) afforested by DFO	
	DGHC	DFO	e.g. Bagora	e.g. Kurseong
1997	219	353	80	25
1998	308	238	58	25
1999	254	291	100	35
2000	378	355	100	25
2001	274	320	105	10
2002	170	220	48	7

The tree species used by the DFO for planting in afforestation areas, is shown in table 5.9.

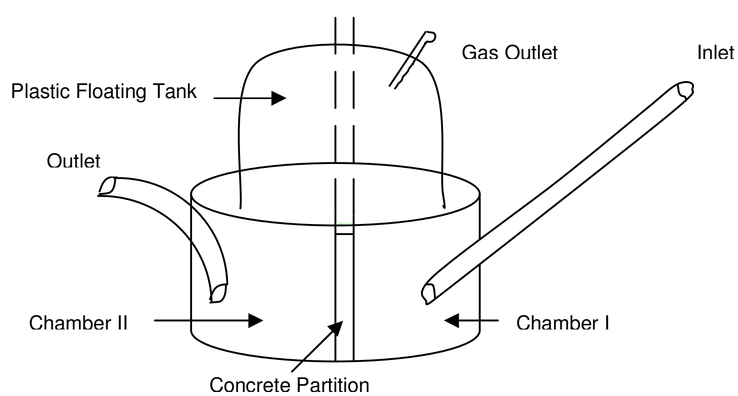
Table 5.9: Afforestation by DFO with specific trees, Darjeeling District (Source: GHOSH 1996, p. 35; 37; 65)

Fuel wood Species		**Indigenous Fuelwood Species**	
Local name	Botanical name	Local name	Botanical name
Pine	*Pinus patula, Pinus insularis, Pinus langifolia*	Gokul	*Ailanthus grandis*
Willows	*Salix babitonica*	Chilaune	*Schima wallichii*
Poplar	*Populus glauca, Populus gamblii*	Malagiri	*Cinnamomum cecidodaphne*
Eucalyptus	*Eucalyptus grandis, Eucalyptus saligna*		
Fodder Species		**Bamboo**	
Nebharo	*Ficus hookeri*	Choya bans	*Dendrocalamus homiltonii*
Dudhila	*Ficus nemoralis*	Makla bans	*Bambusa nutans*
Gogun	*Saurania nepalensis*	Betua bans	*Bambusa polymorpha*
------		Bara bans	*Bambusa gigantia*
		Muli bans	*Malocana bambusoides*
For regeneration of forests in areas between 1,200-2,100 m altitude, the following trees are listed:			
Endemic Species		**Exotic Species**	
Kapasi	*Acer campbelii*	Pines	*Pinus insularis, Pinus langifolia*
Phusre Champ	*Michelia lanuginosa*	Cypressus	*Cupressus lucitanica*
Tite Champ	*Michelia cathcartii*	Willows	*Salix babilonica*
Gokul	*Ailanthus grandis*	------	------
Dhupi	*Cryptomeria japonica* (not more than 20 % of total species)	------	------
Lampate	*Duabanga sonnertioides*	------	------
Pipli	*Symintonia populnea*	------	------
Kawla	*Machilus odoratissima*	------	------
Utis	*Alnus nepalensis*	------	------

Some farmers in Kanagawa Prefecture and Kanto still own their own forest and bamboo grove. These belong to the farming family just as the fields and the farmhouse. *"The woodlands were closely connected with upland areas, farm households and livestock"* (INUI, 1996). These woodlands not only provided fallen leaves for compost and hence, for the fields, but also as heating material in nursery beds, fuel wood, timber, mushroom cultivation and medicinal herbs (INUI, 1996). Other positive functions were the windbreak purpose and watershed protection. Trees were felled in a cycle of 15-25 years for fuel wood purposes, maintaining the woodland though forestation (pines) or sprout regeneration (red oaks and konara oaks) (INUI, 1996; see chapter 5.1.2. on wood vinegar). Family forest groves were established in earlier times, e.g. some farmers stated that their land and house are part of their family for 200 or even 500 years; this includes the forest area. In recent times, the local prefectural government has bought these family forests from the farmers and put them under governmental care, either for building purposes or conservation. Those farmers, who still own their forest areas, use them for their fuel wood supply for heating and cooking purposes.

Biogas (popularly known as 'gobar gas' in India) is used at the NGO experimental farm St. Alphonsus Social and Agricultural Centre (SASAC) in Kurseong subdivision, as well as at a Project SERVE village in Darjeeling subdivision and by a non-organic farmer in Kalimpong subdivision. The former uses a floating gas tank (Fig. 5.6), while Project SERVE uses a rubber biogas tank and the farmer in Kalimpong has a fixed dome biogas plant. The gas serves for cooking purposes and uses cattle manure as input material. In Kanto, especially in Saitama Prefecture, organic farmers apply biogas. Through decomposition process under anaerobic conditions, i.e. without oxygen supply, bacteria, who work on animal dung, vegetable residue or any other organic material produce methane gas (SASSE, 1987; CHAWLA, 1986). This gas consists mainly of methane (60 %) and carbon dioxide (40 %). At SASAC, the input material flows from an inlet. The material flows into a pond-type concrete basin, which is filled with water. Water amount is of same quantity as the input material. Through an underground canal or channel-system, the manure and the water are funnelled into biogas tanks.

Fig. 5.6: Floating gas tank at SASAC, Darjeeling District
(Source: Author, *based on* a drawing of DORJI, supervisor 2002)



From the inlet, the chicken manure goes into chamber I. The gas builds up and it rises up into the plastic floating tank. From the gas outlet, biogas can be used for cooking and heating. From chamber II, the used or "processed" manure, which is the slurry (Photo 5.44), goes out into an outer or circular type of pond and can be mixed with the compost to be used on the Square Meter beds or on the fields. Liquid slurry is rich in nitrogen and potassium, while dry slurry is richer in phosphate (SASSE, 1987). A low C/N ratio (see chapter 5.1.3.) has a good fertilizer quality. Slurry can increase yields by 5-15 % and combinations of compost with slurry have given very good results (SASSE, 1987).

Photo 5.44: Floating biogas tank and slurry, a methane gas by-product, Darjeeling District
(Photo by SHILPI SAXENA, 2002)

A suitable biogas unit for a single family, consists of a digester tank and a gasholder of 4-5 m^3 and 2 m^3 capacity size, respectively (GOTAAS, 1956). It should be placed near a stable so that transportation to the inlet is reduced, just as one farmer from Sindebong village, Kalimpong subdivision in Darjeeling District has constructed it (**Photo 5.45**). Digestion in the tank can take a few months, depending on the input material and climate. In tropical highland regions or in temperate climates, simple biogas units are 50 % less effective in winter than in summer between 25°-30° latitude (SASSE, 1987). High and steady temperatures (e.g. 33°C), long period of decomposition (e.g. 100 days) and a proper mixing of the materials have a positive influence on gas production. The longer the digestion period, the higher the methane content. If it is below 50 %, methane does not burn (SASSE, 1987). Appropriate burners are needed to use the gas effectively for cooking. One litre of water needs 10 min. to boil and uses 40 l of gas; 500 g of rice needs 30 min. and requires 145 l of gas (SASSE, 1987).

Photo 5.45: Placement of inlet below the stable, Kalimpong subdivision
(Photo by SHILPI SAXENA, 2002)

GOEL *et al.* (2001) even suggest using spent tea leaves for biogas and manuring generation. Spent tea leaves are a waste product after extracting the liquor. As Darjeeling District is a tea producing and consuming area, this might be a potential input material. KALIA & SINGH (1998) suggest a mixture of cattle dung and *Lantana camara*, a shrub also growing in Darjeeling District, for biogas production, especially if a farmer does not have enough cattle to sustain the tank with dung alone. They achieved satisfactory results with a 1:4 mixture of 5 kg partially aerobically decomposed *Lantana camara* and 20 kg pure cattle dung, mixed with 25 kg water/day. This led to a gas increase of 4.23 % compared to pure cattle dung.

Biogas is an environment-friendly energy source, which can be applied for cooking, fuel and lighting. Financing or subsidies need to be provided by the local government. As this method aims at reducing pressure on forests, it is an idea to think about for implementation. Nevertheless, decisions of whether a community or individual biogas unit should be used and the costs for construction are important aspects to consider. As temperatures in Darjeeling District are often unsteady and the area has frequent fog, these aspects have to be considered as well, before implementing biogas. Often biogas tanks in the hills have non-functionality problems, due to poor maintenance, lack of knowledge, dung shortage and bad installation. Though around 67-90 % of functional biogas plants are installed in the north-eastern region, in effect less than 30 % are in operation (BANSAL, 1999).

5.3. The Importance of Educating the Consumer

"Integrated pest management programmes across Asia continue to develop through community empowerment and policy reform in a wide range of crops, including vegetables and cotton on which the largest amounts of pesticides are being used. Better informed Asian urban consumers now demand pesticide-clean produce, and this

has given further impetus to integrated pest management in a number of Asian countries" (UN 2000, p. 11).

As the above example shows, education and information are crucial for the understanding of organic farming, in this case for reduction of chemical input and natural insect control. It is important to educate the people, i.e. the farmer and consumer alike, for organic farming, its principles and the benefit for all parties involved. The benefits can be seen in terms of no chemical input, which reduces pollution of water and soil, produces healthier crops for consumption and reduces plastic packing material due to re-useable delivery boxes, as practiced by organic farmers in Japan. It is necessary for the consumer who lives in the town, city or in the near environment of a farmer to understand the importance of sustainable livelihood for the farmer, especially in a fragile mountain or hill ecosystem, as is the case with Darjeeling District. *"Ensure people's participation: to promote greater public awareness of the role of people's participation and people's organizations, especially women's groups, youth, indigenous people and people under occupation, local communities and small farmers, in sustainable agriculture and rural development..."* (DEPARTMENT OF AGRICULTURE, GOVERNMENT OF CANADA, 1995).

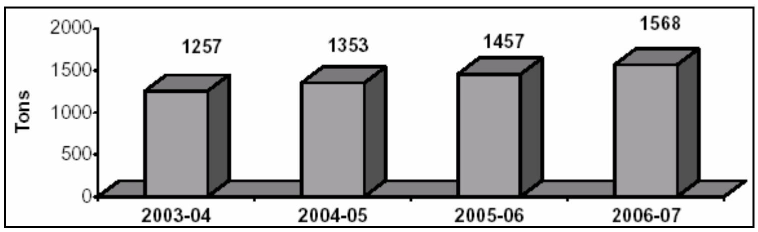
The consumer alike will only benefit from the improved situation, if he or she is actively involved in the process by also buying organic crops and understanding why a higher cost is involved for such products. In **India**, there is a lack of *"consumer awareness of the health and environmental benefits of organic products, as those services that provide marketing and information only refer to conventional products"* (UN-ESCAP 2002, p. 6). The low awareness for organic products from consumers, the higher prices and a neglect of marketing by producers, NGOs and traders are reasons why this market has not grown (GARIBAY & JYOTI, 2003). Though mainly the upper and upper-middle class are buying organic, there are also some health-conscious lower middle-class families with children going for organic in smaller towns (GARIBAY & JYOTI, 2003). As mentioned in chapter 3.2., the farmer-consumer group established in Mysore sells its crops at 20 % higher than conventional products; but there is a mutual understanding for a minimum support price and thus the prices are set in consensus (BAKSHI, 2001). Whereas a survey carried out among Mumbai consumers[32] showed that health consciousness was the primary motive to buy organic, environmental reasons and well-being of the farmer were not (GARIBAY & JYOTI, 2003). An additional way of promoting organic consumption and raising awareness would be by using government-

[32] The survey was conducted in Mumbai and had 50 respondents from various income groups concerning questions like health consciousness, readiness to pay a higher price, importance of convenience etc. (GARIBAY & JYOTI, 2003).

related entities, such as schools, government canteens, and army installations as user groups, next to local consumers, hotels and restaurants (UN-ESCAP 2002, p. 25).

In the future there might be an increase in the awareness concerning the health benefits of consuming organic products owing to the fact that *"media discussed pesticides as a likely source of various health problems, an increase of health awareness among the literate Indian population, and Indian traditions' emphasis on the importance of diet"* (GARIBAY & JYOTI 2003, p. 32). Hence, the future demand on the domestic market can be seen in fig. 5.7.

Fig. 5.7: Future demand of Indian organic products on the domestic market
(Source: ORG-MARG 2002, in: GARIBAY & JYOTI 2003, p. 19)



Since 1990, the consumer awareness for organic products in **Japan** is on the rise, mainly due to the allergies of the consumers concerning pesticides and fertilizers; this has induced a health consciousness and an interest for organic products (NEIDHARDT, 2002). As more than 25 % of the Japanese people suffer from allergies, their mistrust towards chemicals rose (NEIDHARDT, 2002). Other issues were the milk poisoning scandal, which also contributed to the organic trend, as described in chapter 3. Since 2001, the BioFach, the International Organic Trade Fair, is launched in Tokyo; therefore, every year a lot of information and advertising for the fair through newspapers and other media, additionally tries to create awareness and an interest in organic products.

Unfortunately, the local Prefectural Agriclturural Extension Centers (extension services of the Ministry of Agriculture, Forestry and Fisheries) still only promote conventional agriculture and cannot advise a farmer requesting information on organic farming. This is a big problem, because extension officers, politicians and scientists need to know the benefits and constraints of organic agriculture in order to give farmers guidance and the opportunity to decide for themselves which farming practice to pursue (SCIALABBA, 2000).

5.4. Women and their Role in Hill Farming

Though the present study does not focus on gender research in hill farming, it is necessary to briefly point out the important role of women in hill agriculture in Darjeeling District. Women in the hill society are the backbone of families and in agriculture, as they have to contribute time on the field for harvesting and weeding, taking care of the animals, needing several hours for collecting and carrying the quite heavy loads of fuel wood and fodder (Photo 5.46), and of course running the household and the families. Men use draught animals on the field for ploughing; women prefer using manual labour, like small tools on the field. These farming women of the Himalayas barely have four hours of sleep every day, due to the enormous workload (ICIMOD, 1998). Only two times did the author encounter men collecting fuel wood and fodder.

Photo 5.46: Two women carrying fodder, Darjeeling District
(Photo by SHILPI SAXENA, 2002)

The management of tea plantations have also seen the value and benefit of female labour, as they solely employ women as tea pluckers. Besides being employed in the tea garden, they too have the most work, in terms of taking care of family, cooking, livestock rearing and homestead farming. During their working hours from 7 am till 4 pm in the estate, the tea pluckers often have to carry heavy loads of their hand-plucked tea leaves from the field to the factory. The reason for employing women as tea pluckers in the tea estates in Darjeeling District is that they are much more reliable than their male counterpart is. They come punctually to work, do the work required, and take care of their wages by not spending it on anything unnecessary; men would spend money on alcohol or not come to work. Men are rather employed for putting compost on the tea fields, spraying of organic or conventional insecticide, uprooting old tea bushes and planting new ones, making trenches and operating machines in the factory. Furthermore, men are responsible as an overseer for tea sections/subdivisions. The tea management, i.e. tea manager and assistant tea managers on the estate are also predominantly male; at the time of field study, only each one female tea manager and assistant tea manager were employed in more than 80 tea estates (see chapter 5.1.1.).

The NGO RCDC has also started a women's group in the Dabaipani, Harsing and Yankhoo villages with great success. The women have even achieved to open bank accounts in Darjeeling Town and taking care of the financial aspect themselves, based on the savings credit. Furthermore, these self-help groups (SHG) have undertaken social issues (RCDC, 2004). Additionally, income diversification through NGO promoted projects tries to incorporate women and lessen their heavy work load. But according to the ICIMOD study (1998, p. 4), these *"farm and home-based activities are low-learning and slow–growing resulting in small profits for women, while men have access to capital, credit and larger markets. This enables them to run more remunerative and dynamic enterprises."*

If women are better integrated in decision-making processes, they can be of great help in achieving sustainable development economically, in family size and population growth (CARROLL-FOSTER, 1995). Women can be regarded as environmental managers and guardians of resource stocks, as educators, facilitators and negotiators; with a more systematic integration, they would be able to add enormously and more effectively to their families' and communities' improvements (CARROL-FOSTER, 1995).

In Kanagawa Prefecture, several young female farmers (between 20 and 30 years old) were encountered during the field survey, who were farming on their own. Each of them had leased land and successively bought equipment for farming. They are farming organically, selling their goods directly to the consumers and trying to maintain their livelihood sustainably.

CHAPTER 6

Mahalderam Tea Estate, Darjeeling District
Photo by SHILPI SAXENA, 2002

6. Conclusion

6.1. Sustainable Development: Ecological and Socio-Economic Aspects

Mountainous areas, such as Darjeeling District, face a number of problems: poverty, difficult landform, small and marginal landholdings, landslides and even political instability, to name just a few. From an ecological aspect, mountain farmers encounter soil degradation and soil erosion, resulting in low yields. These affect the economic aspect, namely leading to low income. The income level, though an economic indicator, also reflects the quality of life available to the farmer and his family, thus, it can equally be seen as a social indicator.

This study contributes to research done in other Indian Himalayan states on sustainable development. The previous studies on Darjeeling District, have mainly researched the tea and cinchona industry, monsoons, soils and landslides. Very few have actually looked into the aspect of rural development linked with the environmental degradation of the region, but not with an emphasis on small-scale farmers. The current research has tried to bring forward the situation of farmers and farming in a mountain environment, in context of sustainable agriculture and the necessity thereof in a fragile mountain ecosystem.

As organic farming has a holistic understanding of agriculture, this study assessed ecological and socio-economic aspects that show benefits of the strategy and achievements of organic farming in comparison to conventional farming. In order to assess the objective of this study, aspects on crop diversity, yield, income and sales prices have been empirically analysed in the two study regions of Darjeeling District in West Bengal State, India and Kanagawa Prefecture/Kanto region in Central Japan (here, the first three aspects were analysed). In both areas 50 households each, i.e. in total 100 households were interviewed. The surveyed farmers are subsistence and predominantly vegetable cultivators. Due to small sample size, this study may therefore not be representative on a broad scale.

However, in Darjeeling District the benefits were positive only for crop diversity: here, the organic crop diversity differs from conventional crop diversity, as shown in frequency tables, boxplots and the H-Test. Therefore, it can be concluded that organic farmers have a higher crop diversity than conventional farmers, which is better for their home consumption in nutritional terms, for selling purposes and furthermore, higher crop diversity can effectively fend off pests. Unfortunately, yields and output for the farmers are low compared to the surveyed conventional farmers, as no premium prices are attained through the sales channels for (certified) organic crops that are still conducted through the middle-man, which implies a direct market inaccessibility for the farmers. As no difference in yield and output were found, this could be either due to small sample size, or due to the H-Test, which in general is weaker than the T-Test or because yield and output between organic and conventional farmers are the same, as boxplots and frequency tables indicate.

The benefits of organic farming though were shown for the Kanto farmers: a difference in organic crop diversity over conventional crop diversity was proven through frequency tables, boxplots and the U-Test. Here too, it can be concluded that organic farmers have higher crop diversity than conventional farmers. Additionally, due to farming organically over a longer period than the Darjeeling District farmers, they have achieved, though not higher, but equally high yields like conventional farmers, who rely on chemical input. Small sample size can have an influence on the non-significant result of the U-Test, but in this case, yields have the same high level. Lastly, due to premium prices for organic crops and a direct marketing system, boxplots and frequency tables give an indication of a difference in income between both farming groups, i.e. organic farmers have a higher income, though the non-significant result of the U-Test concerning income could be due to small sample size. Though premium prices as such were not tested separately for Kanto farmers because they did not specify any, they nevertheless stated that their crops are sold at higher prices than conventional ones, which is indirectly supported by the boxplots and vfrequency tables on income.

Even though cultivation land in both study areas is well below 1 ha, the results above show clearly that sustainability in yields and income for organic farming have been achieved in the long-term perspective in Kanto. Although the study time in both research areas was too short to establish a temporal variability, the fact that Kanto farmers are involved in organic agriculture for a longer time than in Darjeeling District, might be a reason for the better results: at the time of survey, many of the surveyed farmers in Kanto were more than 10 years into organic agriculture, compared to about 2-4 years in Darjeeling District. Since there is no fixed period when yields start to increase, the assumption for Darjeeling District is that the yields are still in the declining stage. In the long run though, they might attain better results than the conventional farmers. For the organic Kanto farmers it was provable that, as indicated by boxplots and frequency tables, they have better results than conventional farmers do.

This implies the necessity of monitoring the development in Darjeeling District by local NGOs over the next few years, as sustainability is not a goal, which is achieved in the short-term. When starting alternative farming practices, yields decline, but improve later on; this is an important aspect to consider in short-term studies (LEE, 1992). Yet, a long-term is not a guarantee for sustainability; in 20 years this might decline even in Kanto.

For other factors and aspects that were evaluated, there was not much difference between organic and conventional farmers in Darjeeling District, such as on chemical input: there is generally no chemical input for the crops and all farmers mainly use farmyard manure, though organic farmers use more input materials to upgrade their compost. Responses on chemical input by the surveyed farmers might have been influenced by the fact that an NGO representative mostly accompanied the author during the surveys. Even though a farmer in a project village was found to be applying fungicide, most non-certified and conventional farmers declined using any. Only in Kalimpong subdivision the author had gone by herself; here, conventional farmers replied that chemical inputs for rice and vegetables are applied. Concerning livestock, chicken and cows are the most frequent animals kept by farmers, whether organic or conventional. Livestock rearing is not practiced according to the farmers' organic or conventional system, as in Europe. Crops are largely used for sale and home consumption, while crop consumption is low even though the farmers stated that the crops are sufficient for home consumption. Food is supplemented by purchasing from the market, namely crops that are grown in the Terai, like lentils and white rice. Organic farmers assessed their agricultural practice as very positive and helpful. The sales channel used is mostly through the middle-man, who then sells the crops at the market. Fuel wood use is quite high even though LPG is used as an additional energy source. Biogas has been considered by less than half of the organic farmers, even though these are mostly NGO project villages, where alternative energy sources are promoted, but more than half of conventional farmers had considered it. Farm labour consists mostly of family labour, only very few cases hire help. The surveyed farmers were predominantly male and between 40-60 years of age. The majority of surveyed organic farmers were certified and cultivate certified cash crops, such as ginger, cardamom and tea.

The non-certified farmers in Darjeeling District, using Square Meter Farming, have better marketing conditions than the certified organic farmers: the NGO SASAC offers a direct marketing without profit at SASAC outlets in Kurseong Town. Unfortunately, the m^2-farmers are dependent on this system, as they do not sell their crops themselves. They have to rely on the packing, transportation and selling through the NGO. This could pose a problem in the future, if the NGO is unable to sustain itself through its donations and thus would have to give up its operation entirely. As the sale is conducted from SASAC outlet shops in Kurseong Town, the consumers have no direct contact with the farmer, which is the opposite case e.g. in Kanagawa Prefecture, where the farmers deliver directly to the consumer. The NGO RCDC on the other hand tries to have least involvement once a system starts operating on its own, such as the small-scale organic tea processed and marketed through an organic tea estate. Like this, the NGO does not want to create a dependency of the farmers on external aid.

In Kanto, surveyed farmers were also mostly male and above 60 years old. Farm labour here too constituted from family members and only few hire labour. Organic farmers were mostly not certified. Non-certified organic farmers do not use chemical inputs, but mostly compost made by them, whereas conventional farmers prefer to buy compost and use chemicals. Organic compost uses many components from the farm. A few organic farmers own some livestock, while the surveyed conventional farmers did not own any. Biogas was considered by most organic farmers, but not considered by most conventional farmers. The purpose of crops is mainly sale and home consumption, while here too, crop consumption is rather low, even though the farmers stated it to be sufficient. The organic farmers conduct sales directly to the consumer.

The marketing (distribution) system of organic products in Darjeeling District clearly shows, that channels via the middle-man are still used, even for some organically certified crops, and that furthermore, consumer awareness needs to be increased. Therefore, suggestions have been made, based on the observations from Kanagawa Prefecture and the Kanto region, on direct producer-consumer sale, i.e. the TEIKEI system. Concerning certification, the example from Japan has shown, that for local consumption and sale, such an expensive system is not necessary. Most organic farmers in Kanto are non-certified and prefer to stay that way, as they stated. They rather like to maintain their close ties to their customers based on a trust relationship, which is part of the TEIKEI idea. If certification is nevertheless necessary for Darjeeling District, then participatory or group certification, which reduces the costs of inspection and issuance, is a more sensible alternative to individual certification. The certified organic farmers in Darjeeling District used this option.

Further supportive observations from Kanagawa Prefecture and the Kanto region, some of which can be easily applied by organic Darjeeling District farmers, include natural insect repelling methods and soil management practices: intercropping, black polyethylene film, tunnel farming, Effective Microorganisms (EM), clover, duck integrated rice farming, rice husk charcoal, wood vinegar, bamboo stems as windbreak, water and potato storage and composting. Additional observations from the organic and biodynamic tea estates in Darjeeling District include simple and low-cost soil management practices, such as citronella, neem, marigold, leguminous plants and soil binding plants. Ginger and turmeric applications have been added from literature, based on applications practiced by small farmers in developing countries. Most inputs are either available at the tea estates or in the district itself, as well as the know-how. For applications on the supportive observations from Kanagawa Prefecture and Kanto, NGOs could take over the monitoring and providing information in the district. A local NGO has already shown interest in EM for its application in Darjeeling District. The organic farmers in Darjeeling District are supposed to decide for themselves what they prefer to use and then can start by applying a few of these methods on small plots first. Like this, they can monitor the results themselves. If positive, these can be augmented on larger portions of their fields.

Farm forestry, community forests or biogas as alternative energy source are further suggestions, since illegal felling is a major problem in the region. Kanto farmers have farm forests, which is an essential part in Japanese agriculture, providing leaves for compost, medicinal plants, windbreak and watershed protection.

Attention needs to be paid to the fact, that an oversupply of organic goods, e.g. vegetables might decrease the premium prices once these are established in the future. If too many villages focus on organic vegetable cultivation, the economic benefits of organic agriculture, i.e. premium prices, might diminish. Hence, a diversification by creating different income generating means is necessary for farmers, in order not to be too dependent on one livelihood source. The NGOs have therefore introduced several small income generating means next to organic vegetable cultivation, such as floriculture, apiary, mushroom and small-scale organic tea cultivation. In some cases these projects have been successful, in other cases not. But here too, for all income-diversifying means, it is important for NGOs to diversify the tasks in the different villages, such as not to grow the same products in all project villages. This might lead to too much price competition, which eventually would result in lower prices for the commodity.

Furthermore, it is necessary to promote domestic consumption by the farmers and local consumption, i.e. not only to sell the products. Often the NGOs focus on export of cash crops. As HARKALY (1990, p. 19) put it, who favours to promote local consumption of products that are exported *"The question is: how much are these individual (NGO) projects helping to develop and stimulate local consumption of organic products and local awareness of the environmental problems?"* Of course, it is necessary to acknowledge the work of NGOs in terms of promoting small farmers' cooperatives and trying to preserve natural resources.

Critical aspects of the study are the small sample size, which in part was related to the short time of study in both regions. Sampling data could therefore have been more exhaustive, reducing the sampling error for the empirical analysis. The questionnaire developed for Darjeeling District and Kanto might have included the aspect of education level of the farmers, in order to establish whether there is a general awareness of the organic farming practice, its health and soil aspects. Latter leads to the point of soil samples taken by the author. The soil analysis should have been dealt with more intensively. As this aspect was only supposed give additional data and not the focus of the research, it was worked on very basically. Furthermore, soil samples were tested at a lab, which normally only test tea soils. Hence, included only a very standard testing.

Often state and federal policies are not applicable to the hill areas, as these are issued in the plains. Here, local NGOs and farmers' cooperatives need to play a more active role in promoting their issues to the politicians. The Darjeeling Gorkha Hill Council (DGHC) a local government established in the area since the mid-1980s and which is trying to handle issues within the hill district, might be a good basis for conveying ideas, problems and concerns, which could then be delegated further to the Government of West Bengal in Calcutta. The prefectural governments of Kanto too, need to provide more data and expertise on organic farming, as there are farmers who are pursuing and want to start this practice. Mostly they only propagate conventional farming and chemical inputs.

6.2. Future Research

This study has certain limitations and could therefore neither cover all relevant aspects of sustainable development in the Darjeeling Hills and Kanagawa Prefecture/Kanto, nor cover it exhaustively. Further research needs to be done on the following areas:

- Monitoring the progress of the organic farming sector in Darjeeling District and Kanto. The aspect of temporal variability has already been mentioned, hence, yields, income and sales prices could change over the next few years in Darjeeling District, but maybe a decline thereof might occur in Kanto, as long-term is not a definite guarantee for continuous sustainability.
- Sales channels for organic products might improve in Darjeeling District, when alternatives are found, this is correlated with the next aspect.
- Consumer awareness or lack thereof for organic goods. Without consumers being informed about health hazards of chemical residues in food from conventional agriculture, and a demand for food security, it will remain difficult for farmers to sell their products to a wider clientele. This refers to both study areas, as consumer awareness in both is still low.
- Monitoring of fuel wood use and alternative energy sources need to be enforced more strongly. Sensible alternatives need to be offered to farmers, to reduce illegal felling. If income is raised through organic and other income generating means, then the ability to buy other energy sources is raised. In addition, sustainable forest management can be pursued.

- By making rural areas more attractive for the younger generations to continue with agriculture and diversified income means, the unemployment, drug use and suicides of youths could decrease. The youth in Darjeeling District is not interested to continue agriculture like their parents. They try to seek better job opportunities in big cities, often being disappointed at the hard competition and resorting to drug use. Many villages in the district, especially in Darjeeling Town, have no jobs, regarding agriculture as not interesting or lucrative enough. If better income options are offered through income diversifying means in organic agriculture, as partly incorporated by NGOs in some of the villages, then maybe the interest in farming might be revitalized. The upland and hill areas in Kanto are suffering from depopulation and ageing, because the younger generations are not interested in farming. Organic farming though, has recently inspired a young generation to pursue this path.
- Roads and infrastructure need to be improved for better transportation and safe pathways for villagers to carry crops. Concerning infrastructure, the construction of ropeways for transportation of crops would facilitate the work of farmers, by saving time and strenuous pathways. The collection points can be established near roads, from where the material can easily be brought by car or truck to the markets. This is only possible if farmers’ cooperatives take the issue into their hands with the help of local NGOs and the local municipality. Ropeway is by no means new to Darjeeling District, as Kalej Valley Tea Estate uses it for sending supplies and the plucked tea leaves from difficult to access areas or from the main road to the factory. This ropeway had been built during the 19th century, when the British established the tea industry in Darjeeling District.

Summary

Organic farming means a holistic application of agricultural land-use, hence, this study aimed to assess ecological and socio-economic aspects that show benefits of the strategy and achievements of organic farming in comparison to conventional farming in Darjeeling District, State of West Bengal, India and Kanagawa Prefecture/Kanto in Central Japan. The objective of this study has been empirically analysed on aspects of crop diversity, yield, income and sales prices in the two study regions, where 50 households each, i.e. in total 100 households were interviewed at farm-level. Therefore, the small sample size does not necessarily reflect the broad-scale of the use and benefit of organic farming in both regions.

The problems faced in mountainous regions in terms of agriculture and livelihoods for small-scale farmers, which are most affected and dependant on their immediate environment, such as low yields, income and illegal felling leading to soil erosion and landslides, are analyzed. Furthermore, factors such as climate, soils, vegetation and relief equally play an important role for these farmers, in terms of land-use. To supplement and improve the income of farmers, local NGOs have introduced organic farming and high value organic cash crops such as ginger, tea, orange and cardamom.

For non-certified and certified organic products the volume is given for India, while for Japan only certified organic production figures are given, as there are several definitions for organic in Japan. Hence, prior to the implementation of organic laws and standards, even reduced chemical input was sold as non-certified organic. Furthermore, the distribution and certification system of both countries are explained in detail, including interviews with distribution companies and cooperatives.

The results of the empirical evaluation on the objectives and other factors of the study from the survey have been discussed. The benefits of the organic farming practice were proven for crop diversity in Darjeeling District, as the organic farmers have higher crop diversity than the conventional farmers. Whereas for yield, income and sales prices, the analysis could not prove a higher or better outcome for the organic farmers: This is in part linked to the farming on marginal landholdings of less than 0.5 ha, low input of compost materials mainly consisting of farmyard manure, and dependency of the organic farmers on the middle-men, even for certain certified organic cash crops. This cycle and system of farming, production and marketing will continue if alternatives are not provided for the farmers, as suggested by the supportive observations from Kanagawa Prefecture and Kanto.

The surveyed organic farmers of the Kanto region, proved not only to have a higher crop diversity (up to 60 crops and varieties are cultivated, with landholdings

between 0.5-1 ha), but also show equally high yields and a higher income as the conventional farmers. Even though the results of the empirical tests were not significant for the latter two, the boxplots and frequency tables support the benefits of the organic farming practice as stated above. Hence, the non-significant result might have been influenced by small sample size. Furthermore, the temporal variability is an important aspect, when interpreting these results: the organic farmers in Darjeeling District have only recently (2-4 years at time of survey) begun with this farming practice, while the majority of organic farmers from Kanto are already using organic agriculture since more than 10 years. Thus, increase in yields can be attributed to this aspect, as yields normally decline after conversion and take time till they increase to a significant level, also due to useful soil management practices to improve soil fertility and texture, and natural control of insects. As there is no fixed period when yields start to increase, the assumption is that the yields are still in the declining stage in Darjeeling District. In other organic farming systems, farm yields began to increase beyond the third or fourth year after conversion (LAMPKIN, 1990). Altogether, the factors aim at the long-term effect and benefit of organic farming. In comparison, organic agriculture for the Kanto farmers has brought benefits to the quality of life, as results have shown, whereas, it has not been shown for the organic farmers of Darjeeling District, except for crop diversity.

Supportive observations from Kanagawa Prefecture and the Kanto region are helpful and practical suggestions for organic farmers in Darjeeling District. Most of these are simple and applicable soil management measures, natural insect repelling applications and describe the direct marketing system practiced in Japan. The former two include compost, intercropping, Effective Microorganisms (EM), clover, rice husk charcoal and wood vinegar. More supportive observations have been made at organic and biodynamic tea estates in Darjeeling District, which use citronella, neem, marigold, leguminous and soil binding plants for soil management and natural insect control. Additional income generating means have been introduced by NGOs for the smallholder farmers: floriculture, apiary, mushroom cultivation and organic tea, so that farmers are not too dependent only on organic crop cultivation. The m^2 experimental plots showed that natural resources are an environmental-friendly and cheap alternative to the method practiced by the NGO SASAC, like the Tunnel Farming in Kanto.

Due to the close ties between farmers and consumers in Japan, certification is often neither necessary nor wanted by the producers. They have built a confidence relationship with their customers; thus, such measures are simply not required. Another option is group certification, instead of the expensive individual certification. The former aims at lower costs for farmers who have formed a cooperative or a farmers' group.

Consumer awareness for organic goods is another crucial aspect to help improve the situation of organic farmers. Awareness is slightly more advanced in Kanto than in Darjeeling District, as it is improved due to the close (sales) ties between farmers and consumers in Kanto. Interviews conducted with several such cooperatives and companies underline the positive system of TEIKEI.

Illegal felling is a continuous problem in Darjeeling District, because the farmers prefer to use the available fuel wood from forests, even though Liquefied Petroleum Gas has been introduced. Therefore, the system of community forests or planting of fuel and fodder trees on/near the farmers' field has been suggested. Currently, latter is only practiced at one NGO project village. Farm forests are an integral and traditional part in Japanese agriculture, from which fuel wood and compost requirements are covered, although they have also commenced using other energy sources, such as LPG and Kerosene. Furthermore, biogas is a useful energy source, with easy available inputs of animal manure producing methane gas for cooking, though farmers' showed doubts about its feasibility and use on the rugged landforms of Darjeeling District. Only very few NGO-affiliated farmers use biogas and even one conventional farmer in Darjeeling District; in Kanto, especially in Saitama Prefecture, organic farmers use biogas.

The study has its limitations, due to the short time of study; therefore, it could not deal with all factors, as described above, exhaustively. Further monitoring is necessary on the development of organic farming, consumer awareness and alternative energy sources in both regions. In Darjeeling District, alternative sales channels and infrastructure need to be implemented and monitored by NGOs, and supported by the local and state governments.

The introduction of organic farming in the study regions has shown positive effects for those involved, even though it still in its beginning stages in Darjeeling District. This study was only partly able to assess the benefits of organic agriculture at its present level for Darjeeling District, while more positively for the organic farmers of Kanto. The organic farming practice needs further improvement, encouragement and monitoring for the Darjeeling District farmers by locals, consumers, NGOs and politicians. The supportive observations from Kanagawa Prefecture and the Kanto region are a small step in this direction, showing how, simple soil improvements and thus, yield and income increases, as well as direct sales options can enhance the livelihood of organic farmers without destroying their environment and natural resources.

Bibliography

AGRAWAL, RAMESH C. (2000): Perspectives of Small Farmers in Developing Countries – Do They have a Future? In: GARDENING CONFERENCE (2000): "Perspectives of Small-Scale Farming in urban and rural areas - about the social and ecological necessity of gardens and informal agriculture" from 21. – 25. July 2000. Berlin. In: http://userpage.fu-berlin.de/~garten/Abstracts/Agrawal.htm

AHMED, SALEEM (1994): TEIKEI: A farmer/consumer alliance succeeds in Japan. In: Extracts from CERES, No. 148, July-August 1994: Working out the Kinks: Labour in Sustainable Agriculture. In: http://www.fao.org/organicag/doc/ceres148.htm

ALTIERI, MIGUEL (2002): Non-certified Organic Agriculture in Developing Countries. In: SCIALABBA EL-HAGE, NADIA & HATTAM, CAROLINE (Editors): Organic agriculture, environment and food security. Environment and Natural Resources Series No. 4. FAO, Rome; p. 107-139.

ALTIERI, MIGUEL (1983): Agroecology, the Scientific Basis of Alternative Agriculture. In: http://www.interdev-net.org/uk/theme/agroeco/pres1.htm

APEDA - AGRICULTURAL AND PROCESSED FOOD PRODUCTS EXPORT DEVELOPMENT AUTHORITY (2003): Organic Certification Mark. Section 5. National Programme for Organic Production (NPOP). In: http://www.apeda.com/organic/

ARAKAWA, TOMOKO (1995): Japanese Women and Japanese Organic Agriculture Movement. UMI. Ann Arbor, Michigan.

ARAKAWA, H. & TAGA, S. (1969): Climate of Japan. In: ARAKAWA, H. (Editor): Climates of Northern and Eastern Asia. World Survey of Climatology, Vol. 8. Elsevier Publishing Company, Amsterdam; p. 119-158.

ARUNACHALAM, A.; KHAN, M. L. & ARUNACHALAM, K. (2002): Balancing traditional jhum cultivation with modern agroforestry in eastern Himalaya – A biodiversity hot spot. Current Science, Vol. 83, No. 2, 25 July 2002; p. 117-118. In: http://www.ias.ac.in/currsci/jul252002/117.pdf

ATTRA – APPROPRIATE TECHNOLOGY TRANSFER FOR RURAL AREAS (2002): Introduction to Permaculture: Concepts and Resources. Alternative Farming Systems. In: http://attra.ncat.org/attra-pub/perma.html#intro

AUSTROPROJECT/ICIMOD BEE PROJECT (2000): From traditional fixed comb to modern frame hive beekeeping. A short guidance to a modern *Apis cerana* beekeeping. In: http://web.utanet.at/huttinge/projekte/nepal/book_off/trainbook.htm

BAKSHI, RAJNI (2001): New Possibilities. The Hindu, Online Edition of India's National Newspaper. 21. January 2001. In: http://www.hinduonnet.com/thehindu/2001/01/21/stories/1321002a.htm

BAMBERGER, KORNELIUS (2002): SPSS Grundlagen. Einführung anhand der Version 11. 7. Auflage. April 2002. Rechenzentrum der Universität des Saarlandes, Saarbrücken.

BANERJI, AMIYA KUMAR; DE, BARUN; MAJUMDAR, DURGADAS; MUKHERJEE, SAUGATA PRASAD; RAY, PRANABRANJAN; SENGUPTA, KIRAN SANKER; BHATTACHARYA, BIRENDRA KUMAR; KUSARI, ABANI MOHAN; MUKERJI, SANKARANANDA; NAG, RAMENDRA NARAYAN; SEN, NIRENDRA NATH & SENGUPTA, SATYARANJAN (1980): West Bengal District Gazetteers Darjiling. Government of West Bengal, Calcutta.

BANSAL, N. K. (1999): The Pattern of Energy Use in the HKH Region of India. In: RIJAL, KAMAL (Editor): Energy Use in Mountain Areas. Trends and Patterns in China, India, Nepal and Pakistan. International Centre for Integrated Mountain Development (ICIMOD), Kathmandu; p. 71-105.

BARTHOLOMEW, MEL (1981): Square Foot Gardening. Rodale Press, Emmaus (Pennsylvania).

BARUA, D. N. (1989): Science and Practice in Tea Culture. Tea Research Association. Calcutta.

BASU, SUBHASHRANJAN (2000a): Environment: Geology. In: STARKEL, LESZEK & BASU, SUBHASHRANJAN (Editors): Rains, Landslides and Floods in the Darjeeling Himalaya. Indian National Science Academy, New Delhi; p. 12-16.

BASU, SUBHASHRANJAN (2000b): Natural Vegetation. In: STARKEL, LESZEK & BASU, SUBHASHRANJAN (Editors): Rains, Landslides and Floods in the Darjeeling Himalaya. Indian National Science Academy, New Delhi; p. 30-33.

BASU, SUBHASHRANJAN; LAMA, SANGITA & SARKAR, SUBIR (2000): Landslides and Water Management in Darjeeling Town. In: STARKEL, LESZEK & BASU, SUBHASHRANJAN (Editors): Rains, Landslides and Floods in the Darjeeling Himalaya. Indian National Science Academy, New Delhi, p. 67-76.

BASU, SUBHASHRANJAN & SARKAR, SUBIR (2000): Landslides along Roads. In: STARKEL, LESZEK & BASU, SUBHASHRANJAN (Editors): Rains, Landslides and Floods in the Darjeeling Himalaya. Indian National Science Academy, New Delhi; p. 76-83.

BASU, SUBHASHRANJAN & GHATOWAR, LIKANESHWAR (2000): Landslides in the Lish Basin. In: STARKEL, LESZEK & BASU, SUBHASHRANJAN (Editors): Rains, Landslides and Floods in the Darjeeling Himalaya. Indian National Science Academy, New Delhi; p. 83-87.

BEETZ, ALICE & KUSTUDIA, MICHAEL (2004): Mushroom Cultivation and Marketing. Horticulture Production Guide. July 2004. National Centre for Appropriate Technology. In: http://attra.ncat.org/attra-pub/PDF/mushroom.pdf

BGRGL - BUNDESANSTALT FÜR GEOWISSENSCHAFTEN UND ROHSTOFFE UND GEOLOGISCHE LANDESÄMTER (1996): Bodenkundliche Kartieranleitung. 4th Edition. Finnern, Hannover.

BHUJEL, R. B. (1993): Darjeeling Hills: Its Environmental Status. *Unpublished*.

BISHOP, MIRIAM (1989): Strategies for Apicultural Development in Nepal. In: VERMA, L.R. (Editor): Honeybees in Mountain Agriculture. Proceedings of International Expert Meeting on Beekeeping Development in the Hindu Kush-Himalayan Region, Kathmandu, 21.-23. June, 1989. ICIMOD, Kathmandu; p. 149-155.

BOHLE, HANS-GEORG (1999): Coping with Vulnerability and Unsustainability. The case of Nepalese upland farmers. In: LOHNERT, BEATE & GEIST, HELMUT (Editors): Coping with Changing Environments. Social dimensions of endangered ecosystems in the developing world; p. 55-74. Ashgate Publishing Ltd., Hants.

BRUCKLACHER, ANN D. (2000): Facing Globalization: Japanese Farmers' Responses to Changing Markets. In: Deutsches Institut für Japanstudien der Philipp Franz von Siebold Stiftung (Editor): Japanstudien. Volume 12, pp. 229-247.

BRUIJNZEEL, L. A. & BREMMER, C. N. (1989): Highland-Lowland Interactions in the Ganges Brahmaputra River Basin: A Review of Published Literature. In: INTERNATIONAL CENTRE FOR INTEGRATED MOUNTAIN DEVELOPMENT (Editors): ICIMOD Occasional Paper No. 11. Kathmandu, Nepal, July 1989.

BURNS, W. (1918): Firminger's Manual of Gardening for India. 6th Edition. Thacker, Spink & Co., Calcutta.

BUSCH, PAUL & KUTTLER, WILHELM (1990): Klimatologie. Grundriss Allgemeine Geographie. Ferdinand Schöningh Verlag, Paderborn.

CANTÚ SILVA, ISRAEL & OKUMURA, TAKENOBU (1996): Rainfall Partitioning in a mixed white oak forest with dwarf bamboo undergrowth. Journal of Environmental Hydrology. The Electronic Journal of the International Association for Environmental Hydrology. Volume 4, 1996. In: http://www.hydroweb.com/jeh/jeh1996/cantu.pdf

CARROLL-FOSTER, THEODORA (1995): Global Action for Women Towards Sustainable and Equitable Development. In: PROJET DE SOCIÉTÉ (Editor): Canada and Agenda 21. International Institute for Sustainable Development (IISD), Winnipeg. In: http://iisd.ca/worldsd/canada/projet/c24.htm

CARROLL-FOSTER, THEODORA & LI-PUN, HUGO (1995): Managing Fragile Ecosystems: Sustainable Mountain Development. In: PROJET DE SOCIÉTÉ (Editor): Canada and Agenda 21. International Institute for Sustainable Development (IISD), Winnipeg. In: http://iisd.ca/worldsd/canada/projet/c13.htm

CENSUS OF INDIA MAPS (2001): Population Density Darjeeling, Population Darjeeling and West Bengal, Labourers in Agriculture Darjeeling, Workers in Agricultural Sector Darjeeling; *Provisional Data*. In: http://www.censusindiamaps.net/states/wbengal.htm

CHAKRABORTY, P. K. (1989): Darjeeling Himalaya: A Study in Environmental Degradation. In: CHADHA, S. K. (Editor): Ecological Hazards in the Himalayas. Pointer Publishers, Jaipur; p. 132-143.

CHATTOPADHYAY, GURU PRASAD (1987): Landslide Phenomena in the Darjeeling Himalaya: Some Observations and Analysis. In: DATYE, V. S.; DIDDEE, JAYMALA; JOG, S. R. & PATIL, CHARULATA (Editors): Explorations in the Tropics. Published by Prof. Dr. K. R. DIKSHIT Felicitation Volume Committee, Pune; p. 198-205.

CHAUDHURI, A. B. (1992): Himalayan Ecology and Environment. Ashish Publishing House, New Delhi.

CHAWLA, O.P. (1986): Advances in Biogas Technology. Indian Council of Agricultural Research (ICAR), New Delhi.sn.com

CHHETRI, VIVEK (2003): McKinsey plan for plantation. The Telegraph, January 20, 2003. Calcutta. In: http://www.telegraphindia.com/1030120/asp/bengal/story_1590410.asp

CHIAVACCI, DAVID (2002): Qualitative Leitfadeninterviews in der Japanforschung: Chancen und Problemfelder. In: ZEITSCHRIFT DER SCHWEIZERISCHEN ASIENGESELLSCHAFT (Editor): Asiatische Studien, LV 4, 2001, p. 953-960.

CLARK, SEAN; KLONSKY, KAREN; LIVINGSTON, PETER & TEMPLE, STEVE (1999): Crop-yield and economic comparisons of organic, low-input, and conventional farming systems in California's Sacramento Valley. American Journal of Alternative Agriculture, Vol. 14, No. 3, p.109-121.

CORREA, MARGARITA (2001): The impact of Effective Microorganisms (EM) in various farming systems. In: http://www.auroville.org/environment/EM_impact.pdf

CORSELIUS, KRISTEN; WISNIEWSKI, SUZANNE & RITCHIE, MARK (2001): Sustainable Agriculture: Making Money, Making Sense. Twenty Years of Research and Results: Literature Review. The Institute for Agriculture and Trade Policy (IATP). March 2001. Fires of Hope, Washington D.C.

COTTON, DON & COTTON, LEAH (2004): Pest Control Catalogue Index. Buglogical Control Systems, Low Cost Source for Natural Insect Predators. In: http://www.buglogical.com/

DAHAMA, A. K. (1997): Organic Farming for Sustainable Agriculture. 2nd Edition. Agro Botanica, Bikaner.

DAICHI CO. LTD. (2002a): Daichi-wo-Mamoru-Kai – The Association to Preserve the Earth. Information Paper, revised on 21. November 2002. Tokyo.

DAICHI CO. LTD. (2002b): Daichi-wo-Mamoru-Kai – The Association to Preserve the Earth. Company brochure, October 2002. Tokyo.

DALZELL, H. W.; GRAY, K. R. & BIDDLESTONE, A. J. (1981): Composting in Tropical Agriculture. Review Paper Series No. 2. 2nd Edition. Organic Farmers & Growers Ltd., Ipswich.

DANIEL, J. N. (2004): EM-Based Farming Practices for Small Farmers in India. EM Research Organization. In: http://www.emro.co.jp/english/library/abstracts/0012india.html

DAS, KASTURI (2004): Organic: to combat pesticide residues. India Together, March 2004. In: http://www.indiatogether.org/2004/mar/agr-organic.htm

DASH, ARTHUR JULES (1947): Bengal District Gazetteers Darjeeling. Bengal Government Press, Alipore.

DE, N. K. & BERA, A. K. (1990): Soils of the Darjeeling Himalayas. In: SAH, NIRMAL K.; BHATT, SHANKER D. & PANDE, RAVINDRA K. (Editors): Himalaya: Environment, Resources & Development. Shree Almora Book Depot, Almora; p. 151-163.

DEPARTMENT OF AGRICULTURE, GOVERNMENT OF CANADA (1995): Promoting Sustainable Agriculture and Rural Development. PROJET DE SOCIÉTÉ (Editor): Canada and Agenda 21. International Institute for Sustainable Development (IISD), Winnipeg. In: http://iisd.ca/worldsd/canada/projet/c14.htm

DFO – DIVISIONAL FOREST OFFICE (2002): Afforestation of Darjeeling District. *Unpublished*.

DGHC – DARJEELING GORKHA HILL COUNCIL (2002a): Marketing Channel for Ginger, Darjeeling District. Agricultural Marketing Office, Darjeeling. *Unpublished*.

DGHC – DARJEELING GORKHA HILL COUNCIL (2002b): Wholesale and Retail Market Prices for the Kurseong, Sonada and Kalimpong Markets. Agricultural Marketing Offices, July-August 2002. *Unpublished*.

DGHC – DARJEELING GORKHA HILL COUNCIL (2002c): Afforestation of Darjeeling District. *Unpublished*.

DGHC – DARJEELING GORKHA HILL COUNCIL (1999): Map of Darjeeling District. *Unpublished.*

DHANKAR, G. H. (2002): An Overview of Operation of agricultural Wholesale Markets in South Asian Countries. In: ASIAN PRODUCTIVITY ORGANIZATION (Editor): Operation of Agricultural Wholesale Markets. Report of the Multi-Country Study Mission on Operation of Agricultural Wholesale Markets held in Japan from 4 to 11 July 2000; p. 19-39 (OSM-04-00). APO, Tokyo.

DIERCKE (1996): Weltatlas. DORNBUSCH, JOACHIM & KÄMMER, HANS-JOACHIM (Chief editors), 4th Edition. Westermann Druck, Braunschweig.

DIERCKS, ROLF (1983): Alternativen im Landbau. Eine kritische Gesamtbilanz. Ulmer Verlag, Stuttgart.

DOMRÖS, MANFRED (2003a): Towards a Secure Development: An Introduction. In: DOMRÖS, MANFRED (Editor): Translating Development. Social Science Press, New Delhi; p. 1-19.

DOMRÖS, MANFRED (2003b): Cameron Highlands, Malaysia. In: GEOGRAPHISCHE RUNDSCHAU 55, Januar 2003, Heft 1, p. 51-55.

DOMRÖS, MANFRED (1993): Tee in Indien: Nationale und internationale Bedeutung eines Plantagen-Cash Crop. In: GEOGRAPHISCHE RUNDSCHAU 45 (1993), Heft 11, p. 644-649.

DOMRÖS, MANFRED (1989): Der Monsun als Regenbringer? Das Beispiel Sri Lanka. In: GEOGRAPHISCHE RUNDSCHAU 41 (1989), Heft 2, p. 84-90.

DOMRÖS, MANFRED & PENG, GONGBING (1988): The Climate of China. Springer-Verlag, Berlin/Heidelberg.

DOMRÖS, MANFRED (1981): Südasien. In: GRÖTZBACH, ERWIN & RÖLL, WERNER (Editors): Asien 1. 12th Edition. HARMS Handbuch der Geographie. Paul List Verlag, München; p. 119-190.

DOMRÖS, MANFRED (1977): Temporal and Spatial Variations of Rainfall in the Himalaya with Particular Reference to Mountain Ecosystems. Papers presented at the seminar held at Max Mueller Bhavan, New Delhi, 14.-17. November 1977. Max Mueller-Bhavan Publication, Bangalore; p. 63-75.

DOMRÖS, MANFRED (1974): The Agroclimate of Ceylon. A Contribution towards the Ecology of Tropical Crops. In: SCHWEINFURTH, ULRICH & DOMRÖS, MANFRED (Editors): Geological Research, Vol. 2. Franz Steiner Verlag, Wiesbaden.

DOWN TO EARTH (2004): Three Darjeeling villages help themselves to water and organic tea. 31. August 2004. In:
http://www.infochangeindia.org/LivelihoodsItop.jsp?section_idv=8#3378

DPA – DARJEELING PLANTERS ASSOCIATION (1999): Darjeeling Tea. 2nd Edition. Thomson Press, Calcutta.

DTRDC – DARJEELING TEA RESEARCH & DEVELOPMENT CENTRE (2003a): Cultivation of Darjeeling Tea. In: http://www.dtrdc.org/cultivation.htm

DTRDC – DARJEELING TEA RESEARCH & DEVELOPMENT CENTRE (2003b): History of Darjeeling Tea Estates. In: http://www.dtrdc.org/history.htm

DTRDC – DARJEELING TEA RESEARCH & DEVELOPMENT CENTRE (2003c): Chemistry of Darjeeling Tea. In: http://www.dtrdc.org/chemistry.htm

DTRDC – DARJEELING TEA RESEARCH & DEVELOPMENT CENTRE (2003d): Organic Tea. In: http://www.dtrdc.org/organic.htm

EAP - ECOLOGICAL AGRICULTURE PROJECTS (2003): Organic Farming Definition. Based on: Food and Agriculture Organization (1998): Draft Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods. Codex Alimentarius Commission, May 27, 1998. In: http://www.agrenv.mcgill.ca/agrecon/ecoagr/doc/org-def.htm

EAP - ECOLOGICAL AGRICULTURE PROJECTS (1989): An Introduction to Sustainable Agriculture. EAP Publication 16, Macdonald College of McGill University June, 1989. In: http://www.eap.mcgill.ca/Publications/EAP16.htm

EARLES, RICHARD (2002): Sustainable Agriculture: An Introduction. Appropriate Technology Transfer for Rural Areas (ATTRA) Summary. In: http://attra.ncat.org/attra-pub/PDF/sustagintro.pdf

EBODAGHE, DENIS (1996): Overview of Small Farm Programs at the Land Grant Colleges and Universities. Proceedings of the National Small Farms Conference, 10.-13. September 1996 in Nashville, Tennessee. The Plant and Animal Production, Protection and Processing Division of USDA-Cooperative State Research, Education and Extension Service, Washington, DC. In: http://www.nal.usda.gov/afsic/nsfc/38.htm

EDOLS, LIZ (2002): Masanobu Fukuoka – The Natural Farmer. Ecoliving Magazine, Issue 11, January 2002. New Zealand. In: http://www.ecoliving.co.nz/Ecoliving/mag/issue11/Masanobu%20Fukuoka%20%E2%80%93%20The%20Natural%20Farmer.htm

ELZAKKER, BO VAN & SCHOENMAKERS, MICHIEL (2001): Smallholder Group Certification. In: THE ORGANIC STANDARD: Certification & Accreditation. No. 1, May 2001, p. 6-10. Grolink AB, Torfolk. In: http://www.organicstandard.com/TOS%20May%202001.pdf

EPP, RAY (2002): Building a farm with a future in Japan. The New Farm, Rodale Institute. In: http://www.newfarm.org/features/0802/japan1/japan1.shtml

EYHORN, FRANK (2004): Organic Agriculture in India. Research Institute of Organic Agriculture (FiBL), Frick, Switzerland. In: http://orgprints.org/2768/01/eyhorn-2004-Organic_Agriculture_in_India.pdf

FANTON, MICHEL & FANTON, JUDE (2002): Making Seeds at Home Handbook. Practical Handbook about vegetables and herbs in Japan. Gendai-Shokan, Tokyo.

FAO - FOOD AND AGRICULTURAL ORGANIZATION (2004a): *Tripsacum laxum* Scrib and Merr. Grassland and Pasture Crops: Fodder Crops. The FAO Crop and Grassland Service (AGPC). In: http://www.fao.org/ag/AGP/AGPC/doc/GBASE/Data/pf000336.HTM

FAO - FOOD AND AGRICULTURAL ORGANIZATION (2004b): *Crotalaria juncea* L. The FAO Crop and Grassland Service (AGPC). In: http://www.fao.org/ag/AGP/AGPC/doc/GBASE/DATA/PF000475.HTM

FAO - FOOD AND AGRICULTURAL ORGANIZATION (2003): Organic Agriculture. Factsheet: Organic Pest Management. March 2002. In: ftp://ftp.fao.org/paia/organicag/OA_13_y4587e.pdf

FAO - FOOD AND AGRICULTURAL ORGANIZATION (2001): FAO Statistical Database (FAOSTAT): Agriculture, Fisheries, Forestry, Nutrition. CD-Rom.

FAO - FOOD AND AGRICULTURAL ORGANIZATION (2000): Japan - Agricultural Census 2000 – Main Results. In: http://www.fao.org/es/ess/census/wcares/Japan_2000.pdf

FAO - FOOD AND AGRICULTURAL ORGANIZATION (1999): Committee on Agriculture Fifteenth Session Rome, 25-29 January 1999. Organic Agriculture Item 8 of the Provisional Agenda. In: http://www.fao.org/unfao/bodies/COag/cOAG15/X0075E.htm#P86_4004

FAO - FOOD AND AGRICULTURAL ORGANIZATION (1998): Agricultural Land, India. In: http://www.fao.org/DOCREP/004/AB988E/ab988e03.htm#bm03.2

FFTC - FOOD & FERTILIZER TECHNOLOGY CENTER (2001a): Application of Rice Husk Charcoal. FFTC, Leaflet for Agriculture. Practical Technologies, No. 2001-4. In: http://www.agnet.org/library/data/pt/pt2001004/pt2001004.pdf

FFTC - FOOD & FERTILIZER TECHNOLOGY CENTER (2001b): Composting of Organic Wastes. FFTC, Leaflet for Agriculture. Practical Technologies, No. 2001-16. In: http://www.agnet.org/library/data/pt/pt2001016/pt2001016.pdf

FFTC - FOOD & FERTILIZER TECHNOLOGY CENTER (2001c): Composting Wood Chips. FFTC, Leaflet for Agriculture. Practical Technologies, No. 2001-22. In: http://www.agnet.org/library/data/pt/pt2001022/pt2001022.pdf

FLETCHER, ROB (2001): *Juncus effusus* var. *decipiens*. Australian New Crops. Listing of Useful Plants of the World. In: http://www.newcrops.uq.edu.au/listing/juncuseffususvardecipiens.htm

FLÜCHTER, WINFRIED (1994): Japan. Klett Verlag, Stuttgart.

FLÜCHTER, WINFRIED (1982): Japan. In: GRÖTZBACH, ERWIN & RÖLL, WERNER (Editors): Asien 2. 12th Edition. HARMS Handbuch der Geographie. Paul List Verlag, München.

FONSECA, MARIA FERNANDA (2003): Tensions continue over direction of Brazilian certification. In: THE ORGANIC STANDARD (Editor): Certification and Accreditation. Issue 24, April 2003, p. 3-6. Grolink AB, Torfolk. In: http://www.organicstandard.com/TOS%2024%20April%202003.pdf

FROEHLICH, WOJCIECH & SARKAR, SUBIR (2000): Environment: Soils. In: STARKEL, LESZEK & BASU, SUBHASHRANJAN (Editors): Rains, Landslides and Floods in the Darjeeling Himalaya. Indian National Science Academy, New Delhi; p. 16-19.

FUCHS, HANS-JOACHIM (2000): Typisierung der Annuellen Niederschlagsvariationen in Nordostindien in Abhängigkeit vom Indischen Monsunklima. In: DOMRÖS, MANFRED (Editor): Mainzer Geographische Studien, Heft 46. Geographisches Institut, Universität Mainz.

FUJITA, YOSHIHISA (1989): Land-Use Change in the Mountains of Japan since the Period of Higher Economic Growth. In: HILL, R. D. (Editor): Land-Use Change. Proceedings of the Asahikawa-Sapporo International Symposium, August 1987. Published for the International Geographical Union Study Group on the Dynamics of Land Use Systems. Hong Kong University Press; p. 85-100.

FUKUI, EIICHIRO (1977): The Seasons in Japan. In: FUKUI, EIICHIRO (Editor): The Climate of Japan. In: Developments in Atmospheric Science, 8. Kodansha Ltd., Tokyo; p. 11-27.

FUKUOKA, MASANOBU (1985): Restoring Paradise on Earth. The Natural Way of Farming. In: http://home.iae.nl/users/lightnet/creator/paradiseonearth.htm

FUKUOKA, MASANOBU (1978): The One-Straw Revolution. An Introduction to Natural Farming. Rodale Press, Emmaus.

GARIBAY, SALVADOR V. & JYOTI, KATKE (2003): Market Opportunities and Challenges for Indian Organic Products. February 2003. In: http://www.indocert.org/marketstudy.pdf

GHOSH, DEEPAK K. (1996): 6th Working Plan for the Forest of Kurseong Sub-Division. Vol. II; Hill Circle 1997-98 to 2017-18. Part II and Annexure I to IV. Prepared under Supervision of Conservator of Forest (Working Plan and Geographical Information System). Government of West Bengal, Directorate of Forest.

GOEL, B.; PANT, D. C. & KISHORE, V. V. N. (2001): Two-phase anaerobic digestion of spent tea leaves for biogas and manure generation. Bioresource Technology 80, p. 153-156.

GOLD, MARY V. (1999): Sustainable Agriculture: Definitions and Terms. Special Reference Briefs Series no. SRB 99-02. Alternative Farming Systems Information Center. In: http://www.nal.usda.gov/afsic/AFSIC_pubs/srb9902.htm#term5

GOSWAMI, S. N.; SARMA, B. K. & CHOUDHURY, A. N. (1993): Agriculture in North-Eastern Region – Potentialities, Problems and Strategies for Development. In: ALAM, K. (Editor): Agricultural Development in North-Eastern India: Constraints and Prospects; p. 29-39. Deep & Deep Publications, New Delhi.

GOTAAS, HAROLD B. (1956): Composting. Sanitary Disposal and Reclamation of Organic Waste. World Health Organization (WHO), Geneva.

GoWB – GOVERNMENT OF WEST BENGAL (1998): Status of Environment in West Bengal, September 1998. Part I, Environmental Resources. Executive Summary of the Report on the State of the Environment. In:
http://kolkata.wb.nic.in/environment/html/state_o_env/exec_summary_p1.htm

GoWB – GOVERNMENT OF WEST BENGAL (1993): Key Statistics of the District of Darjeeling for the year 1993. District Statistical Office, Bureau of Applied Economics and Statistics, Darjeeling.

GoWB – GOVERNMENT OF WEST BENGAL (1985): A Brief Review on Agricultural Marketing in the District of Darjeeling for 1985. District Agricultural Marketing Office, Darjeeling. Directorate of Agricultural Marketing, Department of Agriculture. *Unpublished Paper*.

GOVINDACHARI, T. R.; SURESH, G. & GOPALAKRISHNAN, GEETHA (1997): Neem Kernel Triterpenoids for Insect Control. In: IFOAM (Editor): Organic Tea – A Successful Approach in Low Energy Input Agriculture. Proceedings of 2nd International IFOAM Conference April 28 & 29, 1997 in Calcutta, India. Tea Research Association, Calcutta; p. 78-83.

GREGORY, PAMELA (1986): Organic farming in Israel. The Anglo-Israel Association, London.

GREIN, MARION (1997): Japan gestern und heute. In: http://www.liber.de/Japan/Kapitel01.htm

GRÖTZBACH, ERWIN (1981): Asien im Überblick: Physisch-geographische Grundzüge. In: GRÖTZBACH, ERWIN & RÖLL, WERNER (Editors): Asien 1. 12th Edition. HARMS Handbuch der Geographie. Paul List Verlag, München.

HAJRA, N. GHOSH (2001): Tea Cultivation: Comprehensive Treatise. International Book Distributing Company, Lucknow.

HANADA, TOSHIO (1991): The Effect of Mulching and Row Covers on Vegetable Production. Food and Fertilizer Technology Center (FFTC), an International Information Center for Farmers in the Asia Pacific Region. In: http://www.agnet.org/library/data/eb/eb332/eb332.pdf

HARKALY, ALEXANDRE (1990): The Chance to Regenerate Agriculture and Human Values in Developing Countries. In: Ecology and Farming 1, p. 18-20.

HARPER, DAMIAN & STOREY, ROBERT (1999): Hong Kong, Macao & Guangzhou. Lonely Planet, 9th Edition. Lonely Planet Publications, Australia.

HATTAM, CAROLINE (2002): Organic Agriculture and Sustainable Agriculture and Rural Development. FAO Organic Agriculture Documents, May 2002. In: http://www.fao.org/organicag/doc/oa_sard.htm

HAU, PATRICK & JOARIS, ALAIN (1999): Organic Farming. In: THE EUROPEAN COMMISSION – EUROSTAT (Editor): Agriculture, Environment and Development: Facts and Figures – A Challenge for Agriculture, July 1999. In: http://europa.eu.int/comm/agriculture/report/en/organ_en/report_en.htm

HERRMANN, GERALD A. (2003): Certification. In: YUSSEFI, MINOU & WILLER, HELGA (Editors): The World of Organic Agriculture – Statistics and Future Prospects 2003. 5th revised edition. International Federation Organic Agriculture Movements. Tholey-Tholey; p. 27-40. In: http://www.soel.de/inhalte/publikationen/s/s_74.pdf

HIGA, TERUO & PARR, JAMES F. (1994): Beneficial and effective microorganisms. For a Sustainable Agriculture and Environment. International Nature Farming Research Center. In: http://www.agriton.nl/higa.html#5

HOLM, KURT (1975): Die Befragung. Band 1. Francke Verlag, München.

HUNTER, W. W. (1984): A Statistical Account of Bengal. Vol. X. Districts of Darjiling and Jalpaiguri, and State of Kuch Bihar. First Published in 1877. Reprint. Concept Publishing Company, New Delhi.

HUSSAIN, PERVEEZ (2002): Insect Repelling Methods, Vermicompost and Leguminous Plants used at Organic & Biodynamic Tea Estates, Darjeeling. Manager. *Personal Communication*.

ICAR – INDIAN COUNCIL OF AGRICULTURAL RESEARCH (1980): Handbook of Agriculture. Facts and Figures for Farmers, Students and all interested in Farming. ICAR, New Delhi.

ICIMOD – INTERNATIONAL CENTRE FOR INTEGRATED MOUNTAIN DEVELOPMENT (2004): Principal Farming Systems of the Hindu Kush-Himalayan Region. http://www.icimod.org/focus/agriculture/agri_types.htm

ICIMOD – INTERNATIONAL CENTRE FOR INTEGRATED MOUNTAIN DEVELOPMENT (1998): Mountain Women of the Hindu Kush-Himalayas: The Hidden Perspective. Issues in Mountain Development (1998/6). In: http://www.icimod.org/publications/imd/imd-98-6.htm

ICIMOD - INTERNATIONAL CENTRE FOR INTEGRATED MOUNTAIN DEVELOPMENT (1997): Ensuring Local Food Security: An Example from the Mountains of Nepal. Issues in Mountain Development (1997/1). In: http://www.icimod.org/publications/imd/issue4.htm

ICIMOD – INTERNATIONAL CENTRE FOR INTEGRATED MOUNTAIN DEVELOPMENT (1994): Beekeeping. Sustainable Options for the Mountains, Best Practices and Appropriate Technologies. In: http://www.icimod.org/sus_options/bestprac.htm#bee

IIRR – INTERNATIONAL INSTITUTE OF RURAL RECONSTRUCTION (1998): Composting. Sustainable Agriculture Extension Manual for Eastern and Southern Africa. In: http://www.iirr.org/saem/page142-146.htm#page-143a

ILEIA - CENTRE FOR INFORMATION ON LOW EXTERNAL INPUT AND SUSTAINABLE AGRICULTURE (2002): What is LEISA? In: http://www.ileia.org/3/leisa.html

IMAI, TOSHIKI (2003): Market Trends of Organic Farming and Organic Products 2002 through 2003: Organic Market Trends from the Viewpoint of Certified Products, Volume and News. Presentation at the Organic Forum 2003, November 14. IFOAM. Tokyo.

INDIAAGRONET (2003): Organic Farming. Agronet Software, Nagpur.

INDIAAGRONET (2000): Plantation Crops: Cinchona. Agricultural Technologies (Horticulture). Agriculture Resource Center. In: http://www.indiaagronet.com/indiaagronet/horticulture/CONTENTS/Cinchona.htm

INUI, TADASHI (1996): Traditional Uses of Woodlands in the Kanto Plain and Their Environmental Implications. In: SASAKI, HIROSHI; SAITO, ISAO; TABAYASHI, AKIRA & MORIMOTO, TAKEHIRO (Editors): Geographical Perspectives on Sustainable Rural Systems. Proceedings of the Tsukuba International Conference on the Sustainability of Rural Systems; p. 122-130. Keisei Publications, Tokyo.

ITO, MICHIO; KAZUSHI, MATSUMOTO & LUCERO, FAINA V. (1997): Case Study: The Tashita Farm and organic farming in Ogawamachi. In: THE ASIAN NGO COALITION (ANGOC): Sustainable Agriculture in Asia. Assessment of Community Initiatives on Alternative Agriculture Systems 1, p. 73-80.

IWABUCHI, YUKO & HOSHINO, YOSHINOBU (2003): Geographical Variations in the acorn morphology of *Quercus serrata* Thunb. for two years in the Kanto region, Japan. In: VASILIVA, LARISSA N. (Editor): Phytogeography of Northeast Asia: task for the 21 century. Abstract paper of the symposium held in Vladivostok, Russia, 21-25 July 2003; p. 36. In: http://www.geopacifica.org/symposium/ABSTRACT_BOOK.pdf

IWAMA, NAOKO (2001): Development and application of useful koji-molds (Part IV). Fermented Food Products Division. Hirosaki Technical Laboratory. In: http://www.aomori-tech.go.jp/hiro/en/k_hakko.html

JACKSON, MICHAEL L. (1958): Soil Chemical Analysis. Constable & Co. Ltd., London.

JANSSEN, JÜRGEN & LAATZ, WILFRIED (2003): Statistische Datenanalyse mit SPSS für Windows. 4. Auflage. Springer Verlag, Berlin.

JETRO – JAPAN EXTERNAL TRADE ORGANIZATION (2004): Scale of the Organic Market in Japan. In: NÜRNBERG GLOBAL FAIRS (Editor): The Asian Organic Food Industry. BioFach Japan 2004 Exhibition Guide, September 2004, p. 76-91.

JIN – JAPAN INFORMATION NETWORK (2000): Food Self-Sufficiency: Government Targets Rate of 45% by Fiscal 2015. Trends in Japan. June 05, 2000. In: http://www.jinjapan.org/trends00/honbun/tj000604.html

JOAA – JAPANESE ORGANIC AGRICULTURE ASSOCIATION (1993): "TEIKEI" system, the producer-consumer co-partnership and the Movement of the Japan Organic Agriculture Association. Country Report for the First IFOAM Asian Conference. 19.-22. Aug. 1993 in Hanno, Saitama, Japan. In: http://www.jca.ax.apc.org/joaa/right.files/enteikei.htm

JODHA, NARPAT SINGH (1993): Socio-Economic Constraints to Development of SAT and Highland Agriculture. In: ASIAN PRODUCTIVITY ORGANIZATION (Editor): Improvement of Semi-Arid and Highland Agriculture in Asia. Report of APO Study Meeting, 7-12 December 1992, Japan (STM-07-92). APO, Tokyo; p. 7-35.

KÄHLER, WOLF-MICHAEL (1998): SPSS für Windows: Eine Einführung in die Datenanalyse für die aktuelle Version. Vieweg, Wiesbaden.

KALIA, ANJAN K. & SINGH, SHIV P. (1998): Operation of 1 m^3 Plug Flow Plant on Mixture of *Lantana camara* and Cattle Dung for Biogas Production. Biogas Forum III (74), p. 13-16.

KANAGAWA ENVIRONMENTAL RESEARCH CENTER (1996): Map of Kanagawa Prefecture. In: http://www.k-erc.pref.kanagawa.jp/en_hp/geography/location.htm

KANAGAWA ENVIRONMENTAL RESEARCH CENTER (1994): Land Use Map of Kanagawa Prefecture. In: http://www.k-erc.pref.kanagawa.jp/en_hp/pollution/natural.htm

KANAGAWA-KEN NOKYO DOJO SHINDAN CENTER (2003): Soil Analysis Data. Odawara. *Unpublished.*

KANAGAWA PREFECTURAL GOVERNMENT (2004): Population of Kanagawa Prefecture. In: http://www.pref.kanagawa.jp/syoukai/e03-profile.htm#Population

KAPLITZA, GABRIELE (1975): Die Stichprobe. In: HOLM, KURT (Editor): Die Befragung. Band 1, p.136- 187.

KATIYAR, VIDYA S. (1990): The Indian Monsoon and Its Frontiers. Inter-India Publications, New Delhi.

KATSAROS, DIMITRIS (2002): Policies for the Development of the Greek Mountains. Innovative Structures for the Sustainable Development of Mountainous Areas (ISDEMA Project). Paper to the Thessaloniki seminar, 17-18 March 2002. In: http://www.mtnforum.org/resources/library/katsd02a.htm

KAUKLER, BENEDIKT (1998): A brief introduction of Mineral Spring. Topqualitea Small Holders Cooperative Darjeeling. In: http://www.topqualitea.com/english/mineral_spring.html

KAVANAGH, HELEN (1997): Farmer-Consumer Co-partnership Agreements in Japan. In: SIXTH INTERNATIONAL PERMACULTURE CONFERENCE & CONVERGENCE (IPC-VI), September 27 to October 7, 1996. Conference Proceedings, Chapter Three – Economics Stream. Perth & Bridgetown, Western Australia. Permaculture Association of Western Australia Inc. In: http://www.rosneath.com.au/ipc6/ch03/kavanagh/

KAWOSA, M. A. (1988): Remote Sensing of the Himalaya. Natraj Publishers, Dehra Dun.

KAZUSHI, MATSUMOTO (1997): Japan: Individual farmer level. In: THE ASIAN NGO COALITION (ANGOC): Sustainable Agriculture in Asia. Assessment of Community Initiatives on Alternative Agriculture Systems 1, p. 81-88.

KHAWAS, VIMAL (2002): Environment and Rural Development in Darjeeling Himalaya: Issues and Concerns. Centre for Environmental Planning and Technology. Ahmedabad, India. In: http://www.mtnforum.org/resources/library/khawv02a.htm

KHOSLA, P. K. (1998): Himalayas facing ecological disaster: Depletion of natural resources alarming. The Tribune India. In: http://www.tribuneindia.com/50yrs/environ1.htm

KIPE, SANDRA (2004): The World Fresh Fruit Market. Foreign Agricultural Service (FAS) of the United States Department of Agriculture (USDA). In: http://www.fas.usda.gov/htp/Presentations/2004/World%20Fresh%20Fruit%20Market%20(08-04).pdf

KOBAYASHI, KOHEI (1989): Trends in Vegetable Production. In: ASIAN PRODUCTIVITY ORGANIZATION (Editor): Vegetable Production and Marketing in Asia and the Pacific. Report on APO Symposium on Vegetable Production and Marketing (SYP/VII/88) held in Japan in 1988. APO, Tokyo; p. 19-35.

KOEPF, HERBERT H. (1989): The Biodynamic Farm. The Anthroposophic Press. Hudson, New York.

KORTBECH-OLESEN, RUDY (2003): Market. In: YUSSEFI, MINOU & WILLER, HELGA (Editors): The World of Organic Agriculture – Statistics and Future Prospects 2003. 5th revised edition. International Federation Organic Agriculture Movements; p. 21-25. In: http://www.soel.de/inhalte/publikationen/s/s_74_05.pdf

KRÄMER, NICOLE (2003): Farming Fungus – Germany. Hands On, Ideas to Go. Earth Report. In: http://www.tve.org/ho/doc.cfm?aid=996

KUHLMANN, HEINZ (2004): The World of Organic Products. Biofach Japan 2004. In: http://www.abc-language-media-tradefairs.jp.com/BioFach2004/Japanese/Files/WorldofOrganicProducts_full.pdf

KUNG WAI, ONG (2004): Asia. In: WILLER, HELGA & YUSSEFI, MINOU (Editors): The World of Organic Agriculture 2004 Statistics and Emerging Trends. 6th revised edition, February 2004. IFOAM Publication; p. 69-78. In:
http://www.soel.de/inhalte/publikationen/s/s_74.pdf

KURSEONG Soil CONSERVATION (2002): Afforestation conducted by the Kurseong Soil Conservation, Darjeeling District. *Unpublished; (see appendix)*.

LAMA, MAHENDRA P. (2004): Turning Red into Green. The Telegraph, March 16, 2004. Calcutta. In: http://www.telegraphindia.com/1040316/asp/opinion/story_2960203.asp

LAMPKIN, NICOLAS H. (1994): Researching Organic Farming Systems. In: LAMPKIN, NICOLAS H. & PADEL, SUSANNE. (Editors): The Economics of Organic Farming. An International Perspective; p. 27-43. CAB International, Wallingford.

LAMPKIN, NICOLAS H. (1990): Organic Farming. Farming Press Books, Ipswich.

LANCASTER UNIVERSITY (2001): What's happening in Sustainable Development? Department of Geography, Lancaster University. November 2001. In:
http://geography.lancs.ac.uk/posters/Sustainable%20Development.PDF

LECLERQ, BERNWARD (2002): Farming with weeds, Mohanpur, Uttar Pradesh, India. Case Study 2. In: SCIALABBA EL-HAGE, NADIA & HATTAM, CAROLINE (Editors): Organic Agriculture, environment and food security. Environment and Natural Resources Series No. 4. FAO, Rome; p. 186-190.

LEE, LINDA K. (1992): A perspective on the economic impacts of reducing agricultural chemical use. American Journal of Alternative Agriculture, Vol. 7, No. 1 and 2, p. 82-88.

LEHNERT, UWE (2000): Datenanalysesystem SPSS Version 9. 3. Auflage. Oldenburg Verlag, München.

LITTLEMORE, RICHARD (1997): Poverty in West Bengal. International Development Research Centre (IDRC), Ottawa. In:
http://archive.idrc.ca/books/reports/1997/18-02e.html

MACLAREN, FERGUS TYLER (2002): A Strategic Overview of Ecotourism Accreditation and Certification: The Road Forward. International Year of Ecotourism. In:
http://www.world-tourism.org/sustainable/IYE/Regional_Activities/Brazil/cases/TIES.htm

MAFF - MINISTRY OF AGRICULTURE, FORESTRY AND FISHERIES (2004): Supply and Demand of Food. Agriculture, Forestry, and Fisheries. In:
http://www.stat.go.jp/english/data/figures/zuhyou/1631.xls

MAFF - MINISTRY OF AGRICULTURE, FORESTRY AND FISHERIES (2000): Japanese Agricultural Standard of Organic Agricultural Products. Notification No. 59 of January 20, 2000. Unofficial Translation. In:
http://www.maff.go.jp/soshiki/syokuhin/hinshitu/organic/eng_yuki_59.pdf

MAGLINAO, AMADO R. (1998): Characterization of Slopeland Environment and Resources. Food and Fertilizer Technology Center (FFTC), an International Information Center for Farmers in the Asia Pacific Region. In:
http://www.agnet.org/library/data/bc/bc48002/bc48002.pdf

MAHALE, PRABHA & SOREE, HAY (2002): Cosmovisions in Health and Agriculture in India. In: HAVERKORT, BERTUS and HIEMSTRA, WIM (Editors): Food for Thought - ancient visions and new experiments of rural people. COMPAS (Comparing and Supporting Endogenous Development). In: http://compas-network.org/english/dloadz/02mahale.pdf

MAHALE, PRABHA (2002): Organic Agriculture in India. In: THE ORGANIC STANDARD. No. 19, November 2002, p. 1-6. Grolink AB, Torfolk. In: www.organicstandard.com/TOS%2019%20page%201.pdf

MAJUMDAR, SUDIPTA; BANERJEE, SOMENATH & DE, K. K. (2004): Vivipary in white clover (*Trifolium repens* L.). In: Current Science, Vol. 86, No. 1. 10. January 2004; p. 29-30. In: http://www.ias.ac.in/currsci/jan102004/29.pdf

MANDAL, KOHINOOR (2004): Bengal takes steps to raise tea workers' lot. The Hindu Business Line, January 27, 2004. In: http://www.thehindubusinessline.com/2004/01/27/stories/2004012701241100.htm

MATHIJS, ERIK & WAUTERS, ERWIN (2004): Assessing the sustainability of farming systems: Back to basics. Paper presented at the Agricultural Economics Society 78th Annual Conference, 2-4 April 2004, Imperial College, South Kensington, London.

MASKEY, MEERA (1989): Mountain Women and Beekeeping in Nepal. In: VERMA, L. R. (Editor): Honeybees in Mountain Agriculture. Proceedings of International Expert Meeting on Beekeeping Development in the Hindu Kush-Himalayan Region, Kathmandu, 21.-23. June, 1989. ICIMOD, Kathmandu; p. 119-133.

MAYBAUM, GUDRUN (2003): Herbs for Health. Holistic Health Newsletter, Vol. III, Issue 1, Winter 2003. In: http://www.holisticbirds.com/hbn03/winter03/pages/basil.htm

MERCHAN, GLADYS & NIETO, MERCEDES (2004): Bamboo Breakthrough – Ecuador. Earth Report, Hands on – Ideas to go. In: http://www.tve.org/ho/doc.cfm?aid=1310

MINISTRY OF AGRICULTURE, GOVERNMENT OF INDIA (2000): Districtwise Area and Production of Crops in India, 1997-98 and 1998-99, Vol. I. Directorate of Economics and Statistics. Department of Agriculture and Cooperation. New Delhi.

MINISTRY OF INTERNAL AFFAIRS AND COMMUNICATION (2004): Japan Statistical Yearbook 2004. Statistics Bureau. In: www.stat.go.jp/english/data/nenkan/zuhyou/y0108000.xls

MINISTRY OF INTERNAL AFFAIRS AND COMMUNICATION (2003): Farm Households by Degree of Engagement and Farm Household Population, by Prefecture (Commercial Farm Households). In: http://www.stat.go.jp/data/nenkan/pdf/y0703000.pdf

MINISTRY OF INTERNAL AFFAIRS AND COMMUNICATION (2002): Family income and expenditure of farmer's household. In: http://www.stat.go.jp/data/ssds/zuhyou/5-12-2.xls

MINISTRY OF INTERNAL AFFAIRS AND COMMUNICATION (2000): Population Census. In: http://www.stat.go.jp/english/data/kokusei/2000/kihon1/00/01.htm

MISHRA, B. K. & RAMAKRISHNAN, P. S. (1982): Energy flow through a village ecosystem with slash and burn agriculture in North-Eastern India. In: Agricultural Systems 9, p. 57-72.

MISRA, R. V. & ROY, R. N. (2002): On-farm composting methods. FAO, Rome. In: http://www.fao.org/organicag/doc/On_farm_comp_methods.pdf

MOA INTERNATIONAL – MOKICHI OKADA ASSOCIATION INTERNATIONAL (1995): MOA Nature Farming and Its Practice. In:
http://www.moa-inter.or.jp/english/naturefarm/nf-contents.html

MOORE, DAVID S. & MCCABE, GEORGE P. (1999): Introduction to the practice of statistics. 3rd Edition. W. H. Freeman and Company, New York.

MOUNTAIN FORUM (2001a): Why Mountains?: Water Resources. *Slide 6*. In:
http://www.mtnforum.org/members/water.htm

MOUNTAIN FORUM (2001b): Why Mountains? *Slide 1*. In:
http://www.mtnforum.org/members/whymtns.htm

MOUNTAIN FORUM (2001c): Why Mountains?: Poverty and Marginality. *Slide 8*. In:
http://www.mtnforum.org/members/poverty.htm

MSS SEVA - MANAV SEVA SANSTHAN SEVA (2003): Sustainable Agriculture – Organic Farming. In:
http://www.mssseva.org/SUSTINABLE_AGRICULTURE_ORGANIC_FARMING.pdf

MUDGAL, B. N. (2002): Insect Repelling Methods used at Organic Tea Estates, Darjeeling. Manager. *Personal Communication*.

MUKHERJEE, NEELA (1997): Participatory Appraisal of Natural Resources. Concept Publishing Company, New Delhi.

MÜLLER, MANFRED J. (1996): Handbuch ausgewählter Klimastationen der Erde. 5. Heft, 5th Edition. Forschungsstelle Bodenerosion der Universität Trier, Trier.

NAGPAL, SHANTANU (1999): Self-Sufficient Slope: Food Security in the Highlands. In: DIXIT, K.; SUBBA, B. & JOHN, A. (Editors): Tough Terrain: Media Reports in Mountain Issues. Asia Pacific Mountain Network and PANOS Institute South Asia. Kathmandu; p. 27-37. In: http://www.mtnforum.org/resources/library/nagps99a.htm

NATMO – NATIONAL ATLAS & THEMATIC MAPPING ORGANISATION (2000): Soil Map West Bengal. Government of India, Calcutta.

NATURLAND - VERBAND FÜR NATURGEMÄßEN LANDBAU e.V. (2003): Erste Öko-Teefabrik in der Hand von Kleinbauern. Eröffnungsfeier in Peermade in Südindien. Naturland Pressrelease, 05. December 2003. In:
http://www.naturland.de/n5/pressemeldungen/5_dezember_2003.html

NATURLAND - VERBAND FÜR NATURGEMÄßEN LANDBAU e.V. (2000): Standards for Organic Agriculture, Edition 05/2000. *Unpublished*.

NEIDHARDT, CHRISTINE (2002): Der Markt für Bioprodukte in Japan. BioFach Japan. Nürnberg Global Fairs, Press Releases. February 2002.
http://www.nuernbergglobalfairs.de/main/dpgz1xu3/dpgzv38b/page.html

NEWTON, JON (1995): Profitable Organic Farming. Blackwell Science Ltd., Oxford.

NGA – NATIONAL GOVERNORS' ASSOCIATION (2002): Agricultural Land 2000. Based on Japan National Statistics Website. In:
http://www.nga.gr.jp/english/kisodata/2002/1-4_data.pdf

NITM - Darjeeling Tea Research & Management Association (2002): Soil Analysis Report. *Unpublished*.

NOH, TOSHIO & KIMURA, JOHN C. (1989): Japan: A Regional Geography of An Island Nation. 2nd Edition. Teikoku-Shoin, Tokyo.

NORMAN, DAVID; JANKE, RHONDA; FREYENBERGER, STAN; SCHURLE, BRYAN & KOK, HANS (1997): Defining and Implementing Sustainable Agriculture. Kansas Sustainable Agriculture Series, Paper #1. Kansas Center for Sustainable Agriculture and Alternative Crops (KCSAAC). In: http://www.oznet.ksu.edu/sustainableag/Pubs_kcsaac/ksas1.htm

NÜRNBERG GLOBAL FAIRS (2002): Bio auch in Tokio "mit Brief und Siegel". BioFach Japan. Pressemitteilungen. April 2002. In: http://www.nuernbergglobalfairs.de/main/dpgz1xu3/dpgzv38b/page.html

OGAWA, YASUO (1995): Combined Forestry and Livestock Production in the Uplands of Kyushu, Japan. Food and Fertilizer Technology Center (FFTC), an International Information Center for Farmers in the Asia Pacific Region. In: http://www.fftc.agnet.org/library/data/eb/eb404/eb404.pdf

OHIRA, HIROSHI (2003): Planting Pattern. *Unpublished; (see appendix)*.

OHYAMA, RYUICHI (1989): Agronomic Aspects in Vegetable Production. In: ASIAN PRODUCTIVITY ORGANIZATION (Editor): Vegetable Production and Marketing in Asia and the Pacific. Report on APO Symposium on Vegetable Production and Marketing (SYP/VII/88) held in Japan in 1988. APO, Tokyo; p. 37-46.

O'MALLEY, L. S. S. (1999): Bengal District Gazetteers: Darjeeling. First Published 1907. Second Reprint. Logos Press, New Delhi.

OPẼNA, ROMEO T. (1989): Areas for Further Research and Development. In: ASIAN PRODUCTIVITY ORGANIZATION (Editor): Vegetable Production and Marketing in Asia and the Pacific. Report on APO Symposium on Vegetable Production and Marketing (SYP/VII/88) held in Japan in 1988. APO, Tokyo; p. 181-209.

OPTA – ORGANIC PRODUCERS TRADE ASSOCIATION (2000): Organic Matters. Official Magazine of OPTA, Philippines. Vol. 2, Issue, January-March 2000. Manila.

ORGANIC MONITOR (2002): #5101-46 The Japanese Market for Fresh Organic Fruit & Vegetables. Published: June 2002. In: http://www.organicmonitor.com/510146.htm

PANDEY, UMA & SINGH, J. S. (1984): Energetics of Hill Agro-Ecosystems: A Case Study from Central Himalaya. In: Agricultural Systems 13, p. 83-95.

PANOS London Online (2002): High Stakes: The Future of Mountain Societies. PANOS Press Centre, 21.05.2002. In: http://www.panos.org.uk/press/news_releases.asp?newsid=1055

PARROT, NICHOLAS & MARSDEN, TERRY (2002): The Real Green Revolution: Organic and agroecological farming in the South. Greenpeace Environmental Trust, London. In: http://archive.greenpeace.org/~geneng/highlights/hunger/greenrev.htm and http://a1776.g.akamai.net/7/1776/1532/75688489b16126/archive.greenpeace.org/%7Egeneng/reports/hunger/realgreenrevwhole.pdf

PARTAP, TEJ (1998): Sloping Land Agriculture and Resource Management in the Semi Arid and Humid Asia: Perspective and Issues. In: ASIAN PRODUCTIVITY ORGANIZATION (Editor): Perspectives on Sustainable Farming Systems in Upland Areas. Proceedings of the APO-FFTC Study Meeting held in Tokyo and Takamatsu, Japan from 27 October to 1 November 1997 (STM-07-97). APO, Tokyo; p. 38-84.

PARTAP, TEJ (1989): Honey Plant Sources in Mountain Areas: Some Perspectives. In: VERMA, L. R. (Editor): Honeybees in Mountain Agriculture. Proceedings of International Expert Meeting on Beekeeping Development in the Hindu Kush-Himalayan Region, Kathmandu, 21.-23. June, 1989. ICIMOD, Kathmandu; p. 91-113.

PATHAK, S. K. (2002): Insect Repelling Methods and Leguminous Plants used at Organic Tea Estates, Darjeeling. Advisory Officer Tea Research Association. *Personal Communication*.

PAYER, MARGARETE (2001): Entwicklungsländerstudien. Teil I: Grundgegebenheiten. Kapitel 8: Tierische Produktion. 7. Geflügel. 2. Enten. In: http://www.payer.de/entwicklung/entw0872.htm

PAYNE, KATRINA; WARRINGTON, SIOBHAN & BENNETT, OLIVIA (2002): High Stakes: The Future for Mountain Societies. PANOS Report No. 44. In: http://www.panos.org.uk/PDF/reports/Highstakes.pdf

PRASAD, RAM (1999): Fuel wood Based Energy Scenario and its Impact on Natural Forest in India. ENVIRO News, October 1999, Vol. 3, No. 10. In: http://envfor.nic.in/news/oct99/energy.html

KANAGAWA PREFECTURAL AGRICULTURAL RESEARCH INSTITUTE (2003): Soil Anyalsis Report. Odawara. *Unpublished*.

PRESS, FRANK & SIEVER, RAYMOND (1995): Allgemeine Geologie: Eine Einführung. Spektrum Akademischer Verlag, Heidelberg.

PRETTY, JULES (2002): Lessons from certified and non-certified organic products in developing countries. In: SCIALABBA EL-HAGE, NADIA & HATTAM, CAROLINE (Editors): Organic Agriculture, environment and food security. Environment and Natural Resources Series No. 4. FAO, Rome; p. 141-162.

RAHMAN, ABID (2002): Insect Repelling Methods and Leguminous Plants used at Organic Tea Estates, Darjeeling. Assistant Manager. *Personal Communication*.

RAI, PRASANNA (2002): From Depredation to Development. The Statesman, NB Extra, 30. August 2002, p. 4.

RAI, J. D. (2001): Insect Repelling Methods used at Organic Tea Estates, Darjeeling. Manager. *Personal Communication*.

RAI, LALITKUMAR & SHARMA, EKLABYA (1994): Medicinal Plants of the Sikkim Himalaya – Status, Uses & Potential. Himavikas Occasional Publication No. 5. Govind Ballabh Pant Institute of Himalayan Environment Development, Dehra Dun.

RAO, Y. P. (1981): The Climate of the Indian Subcontinent. In: TAKAHASHI, K. & ARAKAWA, H. (Editors): Climates of Southern and Western Asia. World Survey of Climatology, Volume 9. Elsevier, Amsterdam; p. 67-183.

RATANAWARAKA, CHANUAN (2002): Organic Agriculture: An Approach to Sustainable Development. In: ASIAN INSTITUTE OF TECHNOLOGY (Editor): Organic Farming and Certification. AIT Workshop, 28. February 2002. *Unpublished*.

RATHORE, M.S. & VERMA, L.R. (1989): Economics of Beekeeping in Hindu Kush-Himalayan (HK-H) Region. In: VERMA, L.R. (Editor): Honeybees in Mountain Agriculture. Proceedings of International Expert Meeting on Beekeeping Development in the Hindu Kush-Himalayan Region, Kathmandu, 21.-23. June 1989. ICIMOD, Kathmandu; p. 221-235.

RAUPP, JOACHIM (1999): Fertilization Systems in Organic Farming Based on Long-Term Experiments. Institute of Biodynamic Research, Brandschneise.

RCDC – DARJEELING LADENLA ROAD PRERNA (2004): Annual Report 2003-2004. Darjeeling Ladenla Road Prerna, Darjeeling.

RCDC – DARJEELING LADENLA ROAD PRERNA (2002): Region Community Development Committee – Strategic Plan. RCDC, Darjeeling.

REIJNTJES, COEN; HAVERKORT, BERTUS & WATERS-BAYER, ANN (1993): Farming for the future. An introduction to Low-External-Input and Sustainable Agriculture. ILEIA. Macmillan Press Ltd., London.

RICHARDSON, SARAH (1995): International Cooperation to Accelerate Sustainable Development in Developing Countries and Related Domestic Policies. In: PROJET DE SOCIÉTÉ (Editor): Canada and Agenda 21. International Institute for Sustainable Development (IISD), Winnipeg. In: http://iisd.ca/worldsd/canada/projet/c02.htm

RIJAL, KAMAL (1999): Approaches and Strategies for Sustainable Energy Development in the Mountains: An Agenda for the Future. In: RIJAL, KAMAL (Editor): Energy Use in Mountain Areas. Trends and Patterns in China, India, Nepal and Pakistan. International Centre for Integrated Mountain Development (ICIMOD), Kathmandu; p. 181-207.

ROJANALAK, DISATHAT (2002): Nongjok Natural Farming Centre. Bangkok. Manager. *Personal Communication.*

RUENGLERTPANYAKUL, VITOON (2002): Organic and fair trade rice project: back to school in the farmers' fields Surin and Yasothorn Provinces, Thailand. In: SCIALABBA EL-HAGE, NADIA & HATTAM, CAROLINE (Editors): Organic agriculture, environment and food security. Environment and Natural Resources Series No. 4. FAO, Rome; p. 206-216.

SAIKIA, JOGMAYA (1995): Agriculture in the Hills of North-East India and the Role of North-Eastern Council. In: DEB, BIMAL J. (Editor): Regional Development in North-East India. Issues and Prospects. Reliance Publishing House, New Delhi; p. 169-172.

SAKAGAMI, KYOKO (2003): Gifts from the forest. Nipponia No. 24, Special Feature. 15. March 2003. In: http://web-japan.org/nipponia/nipponia24/en/feature/feature04.html

SAKUYOSHI, MUTSUMI (2001): Japanese Organic Rules and Implementation. In: THE ORGANIC STANDARD: Country Focus. Issue 1, May 2001, p. 2-5. Grolink AB, Torfolk. In: http://www.organicstandard.com/TOS%20May%202001.pdf

SANDARS, D. L. & AUDSLEY, E. (1996): Quantitative modelling with a view to determining optimal reduced input cropping systems. Rotations and Cropping Systems, Aspects of Applied Biology 47. Conference Proceedings Churchill College, Cambridge, 16-18 December 1996, p. 309-317.

SASAC – ST. ALPHONSUS SOCIAL AND AGRICULTURE CENTRE (2002a): SASAC SMF-Vegetables and Sales Prices, Darjeeling District. *Unpublished; (see appendix)*.

SASAC – ST. ALPHONSUS SOCIAL AND AGRICULTURE CENTRE, (2002b): SASAC Planting and Harvest Table for SMF-Vegetables, Darjeeling District. *Unpublished; (see appendix)*.

SASSE, LUDWIG (1987): Die Biogas-Anlage: Entwurf und Details einfacher Anlagen. Deutsches Zentrum für Entwicklungstechnologien (GATE) in Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ). Vieweg, Braunschweig/Wiesbaden.

SAXENA, SHILPI (1998): The Ecology and the Economy of the Homestead Gardens in Darjeeling, India. Research Paper, University of Mainz. *Unpublished*.

SCHAARSCHMIDT, KATHARINA (1995): Steiner's Impulse in Agriculture. Updated Reprint. In: DEUTSCHER LANDWIRTSCHAFTSVERLAG (Editor): Kraut und Rüben. No. 11/95.

SCHEIDL, LEOPOLD G. (1937): Der Boden Japans. Mitteilungen der Deutschen Gesellschaft für Natur- und Völkerkunde Ostasiens. Band XXX Teil A. Otto Harrassowitz Verlag, Leipzig.

SCHMID, OTTO (2002): A look at the differences between three international standards: Comparison of EU-Regulation 2092/91* and Codex Alimentarius Guidelines for organically produced food 1999/2001 with IFOAM Basic Standards 2000. In: THE ORGANIC STANDARD: Standards & Regulations. Issue 10, February 2002, p. 12-13. Grolink AB, Torfolk. In:
http://www.organicstandard.com/TOS%2010%20February%202002.pdf

SCHOCH, RUSSELL (2001): A messenger from the South brings word to the North: There's a better way to feed the world. A Conversation with Miguel Altieri. In: CALIFORNIA MONTHLY. June 2001, Vol. 111, No. 6. In:
http://www.alumni.berkeley.edu/Alumni/Cal_Monthly/June_2001/QA-_A_conversation_with_Miguel_Altieri.asp

SCHÜTTE, STEFAN (1998): Sozio-Ökonomie des kleinbäuerlichen Teeanbaus in den Nilgiri-Bergen, Südindien. Das Fallbeispiel der Gemeinde Denad. Ibidem-Verlag, Stuttgart.

SCHWIND, MARTIN (1990): Geographie. In: HAMMITZSCH, HORST (Editor): Japan-Handbuch. 3rd Edition. Franz Steiner Verlag, Wiesbaden; p. 109-260.

SCIALABBA EL-HAGE, NADIA & HATTAM, CAROLINE (2002): General Concepts and Issues in Organic Agriculture. In: SCIALABBA EL-HAGE, NADIA & HATTAM, CAROLINE (Editors): Organic Agriculture, environment and food security. Environment and Natural Resources Series No. 4. FAO, Rome; p. 1-20.

SCIALABBA, NADIA (2000): Opportunities and constraints of Organic Agriculture, a Socio-Ecological Analysis. FAO, Rome. In:
http://www.fao.org/organicag/doc/SOCRATES1999.htm

SETO, KAZUYOSHI (2002): The present status of the Japanese Wholesale Market Law. In: ASIAN PRODUCTIVITY ORGANIZATION (Editor): Operation of Agricultural Wholesale Markets. Report of the Multi-Country Study Mission on Operation of Agricultural Wholesale Markets held in Japan from 4 to 11 July 2000 (OSM-04-00). APO, Tokyo; p. 40-53.

SEUFFERT, OTMAR (1989): Ökomorphodynamik und Bodenerosion. In: GEOGRAPHISCHE RUNDSCHAU 41 (1989), Heft 2, p. 108-115.

SHAH, S. L.; MELKANIA, N. P. & JOSHI, C. (1984): Social Forestry – The key to Integrated Rural Development in Western Himalaya. In: JOSHI, S.C. (Editor): Rural Development in the Himalaya. Problems and Prospects. Gyanodaya Prakashan, Naini Tal; p. 231-249.

SHANNON, RON (1997): Biogas. Proceedings from the Sixth International Permaculture Conference & Convergence (IPC-VI). Designing for a Sustainable Future. September 27 to October 7, 1996. Perth & Bridgetown. In:
http://www.rosneath.com.au/ipc6/ch08/shannon2/index.html

SHARMA, DEVINDER (2003): Feeding the Farmers. India Together, January 2003. In:
http://www.indiatogether.org/2003/jan/dsh-feedfarmer.htm

SHARMA, EKLABYA (2001): Absolute Advantage Resources as Potential Neutralisers of Globalisation Risks. In: International Centre for Integrated Mountain Development (ICIMOD) (Editor): Mountain Risks and Hazard. ICIMOD Newsletter No. 40. In:
http://www.icimod.org/publications/newsletter/news40/final%20newsletter%2040.pdf

SHARMA, E. & SUNDRIYAL, R. C. (1998): The Successful Development of a Cash Crop from Local Biodiversity by Farmers in Sikkim, India. In: PARTAP, T. & STHAPIT, B. (Editors): Managing Agrobiodiversity - Farmers' Changing Perspectives and Institutional responses in the Hindu Kush-Himalayan Region. International Centre for Integrated Mountain Development (ICIMOD), Kathmandu. In:
http://www.icimod.org/focus/agriculture/agribio_bk/agrobio8.htm

SHARMA, HANS RAJ & SHARMA, EKLABYA (1997): Mountain Agricultural Transformation Processes and Sustainability in the Sikkim Himalayas, India. International Centre for Integrated Mountain Development, MFS Series No. 97/2. Kathmandu.

SHARMA, SUBRAT (1991): Energy budget studies of some multiple cropping patterns of the Central Himalaya. In: Agriculture, Ecosystems and Environment 36, p. 199-206.

SINGH, RAJESH (2004): Need for awareness on 'organic' certification. The Tribune, Online Edition. Agriculture Tribune, January 12, 2004. Chandigarh. In:
http://www.tribuneindia.com/2004/20040112/agro.htm#2

SINGH, G. S.; RAO, K. S. & SAXENA, K. G. (1997): Energy and Economic Efficiency of the Mountain Farming System: A Case Study in the North-Western Himalaya. In: Journal of Sustainable Agriculture. Vol. 9 (2/3), p. 25-49.

SOIL ASSOCIATION (2002): Organic crops risk GM contamination. Press Release, 30. January 2002. In:
http://www.soilassociation.org.uk/sa/saweb.nsf/0/80256ad80055454980256b510062a088?OpenDocument

SOIL ASSOCIATION (2001): Organic Farming, food quality and human health. A review of the evidence. Soil Association, Bristol.

SONOBE, SOUAN (2001): Map of Kanto Area. In:
http://www.mars.dti.ne.jp/~opaku/shogun/map_kanto.html

STARKEL, LESZEK (2000a): Environment: Relief. In: STARKEL, LESZEK & BASU, SUBHASHRANJAN (Editors): Rains, Landslides and Floods in the Darjeeling Himalaya. Indian National Science Academy, New Delhi; p. 19-26.

STARKEL, LESZEK (2000b): Mountains of the Monsoon Tropics: Rainfall, Hydrology and Geomorphic Processes. In: STARKEL, LESZEK & BASU, SUBHASHRANJAN (Editors): Rains, Landslides and Floods in the Darjeeling Himalaya. Indian National Science Academy, New Delhi; p. 1-5.

STARKEL, LESZEK & SOJA, ROMAN (2000): Environment: Climate. In: STARKEL, LESZEK & BASU, SUBHASHRANJAN (Editors): Rains, Landslides and Floods in the Darjeeling Himalaya. Indian National Science Academy, New Delhi; p. 26-30.

STARKEL, LESZEK & BASU, SUBHASHRANJAN (2000): Land Use Changes and Population Pressure. In: STARKEL, LESZEK & BASU, SUBHASHRANJAN (Editors): Rains, Landslides and Floods in the Darjeeling Himalaya. Indian National Science Academy, New Delhi; p. 33-37.

STARKEL, LESZEK & GIL, E. (2000): Mechanism of Slope Processes and Their Evolution: Typology of Slope Processes and Forms. In: STARKEL, LESZEK & BASU, SUBHASHRANJAN (Editors): Rains, Landslides and Floods in the Darjeeling Himalaya. Indian National Science Academy, New Delhi; p. 48-51.

STEINFELD, CAROL (1995): Definitions. Gale Publishing's Encyclopaedia of the Environment. In: http://www.ecological-engineering.com/defs.html

STOCKLE, C. O.; PAPENDICK, R. I.; SAXTON, K. E.; CAMPBELL, G. S. & VAN EVERT, F. K. (1994): A framework for evaluating the sustainability of agricultural production systems. American Journal of Alternative Agriculture, Vol. 9, No. 1 and 2, p. 45-51.

STOFFELLA, PETER J.; LI, YUNCONG; ROE, NANCY E.; OZORES-HAMPTON, MONICA & GRAETZ, DONALD A. (1997): Utilization of Composted Organic Wastes in Vegetable Production Systems. Food and Fertilizer Technology Center (FFTC), an International Information Center for Farmers in the Asia Pacific Region. In: http://www.agnet.org/library/data/tb/tb147/tb147.pdf

STOLL, GABRIELE (2000): Natural Crop protection in the Tropics. Letting Information Come to Life. 2nd Revised Edition. Margraf Verlag, Weikersheim.

STOLTON, SUE; GEIER, BERNWARD & MCNEELY, JEFFREY (Editors) (2000): The relationship between nature conservation, biodiversity and organic agriculture. IFOAM, Tholey-Theley.

SURENDRANATH, C. (2003): Organic: Market-driven and sustainable? India Together, November 2003. In: http://www.indiatogether.org/2003/nov/agr-jaivakerl.htm

SWISS FEDERAL OFFICE FOR AGRICULTURE (2000): Farm Businesses, Utilised Agricultural Area and Livestock Units. In: http://www.blw.admin.ch/agrarbericht2/e/anhang/table_1_2.pdf

TAKAHASHI, KOICHIRO (1977): Typhoons and Shûrin (Autumn Rain). In: FUKUI, EIICHIRO (Editor): The Climate of Japan. In: Developments in Atmospheric Science, 8. Kodansha Ltd., Tokyo; p. 113-134.

TAKEZONO, T. (1994): Greenhouse growing in Japan. In: XXIVth INTERNATIONAL HORTICULTURAL CONGRESS (IHC): Horticulture in Japan. Asakura, Kyoto.

TALWAR, Y. P. (1988): Soils and Land-use Patterns in the North-East Himalayas. In: CHADHA, S. K. (Editor): Himalayas: Ecology and Environment. Mittal Publications, Delhi; p. 172-178.

TANIGUCHI, YOKO (2002): A Brief Introduction to Agriculture in Japan. Paper prepared for the orientation of Alternative Marketing Program 2002. Asia Jikyu Promotion Network, 11. November 2002, Kobe.

THE HINDU BUSINESS LINE (2002): Government unveils Logo for Organic Agri-Products. The Hindu Business Line, Internet Edition. 26. July 2002. New Delhi. In: http://www.thehindubusinessline.com/bline/2002/07/27/stories/2002072701241100.htm

THE HINDU (2001): Effective microorganism for ecological farming. The Hindu, Online Edition of India's National Newspaper. 14. October 2001. In: http://www.hinduonnet.com/thehindu/2001/10/04/stories/0804000c.htm

THE JAPAN TIMES (2004): Powerful typhoon hits Pacific Coast. October 10, 2004. In: http://www.japantimes.com/cgi-bin/getarticle.pl5?nn20041010a1.htm

THE ORGANIC STANDARD (2002): Organic Regulations emerging in Asia. Standards & Regulations. Issue 10, February 2002, p. 7-11. Grolink AB, Torfolk. In: http://www.organicstandard.com/TOS%2010%20February%202002.pdf

THE ORGANIC STANDARD (2001): What cost is organic certification? Certification & Accreditation. Issue 7, November 2001, p. 7-12. Grolink, AB, Torfolk. In: http://www.organicstandard.com/Articles/cost%20for%20certification.pdf

THE TELEGRAPH (2004): Hill hamlets harvest water of dreams. April 2004. In: http://www.east-himalaya.com/news/2004/apr/08040402n.htm

THE WORLD BANK GROUP (2003a): Japan Data Profile. In: http://devdata.worldbank.org/external/CPProfile.asp?SelectedCountry=JPN&CCODE=JPN&CNAME=Japan&PTYPE=CP

THE WORLD BANK GROUP (2003b): India Data Profile. In: http://devdata.worldbank.org/external/CPProfile.asp?SelectedCountry=IND&CCODE=IND&CNAME=India&PTYPE=CP

THE WORLD BANK GROUP (2003c): Switzerland Data Profile. In: http://devdata.worldbank.org/external/CPProfile.asp?SelectedCountry=CHE&CCODE=CHE&CNAME=Switzerland&PTYPE=CP

THE WORLD BANK (1986): Poverty and Hunger. Issues and Options for Food Security in Developing Countries. A World Bank Policy Study. World Bank, Washington D.C. In: www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/1999/09/17/000178830_98101901455676/Rendered/PDF/multi_page.pdf

TREML (2004): Raritätengärtnerei Treml, Katalog 2004-10. In: http://www.pflanzen-treml.de/createpdf.php?VID=q3dFKJb4tUQJTjyx

TRIVEDI, PRATIBHA P. (1987): Home Gardening. Indian Council of Agricultural Research (ICAR), New Delhi.

TUBENE, STEPHAN & HANSON, JAMES (2002): The wholesale produce auction: an alternative marketing strategy for small farms. American Journal of Alternative Agriculture. Vol. 17, Issue 1, March 2002; p. 1-6. In: http://www.organic-research.com/Pdfs/Research/aja/aja0003.pdf

TUKEY, J. W. (1977): Exploratory Data Analysis. Reading (Massachusetts), Addison-Wesley.

UNITED KINGDOM SECRETARIES OF STATE FOR THE ENVIRONMENT (1994): Principles of Sustainable Development. In: SUSTAINABLE DEVELOPMENT - THE UK STRATEGY. HMSO, London; p. 32-34. In: http://www.iisd.org/sd/principle.asp?pid=20&display=1

UN - UNITED NATIONS (2000): Sustainable agriculture and rural development. Report of the Secretary-General, 02. February 2000. Commission on Sustainable Development. Economic and Social Council. E/CN.17/2000/7; p. 3-13. In:
http://www.un.org/documents/ecosoc/cn17/2000/ecn172000-7.htm

UN-DESA – UNITED NATIONS DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS (2004): Agriculture and Rural Development. Division for Sustainable Development. In:
http://www.un.org/esa/sustdev/sdissues/agriculture/agri.htm

UN-ESCAP - UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC (2002): Report of the Regional Workshop on Exploring the Potential of Organic Agriculture for Rural Poverty Alleviation in Asia and the Pacific, 26-29 November 2001 Chiang Mai, Thailand; p. 1-28. In:
http://www.unescap.org/rural/doc/OA/OA%20Workshop%20report.pdf

UNESCO - UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION (2001): Sustainable Agriculture. Teaching and Learning for a Sustainable Future. In:
http://www.unesco.org/education/tlsf/pdf/theme_c_pdf/mod15.pdf

UNEPTIE - UNITED NATIONS ENVIRONMENT PROGRAMME TECHNOLOGY, INDUSTRY, AND ECONOMICS (2001): WSSD Sector Report. Journey to a Common Future Background Information on Rio +10. In: http://www.uneptie.org/pc/mining/wssd/milestone.htm

UNU - UNITED NATIONS UNIVERSITY (2002): Mountain Ecosystems Endangered: War, exploitation and pollution threaten freshwater source for half of world's population. UNU News Release, 27. January 2002. In:
http://www.unu.edu/mountains2002/news/news-release.html

VARUGHESE, SUMA (1997): Nature Knows Best. Life Positive, May 1997 In:
http://www.lifepositive.com/body/nature/fukuoka-organicfarming.asp

VENKATRAMAN, LATHA (2003): Opening up fruit exports has improved quality. The Hindu Business Line, Internet Edition. 10. November 2003. In:
http://www.blonnet.com/2003/11/11/stories/2003111100701100.htm

VERMA, L. R. (1992): Species and Genetic Diversity in Himalayan Honeybee. In: VERMA, L. R. (Editor): Honeybees in Mountain Agriculture. Proceedings of International Expert Meeting on Beekeeping Development in the Hindu Kush-Himalayan Region, Kathmandu, 21.-23. June, 1989. ICIMOD, Kathmandu; p. 39-51.

VISUAL HUMAN LIFE (1986): The Nihon. Kodansha, Tokyo.

VROLIJK, BART & MAY, CHRIS (2001): Japan. In: LIU, PASCAL; BOTO, ISOLINA; KORTBECH-OLESEN, RUDY; VROLIJK, BART & PILKAUSKAS, PAUL (Editors): World markets for organic fruit and vegetables. Opportunities for developing countries in the production and export of organic horticultural products. INTERNATIONAL TRADE CENTER (ITC); TECHNICAL CENTRE FOR AGRICULTURAL AND RURAL COOPERATION (CTA) & FOOD AND AGRICULTURAL ORGANIZATION (FAO) (joint publishers), Rome.

WANGYAL, SONAM B. (2002): Sikkim & Darjeeling. Division and Deception. KMT Press, Phuentsholing.

WCED - WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT (1987): Our common future. Oxford University Press, Oxford. In: http://www.sdgateway.net/introsd/definitions.htm

WILK, LISELOTTE (1975): Die postalische Befragung. In: HOLM, KURT (Editor): Die Befragung. Band 1, p. 187-200.

WILLARD, TERRI (2000): Introduction to Sustainable Development. Sustainable Development Gateway, August 2000. In: http://www.sdgateway.net/introsd/definitions.htm

WILLENBRINK, JOHANNES (2003): Reisanbau in Südostasien: Geschichte, Züchtung, Erträge (Rice Cultivation and Rice Yields in South East Asia). In: GEOGRAPHISCHE RUNDSCHAU, Januar 1/2003; p. 26-31.

WILLER, HELGA & RICHTER, TORALF (2004): Europe. In: WILLER, HELGA & YUSSEFI, MINOU (Editors): The World of Organic Agriculture 2004 Statistics and Emerging Trends., 6th revised edition, February 2004. IFOAM Publication; p. 93-121. In: http://www.soel.de/inhalte/publikationen/s/s_74.pdf

WIMBERLEY, RONALD C. (1996): What Is a Farm, and Why Does It Matter? Proceedings of the National Small Farms Conference, 10.-13. September 1996 in Nashville, Tennessee. The Plant and Animal Production, Protection and Processing Division of USDA-Cooperative State Research, Education and Extension Service, Washington, DC. In: http://www.nal.usda.gov/afsic/nsfc/2iif3.htm

WIRSIG, ALEXANDER (2000): Ökosystem Teeplantage – Arten, Mechanismen und Aspekte im Rahmen des Schädlingsbefalls. Universität Hohenheim. http://www.teeverband.de/texte/download/wit2-2000-beitrag2.pdf

WISTINGHAUSEN, CHRISTIAN V.; WISTINGHAUSEN, ECKARD; SCHEIBE, WOLFGANG & KÖNIG, ULI JOHANNES (2000): The Biodynamic Spray and Compost Preparations Production Methods. Booklet 1. 1st English edition. Biodynamic Agricultural Association, Stroud.

WITHERICK, MICHAEL & CARR, MICHAEL (1993): The Changing Face of Japan. A Geographical Perspective. Hodder & Stroughton, Kent.

WYNEN, ELS & VANZETTI, DAVID (2002): Certified Organic Agriculture – Situation and Outlook. In: SCIALABBA EL-HAGE, NADIA & HATTAM, CAROLINE (Editors): Organic Agriculture, environment and food security. Environment and Natural Resources Series No. 4. FAO, Rome; p. 63-107. In: http://www.fao.org/documents/show_cdr.asp?url_file=/DOCREP/005/Y4137E/y4137e03.htm

YA, TANG (2001): Potential Risks with Development of Cash Crops. In: ICIMOD Newsletter: Mountain Risks and Hazards. No. 40, Winter 2001. In: http://www.icimod.org/publications/newsletter/news40/final%20newsletter%2040.pdf

YADAV, S.P (2004): Performance of Effective Microorganisms (EM) on Growth and Yields of Selected Vegetables. EM Research Organization. In: http://www.emro.co.jp/english/library/abstracts/0004vegetables.html

YAGASAKI, NORITAKA & NAKAMURA, YASUKO (2003): Protection of Urban Farming and Farmland in Tokyo. Summary. International Conference on Grassroots Environmental Movements in Japan and the United States, April 25-26, 2003. University of Kentucky, Lexington; p. 1-3. In: http://www.uky.edu/~ppkaran/conference/Protection%20of%20Urban%20Farming%20and%20Farmland%20in%20Tokyo.pdf

YOKOI, YUKIO (2002): Organic Agriculture in Japan: Development of Labelling Scheme and Production Policies. OECD Workshop on Organic Agriculture, 23-26 September 2002. Washington D.C.

YONEYAMA, SHOKO (1996): Growth in Organic Agriculture: Japanese Farmers' Perspectives. In: Ecology and Farming, January 1996, p. 14-16.

YOSHINO, MASATOSHI M. (1977a): Bai-u, the Rainy Season in Early Summer. In: FUKUI, EIICHIRO (Editor): The Climate of Japan. In: Developments in Atmospheric Science, 8. Kodansha Ltd., Tokyo; p. 85-101.

YOSHINO, MASATOSHI M. (1977b): The Winter Monsoon. In: FUKUI, EIICHIRO (Editor): The Climate of Japan. In: Developments in Atmospheric Science, 8. Kodansha Ltd., Tokyo; p. 65-84.

YUSSEFI, MINOU (2003): Asia. In: YUSSEFI, MINOU & WILLER, HELGA (Editors): The World of Organic Agriculture – Statistics and Future Prospects 2003. 5th revised edition. International Federation Organic Agriculture Movements. Tholey-Theley; p. 55-65. In: http://www.soel.de/inhalte/publikationen/s/s_74.pdf

YUSSEFI, MINOU & WILLER, HELGA (2002): Organic Agriculture Worldwide 2002 – Statistics and Perspectives. SÖL-Sonderausgabe, No. 74; 4th revised edition. Bad Dürkheim. In: http://www.soel.de/inhalte/publikationen/s_74_04.pdf

List of Tables

List of Illustrations

Figures

Photos

Appendix

Questionnaire Darjeeling District (English)

I. Statistical Information

a) Gender:

1. Male
2. Female

b) Age:

1. below 20
2. 20-39
3. 40-60
4. above 60

II. Questions concerning farm and farming practice

a) Number of people working on the farmland:

1. < 5
2. 5 - < 10
3. 10 - 15
4. > 15

---

b) Since how many years are you a farmer?

1. less than 5 years
2. 5 to less than 10 years
3. 10 to less than 20 years
4. 20 years and more

---

c) What is your farm-size?

Pure Cultivation Land:

1. < 10 m^2
2. 10–50 m^2
3. >50 m^2
4. < 30 decimals
5. 30-< 50 decimals
6. 50–100 decimals

Total Farm Land:

7. < 100 decimals
8. 100-< 200 decimals
9. 200- 400 decimals

---

d) Do you have any livestock?

0. No **If No, continue with e)**
1. Yes **If Yes, continue with d_1)**

---

d_1) What kind and how many of livestock do you have?

	Chicken
1 < 2	
2. 2 - 5	
3. > 5	

	Goat	Pig	Cow
1. 1 - 2			
2. 3 and more			

---

e) What type of farming are you practicing at present?

1. Conventional (i.e. use of chemicals) **continue with f)**
2. Organic (i.e. no use of chemicals) **continue with h)**
3. Traditional (i.e. low input of chemicals, low crop diversity) ***continue with $e3_1$)***

---

f) What kind of chemicals do you use?

1. Pesticides
2. Insecticides
3. Herbicides

---

g) In what amounts do you use the chemical(s)?

1. < 0.25 kg/m^2 (= 250 g/m^2)
2. 0.25 - 0.5 kg/m^2 (= 250 - 500 g/m^2)
3. > 0.5 kg/m^2 (= 500 g/m^2)

---

h) What kind of crops are you growing traditionally / conventionally?

1. Radish
2. Cabbage
3. Cucumber
4. Tomato
5. Others: ______________________

---

i) How much is your traditional / conventional yield per month?

1. < 15 kg
2. 15 - < 30 kg
3. 30 - < 45 kg
4. 45 – 60 kg
5. > 60 kg

---

j) How much is your traditional / conventional income (in Rupees) per month?

1. < 100 Rs.
2. 100 - < 200 Rs.
3. 200 - < 400 Rs.
4. 400 - < 600 Rs.
5. 600 Rs. and more

III. Questions about Organic and Square Meter Farming

a) What kind of organic / traditional / conventional crops do you sell?

1. Tomato
2. Onion
3. Cabbage
4. Brinjal (Eggplant)
5. Others: ______________________

---

b) How much is your monthly yield from organic crops?

1. < 15 kg
2. 15 - < 30 kg
3. 30 - < 45 kg
4. 45 – 60 kg
5. > 60 kg

---

c) Is the yield/harvest from organic/SMF / conventional also usable and satisfactory for the non-commercial use, i.e. for personal use? (Do you produce enough for personal consumption?)

0. No
1. Yes
2. Do not know

---

d) How much of your organic/SMF/conventional monthly yield is for personal (family) use?

1. < 5 kg
2. 5 – 10 kg
3. > 10 kg

---

e) What kind of experience did you have with organic/Square Meter Farming - in comparison with the traditional / conventional farming?

1. Very positive experience
2. Positive experience
3. No positive experience

---

f) How successful and helpful is organic/Square Meter Farming compared to traditional / conventional farming?

1. Very successful and helpful
2. Successful and helpful
3. Unsuccessful and unhelpful

---

g) What kind of crops do you grow organically/with SMF?

1. Tomato
2. Cauliflower
3. Cabbage
4. Onion
5. Others: ____________________

____

____

---

h) How much is your income per month (in Rupees) from organic/SMF?

1. < 100 Rs.
2. 100 - < 200 Rs.
3. 200 - < 400 Rs.
4. 400 - < 600 Rs.
5. 600 Rs. and more

IV. Questions about Biogas

a) Are you making your own organic compost?

0. No
1. Yes

---

b) Have you considered using biogas (produced from animal waste) for heating / cooking?

0. No **If No, continue with h)**
1. Yes **If Yes, continue with c)**
2. Never heard of **continue with h)**

---

c) Are you using biogas for heating / cooking?

0. No **If No, continue with h)**
1. Yes **If Yes, continue with d)**
2. Never heard of **continue with h)**

---

d) How much is the input of animal waste into the biogas tank?

	Chicken	Goat	Pig	Cow
1. < 5 kg/day				
2. 5- < 10 kg/day				
3. 10- < 20 kg/day				
4. 20- < 30 kg/day				
5. 30 kg/day and more				

---

e) How much biogas are you able to produce?

1 < 500 l/month
2. 500 – 1000 l/month
3. > 1000 l/month

---

f) How much biogas do you use?

	Cooking	Heating	Bathing	Washing
1. < 50 l/day				
2. 50 - < 100 l/day				
3. 100 - < 200 l/day				
4. 200 - < 300 l/day				
5. 300 l/day and more				

---

g) Are you also using the slurry (a by-product from biogas) as additional compost / fertilizer for the vegetables?

0. No
1. Yes
2. Have not thought of it

---

h) What is the cooking / heating system you are using?

1. (Fuel-) Wood
2. LPG tank
3. Electricity

---

i) How much (fuel-) wood / LPG are you using?

	Cooking	Heating	Bathing	Washing
1. < 5 kg/day				
2. 5–10 kg/day				
3. > 10 kg/day				

****

Thank you very much for your time!

****

Questionnaire Darjeeling District (Nepali)

I Statistical Information

a) Gender:
1. Keta
2. Keti

b) Umer:
1. bis dekhi muni
2. bis dekhi un chalis
3. chalis dekhi sathi
4. sathi dekhi mathi

II. Kheti sanga jodia ko prashnaharu

a) Kati jana manche tapai ko kheti ma kaam gardai cha?

1. panch dekhi muni
2. panch dekhi tara dus bhanda kamti
3. dus dekhi pandhra samma
4. pandhra bhanda besi

---

b) Tapai krishak bhako kati saal bhayo?

1. panch bhanda kamti
2. panch barsa tara dus bhanda kamti
3. dus barsa tara bees bhanda kamti
4. bees ani bees dekhi besi

---

c) Tapai ko khet ko size kati ho?

1. dus m^2 bhanda kamti
2. dus dehki pachas m^2
3. pachas m^2 bhanda besi

1. tees decimals bhanda kamti
2. tees tara pachas decimals bhanda kamti
3. pachas dekhi eek sau decimals samma

---

d) Tapai lay pashu palan garnu huncha?

0. chaina **If No, continue with e)**
1. cha **If Yes, continue with d_1)**

---

d_1) Ke ke palnu huncha? Ani kati wata?

	Kukhura
1. dui dekhi kamti	
2. dui dekhi panch	
3. panch bhanda besi	

	Bakhra	**Sungur**	**Guy**
1. ek dekhi dui			
2. teen ya besi			

---

e) Tapai le kasto khalke kheti garnu hundaicha?

1. Conventional (chemicals chalaunu huncha) **continue with f)**
2. Organic (chemicals chalaunu hun dai na) **continue with h)**
3. Traditional (chemicals, kamti chalaunu hundcha tara kamti fasal ko variety) ***continue with $e3_1$***

---

f) Kasto khalke chemicals chalaunu huncha?

1. Pesticides
2. Insecticides
3. Herbicides

g) Chemicals ke matra ma chalaunu huncha (kati)?

1. duiso pachas gram bhanda kamti har m^2 ko lagi
2. duisai pachas dekhi panso gram har m^2 ko lagi
3. panso gram bhanda besi har m^2 ko lagi

h) Conventionally- tapaile kasto khalke fasal umarnu huncha?

1. mula
2. bandh gobi
3. kakra
4. tamatar
5. aru kai: ______________________________

i) Conventionally tapai ko kati fasal huncha?

1. pandhra kg bhanda kamti
2. pandhra kg tara tees bhanda kamti
3. tees kg pai talis bhanda kamti
4. paitalis dekhi sathi kg samma
5. satt thi dekhi besi

j) Tapai lay conventional kheti garada mahinama kati amdani huncha?

1. ache sau rupiah bhanda kamti
2. ache sau tara dui sau bhanda kamti
3. dui sau tara char sau bhanda kamti
4. char sau tara chha sau bhanda kamti
5. chha sau rupiah dekhi besi

III. Questions about Organic and Square Meter Farming

a) Kasto khalke organic/conventional fasal bechnu huncha?

1. tamatar
2. pyach
3. bandh gobi
4. baigun
5. aru kai: ______________________
____
____

b) Tapai ko organic/SMF fasal kati huncha?

1. pandhra kg bhanda kamti
2. pandhra kg tara tees bhanda kamti
3. tees kg pai talis bhanda kamti
4. paitalis dekhi sathi kg samma
5. satt thi dekhi besi

c) Tapai le organic/SMF /conventional ma umarno bhaye ko fasal afno gharma pani chalaunoo huncha?

1. chaina
2. cha
3. thaha chaina

d) Yus fasal umare ko ma kati chai ghar ma khanu huncha?

1. panch kg bhanda kamti
2. panch dekhi dus kg
3. dus kg dekhi besi

e) Conventional kheti rha organic/SMF kheti ko tulna garda tapai lai kasto anubhav bhayo?

1. ekdam ramro anubhav
2. ramro anubhav
3. kehi ramro anubhav bhaena

f) Organic/SMF conventional kheti bhanda kati safal ani sahayak cha?

1. ekdam safal ani sahayak
2. safal ani sahayak
3. safal ani sahayak chaina

g) Organic/SMF le kasto khalke fasal umarnu huncha?

1. tamatar
2. ful gobi
3. bandh gobi
4. pyach
5. aru kai: ____________________
____
____

h) Mahina-ma kati jasto le tapai ko amdani sudhre ko cha (organic/SMF)?

1. ache sau rupiah bhanda kamti
2. ache sau tara dui sau bhanda kamti
3. dui sau tara char sau bhanda kamti
4. char sau tara chha sau bhanda kamti
5. chha sau rupiah dekhi besi

IV. Biogas ma prashna

a) Tapai le afno organic mal banaunu hundaicha?

0. chaina
1. cha

b) Pasoo bata payeko mal le bio-gas banayera tataunoo rha pakaunoo sochnoo bhae ko cha?

0. chaina **If No, continue with h)**
1. cha **If Yes, continue with c)**
2. kahile sune ko chaina **continue with h)**

c) Tapaile biogas chalaunu hundaicha?—tataunu/pakaunu ko lai?

0. chaina **If No, continue with h)**
1. cha **If Yes, continue with d)**
2. kahile sune ko chaina **continue with h)**

d) Biogas tank ma kati chai pashu ko waste halnu huncha?

Harek din...	**Kukhura**	**Bakhra**	**Sungur**	**Guy**
1. panch kg bhanda kamti				
2. panch kg tara dus bhanda kamti				
3. dus dekhi kg tara bees bhanda kamti				
4. bees kg tara tees bhanda kamti				
5. tees kg ani besi				

e) Kati biogas banaunu saknu huncha?

1. harek din panso l bhanda kam
2. harek din panso dekhi ek hazar l
3. harek din ek hazar bhanda besi

f) Tapaile kati biogas chalaunu huncha?

Harek din...	**Pakaunu**	**Tataunu**	**Nuhaunu**	**Dhunu**
1. pachas l bhanda l kam				
2. pachas l tara sau bhanda kamti				
3. ek sau l tara dui sau bhanda kamti				
4. dui sau l tara teen sau bhanda kamti				
5. teen sau l ani teen sau bhanda besi				

g) Aroo mal sathai bio-gas bata niskay ko pani panni chalaunu hudaicha sabji ko lagi?

0. chaina
1. cha
2. kahile so che ko chuina

h) Tapaile kasto pakaune/tataune tarika chalaunu hun daicha?

1. (Fuel-) daura
2. LPG
3. bijuli

i) Kati (fuel)daura /LPG tapaile chalaunu chalaunu hundaicha?

Harek din...	**Pakanu**	**Tatanu**	**Nuhanu**	**Dhunu**
1. panch kg bhanda kamti				
2. panch dekhi dus kg samma				
3.dus kg bhanda besi				

****

Dhanyabad tapai le samay denu bhaeko lagi!

****

Questionnaire Kanto (English)

I. Statistical Information

a) Gender:
1. Male
2. Female

b) Age:
1. below 20
2. 20 - 39
3. 40 - 60
4. above 60

II. Questions concerning farm and farming practice

a) Number of people working on the farmland:

1. < 2
2. 2 - < 4
3. 4 - < 6
4. 6 and above

---

a_1) Do you hire external labour?

0. No
1. Yes, about: ______________ (fill in number)

1a) Seasonal 1b) Full-Time

---

b) Since how many years are you a farmer?

1. less than 5 years
2. 5 to less than 10 years
3. 10 to less than 20 years
4. 20 years and above

---

b_1) Are you a full-time or part-time farmer?

1. Full-time Farmer
2. Part-time Farmer

2a) How many days do you engage in farming? _______ days/year

2b) Other Part-time Profession: ________________________

3. Vegetable/Fruit/Rice/Floriculture/Livestock/Others:________

---

c) What is your farm-size?

Pure Cultivation Land:	Total Farm Land (incl. Greenhouse/Pasture/ Cow Shed/Housing/Others):
1. < 0.5 ha	6. < 0.5 ha
2. 0.5 - < 2.0 ha	7. 0.5 - < 2.0 ha
3. 2.0 - < 4.0 ha	8. 2.0 - < 4.0 ha
4. 4.0 - < 6.0 ha	9. 4.0 - < 6.0 ha
5. 6.0 ha and above	10. 6.0 ha and above

---

c_1) Is your land

1. Your own (bought), since __________
2. Inherited (Family), since __________
3. Leased, since __________

---

d) Do you have any livestock?

0. No **If No, continue with e)**
1. Yes **If Yes, continue with d_1)**

---

d_1) What kind and how many of livestock do you have?

	Chicken		Goat	Pig	Cow		Others
	Egg	**Meat**			**Milk**	**Meat**	
1. < 2							
2. 2 – 5							
3. > 5							

---

e) What type of farming are you practicing at present?

1. Conventional (i.e. use of chemicals & chemical spray) **continue with f)**
2. Organic (i.e. no use of chemicals) **continue with e_1)**

---

e_1) Are you in conversion period or fully organically converted?

1. Conversion Period
2. Fully Organically Converted, since ________

---

e_2) Are you a certified organic farmer?

0. No
1. Yes, since ____________

---

f) What kind of chemicals do you use?

1. Pesticide/Insecticide
2. Herbicide
3. Fungicide
4. Nitrogen Fertilizer (N)
5. Phosphate Fertilizer (P)
6. Potassium Fertilizer (K)
7. Organic Pesticide/Insecticide

---

f_1) How often do you use chemical spray per year?

_______________________ per year

---

f_2) How much chemical fertilizer do you use per 10 a in a year?

_______________________ per 10 a in a year

---

g) What kind of crops are you growing conventionally?

1. Tomato
2. Chinese Cabbage
3. Cucumber
4. Radish
5. Others: ____________________________________

---

h) What kind of conventional crops do you sell?

1. Tomato
2. Chinese Cabbage
3. Lettuce
4. Cabbage
5. Others: ____________________________________

---

i) How much is your conventional yield per year?

1. < 1 t
2. 1 – < 20 t
3. 20 – < 50 t
4. 50 – 100 t
5. > 100 t

j) How much is your conventional sales income (in Yen) per year?

1. < 500 000 ¥
2. 500 000 ¥ - < 5 000 000 ¥
3. 5 000 000 ¥ - < 10 000 000 ¥
4. 10 000 000 ¥ - < 50 000 000 ¥
5. 50 000 000 ¥ - < 100 000 000 ¥
6. 100 000 000 ¥ and above

k) Are you a member of a TEIKEI group?

0. No
1. Yes
2. Never heard of

l) Where do you sell your (conventional / organic) vegetables?

1. Directly to Consumer
2. JA
3. Directly to Supermarket
4. Others: _____________

III. Questions about Organic Farming

a) What kind of organic crops do you grow?

1. Cucumber
2. Chilli
3. Brussel Sprout
4. Cauliflower
5. Others: __________________
____

b) What kind of organic crops do you sell?

1. Tomato
2. Lettuce
3. Chinese Cabbage
4. Eggplant
5. Others: ______________________
____
____

c) What is your assessment about Organic Farming, after practicing it?

1. Very Good
2. Good
3. Satisfactory
4. Unsatisfied

d) How successful and helpful is Organic Farming compared to Conventional Farming?

1. Very successful and helpful
2. Successful and helpful
3. Unsuccessful and unhelpful

e) How much is your yield per year from organic crops?

1. < 15 kg
2. 15 – < 30 kg
3. 30 – 45 kg
4. 45 – 60 kg
5. > 60 kg

f) Is the organic yield enough for home consumption? /
Is the conventional yield enough home consumption?

0. No
1. Yes
2. Do not know (I cannot say Yes or No)

g) How much of your monthly organic / conventional yield is for personal (family) use?

1. < 5 kg
2. 5 – 10 kg
3. > 10 kg

h) How much is your organic income per year?

1. < 500 000 ¥
2. 500 000 ¥ - < 5 000 000 ¥
3. 5 000 000 ¥ - < 10 000 000 ¥
4. 10 000 000 ¥ - < 30 000 000 ¥
5. 30 000 000 ¥ - < 50 000 000 ¥
6. 50 000 000 ¥ and above

IV. Questions about Compost and Biogas

a) Are you making your own organic compost?

0. No
1. Yes

b) Have you considered using biogas (produced from animal waste) for heating / cooking?

0. No **If No, continue with h)**
1. Yes **If Yes, continue with c)**
2. Never heard of **continue with h)**

c) Are you using biogas for heating / cooking?

0. No **If No, continue with h)**
1. Yes **If Yes, continue with d)**
2. Never heard of **continue with h)**

d) How much is the input of animal waste into the biogas tank?

	Chicken	Sheep	Pig	Cow
1. < 5 kg/day				
2. 5- < 10 kg/day				
3. 10- < 20 kg/day				
4. 20- < 30 kg/day				
5. 30 kg/day and more				

e) How much biogas are you able to produce?

1. < 500 l/month
2. 500 – 1000 l/month
3. > 1000 l/month

f) How much biogas do you use?

	Cooking	Heating	Bathing	Washing
1. < 50 l/day				
2. 50 - < 100 l/day				
3. 100 - < 200 l/day				
4. 200 - < 300 l/day				
5. > 300 l/day				

g) Are you also using the slurry (a by-product from biogas) as additional compost / fertilizer for the vegetables?

0. No
1. Yes
2. Have not thought of it

h) What is the cooking / heating system you are using?

1. (Fuel-) Wood
2. Kerosene
3. Gas
4. Electricity

i) How much (fuel-) wood / kerosene / gas are you using?

	Cooking	Heating	Bathing	Washing
1. < 5 kg/day				
2. 5 – 10 kg/day				
3. > 10 kg/day				

****

Thank you very much for your time!

****

Questionnaire Kanto (Japanese)

I. Toukei jouhou

a) Seibetsu:

1. (Male)
2. (Female)

b) Anata no nenrei wo oshiete kudasai:

1. ni juu sai miman (below 20)
2. ni juu sai kara san juu kyu sai made (20-39)
3. yon juu sai kara roku juu sai made (40-60)
4. roku juu sai yori ue (above 60)

II. Anata no nogyoo keiei ni tsuite ukagaimasu

a) Nooen de wa nan nin hataraite imasu ka:

1.	futari miman	< 2
2.	futari kara yo nin miman	2 - < 4
3.	yo nin kara roku nin miman	4 - < 6
4.	roku nin ijoo	6 and above

---

a_1) Anata wa koyourodousha wo yatotte imasu ka?
Soto kara roudousha wo yatotte imasu ka?

0. Iie
1. Hai, yaku ________________ (fill in number)

1a) Kisetsu-roudousha 1b) Nenkan-koyou

---

b) Nan nen kan anata wa noogyo wo itonan de kimashita ka?

1.	go nen miman	< 5
2.	go nen kara juu nen miman	5 - < 10
3.	juu nen kara ni juu nen miman	10 - < 20
4.	ni juu nen ijoo	20 and above

---

b_1) Anata wa sengyou noka desu ka kengyou noka desu ka?

1. Sengyou noka
2. Kengyou noka

2a) Nan nichi nougyou wo shite imasu ka/ichi nen? __________Nichi ichi nen ni
2b) Noogyoo igai no shigoto wa nan desu ka ________________
3) Yasaii/Kudamono/Kome/Hana/Chikusan/Sonota:______________

---

c) Anata no keiei kibo wa donogurai desu ka?

Koochi menseki:

1.	rei ten go hekutaaru miman	< 0.5 ha
2.	rei ten go hekutaaru kara ni hekutaaru miman	0.5 - < 2.0 ha
3.	ni hekutaaru kara yon hekutaaru miman	2.0 - < 4.0 ha
4.	yon hekutaaru kara roku ha hekutaaru miman	4.0 - < 6.0 ha
5.	roku hekutaaru ijoo	6.0 ha and above

Zen nooen menseki (Onishitu/houbokujo/Chikusha/iye/sonota: ______________):

6.	rei ten go hekutaaru miman	< 0.5 ha
7.	rei ten go hekutaaru kara ni hekutaaru miman	0.5 - < 2.0 ha
8.	ni hekutaaru kara yon hekutaaru miman	2.0 - < 4.0 ha
9.	yon hekutaaru kara roku hekutaaru miman	4.0 - < 6.0 ha
10.	yon hekutaaru ijoo	6.0 ha and above

---

c_1) Tochino syoyuukeitai wa nan desu ka

1. Anata ga jibun de kounyuushita tochi, itsu kara __________
2. Souzoku ni yoru mono, itsu kara __________
3. Syakuchi, itsu kara _________

---

d) Anata wa kachiku wo katte imasu ka?

0. Iie **If No, continue with e)**
1. Hai **If Yes, continue with d_1)**

---

d_1) Donna kachiku wo donogurai katte imasu ka?

	Niwatori		Yagi	Buta	Ushi		Sonota
	Tamago	**Niku**			**Milk**	**Niku**	
1. ni miman < 2							
2. ni kara go wa made 2 - 5							
3. go yori ooi > 5							

---

e) Genzai doo taipu no noogyou wo shite imasu ka?

1. Futsuu Noogyo (kagakuhiryo to nouyako wo tsukatta noogyou) **continue with f)**
2. Yuuki Noogyo (kagakuhin wo tsukawa nai noogyou) **continue with e_1)**

---

e_1) Anata wa yuuki noogyo ni tenkanchu desu ka, soretomo sudeni yuuki noogyo wo hajimete imasu ka?

1. Tenkanchu
2. Subete tenkanzumi, itsu kara _________________

---

e_2) Anata wa yuki noogyo no ninshou wo ukete imasu ka?

0. Iie
1. Hai, itsu kara ________

---

f) Dono youna kagakuhin wo tsukatte imasu ka?

1. Satchuzai
2. Josoozai
3. Sakkinzai
4. Chisso hiryo (N)
5. Rinsan hiryo (P)
6. Kari hiryo (K)
7. Shizen Nooyaku

---

f_1) Nankai nouyaku wo sampu shimasu ka (ichi nen ni)?

__________________ Ichi nen ni

---

f_2) Donokurai kagakuhiryou wo makimasu ka (ichi nen 10 a atari)?

__________________ Ichi nen 10 a atari

---

g) Donna sakumotsu wo futsuu saibai shite imasu ka?

1. Tomato
2. Hakusai
3. Kyuri
4. Daikon
5. Sono hoka no sakumotsu: _______________________

---

h) Dono youna futsuu saibai sakumotsu wo uttemasu ka?

1. Tomato
2. Hakusai
3. Lettuce
4. Cabbatsu
5. Sono hoka no sakumotsu: ________________________

V. Mai toshi no futsuu saibai shuukaku wa donogurai desu ka?

1. ichi tonnoru miman < 1 t
2. ichi t kara ni juu t miman 1 t – < 20 t
3. ni juu t kara go juu t miman 20 t – < 50 t
4. go juu t kara hyaku t made 50 t – 100 t
5. hyaku t yori ooi > 100 t

j) Futsuu saibai shuunyu wa mai toshi ikura desu ka?

1. < 500 000 ¥ miman
2. 500 000 ¥ kara - < 5 000 000 ¥ made miman
3. 5 000 000 ¥ kara - < 10 000 000 ¥ made miman
4. 10 000 000 ¥ kara - < 50 000 000 ¥ made miman
5. 50 000 000 ¥ kara - < 100 000 000 ¥ made miman
6. 100 000 000 ¥ mata wa sore ijoo

k) Anata wa Sanchoku (TEIKEI) guruupu no member (ni haitte imasu ka) desu ka?

0. Iie
1. Hai
2. Kiitakotoganai

l) Doko de anata wa (futsuu saibai / yuuki) sakumotsu wo uttemasu ka?

1. Chokubai
2. JA
3. Supamaketo ni chokusetsu orosu
4. Sonota:________________________

III. Yuuki noogyo ni tsuite no shitumon

a) Yuuki saibai de donoyoona sakumotsu wo saibai shiteimasu ka?

1. Kyuri
2. Toogarashi
3. Mekyabetsu
4. Kalifurawaa
5. Sono hoka no sakumotsu: ________________________
____

b) Dono you na yuuki sakumotsu wo uttemasu ka?

1. Tomato
2. Le ta su
3. Hakusai
4. Nasu
5. Sono hoka no sakumotsu: ____________________
____
____

c) Anata wa Yuuki Nogyo ni tsuite shita ato, donoyoo ni hyouka shite imasu ka?

1. Totemo yoi
2. Yoi
3. Maa maa
4. Fuman

---

d) Yuuki Nogyoo wa futsuu saibai noogyo ni kurabete dou desu ka?

1. Totemo Yakuni tatsu
2. Yakuni tatsu
3. Yakuni tatanai

---

e) Yuuki saibai ni yoru mai toshi no shukaku wa donogurai desu ka?

1.	juu go kg miman	< 15 kg
2.	juu go kg kara san juu kg miman	15 – < 30 kg
3.	san juu kg kara yon juu go kg made	30 – 45 kg
4.	yon juu go kg kara roku juu kg made	45 – 60 kg
5.	roku juu kg yori ooi	> 60 kg

---

f) Yuuki /Futsuu saibai ni yoru shuukaku ryou wa anata no iede shouhi suru noni tarite imasu ka?

0. Iie
1. Hai
2. Dochiratomo ie nai

---

g) Anata wa mai tsuki no yuuki / futsuu shuukaku no uchi, donogurai no ryou wo kojin yoo (katei de) tsukatte masu ka?

1.	go kg miman	< 5 kg
2.	go kg kara juu kg made	5 – 10 kg
3.	juu kg yori ooi	> 10 kg

---

h) Yuuki shuunyu wa mai toshi ikura desu ka?

1. < 500 000 ¥ miman
2. 500 000 ¥ kara - < 5 000 000 ¥ made miman
3. 5 000 000 ¥ kara - < 10 000 000 ¥ made miman
4. 10 000 000 ¥ kara - < 30 000 000 ¥ made miman
5. 30 000 000 ¥ kara - < 50 000 000 ¥ made miman
6. 50 000 000 ¥ mata wa sore ijoo

IV. Taihi to Seibutsu gas ni tsuite no shitsumon

a) Anata wa jibun no taihi wo tsukutte imasu ka?

0. Iie
1. Hai

---

b) Seibutsu Gas (kyuhi; kachiku no haisetsubutsu kara tsukurareta gas) wo danboo ya choori no energy-gen toshite tsukau koto wo kangaeta kotoga arimasu ka?

0.	Iie	**If No, continue with h)**
1.	Hai	**If Yes, continue with c)**
2.	Kiita koto ga nai	**continue with h)**

---

c) Seibutsu Gas wo danboo ya choori ni tsukatte masu ka?

0. Iie **If No, continue with h)**
1. Hai **If Yes, continue with d)**
2. Kiita koto ga nai **continue with h)**

---

d) Yuuki gas tanku ni donogurai no kachiku no haisetsubutsu (kyuhi) wo irete imasu ka?

Ichi Nich Atari:	**Niwa**	**Hitsuji**	**Buta**	**Ushi**
1. go kg miman < 5 kg/day				
2. go kg kara juu kg made miman 5- < 10 kg/day				
3. juu kg kara ni juu kg miman 10- < 20 kg/day				
4. ni juu kg kara san juu kg miman 20- < 30 kg/day				
5. san juu kg ijoo 30 kg/day and more				

---

e) Hitotsuki atari, doregurai no yuuki gas wo tsukure masu ka?

1. go hyaku littoru miman < 500 l/month
2. go hyaku littoru kara sen littoru made 500 – 1000 l/month
3. sen littoru yori ooi > 1000 l/month

---

f) Ichi nich atari donogurai yuuki gas wo tsukai masu ka?

Ichi Nich Atari:	**Choori**	**Danboo**	**Furo**	**Sentaku**
1. go juu littoru < 50 l/day				
2. go juu lit. kara hyaku lit. miman 50 - < 100 l/day				
3. hyaku lit. kara ni hyaku lit. miman 100 - < 200 l/day				
4. ni hyaku lit. san byaku lit. miman 200 - < 300 l/day				
5. san byaku littoru ijoo 300 l/day and more				

---

g) Yuuki gas kara no hukusanbutsu wo yasai no tsuihi ni tsukatte imasu ka?

0. Iie
1. Hai
2. Kangaeta koto ga nai

---

h) Danboo ya choori ni wa genzai nani wo tsukatte imasu ka?

1. (Nenryou) Maki
2. Touyu
3. Gas
4. Denki

---

i) Doregurai no nenryou wo genzai tsukatte imasu ka?

Ichi Nich Atari:	**Choori**	**Danboo**	**Furo**	**Sentaku**
1. go kg miman < 5 kg/day				
2. go kg kara juu kg made 5–10 kg/day				
3. juu kg yori ooi > 10 kg/day				

****

Ojikan wo tsukawasete sumimasen – Doumou arigatoo gozaimasu!

****

SPSS Tables Kanto

(Source: own field survey, 2002-2003)

Table A1: Prefectures and villages of surveyed farmers

KANAGAWA	Fujino, Ichiki, Kanazawa, Kuno, Kurami, Ninomiya, Odawara, Sagamihara-shi, Shiroyama, Tebiro, Tsui-gun, Tsukui-gun, Yugawara
TOKYO	Hachio-ji, Hamura-shi, Higashi Murayama-shi Hinohara-mura*, Hino-shi, Kokubun-ji, Machida-shi Todoroki
CHIBA	Sakura-shi, others*
SAITAMA	Hatogaya-shi, Hiki-gun, Kadodaira*, Kawanoto-machi, Ogawa-machi, Terai*, Tokorozawa-shi

* indicates postal survey

Table A2: Altitude of survey area

	No.	%
< 100 m	34	68
100 -< 200 m	5	10
200 -< 300 m	8	16
400 -< 500 m	1	2
500 -< 600 m	1	2
600 -< 700 m	1	2
Total	50	

Table A3: Organic conversion since (in years)

	No.	%
0	1	2.8
< 5	6	16.7
5 -< 10	4	11.1
>= 10	21	58.3
Total	32	88.9
Missing	4	11.1
Total	36	

Table A4: Synthetic or chemical input used

	No.	%
Organic Fertilizers/Insecticides	15	30
Organic Fertilizer	19	38
common Agrochemicals	12	24
Chemical Fertilizer	1	2
Chemical Fertilizer & Organic Insecticide	1	2
Chemical & Organic Fertilizer	2	4
Total	50	

Table A5: Farmland status * farming practice cross-tabulation

		non-certified Organic	Conventional	certified Organic	Total
bought by Farmer	Count	5	1		6
	within Status of Farmland	83,3%	16,7%		100,0%
Inherited from/belongs to family	Count	12	12	1	25
	within Status of Farmland	48,0%	48,0%	4,0%	100,0%
Leased	Count	9	1	1	11
	within Status of Farmland	81,8%	9,1%	9,1%	100,0%
Leased; Inherited	Count	4			4
	within Status of Farmland	100,0%			100,0%
Leased; Bought	Count	3			3
	within Status of Farmland	100,0%			100,0%
Bought; Inherited; Leased	Count	1			1
	within Status of Farmland	100,0%			100,0%
Total	Count	34	14	2	50
	within Status of Farmland	68,0%	28,0%	4,0%	100,0%

Table A6: Organic and conventional cultivation land

Landholding	m^2 (ha)	Organic		Conventional	
		No.	%	No.	%
	< 1,000 (<0.1)	-----	-----	1	7.1
	1,000 - < 5,000 (0.1-<0.5)	8	22.2	6	42.9
Marginal	5,000 - < 10,000 (0.5-<1.0)	18	50.0	4	28.5
Small	10,000 - < 20,000 (1.0-<2.0)	4	11.1	2	14.2
Above 2 ha	>= 20,000 (>2.0)	6	16.7	1	7.1
Total		36		14	

Table A7: Organic and conventional total farmland

m^2 (ha)	Organic		Conventional	
	No.	%	No.	%
< 10,000 (<1.0)	19	52.8	8	57.1
10,000 - < 20,000 (1.0-<2.0)	4	11.1	2	14.2
20,000 - < 30,000 (2.0-<3.0)	4	11.2	2	14.2
> 30,000 (>3.0)	5	14.0	-----	-----
Total	32	89.1	12	85.5
Missing	4	11.1	2	14.3
Total	36		14	

Table A8: General overview of crops cultivated * farming practice cross-tabulation

		non-certified Organic	certified organic	Conventional	Total
Vegetables	Count	11	1	6	18
	% within VAR00011	61,1%	5,6%	33,3%	100,0%
	% within Farming Practice	32,4%	50,0%	42,9%	36,0%
Veg., Rice & Tea	Count	1			1
	% within VAR00011	100,0%			100,0%
	% within Farming Practice	2,9%			2,0%
Vegetables & Fruits	Count	2		3	5
	% within VAR00011	40,0%		60,0%	100,0%
	% within Farming Practice	5,9%		21,4%	10,0%
Veg., Fruit & Millet	Count	1			1
	% within VAR00011	100,0%			100,0%
	% within Farming Practice	2,9%			2,0%
Fruits & Tea	Count	1			1
	% within VAR00011	100,0%			100,0%
	% within Farming Practice	2,9%			2,0%
Veg,. Fruits & Tea	Count	2		3	5
	% within VAR00011	40,0%		60,0%	100,0%
	% within Farming Practice	5,9%		21,4%	10,0%
Veg. & Rice	Count	7	1	1	9
	% within VAR00011	77,8%	11,1%	11,1%	100,0%
	% within Farming Practice	20,6%	50,0%	7,1%	18,0%
Veg., Fruits & Rice	Count	9		1	10
	% within VAR00011	90,0%		10,0%	100,0%
	% within Farming Practice	26,5%		7,1%	20,0%
Total	Count	34	2	14	50
	% within VAR00011	68,0%	4,0%	28,0%	100,0%
	% within Farming Practice	100,0%	100,0%	100,0%	100,0%

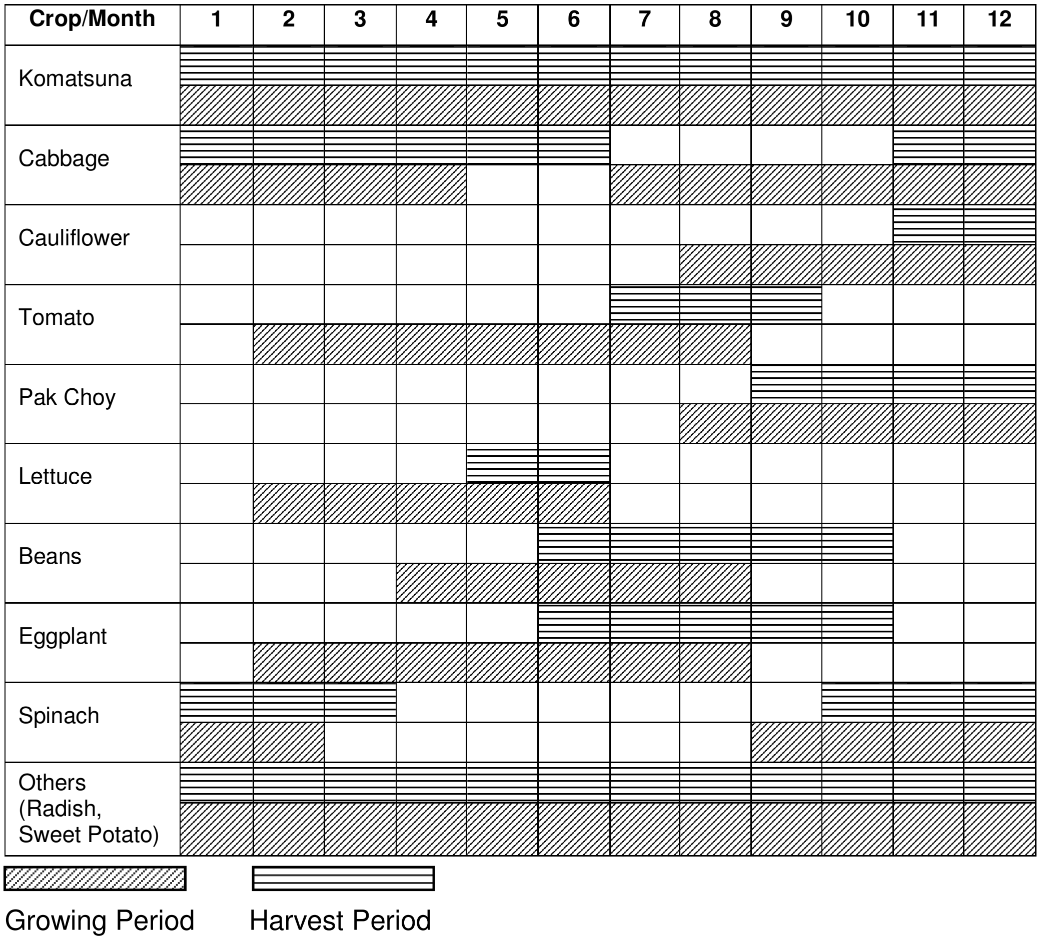
Table A9: Agricultural income from crops

		Organic		**Conventional**	
Yen/yr (€/yr)		No.	%	No.	%
0 (Home consumption only)		1	2.8	-----	-----
< 500,000 (< 4,000)	low	5	13.9	7	50.0
500,000 - < 5,000,000 (4,000-<40,000)		16	44.4	3	21.4
5,000,000 - < 10,000,000 (40,000-<80,000)	medium	5	13.9	1	7.1
(∅ Agricultural Income Kanagawa, Saitama, Chiba & Tokyo in 2002): ¥ 9,452,400 (around € 70,500)					
> 10,000,000 (>80,000)	high	7	19.4	2	14.3
Total		34	94.4	13	92.9
Missing		2	5.6	1	7.1
Total		36		14	

Planting Pattern of Organic Farmer Ohira, Greater Tokyo

(Source: OHIRA, 2003; *abridged*; *unpublished*)

Table A10



SASAC SMF-Vegetables and Sales Prices, Darjeeling District

(Source: SASAC, 2002a; *unpublished*)

Table A11

No.	Vegetables	SASAC Code	Total Harvest Cycle Days	Yield of Vegetables per m^2
1	Broccoli	BCC	104	16
2	Carrot	C	159	350
3	Beetroot	BR	104	49
4	Cabbage	CAB	124	16
5	Cauliflower	CAU	96	16
6	Celery	CEL	130	16
7	Chinese. Raya	CRS	43	30
8	Coriander (Dhania)	D	49	250 g Seedpacket
9	Dwarf Bean	DB	83	-
10	Lali Saag	LS	67	49
11	Lettuce	LT	81	49
12	Fenugreek (Methi)	M	40	250 g Seedpacket
13	Kohlrabi (Knol Khol)	NK	105	49
14	Parsley	PR	107	16
15	Pea	PE	52	Traditional planting not m^2
16	Potato	PT	76	Traditional planting not m^2
17	Radish Local	RL	58	196
18	Radish Japanese	RJ	76	196
19	Raia Saag	RS	47	30
20	Swiss Chard	SC	128	25
21	Spring Onion	SO	97	196
22	Spinach	SP	53	400
23	Mustard (Tori)	T	39	250 g Seedpacket
24	Table Radish	TR	53	196
25	Turnip	TUR	84	49

SASAC Planting and Harvest Table for SMF-Vegetables, Darjeeling District

(Source: SASAC, 2002b; *unpublished*)

Table A12

Days	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	32	60	91	121	152	182	213	244	274	305	335
2	2	33	61	92	122	153	183	214	245	275	306	336
3	3	34	62	93	123	154	184	215	246	276	307	337
4	4	35	63	94	124	155	185	216	247	277	308	338
5	5	36	64	95	125	156	186	217	248	278	309	339
6	6	37	65	96	126	157	187	218	249	279	310	340
7	7	38	66	97	127	158	188	219	250	280	311	341
8	8	39	67	98	128	159	189	220	251	281	312	342
9	9	40	68	99	129	160	190	221	252	282	313	343
10	10	41	69	100	130	161	191	222	253	283	314	344
11	11	42	70	101	131	162	192	223	254	284	315	345
12	12	43	71	102	132	163	193	224	255	285	316	346
13	13	44	72	103	133	164	194	225	256	286	317	347
14	14	45	73	104	134	165	195	226	257	287	318	348
15	15	46	74	105	135	166	196	227	258	288	319	349
16	16	47	75	106	136	167	197	228	259	289	320	350
17	17	48	76	107	137	168	198	229	260	290	321	351
18	18	49	77	108	138	169	199	230	261	291	322	352
19	19	50	78	109	139	170	200	231	262	292	323	353
20	20	51	79	110	140	171	201	232	263	293	324	354
21	21	52	80	111	141	172	202	233	264	294	325	355
22	22	53	81	112	142	173	203	234	265	295	326	356
23	23	54	82	113	143	174	204	235	266	296	327	357
24	24	55	83	114	144	175	205	236	267	297	328	358
25	25	56	84	115	145	176	206	237	268	298	329	359
26	26	57	85	116	146	177	207	238	269	299	330	360
27	27	58	86	117	147	178	208	239	270	300	331	361
28	28	59	87	118	148	179	209	240	271	301	332	362
29	29		88	119	149	180	210	241	272	302	333	363
30	30		89	120	150	181	211	242	273	303	334	364
31	31		90		151		212	243		304		365

	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	continued from below:						
1	366	397	425	456	486	517	**22**	387	418	446	477	507	538
2	367	398	426	457	487	518	**23**	388	419	447	478	508	539
3	368	399	427	458	488	519	**24**	389	420	448	479	509	540
4	369	400	428	459	489	520	**25**	390	421	449	480	510	541
5	370	401	429	460	490	521	**26**	391	422	450	481	511	542
6	371	402	430	461	491	522	**27**	392	423	451	482	512	543
7	372	403	431	462	492	523	**28**	393	424	452	483	513	544
8	373	404	432	463	493	524	**29**	394		453	484	514	545
9	374	405	433	464	494	525	**30**	395		454	485	515	546
10	375	406	434	465	495	526	**31**	396		455		516	
11	376	407	435	466	496	527							
12	377	408	436	467	497	528							
13	378	409	437	468	498	529							
14	379	410	438	469	499	530							
15	380	411	439	470	500	531							
16	381	412	440	471	501	532							
17	382	413	441	472	502	533							
18	383	414	442	473	503	534							
19	384	415	443	474	504	535							
20	385	416	444	475	505	536							
21	386	417	445	476	506	537							

Afforestation conducted by the Kurseong Soil Conservation, Darjeeling District

(Source: KURSEONG SOIL CONSERVATION, 2002; *unpublished*)

Table A13

Location Area (Division)	ha	Location Area (Division)	ha
Year 1991 Total	**285**	**Year 1992**	**306**
Rithu Block (Darjeeling Division)	25	Kankebong (Darjeeling Division)	46
Rongbong (Darjeeling Division)	20	Rongbong (Darjeeling Division)	20
Rongtong (Darjeeling Division)	10	Rongtong (Darjeeling Division)	10
Pokhriabong (Darjeeling Division)	10	Ghoom (Darjeeling Division)	20
Senchal (Darjeeling Division)	20	Pashim (Darjeeling Division)	20
Mahalderam III (Kurseong Division)	10	Mahalderam III (Kurseong Division)	10
Phuguri (Kurseong Division)	10	Phuguri (Kurseong Division)	20
Nurbong (Kurseong Division)	30	Nurbong (Kurseong Division)	20
Shivakhola (Kurseong Division)	20	Shivakhola (Kurseong Division)	15
Mechi (Kurseong Division)	100	Mechi (Kurseong Division)	100
Dhobijhora (Kurseong Division)	10	Paglajhora (Kurseong Division)	25
Sethikhola (Kurseong Division)	20		
Year 1993 Total	**288**	**Year 1994 Total**	**332**
Kankebong (Darjeeling Division)	58	Kankebong (Darjeeling Division)	50
Poobong (Darjeeling Division)	20	Poobong (Darjeeling Division)	20
Rongbong (Darjeeling Division)	20	Sukhiapokhori (Darjeeling Division)	20
Paglajhora (Kurseong Division)	20	Lingding (Darjeeling Division)	12
Shivakhola (Kurseong Division)	20	Badamtam (Darjeeling Division)	30
Mahalderam III (Kurseong Division)	40	Mahalderam III (Kurseong Division)	60
Phuguri (Kurseong Division)	20	Phuguri (Kurseong Division)	20
Jhenakuri (Kurseong Division)	20	Selim Hill (Kurseong Division)	20
Mechi (Kurseong Division)	25	Babukhola (Kurseong Division)	15
Balasun (Kurseong Division)	45	Dhobijhora (Kurseong Division)	5
		Tarabari (Kurseong Division)	40
		Nirpania (Kurseong Division)	20
		Gola (Kurseong Division)	20
Year 1995 Total	**183**	**Year 1996 Total**	**280**
Kankebong (Darjeeling Division)	50	Kankebong (Darjeeling Division)	50
Poobong (Darjeeling Division)	10	Poobong (Darjeeling Division)	25
Lingding (Darjeeling Division)	12	Ghoom (Darjeeling Division)	10
Senchal (Darjeeling Division)	10	Ramam (Darjeeling Division)	30
Seeoke (Darjeeling Division)	11	Gurasadara (Darjeeling Division)	25
Simlijhora (Darjeeling Division)	5	Rangbull (Darjeeling Division)	10
Sim (Darjeeling Division)	25	Paschim (Darjeeling Division)	60
Mahalderam III (Kurseong Division)	40	Mungwar (Darjeeling Division)	5
Paglajhora (Kurseong Division)	20	Paglajhora (Kurseong Division)	20
		Mahalderam V (Kurseong Division)	15
		Tarabari (Kurseong Division)	30
Year 1997 Total	**220**	**Year 1998 Total**	**308**
Poobong (Darjeeling Division)	20	Rithu (Darjeeling Division)	10
Gurasadara (Darjeeling Division)	20	Gurasadara (Darjeeling Division)	40
Phalut (Darjeeling Division)	40	Phalut (Darjeeling Division)	20
Sandakphu (Darjeeling Division)	30	Sandakphu (Darjeeling Division)	30
Sureil (Darjeeling Division)	40	Sureil (Darjeeling Division)	78
Sim (Darjeeling Division)	10	Lepcha Lagat (Darjeeling Division)	30
Tarabari (Kurseong Division)	30	Mangwar (Darjeeling Division)	20
Paglajhora (Kurseong Division)	20	Paglajhora (Kurseong Division)	50
Kundong (Kurseong Division)	10	Dhobijhora (Kurseong Division)	10
		Mangwar (Kurseong Division)	20
Year 1999 Total	**285**	**Year 2000 Total**	**270**
Sandakphu (Darjeeling Division)	30	Sandakphu (Darjeeling Division)	30
Mungwar (Darjeeling Division)	5	Mungwar (Darjeeling Division)	15

Lepchajhagat (Darjeeling Division)	70	Ghoom (Darjeeling Division)	50
Sureil (Darjeeling Division)	80	Dooteriah (Darjeeling Division)	13
Shivakhola (Kurseong Division)	27	Shivakhola (Kurseong Division)	20
Paglajhora (Kurseong Division)	3	Paglajhora (Kurseong Division)	12
Dhobijhora (Kurseong Division)	10	Mahalderam II (Kurseong Division)	80
Tarabari (Kurseong Division)	40	Tarabari (Kurseong Division)	40
Andheri (Kurseong Division)	20	Kungdung (Kurseong Division)	10
Year 2001 Total	**230**	**Year 2002**	**----**
Dooteriah (Darjeeling Division)	135	At time of Field Survey, Data was not available	
Sureil (Darjeeling Division)	15		
Mungwar (Darjeeling Division)	12		
Berrick (Darjeeling Division)	28		
Tarabari (Kurseong Division)	12		
Shivakhola (Kurseong Division)	28		

CV

PERSONAL DATA

Name, Prename	SAXENA, Shilpi
Address	e-Mail: shilpi.saxena@students.uni-mainz.de shilpi.saxena@web.de

ACADEMICS (PhD Research)

02/05	**PhD Degree**; Grade: “very good” (“magna cum laude”)
07/01 - 01/05	**PhD research Geography, University of Mainz, Germany** Title of thesis: “Sustainable Development in Darjeeling Hills, India: Ecological and Socio- Economic Sustainability for Small-Scale Farmers with Supportive Observations from Kanagawa, Japan”
02/04 – 03/04 & 10/03 – 11/03	**Center for Development Research (ZEF), Bonn, Germany** International Doctoral Program for Development Studies (Concepts and Theories of Development; Natural Resource Management)
05/02 – 03/03	**Field Research:** **Darjeeling District, India and Kanagawa Prefecture/Kanto, Japan** Grant by the DAAD (German Academic Exchange Service)
12/01 – 12/03	Scholarship (“Landesgraduiertenförderung“) by University of Mainz

UNIVERSITY STUDIES

09/00	**Master of Science (“Diplom”) in Geography, University of Mainz, Germany** Grade: “very good” Title of honours project: “Do Urban Parks in Hong Kong Contribute towards Recreation and City Image – Assessment and Planning Proposals on Selected Examples in Kowloon“, Grade: “excellent“ Scholarship for the honours project from University
11/98	**“Vordiplom“ in Geography, University of Mainz, Germany**
10/96 – 09/00	**Johannes Gutenberg University, Mainz, Germany** Geography, Botany, Geology
03/99 and 03/98	Excursions to **Thailand** and to the **Ivory Coast** (West–Africa)
10/95 – 08/96	**Johann Wolfgang Goethe University, Frankfurt, Germany** Economics

SCHOOL CARRIER

06/95 — **High School Diploma ("Abitur"), Germany**
Private High School, **New Orleans, Louisiana, USA**
childhood spent in **France** and in **The Netherlands**

WORK ABROAD / INTERNSHIPS GEOGRAPHY & ECONOMICS

12/01 — **BioFach Japan, Tokyo, Japan**
Representative for the Company Ambootia (Indian Organic Tea from Darjeeling District) at the BioFach, the International Organic Trade Fair

08/01 — **oikos PhD summer academy 2001, University of St. Gallen, Switzerland**
International workshop for PhD-Students, with presentation of my thesis topic

03/01 – 04/01 — **ABC Enterprises Inc., Tokyo, Japan**
Internship: promotion of the Bio Fach Japan (International Organic Trade Fair) to Embassies, Organic Farmers and Natural Food Stores, research on Organic Agriculture

11/99 – 01/00 — **German Aerospace Center (DLR) Cologne/Porz, Germany**
Internship

07/99 – 10/99 — **Hong Kong Baptist University, Department of Geography, Hong Kong**
Internship

03/98 – 04/98 — **Monteviot Tea Estate, Darjeeling, India**
Internship

03/97 – 04/97 — **HICHEM (Rhone Poulenc Group), Bhiwani, India**
Internship

08/96 – 09/96 — **ARTHUR C. PULITZER Designs, Harahan, Louisiana, USA**
Internship

08/95 – 09/95 — **Accountants Bornhausen & Kaufmann, Frankfurt, Germany**
(part of the International Network of Accountants and Auditors, INAA)
Internship

07/95 — **AgrEvo (Hoechst & Schering), Frankfurt, Germany**
Internship