2003–2005 Medium-Term Plan

AVRDC – the World Vegetable Center

AVRDC—the World Vegetable Center is an international not-for-profit organization committed to ensuring the world's food security through research, development, and training.

Acknowledgements:

AVRDC acknowledges the assistance of its staff in the preparation of this document, specifically Dr. Tom Kalb as author of Chapters 1–3 and Dr. Jürgen Friedrichsen as author of Chapter 4 and Annex 2. Annex 1 was developed by a team of scientists consisting of Drs. Peter Hanson, Tom Kalb, Subramanyam Shanmugasundaram, Jaw-Fen Wang, and Katinka Weinberger under the leadership of Dr. Jürgen Friedrichsen. The plan was edited by Tom Kalb and the cover was designed by Chen Ming-che. Photos were contributed by AVRDC staff; R. Grossman (p. 7), R. Chalasani (p. 8 bottom), and S. Becchio (p. 10 middle) of the International Fund for Agricultural Development; and United States Agency for International Development (p. 8 middle).

Published by AVRDC—the World Vegetable Center
P.O. Box 42, Shanhua, Taiwan 741
tel: +886 6 583 7801
fax: +886 6 583 0009
http://www.avrdc.org
e-mail: avrdcbox@netra.avrdc.org.tw

AVRDC Publication 03-560

Suggested Citation:

AVRDC. 2003. AVRDC medium-term plan: 2003–2005. Shanhua, Taiwan: AVRDC—the World Vegetable Center. AVRDC Publication 03-560. 47 pp.

AVRDC Medium-Term Plan 2003–2005

Table of Contents

Foreword

As the leading international center for vegetable research in the world, AVRDC is pleased to present our accomplishments for the past year and plans for the future. In 2002 our scientists made remarkable advancements using new technologies and partnerships. For example, using the speed and precision of molecular-based breeding tools, AVRDC and its partners developed lines that resist several of the most severe diseases of tomato and pepper in the tropics—in less than half the time used in conventional breeding methods. These lines are already doubling yields, protecting crops, and reducing the use of pesticides in parts of the developing world today. I invite you to read more about this and many other impacts, beginning on page 3.

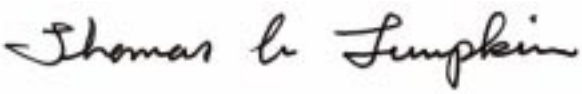
Despite our achievements last year, the needs and opportunities in the developing world in 2003 are greater than ever. Conflicts are ongoing around the world and health epidemics are spreading in East Africa and now Asia. The economies of much of the developing world are faltering. Malnutrition continues unabated as billions of people suffer from micronutrient deficiencies, in large part due to lack of adequate access to vegetables. Under these global circumstances, the mission of AVRDC has never been more important. This is not a time for retrenchment of such a crucial aid organization, but a time to rise to the challenge.

This challenge is being addressed at AVRDC—the World Vegetable Center with a new set of research and development priorities. These include greater efforts in delivering our technologies to regions of distress, and a more precise research focus on increased productivity, improved stability in vegetable supplies, sustaining the environment, and greater food quality and safety.

Our new approach also means a new geographic view for the Center. No longer limited to tropical Asia, with new donor support our outreach will approach the most seriously affected regions facing nutritional distress and suffering, anywhere in the world. Regions passed over in terms of economical development, afflicted by HIV/AIDS, and decimated by drought and war will draw our focus. As the world's only international center focused on vegetables, we must not neglect any area that calls for our expertise and technologies.

I am pleased to share with you the AVRDC Medium-Term Plan 2003–2005. It is a document that was developed with the input of AVRDC staff and its networks of partners. Using a concise format, this document presents an update of the Center, emerging trends in the vegetable sector, and our strategic approaches in empowering needy farmers and populations in the developing world.

A rebirth of AVRDC is now underway. Regional politics have hindered the Center from its start, but determined new efforts will offset and alleviate those constraints. With your help and our global partners, we can create a new vision and reach new levels of productivity and impact. AVRDC, which for three decades *had a mission*, now finds itself *on a mission*. This mission is to realize the potential of vegetables in creating a bright future for members of humanity beset by malnutrition and poverty.



Dr. Thomas A. Lumpkin
Director General

Organizational Statement

Our Mission

Reduce malnutrition and poverty among the poor through vegetable research and development

Our Strategy

Build partnerships and mobilize resources from private and public sectors to promote vegetable production and consumption in the developing world. Our research will contribute to:

- Increased productivity of the vegetable sector
- Equity in economic development in favor of rural and urban poor
- Healthy and more diversified diets for low-income families
- Environmentally friendly and safe production of vegetables
- Improved sustainability of cropping systems

Our Core Expertise

- Management of diverse vegetable germplasm
- Innovations in variety improvement, including the use of molecular tools
- Sustainable production of safe and nutritious vegetables in the tropics
- Networks of strategic alliances for generating and sharing knowledge
- Analysis of direct and indirect impacts of vegetables

Our Unique Role

AVRDC functions as a catalyst to:

- Build international and interdisciplinary coalitions that engage in vegetable and nutrition issues
- Generate and disseminate germplasm and technology that address needs of the poor
- Collect, characterize, and safeguard vegetable germplasm resources for worldwide use
- Provide globally accessible, user-friendly, science-based, appropriate technology

Chapter 1

Overview

Introduction

The Year 2003 marks the beginning of a new era for AVRDC—the World Vegetable Center. Powerful new technologies and emerging partnerships are creating new vistas for vegetable research that will certainly lead to unprecedented impacts.

AVRDC is dedicated to improving nutrition and reducing poverty through vegetable research.

AVRDC remains dedicated to improving nutrition and reducing poverty through improved production and consumption of vegetables. Our long-term strategy has evolved and been clearly defined. AVRDC's Strategy 2010 reflects the emergence of global economies and the remarkable advancements in applications of biotechnology and information technology. AVRDC will utilize these modern technologies to maximize its impact and efficiency in research and communication.

The following document is *AVRDC Medium-Term Plan: 2003–2005*. This plan has been developed with the input of the AVRDC staff and our networks of partners through a series of workshops. The plan complements our longer-term strategy, *Empowering Small-Scale Farmers for Knowledge-Based Agriculture: Strategy 2010*. We invite you to read this long-term plan, which is accessible on the AVRDC website at <www.avrdc.org>. The following medium-term plan highlights major successes of 2002, discusses vegetable production and consumption trends, describes our financial outlook, and defines our specific research and development goals for 2003–2005.

AVRDC—the World Vegetable Center

As an international center, the Center serves a special role. It is a catalyst for action—a catalyst for bringing international and interdisciplinary teams together to develop technologies, empower farmers, and address major issues in the developing world. AVRDC has been accumulating core expertise over the past 30 years. It is recognized as a world leader in the following areas related to vegetable research and development:

1. management of diverse vegetable germplasm;
2. innovations in crop improvement, including the use of molecular tools;
3. sustainable production of safe and nutritious vegetables in the tropics;
4. networks of strategic alliances for generating and sharing knowledge; and
5. analysis of direct and indirect impacts of vegetables.

As we look to the future, AVRDC will focus on its core expertise and build upon its strengths. At the same time, the Center will reach out to utilize the complementary expertise of partners. Extending such partnerships, including with the private sector, is vital for maximizing development impact.

Organizational structure and partnerships

A more flexible structure with reduced administrative layers is being established. AVRDC's program management level has been dissolved and is being replaced with a Deputy Director General for Research who will organize project-based teams. Staff have more responsibility to design and implement projects and be accountable of outputs.

Greater authority has been given to the directors of regional centers to focus on regional priorities with their respective partners. The center will expand partnerships with other centers, institutions, and universities for creative synergies and economic efficiency. Significant efforts are underway to increase the number of expert personnel in key areas of research.

Strategic partnerships, such as this international mungbean team, lead to impact.

AVRDC will strive to annually add two to three international staff positions for the most urgently required tasks such as regionally based project leaders, and headquarters-based researchers in advanced molecular biotechnology and marker development, nutrition, and breeding. Also, AVRDC will accelerate its Ph.D. student program in vegetable research for degree training to expand its working force in research and outputs.

AVRDC will intensify strategic alliances with advanced research institutes and CGIAR Centers. For example, AVRDC is a partner in the new horticulture initiative with U.S. universities, which focuses on horticultural crops in the developing world. AVRDC will build upon partnerships with CGIAR Centers in the areas of: whitefly control (with CIAT); peri-urban agriculture (with CIP); Gangetic Valley Consortium (with ICRISAT, CIMMYT and IRRI); integrated pest management (with ICIPE); and HIV/AIDS impacted regions (with ICRAF).

Strategic program direction

Four central themes have been established in our new strategic program direction:

1. Innovative germplasm enhancement technologies for greater productivity, consumer acceptance, and biofortification;
2. Year-round supply of safe and nutritious vegetables;
3. Indigenous vegetables for biodiversity, healthy diet and marketing; and
4. Interactive, user-friendly information management.

Programs will focus on major solanaceous crops (tomato, chili and sweet pepper, and eggplant), bulb alliums (onion and garlic), vegetable legumes (mungbean and vegetable soybean) and indigenous vegetables (many species). The main outputs, indicators, and expected milestones in 2003–2005 for the four central themes are presented in Annex 1.

The year-round supply of safe and nutritious vegetables is a priority of AVRDC research.

Chapter 2

Impact 2002

Virus-resistant tomatoes help farmers in India

Tomato farmers in India fear leaf curl viruses more than any other disease. Until recently there were no resistant cultivars—no cure whatsoever. In response, AVRDC put together a team of scientists from universities in India and the United States. This team used molecular-based tools to identify strains of the virus complex and select genes of resistance from wild tomato species. Remarkably, after only a few years of research, resistant lines were released in 2002. These lines produce twice the yield of the most popular lines in the region. Farmers now have cultivars that produce reliable yields and local consumers have access to nutritious tomatoes year-round.

A breakthrough for farmers in Africa

Late blight is a major disease of tomatoes grown in the African highlands during the cool-wet season. The bad news was, until recently, there were no resistant cultivars available to farmers in Africa, nor in most areas of the world. The good news is that, with the support of Germany, researchers at AVRDC and its Regional Center for Africa have developed five high yielding lines that resist the blight.

AVRDC strikes gold with vitamin-rich cherry tomatoes

In 2002 AVRDC added a new edition to its collection of golden tomatoes: cherry tomatoes that resist leaf curl viruses. AVRDC's golden tomatoes have three to six times more beta-carotene compared to red tomatoes. Beta-carotene is the natural precursor to vitamin A, an essential vitamin lacking in millions of people's diets. Indeed, vitamin A deficiency (VAD) is the leading cause of preventable blindness in children and raises a child's risk of death from infection. Pregnant women become more vulnerable to night blindness and maternal mortality, and there is a greater risk of mother-to-child HIV transmission. VAD affects the most innocent people in the world and AVRDC is fighting to eliminate the deficiency.

Advanced detection method for bacterial wilt

Bacterial wilt caused by *Ralstonia solanacearum* (Rs) is the most severe disease for tomato production in the tropics during the hot-wet season. A sensitive detection method is essential for designing an effective disease management package. With the support of the ROC, AVRDC has developed a new detection method called enrichment-PCR, using primers specific to Rs and a selective medium to enrich the pathogen for better sensitivity. This advancement will facilitate ecological studies that can determine sources of future epidemics.

Hybrid peppers break the yield barrier

The production of sweet pepper in the tropics is limited by excessive heat and diseases. Hybrid vigor may be utilized to develop lines that grow vigorously, set fruit easily, and resist diseases under stressful conditions. In 2002 AVRDC began testing new experimental hybrid peppers—the results are impressive and show great promise. Whereas no AVRDC inbred line has ever matched the yields of hybrid cultivar Andalus, our screening identified several experimental hybrids that outperformed Andalus in both spring and summer trials. The best of these hybrids are being evaluated for future release.

Stable resistance to anthracnose—achieved

Anthracnose is one of the most damaging diseases of pepper—no commercial cultivar can resist it. AVRDC has identified sources of resistance in wild species and bred that resistance into cultivated peppers. Laboratory studies confirm AVRDC has developed several breeding lines that resist the three most virulent species of anthracnose in the tropics. This broad-based, genetically stable resistance is expected to withstand anthracnose under field conditions.

Grafted pepper opens new markets for growers

Consumers are asking for more sweet peppers—but farmers in the tropics struggle to grow the weak-rooted crop. Chili pepper has a stronger root system that can better tolerate heat, drought, bacterial wilt, and flooding. In 2002 AVRDC grafted sweet pepper plants onto chili pepper rootstocks. The results are encouraging. Under flooded conditions, yields of grafted plants for three top cultivars were increased by 111 to 221%. This strategy shows great potential to stabilize yields and enhance income for farmers during the off-season.

Partnership with tomato/pepper seed sector expands

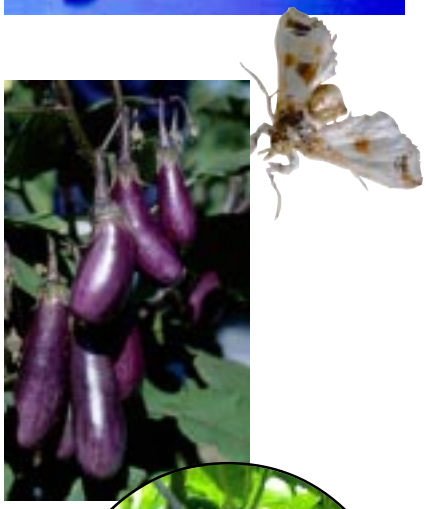
Collaboration between AVRDC and the private seed industry is strong and expanding. A survey of 29 Asian seed companies indicated that 33% of tomato and 16% of chili pepper cultivars to be released in the near future contain AVRDC germplasm. Seed companies value the high quality, uniformity, and disease resistance traits of AVRDC lines. Young, smaller seed companies benefit most from AVRDC, a positive sign that AVRDC supports new economic growth and opportunity.

Virus-free garlic and IPM–a smart strategy

AVRDC is helping garlic farmers incorporate virus-free planting materials into their production systems. These materials, developed from meristem-tip culture, produce much higher yields compared to crops grown using standard planting materials. With the support of Korea, AVRDC is developing technologies that maintain virus-free materials at minimal costs. Through the use of IPM, farmers can maintain their own meristem-derived materials for more than two generations in the open field and maintain the high yields of their original virus-free stock.

New mungbean lines quickly adopted by farmers

The impact of AVRDC's mungbean program continues to grow. Through a network of scientists in South Asia, seven new lines were released in Bangladesh, India and Bhutan. To facilitate the adoption of these high yielding lines, agronomic trials were conducted on sowing dates, seed rates, tillage requirements, fertilization, and irrigation practices. Over 5000 tons of seeds were produced by 18 agencies. These early maturing, mungbean yellow mosaic virus-resistant lines will be integrated into one million ha of fields using rice-wheat cropping systems by 2005, with the assistance of the Department for International Development (DFID) of the UK. These lines will enrich the soil, improve diets of the poor, and generate new income for farmers.



Simple, safe strategy for controlling borer in eggplant

Eggplant fruit and shoot borer is the most serious pest of eggplant in Asia and Africa. To combat the pest, some farmers spray their crop 60 or more times during the growing season. They often use the wrong chemicals, at wrong dosages, and at wrong times. With the help of DFID, AVRDC and a team of scientists in Bangladesh, India and Thailand have developed a safe strategy to control the pest. The strategy involves clipping damaged shoots to remove larvae, using pheromones to trap moths, and allowing natural predators to attack the borers. The method has succeeded in on-farm testing and is now being transferred through NARES.

Discovering—and utilizing—indigenous vegetables

AVRDC is preserving biodiversity and tapping the potential of underutilized vegetables. With support from the Asian Development Bank, AVRDC and collaborating researchers in Bangladesh, India, Indonesia, Thailand, and Vietnam have collected over 5000 new accessions of native vegetables through 2002. In related research, hundreds of lines from promising indigenous vegetables, such as amaranth, kangkong, ivy gourd and spiny bitter cucumber, were evaluated for yield and nutritional properties. Top performers were identified and seeds are being multiplied for international evaluation and distribution.

Feeding megacities in Vietnam, Cambodia, and Laos

The populations of urban areas in Southeast Asia are expanding rapidly. With assistance from France, the national ministries in Vietnam, Cambodia and Laos are working with AVRDC and CIRAD to increase the affordability and accessibility of vegetables in cities. In 2002, surveys were conducted to analyze local vegetable production and marketing systems in each nation's major cities. Intensive training was conducted on developing technologies for producing safe vegetables, particularly during the off-season. Research on developing technologies for off-season production and leafy vegetables were initiated.

The latest in vegetable research—at your finger tips

AVRDC is the gateway for information on vegetable research. In 2002 AVRDC librarians regularly searched scientific literature for new publications on vegetable research. The findings were published monthly and accessed by 551 vegetable researchers from 35 countries. Over 12,000 users from over 100 countries accessed the AVRDC Learning Center, from which thousands of documents were read and downloaded via the internet. Over 40,000 bibliographic records of vegetable research are now on-line, the largest collection of its kind in the world.

Trainees come to AVRDC in record numbers

In 2002, AVRDC trained 116 persons, the most in its history. More graduate students and more undergraduate students were trained than ever. Trainees received intensive, hands-on instruction on an array of research topics that ranged from mapping the genetic code of tomato viruses, to identifying promising lines of underutilized vegetables, to understanding phytochemicals that attract insects to specific crops.

New technologies developed, transferred in Africa

The AVRDC Regional Center for Africa (RCA) is the hub for vegetable research and training in Africa. Researchers developed a wealth of new technologies in 2002. For example, superior lines were identified for tomato, pepper, onion, garlic, and eggplant. In a study supported by Germany, neem was identified as the best natural pesticide to control diamondback moth, a severe pest on cabbage. Production practices for indigenous vegetables were advanced. Technologies were transferred through courses conducted in southern Sudan and Zambia. In addition, 43 scholars from 12 countries and hundreds of local families developed skills through training at RCA.

National scientists throughout Asia trained

Trainers at the AVRDC Asian Regional Center (ARC) were busy throughout the region in 2002. Seed production courses were conducted in Pakistan, Sri Lanka and Thailand. Off-season production courses were conducted in Vietnam and Laos. Through the support of the Swiss Agency for Development and Cooperation, researchers from Bhutan, Cambodia, China, Laos, Myanmar, and Vietnam received extensive training at ARC. Research programs studied the effects of rain shelters on pepper production, seed storage techniques of soybean, and new mungbean lines with resistance to powdery mildew.

Filipino farmers, trainers share knowledge in schools

Technology transfer through Farmer Field Schools (FFS) was the focus of the German-funded, metro Manila peri-urban project in 2002. The FFS approach, a hands-on approach in which farmers and trainers work together to evaluate new technologies at local sites, was used to train over 500 farmers, extension specialists, and local officials. Training focused on leafy vegetable and off-season production.

Chapter 3

Outlook and Objectives 2003

Trends in vegetable production

Vegetable production is steadily increasing in much of the developing world. In South and Southeast Asia, there have been mean annual increases of 5.3% and 4.4% respectively during the past 20 years (Fig. 1).[1] Yields per hectare have also increased, mostly due to the introduction of improved technologies and management techniques (Fig. 2). Despite these gains, not enough vegetables are grown in Asia to adequately nourish its population, particularly during the hot-wet season.

Long-term trends in vegetable production are not available for Africa, but short-term developments are distressing. Drought, floods, and the relentless HIV/AIDS epidemic have ravaged vegetable and indeed, all of agriculture production throughout the continent. The HIV/AIDS crisis has especially reduced productivity in vegetable cultivation, a labor-intensive enterprise.[2] Current levels of farm production cannot keep pace with rising population growth.[3] Food emergencies have been declared in several countries of Sub-Saharan Africa and up to 35 million persons will require food aid to survive.[4]

Looking globally, international trade is opening new markets for farmers in developing countries. However, over 95% of vegetables consumed in developing countries are produced locally.[5] Developing countries will need to feed themselves. Lack of foreign exchange in these countries will continue to limit the importation of food.

Trends in vegetable consumption

Vegetables are essential for human health.[6] They are a rich source of many essential micronutrients, including vitamins C and K, folate, thiamine, carotenes, several minerals, and dietary fiber. In fact, vegetables are the most sustainable and affordable food-based sources of micronutrients.

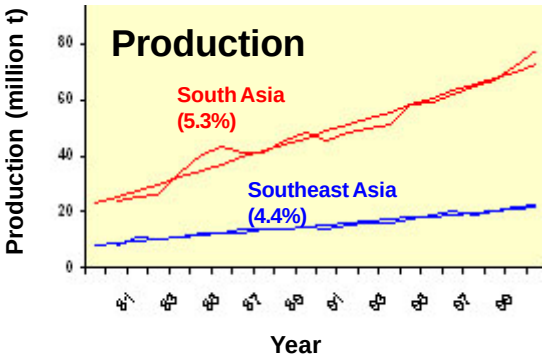


Fig. 1. Vegetable production levels are steadily rising in South and Southeast Asia.

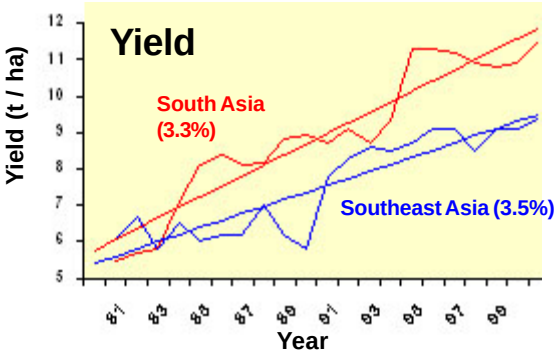


Fig. 2. Vegetable yields continue to increase throughout South and Southeast Asia.

Over 95% of vegetables consumed in developing countries are produced locally. To remedy widespread malnutrition, local farmers must be empowered with modern skills and technologies.

Despite the importance of vegetables to the diet, much of the world does not have adequate access to this food. This has contributed to a severe micronutrient crisis. Two billion persons, the vast majority of whom are women and children, are not getting the micronutrients they need to live healthy lives.[7] Poor diets lead to poor mental and physical development, poor performance in school, poor productivity in the workplace, and the likelihood of poverty in future generations.[8]

In Asia, although vegetable production is increasing at a higher rate compared to other major food crops, not enough vegetables are available, thereby contributing to widespread malnutrition (Fig. 3).[9]

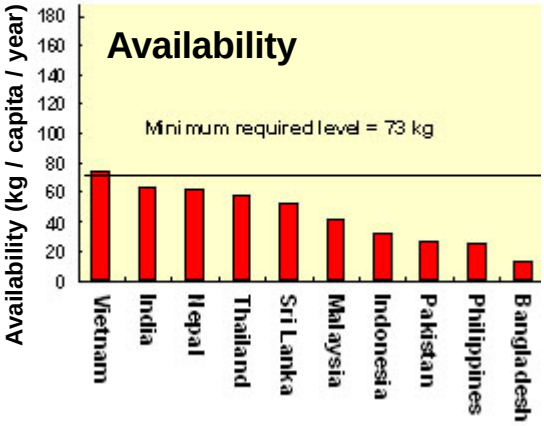


Fig. 3. There are insufficient supplies of vegetables in Asia for proper nutrition.

Malnutrition is also rampant in Sub-Saharan Africa where millions of families are facing severe hunger today. Most of the 615 million people do not have adequate access to food.[10] Of even greater concern is that conditions are expected to worsen. The International Food Policy Research Institute predicts an 18% rise in the number of malnourished children from 2001 to 2020.[11] Malnutrition is already linked to more than 50% of infant and child mortality in the region.[12]

Malnutrition is rampant in Sub-Saharan Africa and food emergency programs are required to prevent widespread starvation. Conditions are expected to worsen in the future. Increased access to nutrient-rich vegetables is critically needed to improve the population's health and reduce harmful effects of diseases.

The harmful effects of vegetable-deficient diets are further compounded by the HIV/AIDS crisis. Malnutrition hastens the progression of HIV and increases transmission rates from mother to child. Mounting evidence indicates that early HIV infection is linked with dietary deficiencies of vitamin A and zinc,[13] nutrients that can be obtained from vegetables. Vitamin supplements are a short-term solution, but the World Health Organization reports that a longer lasting solution to these deficiencies, especially in rural areas of Southeast Asia and Africa, involves vegetable gardening.[14]

Main objectives of AVRDC

AVRDC is focused on increasing ***productivity***. This is the first step to improving nutrition. A recent study has shown that a 1.0% increase in agricultural productivity and outputs in developing countries leads to a reduction in the malnutrition of children by at least 0.4%.[15]

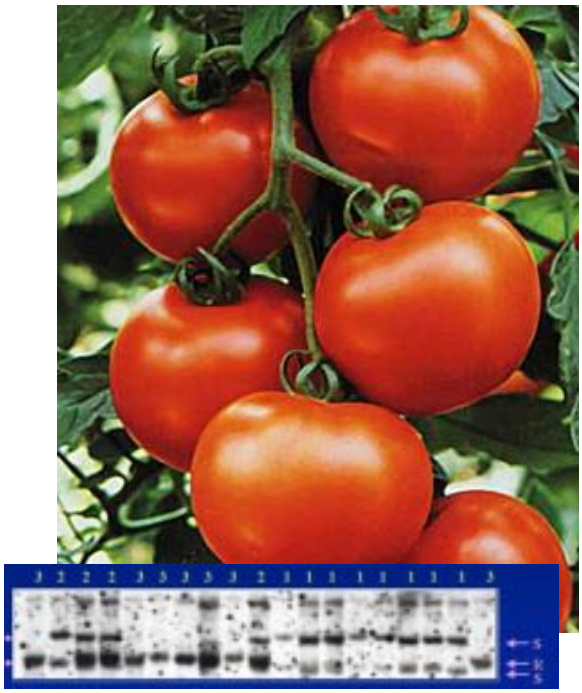
Productivity is key. Increasing yields will improve nutrition, generate jobs, and break the cycle of poverty. Shown here are women earning income by de-stemming a productive harvest of peppers.

Besides reducing malnutrition, greater productivity generates more jobs (more jobs compared to cereal production)[16] and generates more income (more

income than most other agricultural products).[17, 18] More income will lead to more vegetable consumption[19] and this will help break the vicious cycle of malnutrition that causes persistent poverty.

To increase productivity, AVRDC is placing greater emphasis on developing hybrid cultivars. The natural boost of vigor possessed by hybrids is being used to fight the stresses of disease, heat, and drought. This boost was clearly shown in our sweet pepper research of 2002, when newly developed AVRDC hybrids demonstrated unprecedented yield and fruit qualities.

AVRDC is focused on improving ***stability***. Disease, heat, drought, and flooding all threaten stability of vegetable supplies. In this regard, AVRDC's variety improvement programs made remarkable impact in 2002. Our interdisciplinary team of plant breeders, pathologists, and biotechnicians developed tomato lines that resist late blight and leaf curl viruses and pepper lines that resist anthracnose. These are all breeding breakthroughs—no commercial cultivars have resistance to any of these major diseases. AVRDC will share this germplasm with all nations and all seed companies. With regard to the latter, there is a dramatic increase in the use of AVRDC germplasm by private seed companies. One-third of tomato hybrids being released in Asia today contains AVRDC germplasm. Free access to this germplasm has especially benefited young companies, a clear sign that AVRDC contributes to economic growth and development in rural areas. Our partnership with the private sector will continue to grow—these alliances are critical in the fight against hunger.



Molecular markers allow breeders to rapidly develop lines that are more productive and resist diseases in the tropics.

To increase both productivity and stability, AVRDC is placing greater emphasis on using molecular tools in its breeding programs. AVRDC breeders are designing user-friendly molecular markers that link to genes of disease resistance. Breeders can then use these molecular markers to select and build-up or "pyramid" these useful genes and achieve disease resistance that will be stable in the field. Molecular markers are also being used to discover genes in wild species that will resist insect pests, diseases, drought, and heat. Once discovered, these genes can be easily transferred into cultivated lines.

The potential impact of this revolutionary technology was evidenced last year in southern India, where tomato leaf curl virus (ToLCV) is the greatest threat to tomato production. In collaboration with Cornell University, AVRDC used molecular-based tools to identify strains of the virus, select genes of resistance from wild tomatoes, and breed the genes into cultivated lines. After only a few years, ToLCV-resistant lines were developed that produce twice the yield of the most popular varieties in the region.

AVRDC is focused on increasing ***sustainability***. The continous monocropping of cereal crops is reducing the fertility of soils, threatening yields, and depleting water tables in developing countries.[20] The *Green Revolution* has successfully raised yields of cereals, but these production systems are not environmentally sustainable. Furthermore, cereals cannot provide the micronutrients that are essential for human health and productivity. A new revolution, a *Greens Revolution*, one

focused on vegetables, is now needed to sustain the earth's precious soils and provide essential micronutrients for its people.

The revolution has already begun. AVRDC is working with teams of national scientists to develop early-maturing legumes and improved cultural practices that will incorporate legumes into cereal-based systems. Our mungbean team, for example, has developed new lines that will be sown in millions of hectares in South Asia. These legumes will enrich the soil, increase farmers' incomes, and improve diets in the region, where most of the world's poor people live.

AVRDC is focused on ensuring ***food safety***. Today's growers are inappropriately using toxic pesticides, threatening the health of themselves and consumers. In our peri-urban projects, we have seen growers spray crops the day of harvest, and sometimes even on the piles of harvested crops before they go to market. Accessibility to safe vegetables must be provided to all people. AVRDC is working with its partners to develop technologies that are safe for farmers, safe for consumers, and safe for the environment. Innovative technologies, such as insect barriers and pheromone traps, are reducing the need to spray insecticides. Disease-resistant cultivars are a natural means to fight diseases. Organic fertilization strategies are being used to improve soil structure and reduce dependence on chemical fertilizers. In 2003, AVRDC will launch research on organic production technologies of major vegetable crops to provide new options for pest and fertility issues affecting conventional producers.

The focus in all of our work is the welfare of ***people***. For that reason, socio-economics is an integral element of all projects. This expertise is helpful to understand the needs of clients before a project begins, the effects of a project during its implementation, and finally the ultimate impacts.

AVRDC is reaching out to even more people in the world's most neglected and distressed places. Plans are underway to help people in regions of Asia passed over by economic development, in the HIV/AIDS-afflicted areas of Africa, in war-torn regions of the Middle East, as well as Central and Northeast Asia. In this regard, AVRDC will truly be the world vegetable center that helps all people in the developing world reach their full capacity and enjoy healthy lives.

Adding legumes and vegetables into cereal-based systems are needed to enrich soil and provide nutritionally balanced diets in developing countries.

Sustainable production of safe vegetables are a priority. Shown here is a farmer of a co-operative in Ecuador that specializes in organic vegetable production.

AVRDC will extend its programs to more areas of the world, including economically distressed regions of Central and Northeast Asia.

Chapter 4

Financial Highlights 2002–2005

Financial results 2002

Increasing revenues in the middle of a business recession is difficult, yet AVRDC increased its revenues in 2002 to match its increase in expenditures.

Accrual accounting was implemented in 2002, which requires a change in the expression of budgets, compared to previous years.

Our operational fund reserves are 0.9 million USD covering 33 days of operation in 2003, which is far below the Consultative Group on International Agriculture Research (CGIAR) objective to cover at least 120 working days.

With a proportion of more than 50% core contribution (55% in Year 2002), the funding structure is reasonable. However, the developed country environment in Taiwan causes high personnel and operations costs which are much beyond the core contribution. This combined with blocked access to CGIAR funding makes the overall fiscal situation more difficult.

Medium-term financial outlook for 2003–2005

Worldwide demands for a diversified food intake, healthy diets, better nutritional quality, and safe vegetables are increasing. The challenge is to produce sufficient and sustained food-based supplies of essential mineral and micronutrients for the many health-suffering poor. These nutritional needs combined with increasing devastation by war, drought, epidemics, and failing economies justifies AVRDC's goal for growth.

With this in mind, the management of AVRDC developed a financial plan for its future operation with the objective of giving AVRDC—the World Vegetable Center, a rebirth as an adequately funded medium-size international agricultural center.

AVRDC's future development will continue to be based on economic soundness and cost efficiency, which was developed from the experienced funding constraints. As shown in Table 1, the Center is being realistic with expenditures and will not expand until efforts to improve core and project funding prove successful.

New initiatives, such as our project developing multi-disease-resistant chili peppers, are expanding AVRDC funding levels.

Table 1. Budget summary (in USD thousands)

	Estimated 2003	Estimated 2004	Estimated 2005
Income			
Core funds	5 063	5 200	5 400
Project funds	4 017	4 800	5 100
Other funds	372	414	468
Carryover funds from 2002	386		
Subtotal	**9 838**	**10 414**	**10 968**
Expenses			
Operations	9 635	10 175	10 688
Capital costs and depreciation	203	239	280
Subtotal	**9 838**	**10 414**	**10 968**
Balance	**0**		

Operational fund reserves

From 1990 the Center started to set aside operational fund reserves. These have been stagnant at 0.9 million USD since 1994, as our financial constraints did not allow us to enlarge those reserves (Fig. 4). The financial reserves are just enough to cover 33 days of operation. These reserves should be doubled by 2008 in order not to fall below the present coverage of 33 days operation (CGIAR Centers have an average reserve of more than 100 days and a target reserve of 120 days).

Cash flow

The Center will continue to keep a good liquidity position to meet all its obligations. The actual financial position is outlined in Table 2.

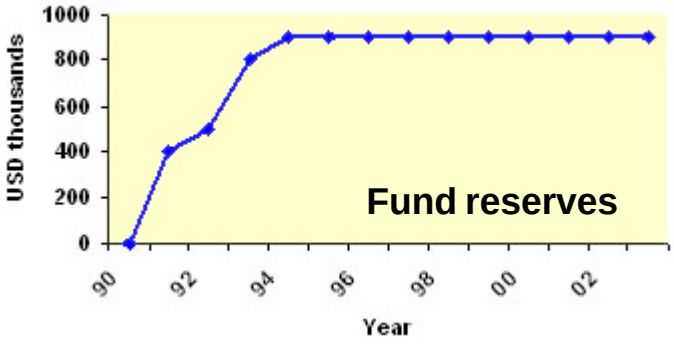


Fig. 4. Operational fund reserves 1990–2003.

Table 2. Financial position (in USD thousands)

	2001	2002
Assets		
Current assets	5 017	5 967
Properties/equipment	–	29
Subtotal	**5 017**	**5 996**
Liabilities		
Current liabilities	2 050	2 317
Net assets	2 967	3 679
Subtotal	**5 017**	**5 996**
Operational fund reserves	**900**	**900**
Operational fund (days)	**33**	**33**

Annex 1

Research Matrices

Summarized Objectives, Outputs, Indicators and Annual Milestones

Summarized Objectives, Outputs, Indicators, and Annual Milestones

Strategic Theme:

I. Innovative germplasm enhancement for greater productivity, consumer acceptance, and biofortification

Overall objective: **Improve vegetable germplasm and breeding technologies to increase the productivity of small-scale farmers and the research efficiency of partners**

Main Outputs	Indicators[1]	Annual Milestones[2]	Financial Source
1. Detecting and transferring important traits from wild species and other sources to broaden the genetic base			COA, NSC, Japan
1.1. Identification of resistance and other desirable traits from wild species	• Resistance to BW, ToLCV, and other traits in wild species identified • Resistance to anthracnose in wild species identified • Introgression of resistance traits from wild species conducted	2003: ‣ Additional accessions of *L. chilense*, *L. hirsutum*, and other species resistant to BW, ToLCV, and other traits identified ‣ Additional accessions of *C. chinense*, *C. baccatum*, and *C. frutescens* resistant to anthracnose, and other traits identified ‣ Introgression of desirable traits from wild species conducted 2004: ‣ Progenies of wild crosses advanced	
1.2. Molecular markers linked to desired traits like pest resistance for breeding purposes	• Molecular markers to tomato BW, ToLCV, and other traits developed • Molecular markers to pepper anthracnose developed • Molecular markers to mungbean bruchid and MYMV resistance developed	2003: ‣ Mapping population derived from PBC932 for pepper anthracnose mapping produced ‣ *L. hirsutum*-derived late blight resistance mapped and markers developed ‣ Populations for advanced backcross QTL in tomato produced ‣ Mapping population derived from NM92 and TC1966 for mungbean bruchid and MYMV resistance mapping produced ‣ Potential of applying molecular markers and ovule culture in breeding assessed	

[1] Indicators are long-term targets and concur with the timeframe of AVRDC's Strategy 2010.

[2] Annual milestones are the immediate targets for the given years.

Main Outputs	Indicators	Annual Milestones	Financial Source
		2004: ‣ Advanced backcross QTL populations evaluated for important tomato traits ‣ Anthracnose resistance genes mapped and characterized ‣ Mapping population for mungbean bruchid and MYMV resistance characterized ‣ Mapping of H7996 bacterial wilt resistance and new ToLCV resistance from *L. chilense*, *L. hirsutum* ‣ Marker-assisted selection for RKN, ToLCV integrated into breeding program 2005: ‣ Molecular markers linked to important tomato traits, e.g. BW, ToLCV, heat tolerance, CMV, etc. identified ‣ Mungbean bruchid and MYMV resistance mapping conducted	
1.3. Protocols for gene transformation and transgenic plant performance evaluation	• Protocols for transforming foreign genes into pepper, mungbean and soybean developed • Protocols to evaluate the effectiveness of gene constructs in tomato developed	2003: ‣ Regeneration and selection procedures for transgenic lines developed for pepper, mungbean, and soybean 2004: ‣ Selection procedures for disease resistance in tomato transgenic lines developed 2005: ‣ Field test of disease-resistant transgenic lines conducted	COA, NSC, BMZ/GTZ, DFID
2. High yielding, disease-resistant, tropically adapted tomatoes, peppers, vegetable legumes, onions, and crucifers			
2.1. High yielding tomato lines for the lowlands	• Raising yield level to 40-50 t/ha (+100%) under high T°, RH with good fruit quality • Stable BW and TYLCV resistance • Stable tospovirus resistance	2003: ‣ Strategy for summer hybrid determined ‣ 3–5 selected hybrids tested internationally ‣ BW, ToLCV strain diversity monitored (continuous) 2004: ‣ Heat tolerant tomato characterized/ strategy developed to increase heat tolerance levels ‣ Factors shaping BW strain population determined 2005: ‣ 3–5 lines with broad-based BW and TYLCV resistance tested in multilocation trials	

Main Outputs	Indicators	Annual Milestones	Financial Source
		‣ Importance of TSWV/WSMV in targeted areas determined ‣ Breeding for resistance to tospovirus initiated	
2.2. Disease-resistant tomato lines for the highlands	• Reduction of pesticide use by 50% • Multiple late blight resistance genes pyramided	2003: ‣ LB strain profile in Taiwan and other locations monitored (continuous) 2004: ‣ Lines with *L. hirsutum* and Ph-3 resistance evaluated internationally 2005: ‣ 3–5 lines with multiple late blight genes and multiple disease resistance evaluated internationally	
2.3. Heat-tolerant sweet pepper lines	• Raising yield level to 20–25 t/ha (+50%) under high T°, RH with good fruit quality • B. spot, (BS), Phytophthora blight (PB), ChiVMV, CMV, anthracnose resistance	2003: ‣ Strategy for hybrid summer sweet pepper determined ‣ Heat tolerant sweet pepper characterized 2004: ‣ 3 summer inbreds/ hybrids each with resistance to BS or PB developed and tested internationally 2005: ‣ Anthracnose- and B. spot-resistant sweet pepper lines developed ‣ Heat-tolerant inbreds/hybrids with resistance to 2 or 3 targeted diseases developed	
2.4. High yielding, disease-resistant chili pepper lines	• Raising yield level to 20–25 t/ha (+100%) under high T°, RH with good fruit quality • CMV, ChiVMV, BW, PB, anthracnose resistance incorporated • Stable resistance to leaf curl viruses	2003: ‣ Crosses completed to incorporate multiple disease resistance into highest yielding ICPN lines ‣ Interaction of available resistance sources with strains of major pathogens (CMV, ChiVMV, BW, anthracnose) from major chili production areas of S/SE Asia elucidated ‣ CMV/ChiVMV screening method refined 2004: ‣ Nominate several advanced breeding lines with resistance to 1, 2, or 3 diseases for international evaluation ‣ Importance of leaf curl viruses in targeted areas determined 2005: ‣ Multilocation testing of pepper leaf curl virus resistance sources initiated	

Main Outputs	Indicators	Annual Milestones	Financial Source
2.5. Vegetable legume	• Raising mungbean yield to 1 t/ha (+150%) in South Asia with MYMV resistance and early maturity (65 days) • Vegetable soybean varieties with 7–8 t/ha adopted in South and SE Asia, and Africa • Increase marketable yield and reduce post-harvest loss of mungbean 20% caused by bruchid • Impact of MYMV resistant mungbeans in South Asia assessed • Raising yield level to 20–25 t/ha (+50%) under high T°, RH with good fruit quality • B. spot, (BS), Phytophthora blight (PB), ChiVMV, CMV, anthracnose resistance	2003: ‣ MYMV strain diversity in S/SE Asia monitored ‣ MYMV-resistant mungbeans extended to farmers in S Asia in existing production areas ‣ Agronomic trials of mungbean in rice-wheat (RW) system conducted. ‣ Improved mungbean varieties evaluated in S Asia and Africa ‣ Baseline farm survey among mungbean farmers conducted in at least 2 Asian countries ‣ Technology developed to overcome barrier of interspecific direct crosses between blackgram and mungbean ‣ Vegetable soybeans are evaluated internationally. 2004: ‣ MYMV-resistant mungbeans evaluated in RW system in South Asia ‣ Farmers in S Asia begin producing and marketing vegetable soybeans ‣ Improved mungbean seed production and distribution mechanism established ‣ Interaction of local MYMV strains and available resistance sources understood ‣ Impact assessment survey among mungbean farmers conducted in at least 2 Asian countries ‣ Promising scented vegetable soybeans identified 2005: ‣ Biochemical factors characterized and traits of bruchid resistance in blackgram (VM2164) identified ‣ Promising scented vegetable soybeans evaluated in selected countries ‣ Improved mungbeans are extended to at least one million hectare in the RW system in S Asia	
2.6. Onion	• Multilocation test of genotypes with good storability • Selection of multiple disease resistance genes (SLB, PB) transferred from *A. fistulosum*	2004: ‣ Contribution of black mold (BM) resistance to enhance storability determined ‣ 5 onion lines with 20 t/ha yield tested and selected by NARS under short-day, cool-dry season in the tropics ‣ 5 onion lines with good storability developed 2005: ‣ Heritability of SLB resistance in *A. fistulosum* known	

Main Outputs	Indicators	Annual Milestones	Financial Source
2.7. Improved crucifers for vegetable consumption and oilseed production in the tropics	• Priorities and goals in crop improvement established • On-going collection, selection, breeding, and evaluation of targeted crucifer crop classes	2003: ‣ Literature reviewed and main constraints identified ‣ Accessions with improved traits obtained from internal and external programs 2004: ‣ Accessions screened for priority traits ‣ Crosses made between trait donors and targeted crucifer crop classes 2005: ‣ Field screening and lab analysis of progenies (on-going)	
3. Tomato, pepper, and vegetable legume lines with improved health promoting properties			COA, NSC, USAID, DFID
3.1. Tomato and sweet peppers with improved β-carotene levels	• Adoption of high β-carotene (3–5 mg/100 g fresh weight) tomato lines • Identification of high β-carotene (3–5 mg/100 g fresh weight) sweet pepper lines	2003: ‣ High β-carotene tomatoes evaluated internationally 2004: ‣ High β-carotene sweet pepper and tomato tested internationally 2005: ‣ Promotion of selected high β-carotene lines of tomato and sweet pepper	
3.2. Solanaceous vegetables with high level of antioxidant activities	• Genetic diversity in antioxidant contents/activities evaluated	2003: ‣ Capsicum, Lycopersicon and Solanum accessions screened for antioxidant contents/activities 2004: ‣ Accessions with high carotenoid and/or high antioxidant activities identified and crossed with elite lines 2005: ‣ Genetics of antioxidant activity of selected accessions determined	
3.3. Mungbeans with improved methionine and iron levels	• Improve the methionine level in mungbean by 75% • High Fe mungbean lines selected	2003: ‣ Crosses between mungbean (MB) and externally developed MB x Blackgram lines completed (refer also to 2.5) ‣ Screening mungbean lines for high Fe 2004: ‣ Selection of high methionine lines ‣ Evaluation of high Fe lines 2005: ‣ Evaluation of high methionine lines ‣ Multilocation testing of high Fe lines	

Main Outputs	Indicators	Annual Milestones	Financial Source
3.4. Vegetable legumes with high levels of health related factors	• Vegetable soybeans with high isoflavone and tocopherol content (+100%)	2003: ‣ Screening vegetable soybeans for isoflavone and tocopherol content 2004: ‣ Selection of promising lines with high isoflavone and tocopherol content 2005: ‣ Stability of isoflavones and tocopherol content in different locations and seasons	
4. Increased capacity of partners to conduct genetic improvement and seed production	• Researchers are capable of conducting genetic improvement and seed production	2003: ‣ 5 researchers trained at HQ in genetic improvement ‣ One training module (variety testing) ‣ One International Cooperators' Guide (variety testing) 2004: ‣ 5 researchers trained at HQ ‣ Seed production manual for training ‣ One training module on selected topic 2005: ‣ 5 researchers trained at HQ ‣ One training module	DFID
5. Better knowledge on the vegetable seed sector	• Constraints and opportunities for the vegetable seed sector in Asia are known and documented • The role of AVRDC genetic material for variety development and release by major players in the Asian vegetable sector is known and documented	2003: ‣ Seed sector assessment study conducted in GMS countries 2004: ‣ Utilization of AVRDC enhanced lines and total number of releases of major vegetable crops by NGOs in Asian countries analyzed ‣ Procedure for tracking varietal releases based on AVRDC material by the private sector is in place 2005: ‣ Updated analysis of the utilization of AVRDC enhanced lines and total number of releases of major vegetable crops by the private sector	

Summarized Objectives, Outputs, Indicators, and Annual Milestones

Strategic Theme:

II. Year-round supply of safe and nutritious vegetables

Overall objective: **Increase production and reduce the price seasonality of vegetables, with special emphasis on peri-urban vegetable production systems, to meet the growing demand from the urban population**

Main Outputs	Indicators[1]	Annual Milestones[2]	Financial Source
1. Recommendations of crops and varieties (fruit and leafy vegetables) for year-round production	• Characteristics of varieties for major vegetable crops compiled, tested, and disseminated	2003: ‣ Database of cultivars from public and private sectors initiated 2004: ‣ Develop protocol for multi-location evaluation of commercial varieties with partners 2005: ‣ Conduct cultivar testing of major vegetables with partners in SE Asia	BMZ/GTZ, France
2. Good agriculture practices (GAP) for year-round vegetable production 2.1. Crop sequences and management practices for short-cycle crops	• Yields of short-cycle leafy vegetables increase by 30–50%	2003: ‣ Suitable crop sequences for different leafy and indigenous vegetables tested at different environments ‣ Suitable farm practices (raised beds, fertilization, mulching) tested ‣ Rain shelter devices tested under different environments 2004: ‣ Rain shelter devices tested under different environments (continued) ‣ Suitable crop sequences for different leafy and indigenous vegetables tested at different environments (continued) ‣ Suitable farm practices (raised beds, fertilization, mulching) tested (continued) 2005: ‣ Rain shelter devices finally assessed and guidelines developed ‣ Profitability of crops, crop-sequences and management practices assessed ‣ Guidelines for short-cycle vegetable production developed	BMZ/GTZ, COA, France

[1] Indicators are long-term targets and concur with the timeframe of AVRDC's Strategy 2010.

[2] Annual milestones are the immediate targets for the given years.

Main Outputs	Indicators	Annual Milestones	Financial Source
2.2. Crop sequences and management practices for fruit vegetables	• Tomato productivity in hot-wet season doubled • Grafting, hormone application, mulching and rain shelters under different environments assessed	2003: ‣ Technical bulletin on off-season production package for tomato (Tomatotone, grafting, shelter, raised bed, etc.) finalized ‣ Grafting devices for tomato outreached to Mekong countries ‣ Hot pepper as new rootstock materials for off-season sweet pepper production tested 2003–05: ‣ Rain shelters assessed and guidelines updated	
2.3. Improved water management practices for vegetable crop production	• Standard water requirements for major vegetable crops established • Mechanisms of drought tolerance for major vegetable crops understood • Tillage and agronomic practices for better water use efficiency developed	2003: ‣ None 2004: ‣ Literature survey conducted, research needs defined, and workplan developed 2005: ‣ Basic and applied research initiated in collaboration with international research centers and NARES	
2.4. Crop sequences and management practices for organic production of major vegetable crops	• Potential for organic production of major vegetable crops defined, from agronomic and socio-economic standpoints, at selected locations • Pilot site for organic vegetable production developed	2003: ‣ Literature survey and research needs defined ‣ Land at AVRDC identified for organic certification ‣ Organic garden established 2004: ‣ Analysis of ex-ante demand for vegetable products defined and conducted at two pilot sites 2005: ‣ Research on organic management practices conducted at selected sites ‣ Application for certification prepared	
2.5. Composting technologies for widely available biosources	• Database on organic sources and composting technologies compiled • Expert system and techniques for composting developed	2003: ‣ Expert system for composting developed (first stage) 2004: ‣ User assessment of expert system and composting protocol published 2005: ‣ Composting calibration techniques for 1–2 regionally available biosources modified and tested	

Main Outputs	Indicators	Annual Milestones	Financial Source
3. Integrated pest and disease management technologies			DFID, BMZ/ GTZ
3.1. Integrated management principles for tomato diseases developed and applied at various locations	• Reduce incidence of BW and ToLCV 50% • Reduce pesticide use 10–20%	2003: ‣ Detection and diagnosis techniques developed for field samples of BW, other soil-borne pathogens, and ToLCV ‣ Component control methods for BW, other soil-borne diseases, and ToLCV developed or refined 2004: ‣ Baseline survey and epidemiology of BW and ToLCV understood ‣ IPM model tested on-station and on-farm in Taiwan 2005: ‣ IPM model tested on-station and on–farm over Asian locations	
3.2. Biological control-based IPM package developed for crucifers in tropical lowlands	• Increase marketable yield; reduce damage caused by DBM, *Crocidolomia*, *Hellula*, and striped flea beetle 50% • Reduced pesticide use 20–40%	2003: ‣ High temperature-tolerant parasitoid against DBM introduced in SE Asian lowlands ‣ Effect of biopesticide and sex pheromone against *Hellula* in open-field verified ‣ Mechanism of host specificity elucidated for striped flea beetle 2004: ‣ High temperature-tolerant parasitoid against DBM introduced in S Asian and African lowlands ‣ Mechanism of host specificity elucidated for the crucifer pests ‣ IPM package consisting of biopesticide and sex pheromone against armyworm developed for different production systems 2005: ‣ Component control methods developed against major crucifer pests based on host specificity information	
3.3. Biological control of DBM for crucifers in tropical highlands further disseminated	• Reduce pesticide use 80%	2003: ‣ Partnership developed for Asian, African and Central American highlands area 2004: ‣ Parasitoid established in African highlands 2005: ‣ Parasitoid established in Central American highlands	

Main Outputs	Indicators	Annual Milestones	Financial Source
3.4. IPM package for eggplant fruit and shoot borer (EFSB) refined and disseminated	• Reduce damage 60% • Reduce pesticide use 60%	2003: ‣ IPM package consisted of sex pheromone and sanitation further disseminated in S Asia ‣ Mechanism of host specificity elucidated for EFSB 2004: ‣ Component control methods developed against EFSB based on host specificity information 2005: ‣ Refined IPM package tested on-station and on-farm in Asia	COA, NSC, Japan
3.5. Biological control methods developed for vegetable legume pests	• Reduce pesticide use in yardlong bean 30% • Reduce damage of mungbean in Asia and cowpea in Africa 20% each	2003: ‣ Mechanism of host specificity elucidated for Maruca podborer and bruchids 2004: ‣ Component control methods developed against Maruca podborer and bruchids based on host specificity information	
3.6. IPM package for onion thrips disseminated	• Reduce damage caused by thrips 50% • Reduce pesticide use 30%	2003: ‣ Publications for technology dissemination completed ‣ IPM technology package ready for dissemination 2004: ‣ Partnerships developed in S Asia and Africa for dissemination	
4. Partnerships to promote vegetable production technologies and consumption	• Collaborative projects with NARES and private sector increased	2003: ‣ Partnership explored with private sector for commercial variety testing 2004: ‣ Working consortium for vegetable database development initiated in selected region 2005: ‣ Extend peri-urban production systems research to other region (S Asia, Central Asia, or Africa)	
5. Increased capacity of partners to adopt, adapt, and promote year-round, safe vegetable production technologies	• Researchers are capable of producing safe vegetable year round	2003: ‣ 5 researchers trained at HQ ‣ Vegetable IPM book for NARES scientists ‣ International Cooperators' Guides and training modules on allium and cabbage production 2004: ‣ 5 researchers trained at HQ ‣ Vegetable IPM manual for NARES extensionists ‣ International Cooperators' Guides on selected topics 2005: ‣ 5 researchers trained at HQ ‣ Revised production training manual ‣ International Cooperators' Guides on selected topics. See Thrust IV.	

Main Outputs	Indicators	Annual Milestones	Financial Source
6. Information database			
6.1. For off-season and year-round vegetable production	• Databases for sustainable and productive cropping systems	2003: ‣ Prototype expert system for fertilization and composting developed 2004: ‣ Expert system for fertilization and composting tested for improvement 2005: ‣ Databases on tropical vegetable production expanded to include materials from database consortium and updated (ongoing)	
6.2. For integrated pest and disease management strategies	• Databases for environment-friendly production of safe food	2003: ‣ Database of tropical IPM for major vegetable crops published on CD-ROM ‣ Database of tropical disease and insect pests on tomato published on CD-ROM 2004: ‣ Databases migrated onto new platform to enhance compatibility and efficiency with external users 2005: ‣ Databases updated (ongoing)	
7. Better understanding on the socio-economic aspects of year-round vegetable supply			France
7.1. Role of vegetable production for rural development	• Assessment of the impact of vegetable technologies on poverty reduction, income, gender and nutrition • Assessment of the role of vegetable consumption for enhanced health and productivity	2003: ‣ Production surveys on chili pepper conducted in Indonesia, India, China and Thailand ‣ Consumption surveys conducted in Hanoi, India, and Bangladesh 2004: ‣ Comparative analysis of income, employment, nutrition and gender roles conducted in Bangladesh 2005: ‣ Demand elasticity analysis conducted for Vietnam, Indonesia, and China	

Main Outputs	Indicators	Annual Milestones	Financial Source
7.2. Peri-urban production systems	• Assessment of the potential of peri-urban vegetable production for enhanced incomes of farmers • Assessments of trends in vegetable prices, supplies, and consumption	2003: ‣ Comparative analysis of profitability of vegetables on farm level in the peri-urban system analyzed in Manila ‣ Seasonality of vegetable prices analyzed for Hanoi and Ho Chi Minh City ‣ Workshop on status of vegetable production in Central Asia conducted in Almaty, Kazakstan 2004: ‣ Comparative analysis of profitability of vegetables on farm level in the peri-urban system analyzed in Hanoi ‣ Seasonality of vegetable prices analyzed for Phnom Penh and Vientiane	
7.3. Post-harvest production technologies	• Assessment of the need and potential for post-harvest production technologies	2003: ‣ None 2004: ‣ Survey conducted in at least 2 GMS countries 2005: ‣ Survey conducted in 2 more GMS countries	

Summarized Objectives, Outputs, Indicators, and Annual Milestones

Strategic Theme:

III. Indigenous vegetables for biodiversity, healthy diet, and marketing opportunities

Overall objective: **Increase diversification of vegetable crops in the tropics, especially indigenous and underutilized species, for better nutrition, health, and increased farmer's income**

Main Outputs	Indicators[1]	Annual Milestones[2]	Financial Source
1. Collection, characterization and conservation of indigenous vegetable genetic resources			ADB, BMZ/GTZ
1.1. Acquisition/collection of new species	• Number of new species/accessions collected from S Asia, SE Asia, Sub-Saharan Africa and other regions (+150 species, +1,500 accessions, ca. 10 accessions/species)	2003: ‣ Strategy and criteria for acquisition/collection of targeted species determined 2003–05: ‣ New accessions acquired/collected and post-entry inspected for potential diseases and insects (+50 species annually)	
1.2. Characterization of newly acquired species	• Number of basic descriptors for new species (+150 species) established	2003–05: ‣ New species morphologically characterized, ambiguous species molecularly depicted, descriptors for new species developed, and basic information collated (+50 species annually)	
1.3. Conservation of newly acquired species	• Ex-situ preservation of new accessions (+1,500 accessions)	2003–05: ‣ Seeds regenerated for conservation, then purified and multiplied for evaluation trials and lab tests 2003–05: ‣ Short-, medium-, and long-term preservation of acquired/collected materials (+50 species, +500 accessions annually)	

[1] Indicators are long-term targets and concur with the timeframe of AVRDC's Strategy 2010.
[2] Annual milestones are the immediate targets for the given years.

Main Outputs	Indicators	Annual Milestones	Financial Source
2. Procurement, generation and integration of requisite information			
2.1. Compilation of indigenous and scientific information	• Comprehensive and user-friendly computer-based database available for research and extension • Connectivity with other databases	2003: ‣ Information collected on genetic resources, botany, agro-ecology, horticulture, constraints, seed production, nutraceuticals, therapeutical values, postharvest handling, and uses and computer-based database established 2004: ‣ Computer-based database expanded with newly acquired and generated information 2005: ‣ Computer-based database expanded with newly acquired and generated information	
2.2. Identification of high yielding, tropically adapted, and palatable species/types	• Promising species/types with minimum yields of leafy 10 t/ha, fruit 7 t/ha, root and tuber 4 t/ha for bulky consumption types selected • Seed availability of promising species/types	2003: ‣ Observational trials of lesser-known species/types conducted, and biotic and abiotic production constraints determined ‣ Potential species/types that thrive under the hot-wet environment identified, require less inputs, and are palatable identified 2004: ‣ Yield trials of potential species/types conducted, and promising species/types that are less dependent on agrochemicals but still can achieve high yields identified ‣ Seed production technologies of promising species/types developed, and seeds multiplied 2005: ‣ Farmer-participated multilocation test of promising species/types conducted ‣ Specific adaptation to unique niches in intended production systems obtained, and promising species/typed determined ‣ Large scale seed production of promising species/types conducted ‣ Comprehensive papers and technical bulletins published	
2.3. Identification of species/types with high contents of micronutrients or functional biochemicals	• Nutraceutical contents of promising species validated • Bio-availability of antioxidant, vitamin A and iron of IV researched	2003: ‣ Density of micronutrients of edible parts determined ‣ Antioxidant capacities (free radical powers and inhibition of lipid peroxidation) of edible parts estimated 2004: ‣ Effects of digestion and processing methods on the bio-availability of antioxidants, vitamin A and iron examined	

Main Outputs	Indicators	Annual Milestones	Financial Source
		‣ Potential anti-nutrition factors or toxicants of selected indigenous vegetables identified 2005: ‣ Promising species/ types for values added products analyzed and selected	
2.4. High throughput technologies for evaluation of nutritional qualities of vegetables	• Nutritional analysis capacity increased 50-fold through NIRS for 60+ vegetables • Introgression of resistance traits from wild species conducted	2003: ‣ NIRS6500 spectrum library prepared using 1000 vegetable samples (30+ species) from several locations and calibration curves tested 2004: ‣ Vegetable spectrum library expanded to 1500+ samples (50+ species) ‣ Calibration and validation tests performed and calibration equations improved for macro components 2005: ‣ Vegetable spectrum library expanded to 2000+ samples (60+ species) ‣ Calibration and validation tests performed and calibration equations established	
3. Knowledge-based production and utilization technologies			
3.1. Integrated production systems that maximize the production of micronutrient-rich or income generating vegetables	• Improved knowledge of production systems • Frequency on the use of the computer-based database • Technology packages for most promising species available • Improved knowledge of utilizations	2003: ‣ Cultural practices that maximize cropping diversity and/or yields, and minimize inputs of selected species/types for home gardening developed ‣ Extension materials on the production of indigenous vegetables prepared 2004: ‣ Household culinary techniques that improve the nutritional/ functional value of promising species/types and reduce demands on homemakers' time developed ‣ Cultural practices that maximize cropping diversity and/or yields, and minimize inputs of selected species/types for school gardening developed 2005: ‣ Cultural practices for farm/commercial production tested	

Main Outputs	Indicators	Annual Milestones	Financial Source
3.2. Nutrition kits developed for improved human nutrition	• Nutrition kit designed for targeted users such as school children and household women in Southeast Asia and/or HIV/AIDS afflicted communities in Africa	2003: ‣ Information on nutraceutical values of locally adapted vegetable species collected or generated ‣ Criteria for selecting tropical/indigenous vegetables used for development of nutrition kits developed 2004: ‣ Technologies for low cost micronutrient and long term preservation of micronutrient developed with selected IV ‣ Nutrition information of the kit prepared, including nutrient composition of the selected vegetables, and suggestions for consumption and preparation 2005: ‣ Nutrition kits including combinations of vegetable seeds, processed vegetables and vegetable extracts designed and evaluated	
4. Socio-economic assessments for market growth and crop diversification with promising indigenous vegetables			
4.1. Role and potential of IV for human consumption and nutrition is understood	• Assessment on knowledge, utilization and consumption of IVs • IVs are institutionalized in the schoolgarden curricula of at least 3 Asian countries	2003: ‣ Baseline survey on knowledge and consumption of IV conducted in Bangladesh, Philippines, and Thailand ‣ IV pilot schoolgardens established in at least 3 Asian countries (Philippines, Bangladesh and Thailand) 2004: ‣ Baseline survey on knowledge and consumption of IV conducted in Malawi, Tanzania, Uganda, and Rwanda 2005: ‣ Role of schoolgardens for enhanced knowledge and consumption of IVs assessed in at least 3 countries of Asia	
4.2. Production potential of IV for home gardening and commercial production is understood	• Assessment of production and marketing aspects of IVs	2003: ‣ Profitability analysis of major IVs conducted in Philippines, Bangladesh, Thailand, Indonesia, and Malaysia 2004: ‣ Baseline survey on production and marketing aspects of IV conducted in Malawi, Tanzania, Uganda, Rwanda 2005: ‣ Assessment on the role of adoption of IVs for rural development initiated in Malawi, Tanzania, Uganda, and Rwanda	

Main Outputs	Indicators	Annual Milestones	Financial Source
4.3. Improved knowledge on perceivable attributes that affect demand for indigenous plants as new vegetables	• Methodology developed and tested for quantifiable or perceivable attributes determining consumption	2003: ‣ Econometric model for hedonic demand analysis for indigenous vegetables developed 2004: ‣ Consumers' survey on external factors (social, marketing, environment, health relevance, safety) and internal factors (appearance, color, texture, flavor, mouthfeel) that influence their demand for traditional and new vegetables conducted 2005: ‣ Recommendations for selection criteria for indigenous vegetables based on consumer preference developed	
4.4. Analytical methods and strategic options for cropping diversity and marketing with new vegetables	• Innovative methodologies developed	2003: ‣ Criteria for cropping diversity with indigenous vegetables established 2004: ‣ Analyses of promising species/types in the traditional notion of a linear food chain conducted ‣ Descriptors of essential marketing information of new crops determined 2005: ‣ Strategic options for marketing new crops for major socio-economic types established	
5. Partnership for promotion of indigenous vegetables and increased capacity of partners	• Agreed agenda on promotion of indigenous vegetables with 8 countries in S and SE Asia and 4 countries in Sub-Saharan Africa established • Researchers are capable of collaborative efforts in germplasm management; data collection, chemical analysis and seed production; and knowledge-based production technologies	2003–05: ‣ 20 researchers from SE Asia, S Asia and Sub-Saharan Africa trained for germplasm management, IV production, and IV research annually	

Summarized Objectives, Outputs, Indicators, and Annual Milestones

Strategic Theme:

IV. Interactive, user-friendly information management for vegetables in the tropics

Overall objective: **Increase access and applications of information technologies to improve competitiveness of small-scale vegetable farmers**

Main Outputs	Indicators[1]	Annual Milestones[2]	Financial Source
1. On-line dissemination of genetic resources (germplasm) and related information			
1.1. Vegetable genetic resources information network	• 5000 samples of accessions and 15,000 samples of improved genetic material distributed outside the Center per year	2003: ‣ Workshop for GRSU staff on use of SINGER and integration of GRSU database into SINGER ‣ AVRDC Vegetable Genetic Information System (AVGRIS) migrated onto new platform to enhance compatibility and efficiency with external users ‣ Genebank database integrated into SINGER (CGIAR System-wide Information Network for Genetic Resources) ‣ Expanded, updated genetic resources database (on-going) 2004: ‣ In-depth germplasm information on AVRDC website ‣ Expanded and updated genetic resources database (on-going) 2005: ‣ Expanded and updated genetic resources database (on-going)	
1.2. On-line seed catalog	• Seed requests of targeted lines increases by 100%	2003: ‣ Strategy established to facilitate seed production and distribution ‣ Seed catalog launched on AVRDC website. Targeted crops include tomato, sweet and chili pepper, mungbean, vegetable soybean, and amaranthus ‣ Seeds multiplied of genetic materials for 2004 catalog	

[1] Indicators are long-term targets and concur with the timeframe of AVRDC's Strategy 2010.

[2] Annual milestones are the immediate targets for the given years.

Main Outputs	Indicators	Annual Milestones	Financial Source
		2004: ‣ Updated seed catalog ‣ Seeds multiplied of genetic materials for 2005 catalog 2005: ‣ Updated seed catalog ‣ Seeds multiplied of genetic materials for 2006 catalog	
2. On-line dissemination of good agriculture practices (GAP) for major vegetable crops	• GAPs suggested for major vegetable crops • Downloads of GAP publications increases by 50% each year	2003: ‣ GAPs suggested for 15 crops, published in English, and put on-line 2004: ‣ Publications of GAP of 15 crops translated into Mandarin, Vietnamese, French, Spanish, and possibly other Asian languages; these publications placed on-line ‣ GAPs established for 6+ additional crops, published in English, translated into selected languages, placed on-line 2005: ‣ GAPs established for 6+ additional crops, published in English, translated into selected languages, placed on-line	
3. On-line sharing of information on food science studies related to vegetables	• Comprehensive database of nutritional composition and functional properties of vegetables • Database of recipes, with emphasis on recipes that enhance bio-availability of iron and recipes for vegetables native to Asia	2003: ‣ Database of available information on nutritional composition and functional properties for 200+ vegetables compiled ‣ Recipes for mungbean dishes that enhance bio-availability of iron, and recipes for 40+ Asian vegetables put on-line 2004: ‣ Database migrated onto new platform to enhance compatibility and efficiency with external users ‣ Nutritional database and recipes made available via CD-ROM and internet ‣ Nutritional database is expanded and updated (ongoing) 2005: ‣ Bulletin board launched on AVRDC website to encourage sharing of information among food scientists ‣ Nutritional database is expanded and updated (ongoing)	
4. On-line sharing of socio-economic impacts and other studies related to vegetable production	• AVRDC socio-economic studies available on-line • Downloads of AVRDC socio-economic studies increases by 50% per year • Bulletin board for socio-economists	2003: ‣ Sources of internal and external socio-economics information identified 2004: ‣ AVRDC socio-economic studies organized in new section of AVRDC website 2005: ‣ Bulletin board launched on website to encourage sharing of information	

Main Outputs	Indicators	Annual Milestones	Financial Source
5. Distance training using CD-ROM, video, and internet technology	• Computer-based distribution of AVRDC research information • On-line study courses	2003: ‣ Informational materials (1998–2002 Annual Reports, International Cooperators' Guides and Fact Sheets, tomato database, indigenous vegetable database, nutrition database, tutorials) made available on CD-ROM 2004: ‣ On-line course on integrated pest management in the tropics 2005: ‣ Informational materials updated and videos of selected technologies added to updated CD-ROM ‣ On-line course on selected topic	
6. Enhanced AVRDC on-line library services	• Number of users of library services via internet increases by 50% per year • Minisis Web Interface (MWI) established to provide online access to Tropical Vegetable Information System (TVIS) databases	2003: ‣ Upgrade MWI to version 9.0 thereby enhancing access to more information and providing more literature on Selective Dissemination of Information (SDI) bulletins ‣ Streamlined access to electronic journals on the internet 2004: ‣ Special section on library services developed on AVRDC web site ‣ Upgrade Ariel software for improved electronic sharing of materials through international library cooperation and exchange 2005: ‣ CD-ROM databases of library organized to facilitate AVRDC on-line search engine	
7. Dynamic and interactive web site	• Number of users increases by 50% per year • Number of information searches, downloads, on-line book orders, and seed requests increases by 25% per year	2003: ‣ On-line bookstore ‣ Updated web site, including information search engine 2004: ‣ Tomato, indigenous vegetable, and nutrition databases migrated onto new platform to enhance compatibility and efficiency with external users 2005: ‣ Bulletin board launched on website to encourage sharing of information	
8. Information to assist priority setting for vegetable research and development	• Priority setting criteria for vegetable research established	2004: ‣ Opinion survey among stakeholders conducted 2005: ‣ Criteria and database for priority setting in vegetable research in place and used	

Summarized Objectives, Outputs, Indicators, and Annual Milestones

Research Matrices for Strategic Themes at Regional Center for Africa (RCA)

Main Outputs	Indicators[1]	Annual Milestones[2]	Financial Source
1. Germplasm management and promotion of African indigenous and priority exotic vegetables			BMZ/GTZ, USAID
1.1. Germplasm of African indigenous vegetables (AIV) collected, conserved and characterized	• 200 accessions of 10 AIV species collected from highland and lowland areas and conserved ex-situ	2003: ‣ Initiation of collection and conservation 2004: ‣ 25% of collected materials characterized morphologically and seed multiplied 2005: ‣ 50% of collected materials characterized morphologically and seed multiplied ‣ Integration of gathered germplasm and information into HQ database for IV	
1.2. Germplasm of indigenous vegetable crops evaluated for adaptation and diversification	• AIV evaluated for productivity and quality traits	2003: ‣ AIV evaluation trials initiated 2004: ‣ Priority AIVs determined and horticultural evaluations conducted 2005: ‣ Promising accessions in each targeted AIV identified, and seed increased for multilocation trials	
1.3. Improvement of AIV through purification and selection	• High priority AIV enhanced for uniformity, quality, and productivity	2003: ‣ Selection within accessions of high priority AIV initiated 2004: ‣ Observational trials of purified AIV conducted 2005: ‣ Replicated trials of potential AIV cultivars conducted	
1.4. Improved genotypes of priority exotic vegetables available for distribution	• Average of 1–2 lines of tomato, vegetable soybean, mungbean or pepper yearly made available to NARES	2003: ‣ Late blight resistant tomato lines evaluated ‣ Vegetable soybean and mungbean lines evaluated for adaptation and yield ‣ Multiple disease resistant pepper lines identified and their productivity established	

[1] Indicators are long-term targets and concur with the timeframe of AVRDC's Strategy 2010.
[2] Annual milestones are the immediate targets for the given years.

Main Outputs	Indicators	Annual Milestones	Financial Source
		2004: ‣ 2–3 promising late blight resistant lines characterized and evaluated for their horticultural characters ‣ 1–2 promising lines of vegetable soybean, mungbean and pepper identified (cont.) 2005: ‣ 1–2 promising lines in each priority crop and made available for distribution	
1.5. Improved horticultural practices developed for AIV and priority exotic vegetables	• Package of production practices for priority exotic and AIVs available in leaflet form, brochures and CD-ROM	2003: ‣ Trials on improvement of horticultural practices (e.g., spacing, irrigation, fertilizer, pest control, post harvest) initiated. 2004: ‣ Continuation of trials on improvement of horticultural practices 2005: ‣ Horticultural practices of 5–7 priority species documented	
1.6. Methods of utilization of priority AIVs developed	• Utilization methods for at least two AIVs developed every year	2003: ‣ Indigenous knowledge of utilization gathered for five AIVs 2004: ‣ Recipes for 2–3 priority AIVs developed and tested 2005: ‣ Utilization methods documented and made available	
2. Sustainable seed supply for AIVs and priority exotic vegetables	• Seed production protocols developed for priority AIV and exotic vegetable crops • Breeder/base seed of priority species available for distribution	2003: ‣ Research on seed production methods initiated 2004: ‣ Methods for seed production, processing, and storage for 5 AIV and exotic crops developed ‣ Breeder/base seed of 1–2 AIV lines produced 2005: ‣ Breeder/base seed of 1–2 AIV lines produced	
3. Strengthening the capacity of researchers and extensionists of national systems through training, participatory technology development and transfer			
3.1. Long-term regional training programs on vegetable crops and seed production	• Participants from NARES, NGOs and private sector with enhanced capacity for vegetable research or extension	2003–05: ‣ 15–20 Africans (40–50% women) trained for 4 months 2003–05: ‣ Training module updated and improved annually	

Main Outputs	Indicators	Annual Milestones	Financial Source
3.2. In-country training courses in vegetable crops and seed production organized	• NARES, NGOs and private sector personnel and progressive farmers trained annually in 1–2 African countries	2003–05: ‣ 15–20 Africans (40–50% women) trained for 4 months 2003–05: ‣ Training module updated and improved annually	
3.3. Special skill courses in vegetable crops	• Graduate researchers updated in selected research areas at RCA and targeted countries	2003–05: ‣ 15–20 participants trained on cultivation and utilization of AIVs 2003–05: ‣ 2–3 undergraduate/graduate research interns trained 2004: ‣ 15–20 participants trained on vegetable seed production ‣ 2–3 undergraduate/graduate research interns trained in specific topics ‣ 15–20 participants trained on cultivation and utilization of AIVs ‣ 2–3 undergraduate/graduates trained	
3.4. Strengthen collaboration through review and planning workshop on vegetable research and development	• Vegetable research agenda set in workshops conducted jointly with major partners in Sub-Saharan countries	2003–05: ‣ Priority setting workshops conducted in 1–2 countries annually 2003–05: ‣ Collaborative research program established with a group of national partners	
3.5. Dissemination of improved vegetable production technologies and varieties	• Seed distribution and information on new technologies demonstrated through field days and extension handouts organized at RCA and NARES	2003–05: ‣ At least one field day conducted annually by RCA and NARES	

Summarized Objectives, Outputs, Indicators, and Annual Milestones

Research Matrices for Strategic Themes at Asian Regional Center (ARC)

Main Outputs	Indicators[1]	Annual Milestones[2]	Financial Source
1. Productive, disease/pest resistant, and locally adapted mungbean varieties	• Mungbean varieties with potential yield of 3.4 t/ha, 70+ g 1000-seed wt, and bright color seeds • Genetic resistance to powdery mildew and MYMV • Uniform maturity to allow one-time harvesting • 2–3 varieties to be adopted by farmers for extensive production	2003: ‣ Evaluation of F_2 lines for target traits, and further crossing 2004: ‣ Evaluation of F_3 and F_4 at ARC and field evaluation in collaboration countries 2005: ‣ 2–3 lines selected by NARS and seed increased for on-farm trials	
2. Year-round supply of safe vegetables in SE Asia			ADB, SDC
2.1. Crop sequences and management practices for year-round production under hot-dry, hot-wet, and remote rural conditions	• Development of 3–5 cropping systems for local adaptation through collaboration with NARES	2003: ‣ 1–2 cropping systems of raised bed culture in tropical lowlands 2004: ‣ 1–2 cropping systems for sandy soil and hot-dry condition in Central Vietnam 2005: ‣ 1–2 cropping systems for upland in Mekong Region	
2.2. Seed storage methods for poor farmers in tropics	• Development of simple seed storage methods and application to rural farmers through collaboration with NARES	2003: ‣ Identification of key factors that limit seed storage in tropics, with emphasis on vegetable soybean 2004: ‣ Development of simple methods to store soybean seeds for longer term 2005: ‣ On-farm demonstration through collaboration with NARES	

[1] Indicators are long-term targets and concur with the timeframe of AVRDC's Strategy 2010.
[2] Annual milestones are the immediate targets for the given years.

Main Outputs	Indicators	Annual Milestones	Financial Source
2.3. IPM for important diseases/insects in tropics	• IPM to combat southern blight and anthracnose on pepper, bean pod borer on yardlong bean, and flea beetles on leafy crucifers	2003: ‣ Identification of key factors to limit the prevalence of diseases/insects through collaboration with NARES 2004: ‣ Development of integrated management to combat the diseases/insects through collaboration with NARES 2005: ‣ On-farm trials of the methods and evaluation through collaboration with NARES	
3. User-friendly database of indigenous vegetables in Mekong Region	• At least 200 crops/types of indigenous vegetables collected from Mekong Region will be stored in AVRDC database after characterization, evaluation and documentation in collaboration with TVRC	2003: ‣ Information on 30–50 crops/varieties added to AVRDC database through TVRC-ARC collaboration 2004: ‣ Information on 30–50 crops/varieties added to AVRDC database through TVRC-ARC collaboration 2005: ‣ Information on 30–50 crops/varieties added to AVRDC database through TVRC-ARC collaboration	
4. Interactive, user-friendly information management for vegetables in the tropics			SDC
4.1. Maintenance and innovation of ARC web site to enrich information	• Dynamic, up-to-date ARC web site • 5000+ accesses to the web site per year	2003: ‣ 2000 accesses to web site and 500 downloads of available documents 2004: ‣ 4000 accesses to web site and 1000 downloads of available documents 2005: ‣ 6000 accesses to web site and 2000 downloads of available documents	
4.2. User-friendly and internet-accessible databases for mungbean, released vegetable varieties, and research reports developed by network	• 1–2 databases established and managed per year	2003: ‣ Garlic variety and production database developed through SDC project 2004: ‣ Mungbean database and research reports 2005: ‣ Revision of developed databases	

Main Outputs	Indicators	Annual Milestones	Financial Source
4.3. Publication of technical information for vegetables and simple guidebooks written in local languages	• 3+ books or technical guides published in local languages per year through collaboration with NARES	2003: ‣ Electronic publication of ARC-RTC technical report ‣ 2 guide books translated into Vietnamese by NARES 2004: ‣ Electronic publication of ARC-RTC technical report ‣ 1 guide book translated into Lao, Khmer and Vietnamese through collaboration with NARES ‣ Extensive list of technical terms in vegetable growing and research for quality translation into Vietnamese, Lao and Khmer through collaboration with NARES 2005: ‣ Electronic publication of ARC-RTC technical report ‣ 1 major publication translated into Lao, Khmer, Vietnamese by NARES	
5. Human resource development for vegetable research, extension and adoption to farmers			ADB, SDC
5.1. Strengthened researchers and extension staff through ARC regional training course (RTC)	• 150 NARES trainees from Cambodia, Lao PDR, Myanmar, Vietnam and South Asian countries	2003: ‣ 21 NARES staff will be trained 2004: ‣ 10 senior extension staff and 5 researchers will be trained in RTC extension and RTC research courses, respectively 2005: ‣ 10 senior extension staff and 5 researchers will be trained in RTC extension and RTC research courses, respectively	
5.2. Strengthened extension staff and lead farmers through in-country training courses, especially in upland and remote rural areas of Mekong Region countries	• At least 50% of graduated trainees serve as a resource to in-country training courses • 4000 extension staff and 4000 lead farmers in Mekong Region trained through collaboration with NARS • At least 80% of trainees organize or consult with farmers interested in growing vegetables	2003: ‣ 250 local extension staff and 250 lead farmers will be trained 2004: ‣ 300 local extension staff and 300 lead farmers will be trained 2005: ‣ 300 local extension staff and 350 lead farmers will be trained	

Annex 2

Budget Requirements 2003–2005

Revenue and budget tables

Table A1. Summary of 2003 revenues and budget allocation by objects (in USD thousands)

	Core funds		Project funds		Total	
Revenues						
Grants	5 063		4 017		9 080	
Other revenues and support	372		0		372	
Total	**5 435**	**58%**	**4 017**	**42%**	**9 452**	**100%**
Budget Allocation						
Personnel						
Internationally-recruited	1 462		350		1 812	18%
Local	2 886		264		3 150	32%
Operations						
Field labor	440		251		691	7%
Supplies	372		497		869	9%
Travel	73		225		298	3%
Training and workshop	48		539		587	6%
Contract outreach research	0		1 287		1 287	13%
Equipment	40		163		203	2%
General expenses	500		441		941	10%
Total	**5 821**		**4 017**		**9 838**	**100%**
Balance	**(386)**		**0**		**(386)**	
Balance, beginning of year	**386**		**0**		**386**	
Balance, end of year[a]	**0**		**0**		**0**	

[a] Excluding the working capital funds of USD 900,000 at end of Year 2003

Table A2. Breakdown of 2003 revenues (USD thousands)

Donor	2003 Proposal	
Core funds		
Republic of China	4 394	
United States	200	
Japan	96	
Korea	75	
Thailand	101	
Philippines	50	
France	147	
Other revenues and support	372	
Subtotal	**5 435**	**58%**
Project funds		
Australia/ACIAR	69	
Asian Development Bank	520	
France	180	
Germany/BMZ/GTZ	1 490	
Japan	62	
Korea/RDA	40	
Republic of China/COA and NSC	649	
Switzerland/SDC	496	
United Kingdom/DFID	281	
United States/USAID	200	
United States/USDA	30	
Subtotal	**4 017**	**42%**
Contribution in kind		
Germany/BMZ/GTZ	[164]	
Japan	[38]	
Korea	[62]	
Subtotal	**0**	**0%**
Total revenues	**9 452**	**100%**

Table A3. 2003 budget allocation by strategic themes and services (in USD thousands)

	Core funds		Project funds		Total	
Revenues						
Grants	5 063		4 017		8 720	
Other revenues and support	372		0		372	
Total	**5 435**	**58%**	**4 017**	**42%**	**9 452**	**100%**
Budget allocation[a]						
Strategy themes						
1. Innovative germplasm enhancement for productivity, consumer acceptance, biofortification	1 336		936		2 272	23%
2. Year-round supply of safe and nutritious vegetables	1 055		1 354		2 409	24%
3. Indigenous vegetables for biodiversity, healthy diet and marketing opportunities	367		920		1 287	13%
4. Interactive, user-friendly information management for vegetables in the tropics	665		598		1 263	13%
Administration and services	2 398		209		2 607	26%
Total	**5 821**		**4 017**		**9 838**	**100%**
Balance	**(386)**		**(386)**			
Balance, beginning of year	**386**		**386**			
Balance, end of year[b]	**0**		**0**			

[a] The regional center budgets are within the strategic themes. The budget estimates for ARC and RCA (for information purposes only) are: Asia Regional Center, USD 864,000; and Regional Center for Africa, USD 827,000.

[b] Excluding the working capital funds of USD 900,000 at the end of Year 2002.

Table A4. 2003–2005 budget projection by objects (in USD thousands)

Object expenditures	2003 Proposal	2004 Projection	2005 Projection
Personnel			
IRS	1 812[a]	2 206[a]	2 430[a]
Local	3 150	3 236	3 326
Operations			
Field labor	691	715	758
Supplies	869	900	951
Travel	298	300	330
Training and workshops	587	590	665
Contract outreach research	1 287	1 287	1 287
Equipment	203[b]	239[b]	280[b]
General expenses	941	941	941
Total	**9 838**	**10 414**	**10 968**

[a] Additional IRS requirements: 2003: Deputy Director General of Research, Marker development scientist; 2004: Nutritionist, ICRISAT/AVRDC collaborative researcher; and 2005: two regional horticulturalists.

[b] Minimum maintenance would require additional USD 700,000, which is not yet included in the budgets.

Table A5. 2003–2005 budget projection by strategic themes and services (in USD thousands)

Themes/Services	2003 Proposal	2004 Projection	2005 Projection
Strategic Themes			
1. Innovative germplasm enhancement for productivity, consumer acceptance, biofortification	2 272	2 543	2 744
2. Year-round supply of safe and nutritious vegetables	2 409	2 570	2 577
3. Indigenous vegetables for biodiversity, healthy diet and marketing opportunities	1 287	1 299	1 470
4. Interactive, user-friendly information management for vegetables in the tropics	1 263	1 270	1 296
Administration and Services	2 607	2 732	2 881
Total	9 838	10 414	10 968

Table A6. Proposed staff composition

Staff category	2003	2004	2005
Internationally recruited staff (IRS)	23	25	27
Seconded research staff	3	3	4
PhD trainees	2	4	4
Consultant staff (with a duration of more than 6 months)	6	5	5
Nationally recruited staff (NRS)	213	213	213

Annex 3

Acronyms

AIV	African indigenous vegetables
ARC	Asian Regional Center (regional center of AVRDC)
ARC-RTC	Asian Regional Center
AVRDC	Asian Vegetable Research and Development Center
BM	black mold
BMZ/GTZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung/ Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
BS	bacterial spot
BW	bacterial wilt
CGIAR	Consultative Group on International Agricultural Research
ChiVMV	chili veinal mosaic virus
CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement
CMV	cucumber mosaic virus
COA	Council of Agriculture, Republic of China
DBM	diamondback moth
DFID	Department for International Development, United Kingdom
EFSB	eggplant fruit and shoot borer
GAP	good agriculture practices
GHARDEN	Global Horticulture and Rural Development Enterprise
GMS	Greater Mekong Subregion
GRSU	Genetic Resources and Seed Unit (AVRDC)
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome
HQ	headquarters
ICIPE	International Centre of Insect Physiology and Ecology
ICPN	International Chili Pepper Nursery
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFPRI	International Food Policy Research Institute
IPM	integrated pest management
IRRI	International Rice Research Institute
IRS	internationally recruited scientist
IV	indigenous vegetables
LB	late blight
MWI	Minisis web interface
MYMV	mungbean yellow mosaic virus
NARES	national agricultural research and extension systems
NIRS	near infrared spectroscopy
NGO	non-government organization
NSC	National Science Council, Republic of China
PCR	polymerase chain reaction
QTL	quantitative trait loci
RCA	Regional Center for Africa (regional center of AVRDC)
RH	relative humidity
RKN	root knot nematode
ROC	Republic of China
RTC	regional training course
RW	rice-wheat cropping system
SDI	Selective Dissemination of Information
SINGER	CGIAR System-wide Information Network for Genetic Resources
SDC	Swiss Agency for Development and Cooperation
SLB	stemphylium leaf blight
T°	temperature
ToLCV	tomato leaf curl virus
TSWV	tomato spotted wilt virus
TVIS	Tropical Vegetable Information System
TVRC	Tropical Vegetable Research Centre
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USD	United States dollars
USDA	United States Department of Agriculture
WSMV	watermelon silver mottle tospovirus

References

[1] Ali, M. 2001. Mega factors affecting the demand for vegetables, commodity choice, and international vegetable research. Proceedings of AVRDC 2001 Internal Review and Planning Workshop. 4–6 Dec. 2001. Shanhua, Taiwan: Asian Vegetable Research and Development Center.

[2] UNAIDS (Joint United Nations Programme on HIV/AIDS). 2001. Nutrition and HIV/AIDS. Nutrition policy paper #20. Report of the 29th session symposium held 3–4 April, 2001, Nairobi, Kenya.

[3] Conway, G. and G. Toenniessen. 2003. Science for African food security. Science, 299, 1187–1188.

[4] USAID (United States Agency for International Development). 2003. Africa food crisis. <http://www.usaid.gov/about/africafoodcrisis/>.

[5] Rabobank. As cited in: R.L. Cook. 1998. International trends in the fresh fruit and vegetable sector. Department of Agricultural and Resource Economics, University of California-Davis.

[6] USDA (United States Department of Agriculture). 1996. The food guide pyramid. Washington D.C.: Center for Nutrition Policy and Promotion. Home and Garden Bulletin No. 252.

[7] Gardner, G. and B. Halweil. 2000. Underfed and overfed: the global epidemic of malnutrition. Worldwatch Paper 150. Washington, D.C.: Worldwatch Institute.

[8] Hadad, L. H. Alderman, S. Appleton, L. Song, and Y. Yohannes. 2002. Reducing child undernutrition: how far does income growth take us? Discussion Paper 137. Washington, D.C.: International Food Policy Research Institute (IFPRI), Food Consumption and Nutrition Division.

[9] Ali, M. *ibid.*

[10] Conway, G. and G. Toenniessen. *ibid.*

[11] IFPRI (International Food Policy Research Institute). 2001. Empowering women to achieve food security: vision 2020. Focus No. 6. Washington, D.C.: IFPRI.

[12] FAO/ILSI (Food and Agriculture Organization of the United Nations/International Life Sciences Institute). 1997. Preventing micronutrient malnutrition: a guide to food-based approaches. Why policy makers should give priority to food-based strategies. Washington, D.C.: ILSI Press. 11 pp.

[13] Keane, L.G., M.K. Ntiru, and B.D. Giyose. 2001. Nutrition briefs: linking multiple sectors for effective planning and programming. USAID SARA, SANA Project Report.

[14] World Health Organization. 2003. Micronutrient deficiencies: Combating vitamin A deficiency. <http://www.who.int/nut/vad.htm.>

[15] Thirtle, C., X. Irz, L. Lin, V. McKenzie-Hill, and S. Wiggins. 2000. Relationship between changes in agricultural productivity and the incidence of poverty in developing countries. DFID Report No. 7946.

[16] Ali, M., U. Farooq and Y.Y. Shih. 2002. Vegetable research and development in the ASEAN region: a guideline for setting priorities. In: C.G. Kuo (ed.). Perspectives of ASEAN Cooperation in Vegetable Research and Development. Shanhua, Taiwan: Asian Vegetable Research and Development Center. p. 20–64.

[17] de Bon, H. and K.T. Tran. 2001. The response of peri-urban agriculture to urbanization in Vietnam. FAO Paper No. EC600E.

[18] Ali, U. Farooq, and Y.Y. Shih. *ibid*.

[19] Ali, M. *ibid.*

[20] Ladha, J.K. 2003. How extensive are yield declines in long-term rice-wheat experiments in Asia? In: Addressing resource conservation issues in rice-wheat systems of South Asia—a resource book. p. 32–33. Mexico D.F.: International Maize and Wheat Improvement Center.

AVRDC at a Glance

AVRDC—The World Vegetable Center is a not-for-profit international agricultural research institute run by a management team that reports to a Board of Directors whose members come from various countries.

Founded: 1971.

Annual budget: Approximately US$10 million, from major donors such as the Asian Development Bank, Australia, France, Germany, Japan, Korea, Philippines, Republic of China, Switzerland, Thailand, United Kingdom, and United States.

Staff: Approximately 20 internationally recruited professional staff, and over 210 locally recruited researchers, technical, and administrative staff.

Headquarters: Shanhua, southern Taiwan.

Outreach centers: Asian Regional Center, Kamphaengsaen, Thailand; and Regional Center for Africa, Arusha, Tanzania.

Outreach project offices: Promotion and Development of Safe, Year-Round Vegetable Production in Peri-Urban Areas of Mekong Region Project, Hanoi, Vietnam; and Peri-urban Production Systems for Metro Manila Project, Muñoz, Philippines.

Principal partners: National agricultural research and extension systems and non-government organizations in developing countries.

Improved technologies: AVRDC-improved vegetable lines and complementary production technologies are improving diets and incomes in over 80 countries.

Training: AVRDC conducts training in a broad range of subject areas, including crop improvement, plant protection and biotechnology applications at its headquarters and outreach sites.

Research and development networks: South Asia Vegetable Research Network (SAVERNET); Cambodia, Laos, Vietnam Network (CLVNET); Collaborative Network for Vegetable Research in Southern Africa (CONVERDS); and ASEAN-AVRDC Regional Network on Vegetable R&D (AARNET).

Biodiversity preservation: AVRDC has one of the world's most diverse collections of vegetable germplasm, over 49,400 accessions of 376 species from 151 countries.