Empowering Small-Scale Farmers for Knowledge-Based Agriculture

AVRDC Strategy 2010

Asian Vegetable Research and Development Center
The Asian Vegetable Research and Development Center is an international not-for-profit organization committed to ensuring the world's food security through research, development, and training.
# Empowering Small-Scale Farmers for Knowledge-Based Agriculture

**AVRDC Strategy 2010**

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## Acronyms

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<th>Acronym</th>
<th>Description</th>
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<tr>
<td>AARNET</td>
<td>ASEAN-AVRDC Regional Network on Vegetable Research and Development</td>
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<td>APAARI</td>
<td>Asia-Pacific Association of Agricultural Research Institutions</td>
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<td>ARC</td>
<td>Asian Regional Center (regional center of AVRDC)</td>
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<td>ASEAN</td>
<td>Association of Southeast Asian Nations</td>
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<td>ASARECA</td>
<td>Association for Strengthening Agricultural Research in Eastern and Central Africa</td>
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<td>AVRDC</td>
<td>Asian Vegetable Research and Development Center</td>
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<td>CARIVEG</td>
<td>Caribbean Vegetable Network</td>
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<td>CGIAR</td>
<td>Consultative Group on International Agricultural Research</td>
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<td>GAP</td>
<td>good agriculture practices</td>
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<td>IARC</td>
<td>international agricultural research centers</td>
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<td>IPM</td>
<td>integrated pest management</td>
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<td>IPR</td>
<td>intellectual property rights</td>
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<td>NARES</td>
<td>national agricultural research and extension systems</td>
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<td>NGO</td>
<td>non-governmental organization</td>
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<td>RCA</td>
<td>Regional Center for Africa (regional center of AVRDC)</td>
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<td>SACCAR</td>
<td>Southern African Centre for Cooperation in Agricultural Research and Training</td>
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<td>SINGER</td>
<td>CGIAR System-wide Information Network for Genetic Resources</td>
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<tr>
<td>WECARD</td>
<td>West and Central African Council for Agricultural Research and Development</td>
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<td>WTO</td>
<td>World Trade Organization</td>
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In the emerging global economy, the management and utilization of knowledge will increasingly drive agricultural development. Small-scale farmers in the tropics must become prepared for this new knowledge-based economy. In addition to increasing productivity, they will need to continuously adjust their farming systems to improve their resource-use efficiency and to produce market-oriented products that increase profits, thereby remaining competitive.

The Asian Vegetable Research and Development Center (AVRDC) is focused on serving the needs of small-scale farmers in the tropics. Its work contributes to higher productivity, better nutrition for the poor, sustainable practices that promote food safety, and capacity building of our partners. The Center has recently been cited for its impressive record in the release of new cultivars and other production technologies, worldwide distribution of germplasm, and training programs that show increased emphasis on the education of women.

The following plan is AVRDC’s long-term strategy, Strategy 2010. It is a document that has been developed with the input of the AVRDC staff and its networks of partners through a series of workshops in 2001. Using a concise format, this document describes the vision, goals, and strategic program direction of AVRDC for this decade.

As we look to the future, AVRDC’s 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. The development of such partnerships, including with the private sector, will be vital for maximizing impact.

Reducing poverty and hunger in the tropics is a daunting and complex task. Working with its partners, AVRDC aims to empower small-scale farmers for the emerging knowledge-based economy. The result will be a stronger agricultural sector that will reduce poverty and improve nutrition for all persons in the tropics.

Sincerely,

Dr. Samson C.S. Tsou
Director General

Declan J. Walton
Chairman of AVRDC Board
Organizational Statement

Our Mission

Improve nutrition and reduce poverty in the tropics through vegetable research and development

Our Strategy

Build partnerships and mobilize resources from private and public sectors to effectively tackle problems of vegetable production and consumption in the tropics. This strategy will contribute to:

- Increased productivity of the tropical 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

Our Core Expertise

- Management of diverse vegetable germplasm
- Innovations in crop 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 timely issues
- Generate and disseminate international public goods that address economic and nutritional needs of the poor
- Safeguard genetic resources for worldwide use within the framework of international undertaking
- Provide globally accessible, user-friendly, science-based information
AVRDC will focus its programs on increasing vegetable productivity, improving diets, preserving biodiversity, and managing information.
Chapter 1

Introduction

Global Challenges

Agriculture in developing countries faces a number of pressing challenges, including population growth and widespread poverty. World population is projected to grow from 6.1 billion today to 7.9 billion in 2025. Most population growth will take place in cities, whose population in 2025 is expected to double to 3.4 billion.

Widespread poverty persists, contributing to severe malnutrition. Approximately 1.2 billion rural people live on less than $1 per day. About 250 million preschool children suffer from vitamin A deficiency, often resulting in blindness (U.N., 2000). Also alarming is that an 18% rise in the number of malnourished children is projected in Africa by 2020 (IFPRI, 2001). Over 2 billion persons suffer from deficiencies of micronutrients in their diets (Gardner and Halweil, 2000). Such malnutrition prevents much of the world’s population from reaching their potentials as human beings, mentally, physically and financially. It also contributes to higher rates of deaths caused by heart disease, stroke and cancer (Khaw, 2001). This intolerable situation can be remedied in great measure by increasing consumption of vegetables. Vegetables are the most affordable and sustainable dietary sources of vitamins, trace elements and other bioactive compounds.

Agriculture faces other challenges as well. There is limited land for expansion of agricultural areas. Land degradation and increasing water scarcity place additional constraints on increasing agricultural productivity.

Most of the farmers in the developing world are small-scale farmers. For example, in South Asia, 125 million farmers operate on an average size of 1.6 ha. In Bangladesh, 96% of all holdings have a size of 0.3 ha. Intensive, yet sustainable production practices need to be developed for these small-scale farmers faced with the challenge of feeding the world’s growing population.

Global, knowledge-based economies are rapidly forming. Globalization likely will disfavor small-scale farmers as a result of increased competition. However, globalization can have a positive impact on these farmers, since it entails access to new opportunities and information, improved linkages between local and international markets, and rapid dissemination of advanced agricultural technologies. However, small-scale farmers will only be able to survive and compete if they have access to information technologies and more alternatives for diversified income.

Population growth continues today, especially in urban areas. Providing nutritious food that is affordable to all remains a great challenge.

Over 2 billion persons suffer from micronutrient deficiencies; the vast majority are poor women and children. Vegetables are the most affordable and sustainable sources of micronutrients in diets.
**Vegetable Production Trends**

Vegetable production is steadily increasing. 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) (Ali, 2001). Yields per hectare have also significantly increased, mostly due to the introduction of improved technologies and management techniques (Fig. 2).

Productivity is the key. Greater productivity will generate more income for farmers, more job opportunities in the vegetable sector, and reduced prices for consumers. 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% (Thirtle et al., 2001). Briefly stated, greater productivity leads to better nutrition.

**Vegetable Consumption Constraints**

Despite the steady gains in vegetable production and yields in Asia, more work needs to be done. There are insufficient supplies of vegetables in most Asian nations for proper nutrition (Fig. 3).

Socio-economic studies conducted by AVRDC show that families in these regions want to eat more vegetables. The most consistent factor limiting vegetable consumption is lack of income. Studies of income elasticities show that for every 10% rise in income, there would be a corresponding rise of 7.7-7.9% in vegetable consumption in these regions (Ali, 2001). Therefore, strategies that generate higher incomes are required to improve vegetable consumption and overall nutrition in developing countries.

**Fig. 3.** There are insufficient supplies of vegetables throughout Asia for proper nutrition (Ali, 2001).
Another limiting factor of vegetable consumption is price. Studies in these regions show that for every 10% reduction in the price of vegetables, there would be a 4.6-5.9% rise in purchases of vegetables (Ali, 2001; Weinberger, 2002). Therefore, strategies are required that reduce the costs of vegetables, especially during the off-season when prices are particularly high. AVRDC has a long history of developing technologies for off-season production. These technologies include heat-tolerant and disease-resistant varieties, raised beds, and grafting techniques.

Chapter 2

AVRDC’s New Vision

Today’s Agriculture

As the global economy becomes knowledge-based, the management and utilization of information will increasingly drive agricultural development. Knowledge-intensive technologies and services (pest management strategies, seed, fertilization strategies, value-added markets), will continue to increase in importance within the agricultural sector.

All farmers, including small-scale farmers, will need both ingenuity and competency to remain competitive. In response, the AVRDC will focus its efforts in generating and managing new scientific information, and promote innovations for small-scale farmers in the production and marketing of vegetables.

Modern Approaches to Research

AVRDC is dedicated to generating science-based information that is useful to small-scale farmers. Remarkable advances are being made today through applications of biotechnology and information technology. AVRDC will utilize these tools to maximize both impact and efficiency in research and communication. Applications of molecular tools will include the diagnosis of diseases and strain typing, molecular markers to assist breeding, fingerprinting for germplasm management, and using transformation as a tool to obtain additional sources of desirable traits. Emphasis will be placed on the development of safe and sustainable technologies.

Information management technologies will break down barriers of communication, increase access to knowledge, and enhance learning. Interactive and user-friendly web sites, accessible databases, and long-distance education programs will be used for generating, managing, and sharing knowledge.

Most of the poor in developing countries are small-scale farmers. Globalization poses a potential threat to their livelihoods. Increasing the productivity and profitability of these farmers will reduce poverty and improve nutrition for all poor living in the tropics.
Partnerships for Poverty Alleviation

AVRDC will place greater emphasis on fostering new strategic partnerships. As a member of a global team, AVRDC will engage in new and innovative forms of cooperation with national agricultural research and extension systems (NARES), the private sector, advanced research institutes, non-governmental organizations (NGOs), and farmers’ organizations. Collaborations with other international agricultural research centers (IARCs) for regional efforts will be strengthened. AVRDC will actively seek new donors, including privately-run organizations with shared principles and vision. Strategic alliances will be expanded in sectors related to the inputs and skills required in knowledge-based agriculture. Through the work of these diverse partnerships, vegetable farmers will have increased access to research-based information and technologies. Farmers will develop skills in applying them to upgrade their operations. There will be better prepared to compete in the dynamic markets of the emerging knowledge-based agriculture (Fig. 3).

AVRDC believes that these empowered small-scale farmers will be more productive and profitable. They will learn the benefit of sustainable production practices. They will take advantage of value-added markets for their products. They will produce a year-round supply of safe food that will be more affordable to poor families. This increased availability of food, in turn, will lead to improved health and educational abilities of families living in the rural sectors. The empowered families can contribute to the development of related industries in the rural sector, thus creating more employment opportunities. All these efforts will contribute to the overall goal of poverty alleviation.

In summary, AVRDC’s vision focuses on partnerships for poverty alleviation. Our strategy is to empower farmers for knowledge-based agriculture. This approach will lead to greater productivity, more income, increased competitiveness, more diversified supply of food, improved nutrition, reduced poverty, and sustainable economic growth.

Fig. 3. Partnerships for Poverty Alleviation – Empowering Vegetable Farmers. Partners continuously work together to empower farmers for knowledge-based agriculture. The empowered farmers are more productive and profitable, leading to a steadily improving quality of life in rural and urban communities.
AVRDC’s Platform for Action

AVRDC is the principal international agricultural research center dedicated to vegetable research and development. Using an interdisciplinary and gender-sensitive approach, AVRDC researchers will work with its partners throughout the tropics to develop technologies and disseminate information on vegetable production and consumption. To empower small-scale farmers for knowledge-based agriculture, AVRDC pledges itself to the following:

**Overall Goal**
Empower small-scale farmers to adapt to knowledge-based agriculture, thereby leading to increased vegetable production and consumption in the tropics

**Intermediate Goals**
- Create, support, and mobilize effective partnerships for serving the needs of small-scale farmers
- Increase productivity and profitability of small-scale vegetable farmers
- Develop and promote good agriculture practices (GAP) of safe vegetables in the tropics
- Diversify production and consumption of vegetables for improved nutrition of the poor
- Enhance capacities of the poor in knowledge-intensive inputs and services for higher income and better job opportunities
- Contribute to the development and increased efficiency of the agri-business sector, especially in rural areas

**Strategic Program Direction** *(please refer to the Annex for details of projected outputs)*

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

*Objective:* Improve vegetable germplasm and breeding technologies so as to increase the productivity of small-scale farmers and the research efficiency of partners.

*Major Activities:*
- Improve screening techniques for evaluation of priority traits, including nutrition and value-added qualities
- Increase efficiency in breeding methodologies, including molecular markers
- Create inbred lines, populations and hybrids, especially of vegetable legumes and solanaceous crops, to expedite variety development by public and private sectors

*AVRDC’s golden tomatoes have three times more beta carotene than standard tomatoes.*
2. **Year-round supply of safe and nutritious vegetables**

*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.

*Major Activities:*
- Promote the concept and approaches that lead to good agriculture practices in the tropics
- Improve and disseminate profitable practices for small-scale farmers during the off-season
- Develop integrated pest management strategies that enhance food safety and increase product quality
- Develop decision-making tools for NARES and NGOs to improve production and marketing skills of vegetable farmers

3. **Indigenous vegetables for biodiversity, healthy diet and marketing opportunities**

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

*Major Activities:*
- Expand efforts in collection, conservation and characterization of vegetable germplasm through collaborations
- Evaluate indigenous and underutilized vegetables for their use in enhancing nutrition and their potential as cultivated crops and/or healthy food
- Develop databases and networks to promote the utilization of diverse vegetable crops

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

*Objective:* Increase the access and applications of information technologies to improve competitiveness of small-scale vegetable farmers.

*Major Activities:*
- Develop and improve information management technologies for vegetable production and utilization
- Promote the exchange of vegetable related information among partners of public and private sectors and strategic alliances
- Increase global outreach through user-friendly on-line tools for training on information technology utilization

*Scientist accesses information on tropical vegetables from AVRDC web site.*
**Emerging Issues**

In addition to the activities listed previously, AVRDC will identify and engage in global and regional issues that emerge concerning vegetable production and consumption in the tropics. Platforms will be developed for consortial actions by policymakers, scientists and related parties. In this arena, AVRDC’s activities will address:

- Effects of WTO on vegetable production, trade and food safety
- Intellectual property rights and restriction of germplasm exchange
- Availability and efficiency of water use in vegetable production
- Issues for participation in the CGIAR Global Challenge Program

**Pathway of Outputs**

Both rural and urban poor are the principal targets of AVRDC’s outputs (Fig. 5). Collaborators will include NARES, NGOs, the private sector, and farmers. Gender-sensitive approaches will be used. A major contribution of AVRDC is to enrich and improve NARES’ and farmers’ assets. Outputs contributed from AVRDC in the form of public goods become assets of NARES and farmers, thus producing income and impact. The urban poor and other consumers benefit from greater access to safe and affordable vegetables.

![AVRDC pathologist instructs NARES scientists on virus detection methods.](image)

**Fig. 5. Pathway of Outputs.** AVRDC outputs are directed toward empowering small-scale farmers. Feedback from clients lead to the development of appropriate technologies. Overall impact includes higher yields for farmers and improved diets for consumers (Friedrichsen and Kalb, 2001).
Chapter 4

Regional Priorities

Regional and subregional organizations will play stronger roles in developing and implementing regional strategies. AVRDC will assist in priority setting, strategic development, technology and information generation, and human resource development. AVRDC headquarters and its two regional centers, Asian Regional Center (ARC) in Thailand and Regional Center for Africa (RCA) in Tanzania, will work closely with respective regional organizations, such as APAARI, ASARECA, SACCAR and WECARD to improve vegetable production and enhance vegetable consumption and marketing.

AVRDC will focus its efforts on developing projects that lead to improved plant materials, information and databases, research methodologies, and training materials. Human resource development strategies and other areas of emphasis will be specified for each region (Fig. 6).

Southeast Asia

This is a densely populated region with rapidly growing urban centers. Rising incomes and populations within the non-agricultural sector will encourage the development of international vegetable markets, especially among countries in Asia. In response to this increased demand, farmers will become more specialized and learn to produce higher quality vegetables. More vegetables will be produced by young farmers who can adopt new technologies and management skills.

AVRDC will promote production and crop diversification. Partnerships will be strengthened with the private sector and higher educational institutes to promote applications of knowledge-intensive inputs and services for small-scale farmers. Socio-economic studies will evaluate the impacts of this strategy on improving nutrition, health, and on- and off-farm productivity. The concept of good agriculture practices and value-added vegetables will be promoted through regional networks, such as AVRDC-ASEAN Regional Network on Vegetable Research and Development (AARNET). Farmers will be trained to produce safe and nutritious vegetables.
South Asia

South Asia is home to the majority of the world’s poor, most of whom live in rural areas. The integration of vegetables into the region’s predominantly cereal-based farming systems are needed to improve the nutrition of poor persons, especially women and children. An increasing demand for nutritious food from the urban poor living in mega cities will need to be satisfied.

AVRDC, jointly with its regional networks and international partners, will develop improved germplasm for the region. Priority will be given to lines with early maturity, heat tolerance, and resistance to major diseases.

The success of the AVRDC mungbean program will be used as a model strategy. Early-maturing mungbean lines were developed through partnership with NARES. These mungbeans have already been integrated into cereal-based cropping systems in nearly 2 million hectares throughout Asia. Looking to the future, these lines will be sown into 1 million additional hectares in the Indo-Gangetic Plains of South Asia by 2005, with the potential of being sown into an additional 9 million hectares in the future. The overall impact will contribute to improved diets for the people and greater sustainability of farming practices for the environment.

Besides genetic improvement research, integrated pest management (IPM) strategies will be applied to reduce pesticide use and production costs in the region.

Sub-Saharan Africa

The vegetable sector in this region is severely underdeveloped. Consumption rates of vegetables are much lower than recommended for proper nutrition. In this diverse agro-climatic region, there is great potential to produce numerous vegetable crops for both domestic and international markets. Institutional development deserves higher priority. Major constraints of the vegetable sector include the lack of quality seed supply systems and human capacity.

AVRDC, through its Regional Center for Africa, will initially focus on human resource development that includes training of NARES, NGOs, and community leaders in the rural sector. Germplasm enhancement and small-scale seed production for fruit vegetables and indigenous vegetables will be promoted. Peri-urban and urban agricultural systems will be studied in collaboration with partners. Surveys will be conducted to evaluate vegetable production and consumption trends throughout the region. Technology development and training will also be conducted to ensure the cultivation of vegetables after social or environmental crises.
**Central America**

This region consists of several countries with similar natural and socio-economical environments. New regional networks for vegetable research and development are forming, such as CARIVEG.

AVRDC will facilitate partnerships with international and regional organizations, including the private sector, for exchange and testing of germplasm and information. AVRDC will expand communications with scientists in the region using modern information technologies.

**Southeast Asia**

- Peri-urban production and marketing
- Vegetables with value-added potential
- Safe vegetables

**South Asia**

- Improvements in germplasm and varieties
- Adding vegetables into cereal-based cropping systems
- Integrated pest management

**Sub-Saharan Africa**

- Training
- Enhancement of indigenous vegetables
- Quality seed production

**Central America**

- New partnerships
- Germplasm exchange
- Information management

AVRDC has one of the largest collections of vegetable germplasm in the world.

Fig. 4. Program thrusts for priority regions.
Chapter 5

Organization and Management

In view of the increasing importance of the vegetable sector to farmers and consumers in developing countries, a marginal growth of vegetable R&D is expected. A healthy balance of core and project-based funding is to be maintained in order to provide flexibility in developing innovative programs. New initiatives, as outlined in this document, will expand the funding base of the Center. These initiatives will reflect AVRDC’s increased emphasis on vegetable production in the global, knowledge-based economy.

To implement the proposed strategy and effectively use resources, investments will be focused on increasing the Center’s capacity within its priority core expertise. Strategic alliance relationships with selected partners in the developed and developing world will be established and strengthened to provide supplementary technologies through various mechanisms, including outsourcing.

A more flexible structure with reduced administrative layers will be established. Working closely with top management, project managers will take more responsibility to design and implement innovative projects and be accountable of outputs.

AVRDC will pursue the formation of a more decentralized management structure. Greater authority will be given to the directors of regional centers to focus on regional priorities with their respective partners. The scientific team at AVRDC headquarters in Taiwan will assure scientific excellence and support regional activities as a team member in projects. Management at AVRDC headquarters will supervise overall research and support services.

Networks will remain as effective means to facilitate subregional activities in vegetable research and development. Communication technologies will be adopted to improve interactions among members. Information technologies will be developed and applied for training.

To cope with the rapid development in science, more resources will be allocated for exchange of staff and graduate students. Collaboration with advanced institutes in public and private sectors will be further strengthened.

The trend of reducing labor-intensive field work and increasing “high tech” research is expected. It is estimated that the current staff number will be needed to maintain an essential critical mass for effective programs at this international center. The staff pattern, however, will be shifted toward increased professional competence.
AVRDC at a Glance

The Asian Vegetable Research and Development 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, France, Germany, Japan, Korea, Philippines, Republic of China, Switzerland, Thailand, United Kingdom, and United States of America

**Staff:** Approximately 25 internationally recruited professional staff, and over 200 locally recruited researchers, technical and administrative staff

**Headquarters:** Shanhua, southern Taiwan

**Outreach offices:** Asian Regional Center, Kamphaengsaen, Thailand; AVRDC Regional Center for Africa, Arusha, Tanzania; Promotion and Development of Safe, Year-Round Vegetable Production in Peri-Urban Areas of Mekong Region (project), Hanoi, Vietnam; 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 short- and long-term training in a broad range of subject areas, from crop production to research design and execution, at its headquarters and outreach sites.

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

**Biodiversity preservation:** AVRDC has one of the world’s largest collections of vegetable germplasm, about 48,000 accessions, including underutilized indigenous species.

References


AVRDC’s Strategic Program Direction
- Outputs of Current and New Research Thrusts¹ -

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<th>Research Thrusts</th>
<th>Outputs</th>
<th>AVRDC Outputs</th>
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<td>Innovative germplasm enhancement for productivity, consumer acceptance, biofortification</td>
<td>- Important traits transferred from wild species to broaden the genetic base</td>
<td>1. Expanded and accessible collection of vegetable germplasm</td>
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<tr>
<td>Year-round supply of safe and nutritious vegetables</td>
<td>- High yielding, disease-resistant, tropically-adapted tomatoes, peppers, vegetable legumes, and onions</td>
<td>2. Enhanced vegetable hybrids and lines for tropical adaptation and increased productivity</td>
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<td>Indigenous vegetables for biodiversity, healthy diet and marketing opportunities</td>
<td>- Tomato and sweet peppers with improved beta-carotene levels</td>
<td>3. Enhanced vegetable hybrids and lines with improved quality and nutritional contents</td>
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<td>Interactive, user-friendly information management for vegetables in the tropics</td>
<td>- Mungbeans with improved methionine and iron levels</td>
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<td>- Vegetable legumes with high levels of health related factors</td>
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<td>- Disease and insect-resistant lines that reduce pesticide use</td>
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<td>- Good agriculture practices (GAP) for year-round vegetable production</td>
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<td>- Integrated pest and disease management technologies</td>
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<td>- Economically viable management practices of indigenous vegetables</td>
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<td>• Tomato, pepper, and vegetable legume lines with improved health promoting and processing properties</td>
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<td>• Strategic partnerships for utilization and consumption of indigenous vegetables</td>
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<tr>
<td>• Increased capacity of partners to conduct genetic improvement and seed production</td>
<td>• Increased capacity of partners to adopt, adapt, and promote year-round, safe vegetable production technologies</td>
<td>• Increased capacity of partners to conduct R&amp;D on cultivation and seed production of indigenous vegetables</td>
</tr>
<tr>
<td>• On-line database of AVRDC’s core germplasm collection</td>
<td>• Database of information for off-season and year-round vegetable production</td>
<td>• Comprehensive database of indigenous vegetables</td>
</tr>
<tr>
<td>• Analysis of utilization of AVRDC enhanced lines by NARES, NGOs and private sector</td>
<td>• Ex-ante and ex-post analyses of farmer adoption and impact on income and employment</td>
<td>• Socio-economic data on production and income generation</td>
</tr>
<tr>
<td>• Effects of WTO on vegetable production, trade, and food safety</td>
<td>• IPR and restriction of germplasm exchange</td>
<td>• Assessments of impact of vegetables on nutrition status and health</td>
</tr>
</tbody>
</table>

1 This matrix provides the framework of AVRDC’s long-term strategic program direction. More details will be described in rolling-term activity plans on a regular basis.