



# Keeping our balance

AVRDC - The World Vegetable Center

2006-2007 Annual Highlights



*Prosperity for the Poor, Health for All*

**Who we are**

AVRDC – The World Vegetable Center, founded in 1971, is the world’s leading not-for-profit institute for vegetable research and development. Vegetables are the best means for overcoming micronutrient deficiencies and malnutrition in the developing world. The Center’s improved vegetable varieties and production methods help farmers increase vegetable harvests to raise incomes for poor rural and urban households, create jobs in communities, and provide healthier diets for all. The World Vegetable Center effectively mobilizes resources from the private and public sectors to promote the safe production of healthy vegetables that nourish people and nurture the earth.

A healthy diet draws on a range of nutrients for balance. So too does this compilation of annual highlights, which features a small selection from the larger array of projects and endeavors the World Vegetable Center engages in to provide readers with a balanced view of our work.

# The World Vegetable Center: Tipping the scales toward health and prosperity

\_\_\_\_ *Editorial*

The formerly sharp contrast between the world's well fed and hungry today has now been blurred by the common scourge of malnutrition. Reliance on starchy staples and the overall lack of diversity in diets is leading to record levels of obesity in developed countries, while in impoverished countries the incidence of diabetes has soared due to the change to developed world consumption patterns. Globally, the micronutrients essential for good health are often missing from the plates of poor and rich alike.

This dietary imbalance is in part a reflection of today's agriculture and its agricultural research funding, in which production is skewed toward a few commodities. Despite the availability of more than 50,000 edible plant species, the world's food supply rests on a mere 15 crop plants, with three—rice, maize and wheat—providing nearly three-quarters of humanity's food energy intake.

Vegetables, in all their many forms, can bring a much-needed measure of balance back to diets, livelihoods, and economies. The World Vegetable Center helps individuals, communities, and countries keep their balance better by providing improved germplasm, disseminating safe production practices, and exploring new market opportunities for vegetables.

Rich in vitamins, minerals, and other micronutrients vital for health, vegetables are our best means for overcoming dietary deficiencies. Improved tomatoes developed by the World Vegetable Center have three times more vitamin A than standard tomatoes; distributed throughout Asia and sub-Saharan Africa, these tomatoes help prevent childhood blindness and strengthen immune systems. Also in India, the Center's mungbean lines are an important source of iron for children and pregnant women.

Often, the most nutritious vegetables of all are “weeds”- plants such as amaranth or Jute mallow, which may be part of traditional diets in much of Africa or Asia. These hardy species are the most important source of micronutrients for the world's poorest rural families. The Center has improved several African indigenous vegetables to make them more palatable and productive; farmers are now finding new markets for “IVs” as demand from urban dwellers increases.

The need for better balance extends to production. Vegetables often receive large amounts of fertilizer, yet the inappropriate use of fertilizer has contaminated groundwater and wasted a costly and limited, yet vital resource. Excessive use of cheap pesticides can throw entire ecosystems off-balance, creating pesticide resistance in damaging insects and threatening the health of farmers and consumers. Integrated pest and plant



management systems, such as the one developed by the Center to help control the eggplant fruit and shoot borer in South Asia, allow for safer vegetable production, reduced fertilizer use, and more stable harvests.

Our efforts to balance better nutrition with improved production occur at different scales. Home garden kits have been popular with families from Africa to the Solomon Islands, while promoting commercial vegetable production in South Asia has helped women farmers. We bring farmers' groups together to find postharvest marketing opportunities, such as a chili sauce produced specifically for Laotian tastes by Laotian farmers. And our new Vegetable Breeding and Seed Systems project is forging the links all of Africa needs for comprehensive distribution of quality vegetable germplasm.

To stay relevant, the World Vegetable Center has done some re-balancing of its own. In accordance with recommendations made during the Center's 7th External Program and Management Review (EPMR), we have significantly expanded our efforts throughout Africa, where vegetable production remains low. We also have a growing project base in India, another location where vegetable production has been static in the recent past

In all we do, the World Vegetable Center strives to balance research with development. We seek better answers to farming and food system questions; we want to share what we have learned and see that knowledge grow and expand as it is applied by farmers. I invite you to learn more about our work, and to join with us in using vegetables to bring health to all and prosperity to the world's poorest people.

A handwritten signature in dark ink that reads "J.D.H. Keatinge". The signature is written in a cursive, slightly slanted style.

*J.D.H. Keatinge  
Director General*

*AVRDC – The World Vegetable Center*

## ω Where we are

— Regional Centers and Offices



- 01\_ AVRDC - The World Vegetable Center, Head Office - Taiwan
- 02\_ Asian Regional Center (ARC) - Bangkok, Thailand
- 03\_ Project Regional Office - Vientiane, Lao PDR
- 04\_ Project Regional Office - Central Java, Indonesia
- 05\_ Project Regional Office - Honiara, Solomon Islands
- 06\_ Korean Sub-Center of AVRDC - Suwon, Republic of Korea
- 07\_ Regional Center for South Asia (RCSA) - Hyderabad, India
- 08\_ Sub-Regional Center for Central Asia and the Caucasus - Tashkent, Uzbekistan

- 09\_ Regional Center for Africa (RCA) - Arusha, Tanzania
- 10\_ Sub-Regional Office for West and Central Africa - Bamako, Mali
- 11\_ Project Regional Office - Niamey, Niger
- 12\_ Project Regional Office - Yaoundé, Cameroon
- 13\_ Project Regional Office - Antananarivo, Madagascar

## What we do

— Our 5 research and development themes

### ++ GERMPLASM

Conservation, evaluation, and gene discovery

### ++ BREEDING

Genetic enhancement and varietal development

### ++ PRODUCTION

Seed and safe vegetable production systems

### ++ MARKETING

Postharvest management and market opportunities

### ++ NUTRITION

Nutritional security, diet diversification, and human health





## THEME GERmplasm

**Our vision** : To collect, conserve, and distribute vegetable germplasm for present and future needs; to evaluate the collection for desirable traits; to characterize species using molecular tools. ::

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The world's wildest species carry the genes for future vegetable production

## Wild relatives: Tough and resilient

Most of the world's poor live in the tropics, but the tropics - with their extremes of heat, humidity, drought, flooding, pests and disease - are a tough place to grow vegetables. As climate change increases, the unpredictability, intensity, and frequency of environmental stresses will make small-scale vegetable production that much tougher.

To help farmers produce good harvests under the harsher, more extreme weather conditions accompanying climate change, researchers must find plant relatives with equally extreme qualities to breed into cultivated vegetable varieties.

"Vegetables are the product of both natural selection as well as farmers' selection, so they have evolved to respond to challenging environmental conditions as well as to cultural practices," says Dr. Liwayway Engle, head of the World Vegetable Center's genebank. "There is so much diversity in vegetables we can expect to find a range of reactions to environmental stress."

Reintroducing wild hardiness into domesticated crops strengthens a crop's ability to thrive under severe conditions. The search for diversity starts in the genebank, where vegetable germplasm has been carefully collected and identified.

Since it began in 1971, the World Vegetable Center has been breeding vegetables to cope with tropical extremes. The Center manages the world's largest public collection of vegetable germplasm, with more than 56,000 accessions of globally important crops and their wild relatives, and more than 13,000 regionally important indigenous vegetables.

The Center is a global leader in breeding heat-tolerant tomatoes and Chinese cabbage, as well as onions and cucurbits. Tomatoes are the world's most important vegetable, and our heat-tolerant varieties have been so successful that the crop is

now widely grown in the tropical lowlands during the hot wet season - a feat rarely possible in the past.

In some parts of the world it's not the heat, but the lack of moisture that limits successful tomato harvests. Breeding tomatoes, which are approximately 95% water, to be drought-tolerant seems an impossible task, yet genes from two wild relatives of tomato from the arid zones of South America may help. *Solanum chilense* grows in the deserts of Chile; it has a huge root system and is five times more tolerant of wilting than cultivated tomato. *S. pennellii* can increase its water use efficiency during drought and absorb dew through its leaves. Center scientists, led by molecular breeder Dr. Robert de la Peña, use advanced genetic marker and crossbreeding technologies to transfer the genes responsible for these remarkable drought adaptations into commercial tomato crops. "Improved adapted vegetable germplasm is the most cost-effective option for farmers to meet the challenges of a changing climate," says Dr. de la Peña.

Breeding tolerance to different types of environmental stress is complex; more than 130 genes related to drought tolerance alone have been identified. Some stressors, like flooding, are better dealt with through good agricultural practices: Tomato, for instance, benefits from raised beds, rain shelters, or grafting plants onto flood-tolerant eggplant rootstocks.

Even best practices can't combat change on the scale of global warming, however. As the world's weather becomes more volatile, we expect the genes of wild relatives will provide the resilience necessary to strengthen future vegetable varieties and ensure successful harvests. ❧



- ▶ The Center maintains the world's largest public collection of vegetable germplasm including more than 56,000 accessions and many wild relatives of major vegetable species.
- ▶ Vegetables are sensitive to environmental extremes. High temperatures, flooding and low soil moisture are major causes of low yields.
- ▶ The Center bred the world's first heat tolerant lines of tomato, creating a new industry in the tropical lowlands that has benefited smallholder farmers and consumers around the world.
- ▶ Germplasm of vegetables tolerant of high temperatures, flooding, and drought have been identified and advanced lines are being developed.



## THEME BREEDING

**Our vision** : To produce varieties that break the boundaries of tropical vegetable production. :::



New vegetable varieties bring positive change to a country and a continent

## Partnerships for a better African tomato

It takes a very special tomato to survive the trip to market on rural African roads. Despite the bumpy ride, tomatoes have a big following in East Africa. Yet for decades, Tanzanian tomato production stagnated. Old varieties Marglobe, Moneymaker, Cal J, and Roma - some dating back almost a century - turned in lackluster performances. Expensive European hybrids were beyond the reach of smallholder farmers. Local processors unable to meet the demand for tomato pulp began importing it from China.

Varieties Tengeru97, Tanya, and the newly introduced Meru have quietly revolutionized tomato production in East Africa. Tanya, bred by scientists at the World Vegetable Center and released by the Tanzanian Horticultural Research Institute, was the first locally adapted processing variety suitable for year-round production. Full-fleshed, juicy and suitable for eating fresh or cooked, Tanya has become the country's most popular variety.

On smallholder farms the new varieties average 36% higher yields. Resistant to tomato mosaic virus, Fusarium wilt and root knot nematodes, the new varieties also keep much better, lasting up to three weeks at room temperature. But no new variety will have an impact without sufficient supplies of high-quality seed.

After retiring from international agricultural work, Mrs. Mariam Mongi and her husband Dr. Hussein Mongi founded the Alpha Seed Company in 1995 in Maweni village, Tanzania. This small but innovative operation has transformed the lives of hundreds of contract growers from Maweni, and also has helped establish new tomato-based industries in the country.

For more than 15 years, Alpha has worked with the World Vegetable Center to produce and market the seed of new varieties. Seed is

produced under irrigation in the village of Maweni in the cool, dry uplands of Tanzania close to the Center's regional headquarters. In recent years, good seed supplies of the new varieties have helped increase production by more than 40%.

The change was gradual. "It has taken a long time for people to realize there were better varieties than what they had," said Dr. Mongi. Now buyers come from as far as Zambia to get supplies of the new varieties.

A recent evaluation of the impact of Tengeru97 and Tanya by the Tanzanian government showed there had been "a remarkable increase in area and production" in the seven years since their release, with net income gains for an average producer of 21%.

"Five years ago you could travel between here and Zambia and see very little economic activity, but now there is widespread production of tomatoes across the country," said Dr. Mongi. The new varieties are even known beyond Tanzania; farmers are now exporting the fresh tomatoes to Mauritius and the Middle East.

The multiplier effect of the Mongi's small business keeps on growing in Tanzania, but can new vegetable varieties change a continent as well as a country? That's the goal of the World Vegetable Center's Vegetable Breeding and Seed Systems program (vBSS), which aims to release 100 new vegetable varieties suited to African conditions in the coming years. Launched in 2007, the program has adopted a "hub-and-spokes" model to build a viable, thriving seed sector in Africa through partnerships with national agricultural systems, NGOs, smallholder seed producers, and private seed companies. ❦



- ▶ Tomatoes are the world's most important vegetable crop, grown on more than 4 million hectares worldwide and a significant source of income for smallholder farmers.
- ▶ Over 120 of the Center's improved tomato lines have been released worldwide and 75% of vegetable seed companies in Asia use the Center's varieties.
- ▶ Just two of the Center's improved tomato lines have lifted tomato production in Tanzania by 40%.
- ▶ Smallholder farmers growing the new varieties had average income gains of 21% and in some districts of Tanzania more than 90% of farmers have been able to build new homes.
- ▶ Investing in a 25 g pack of improved tomato seed for only US\$0.25 can return up to 80-fold in income for a smallholder farmer.

## THEME PRODUCTION

**Our vision** : To improve seed supplies of superior vegetable varieties for poor farmers and to provide research and outreach leadership to help them produce vegetables safely. :::



**A simple pheromone trap lures a major eggplant pest and catches profits for farmers and entrepreneurs alike**

## The scent of success in South Asia

It's a classic example of what economists call a "virtuous circle": Starting in 2000, as part of an integrated pest management strategy (IPM) to reduce pesticide use in Bangladesh, India, and Sri Lanka, World Vegetable Center researchers and partners developed an inexpensive, environmentally safe sex pheromone trap to lure the eggplant fruit and shoot borer (EFSB), a pest that devastates one of South Asia's most important vegetable crops. Farmers tried the trap; it worked. They told other farmers, who then wanted more traps. Small-scale entrepreneurs saw a business opportunity and began making traps. Competing manufacturers experimented with different-shaped release vials to deliver the pheromone over longer periods of time. With competition, the price of each trap went down.

Eight years later, nine companies are making a variety of traps, the price has dropped from US \$1 to US \$0.10 per trap, and thousands of farmers can afford to use more traps more often. More traps in use leads to fewer pesticide applications, better eggplant harvests, healthier people, wealthier farmers, and a diversified local economy.

In the monsoon season when other vegetables are in short supply, eggplant is often the only vegetable available at an affordable price for rural and urban poor alike. It is cultivated on small, family-owned farms where the weekly sale of its produce brings in much-needed cash.

Previously, farmers had been caught in a vicious cycle of pesticide misuse to control EFSB larvae. This led to a spiral of higher production costs, environmental pollution, human health hazards, the destruction of natural enemies of EFSB, and the development of pesticide resistance in EFSB.

To break the cycle, researchers crafted a simple IPM strategy based on keeping fields clean of old eggplant stalks; regular pruning and disposing

of EFSB-damaged shoots with larvae inside; sex pheromone traps to attract and kill EFSB adult males; and refraining from pesticide use for as long as possible to allow native natural enemies of EFSB to thrive.

In addition to hosting field days, NGOs and extension agencies convinced vegetable growers in the pilot project areas to adopt the IPM strategy through puppet shows, wall paintings, and a TV documentary. Local media were actively engaged at press conferences, which led to feature stories, editorials, interviews, and talk shows. In some isolated rural communities, anything received by mail is given careful consideration; for this reason, several thousand EFSB brochures were sent by post directly to Bangladeshi and Indian farmers. A wall calendar with production and protection tips and timing for various eggplant management activities proved to be a popular communication tool in Gujarat.

Without a ready supply of pheromone traps at an affordable cost, however, the IPM strategy could not be fully realized. Alert small and medium enterprises near the EFSB project pilot sites began to produce and sell the lures and traps to local farmers. Agricultural input dealers were encouraged to add the traps to their stock.

The new IPM technology reduced pesticide use by 65–75% in Bangladesh and India. Farmers adopting the IPM strategy reduced their cost of production by 30% - and increased their net income by 60%.

The virtuous circle set in motion by a simple insect lure is expanding into southern and central India with a grant from the Sir Ratan Tata Trust. The Center hopes the strategy's multiple benefits will be felt elsewhere in Asia as well: There are plans to replicate the effort in the Philippines and other countries in Southeast Asia if funding can be secured. ❏



▶ South Asia accounts for almost 50% of world's area under eggplant cultivation and during the wet season it is one of the only vegetables affordable to poor communities.

▶ Each season smallholder farmers spent almost a third of their eggplant production costs on more than 80 applications of pesticides to control the eggplant fruit and shoot borer.

▶ Introduction of the Center's IPM program by smallholder farmers in Bangladesh and India reduced pesticide applications for eggplant fruit and shoot borer by 65–75%.

▶ Farmers adopting the IPM increased their net income by 60% with reduced exposure to pesticides and less contamination of eggplants sold to consumers.

## THEME **MARKETING**

**Our vision** : To develop postharvest technologies and provide information to market agents to enable them to participate in high value vegetable chains. ∴

## Reducing losses of Southeast Asian vegetables benefits everyone

# Developing the hidden harvest

Many vegetables are highly perishable and up to a third of the world's harvest is lost before it ever reaches consumers. Such high postharvest losses make vegetable production and marketing a risky business for smallholders - the main producers in the tropics. In Cambodia, Laos, and Vietnam the World Vegetable Center is researching and developing low-cost postharvest technologies to reduce losses for two important vegetables - tomato and chili pepper - with benefits for farmers and consumers alike.

"It all begins with a simple question: What does the market want, and what happens to vegetable crops after harvest?" says Dr. Katinka Weinberger, the Center's senior socioeconomist. It's harder to answer than it might seem, as there is very little local data available on postharvest losses, storage infrastructure, or how vegetables are traded.

But, "to understand the dynamics of the harvest-to-consumption chain, it is essential that such information is collected and interpreted," says Weinberger.

Losses start right after harvest. "Farmers used to harvest tomatoes around noon and let them sit in the sun while they waited for the collector to arrive about 5 or 6 p.m. and load them onto carts or trucks. By the time they reached the market, the tomatoes at the bottom were crushed and the rest were no longer fresh," says Weinberger. "We advised them to harvest vegetables at dawn, when it's cool, and to keep them that way by simply covering the packed vegetables with a soaked sack to bring down the temperature by a few degrees." Such simple changes extended with the help of private sector partners help create new opportunities. "We have observed that traders are now happily willing to drive up to 700 to 800 kilometers to buy from farmers, as they know they will get high quality products," says Weinberger.

Research to understand the economics of different production and handling technologies

tied with training in quality control is an important aspect of all the Center's postharvest activities involving producers, processors, retailers, researchers, and extension specialists. This also can create opportunities for "improved value adding through small-scale packaging and processing by microenterprises," says Weinberger.

In Vietnam seasonal oversupplies of tomatoes and chilies meant low prices for producers. To overcome this, the Center and its local partners developed and promoted low-cost drying and processing technologies to produce chili-tomato sauces available to consumers year-round. This value-adding worked so well the news spread to other countries.

In neighboring Laos the area of vegetables grown has been expanding recently at 18% per year, encouraged by government support and market liberalizations. But high postharvest losses dampened chili farmers' enthusiasm. A group of alumni from one of the Center's workshops responded to the challenge by starting the first commercial chili drying operation in Laos and producing a chili sauce more attuned to local tastes than the imported competition.

Traditionally, Laos is an importer of dried chilies from neighboring Thailand, but Laotians prefer the taste of the local varieties. The farmers' group began with a chili solar dryer based on a prototype developed by the World Vegetable Center. With an initial investment of US\$ 500 for equipment, a price of 30,000 Kip (US\$ 3.50) per kilo for their product, and target production of one tonne of dried chilies a year, the business has a bright future. Through better postharvest management the Center's research and development work benefits producers, processors, and consumers alike. :::



- ▶ Vegetables consist of about 90% water and are highly perishable. Up to a third of the world's crops are lost between harvest and consumers.
- ▶ Tomatoes and chili are among the most important vegetables in Southeast Asia.
- ▶ Small changes in practices and the introduction of simple technologies can make a huge difference in reducing smallholder producers' post-harvest losses of tomatoes and chili.
- ▶ Reducing postharvest losses through research and training is the first step in creating value-adding industries based on packaging and processing.

## THEME **NUTRITION**

**Our vision** : To assess, improve, and promote the nutritional and nutraceutical values of indigenous vegetables and to encourage their adoption by resource-poor communities. :::



## African indigenous vegetables: a home-grown answer to malnutrition

### A surprising nutritional heritage

Most African diets are highly imbalanced, but a solution can often be found growing along roadsides. African vegetable consumption per capita is only 43% of the internationally recommended levels and well below other developing regions of the world. “Vegetables are our most important source of vitamins and minerals and deficiencies of vitamin A and iron in particular are major causes of malnutrition in Africa,” according to Dr. Ray-yu Yang, head of nutrition at the World Vegetable Center. “Africa’s own indigenous vegetables are an underdeveloped nutritional treasure trove.”

Indigenous vegetables are well adapted to African growing conditions and are a vital and unrecognized food source for the poorest members of rural communities. They are easy to grow and are a cheap and readily available food source.

In rural Tanzania the Center found that they provided up to half of the beta-carotene (vitamin A precursor) and a quarter of the iron requirements for the poorest members of the community; far higher proportions than for wealthy local consumers. Despite being a part of Africa’s heritage and traditional village cuisine, they have been neglected by researchers as “food for the poor” and until recently were unavailable in urban supermarkets.

Improved varieties, growing techniques, and cooking methods developed by the Center for crops such as amaranth, spider plant, African nightshade, and African eggplant are fueling a resurgence in their popularity. Selected high yielding varieties suited to local tastes are being promoted to farmers in East Africa with the help of local partners. Supermarket displays and innovative promotions have raised urban consumer awareness. Sales of indigenous leafy vegetables increased from close to nothing to over 9000 tonnes over a two-year period in Nairobi alone, and farmers cannot keep up with the growing demand.

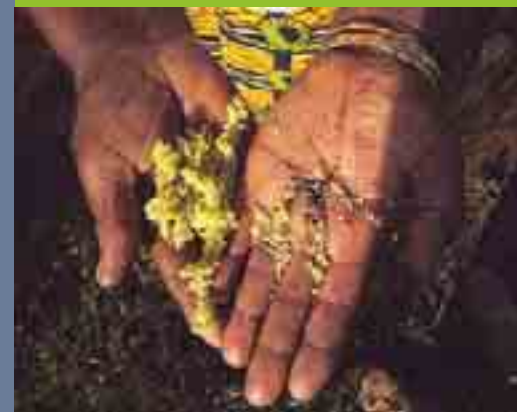
“Indigenous vegetables are surprisingly nutritious as well as an excellent source of many nutraceutical compounds,” says Dr. Yang. She found that while “exotic and African indigenous vegetables have similar levels of beta-carotene and vitamin C, indigenous vegetables have greater levels of vitamin E, folate, calcium, iron, zinc and antioxidant activity.” Indigenous vegetables are a particularly good source of antioxidants, which help protect against cancer; some even have antibacterial properties, hence their traditional role as medicines as well as food.

The Center has modified traditional recipes to improve their nutritional value. Leafy vegetables are usually simply boiled or stir-fried, but Dr. Yang’s team found that adding readily available oil, tomato, lemon, and soybean could double the availability of beta-carotene and more than double the bioavailable iron they supply.

At its regional headquarters in Arusha, Tanzania, the Center’s scientists have developed improved spacing, fertilizing, planting times, and harvesting practices to integrate up to 14 different kinds of vegetables in optimized home garden systems. Using these innovative cropping patterns, yields of over 80t/ha can be obtained to provide a household’s daily vegetable requirements year-round.

“Home garden packs” containing elite lines of indigenous and exotic vegetables have been developed by the Center and widely promoted in East Africa as a part of women farmers’ training courses in growing, processing, and the preservation and cooking of vegetables.

In Tanzania alone almost 8000 seed packs were distributed in 2007. Now in partnership with 23 seed companies in East and Southern Africa, the Center is commercializing its improved lines of African indigenous vegetables to ensure they play a vital part in overcoming African malnutrition. ❧



- ▶ Vegetables are our most important source of micronutrients and essential for a balanced diet.
- ▶ African vegetable consumption per capita is less than half that recommended for adequate nutrition and well below that in other developing regions of the world.
- ▶ African indigenous vegetables are hardy and can provide up to half the vitamin A and a quarter of the iron for the poorest members of rural communities.
- ▶ The Center’s research and promotion of indigenous vegetables is creating new opportunities to develop Africa’s nutritional heritage for the benefit of all consumers.





# The World Vegetable Center

## A highly diverse workforce

The World Vegetable Center has a more diverse workforce than many comparable organizations, and building on this diversity is a key to the Center's vitality. Two measures of staff diversity are the nationalities of international staff and the gender balance. The Center substantially expanded its staff between 2006 and 2007, adding 20 new international positions. By December 2007 there were 67 senior staff members from 30 different countries, with the six most common nationalities represented being Taiwan (10), Germany (7), Philippines (7), India (5), USA (4) and Cameroon (3). Taiwan nationals represented 15% of the senior staff, similar to the average staff diversity for CGIAR Centers. Of the 30 senior management positions, 40% are occupied by women - a level much higher than the 2007 CGIAR average of 25%.

Senior staff as of December 2007 were:

LUMPKIN Thomas A.	Director General, HQ
HUGHES Jacqueline	Deputy Director General for Research, HQ
CHANG Yin-fu	Deputy Director General for Administration and Services, HQ
AKYEAMPONG Ekow	Coordinator, West and Central Africa Office, Mali
CHADHA Madan L.	Director, Regional Center for South Asia, India
CHAI Nancy	Comptroller, HQ
DE LA PEÑA Robert	Head, Biotechnology and Molecular Breeding, HQ
EASDOWN Warwick	Head, Communications, HQ
ENGLE Liwayway	Head, Genetic Resources and Seed, HQ
GNIFFKE Paul	Head, Bulb Allium and Pepper Breeding, HQ
GREEN Sylvia	Head, Virology, HQ
HAMILTON Kathryn	Special Projects Coordinator, HQ
HANSON Peter	Head, Crucifer and Tomato Breeding, HQ
HELSEN Jan	Manager of vBSS Project, Tanzania
KAISER Markus	Grant Development Coordinator, HQ
KANZA George	Financial Administrator, Regional Center for Africa
LU Vincent	Internal Auditor, HQ
MAVLYANOVA Ravza	Coordinator, Central Asia and the Caucasus Office, Uzbekistan
OOI Peter	Director, Asian Regional Center, Thailand
PALADA Manuel	Head, Crop and Ecosystem Management, HQ
RAMASAMY Srinivasan	Head, Entomology, HQ
SUN Zhanyong	Head, Cucurbit Breeding, HQ
TAN-HABACON Lilia	Human Resources Manager, HQ
VIRCHOW Detlef	Director, Regional Center for Africa, Tanzania
WANG Jaw-fen	Head, Bacteriology, HQ
WANG Peter	Head, Technical Services, HQ
WANG Tien-chen	Head, Mycology, HQ
WEINBERGER Katinka	Head, Socio-economics, HQ
WU Lydia	Food and Dormitory Manager, HQ
YANG Ray-yu	Head, Nutrition, HQ



## Quality and relevance of current research

The production of peer-reviewed articles in international journals is a measure of the Center's scientific productivity and publication quality in parallel with its output of developmental publications.

	Total externally reviewed publications per scientist (journal articles, books, chapters and conference papers)	Externally reviewed publications per scientist in journals listed in Thompson Scientific/ISI (with impact factors)	Percentage of peer reviewed scientific papers published with partners from developing countries
2006	1.79	0.60	30%
2007	1.93	0.36	17%
<b>Average</b>	<b>1.85</b>	<b>0.47</b>	<b>23%</b>

The major expansion of new scientific staff in 2007 increased the overall depth of scientific expertise in the Center and publications per scientist also increased. For established scientists, their publications in international journals with impact factors were comparable to those of CGIAR centers. About a quarter of the publications were produced in partnership with scientists from developing countries - a strong indication of the Center's efforts to foster the scientific endeavors of partners.

The Center's top 10 journal articles as rated by Thompson/ISI impact factors focused on plant pathology, genetics, and nutrition, with the two top ranked articles in Phytopathology (impact factor of 2.377) focusing on the genetics of disease resistance.



## Financial health

The World Vegetable Center's financial health is measured by its short-term solvency (liquidity) and long-term financial stability (adequacy of reserves).

	AVRDC-The World Vegetable Center	Recommended range by CGIAR
Working capital (liquidity)	55 days	90-120 days
Adequacy of reserves – long-term financial stability	81 days	75 - 90 days

The Center's strong long-term financial support from its host country, Taiwan, reduces the need for working capital compared to many international agricultural research centers, and helps to compensate for Taiwan's relatively high labor costs. Unrestricted income in 2007 comprised 58% of the total and was obtained from national governments and the private seed sector; unrestricted income was 34%; and other income, 8%.

## \_\_2007 Revenues (★)

<b>Unrestricted grants</b>	7,751	58%
<b>Restricted grants</b>	4,574	34%
<b>Other revenues and cost recovery</b>	1,045	8%
<b>Total income</b>	13,371	100%

<i>Unrestricted grants</i>		
Republic of China	5,557	42%
United Kingdom, DFID	1,406	11%
USAID	291	2%
Thailand	139	1%
Asia and Pacific Seed Association	143	1%
France	109	1%
Japan	68	1%
South Korea	30	0.2%
Sakata Seed Corporation	8	0.1%
<b>Sub-total</b>	<b>7,751</b>	<b>58%</b>

(\*) in 1,000 of USD

<i>Restricted grants</i>		
Germany, BMZ/GTZ	1,207	9%
Bill & Melinda Gates Foundation	969	7%
Republic of China, COA, NSC	509	4%
Australia/ACIAR	337	3%
Asian Development Bank	331	2%
United States, USAID	267	2%
Switzerland, SDC	264	2%
Germany, Vater u. Sohn Eiselen-Stiftung	120	1%
South Korea, RDA	91	1%
Rockefeller Foundation	69	1%
European Union	67	0.50%
East-West International B.V.	48	0.40%
United Kingdom, DFID	46	0.30%
Canadian International Development Agency	43	0.30%
International Fund for Agricultural Development	41	0.30%
Training Fund and others	38	0.30%
Kilimo Trust	23	0.20%
Relief International/RALF	21	0.20%
The Organic Center	19	0.10%
French Ministry of Foreign Affairs	15	0.10%
Asia and Pacific Seed Association	14	0.10%
Sir Ratan Tata Trust	12	0.10%
Japan	10	0.10%
Philippines	9	0.10%
United States, USDA	3	0.02%
<b>Sub-total</b>	<b>4,574</b>	<b>34%</b>
<b>Other revenues</b>	<b>174</b>	<b>1%</b>
<b>Indirect cost recovery</b>	<b>872</b>	<b>7%</b>
<b>Total</b>	<b>13,371</b>	<b>100%</b>









AVRDC

The World Vegetable Center

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