DR ANDREAS EBERT

Feed the world

Genebank Manager **Dr Andreas Ebert** introduces the efforts of one globally mandated research centre to encourage healthy eating and increase production of nutritious vegetables

MORINGA – HARVESTED PRODUCE

From what context did AVRDC – The World Vegetable Center emerge?

In the early 1960s the Green Revolution was well underway. Although the bumper harvests of improved rice and wheat varieties fed millions of people in developing countries across Asia, those staples could not provide people with sufficient vitamins, minerals and protein, resulting in high levels of malnutrition. Consumption of vegetables (and fruit) is critical to supply the essential nutrients needed for good health, and also add variety in taste, texture and colour to human diets.

An international effort to support vegetable production in the tropics resulted in a 1971 agreement to establish the Asian Vegetable Research and Development Center (AVRDC). The Center formally adopted a global mandate in 2008 when it became known as AVRDC – The World Vegetable Center.

As part of AVRDC's work, you aim to increase the genetic diversity of vegetables. What factors have led to this need?

A number of factors have caused a decrease in genetic diversity, including high deforestation rates, overexploitation of natural resources, pollution, natural disasters and climate change.

A major contributor was the global breeding efforts in the early 1960s. These had a clear focus on staple food crops, resulting in high yields, but also a considerable loss of genetic diversity, along with the gradual replacement of traditional fruit and vegetable crops. In the case of the tomato, for example, it has been estimated that the genomes of cultivated varieties contain less than 5 per cent of the genetic diversity of their wild relatives.

Genetic erosion is particularly serious for vegetables not yet well preserved in genebanks, such as slippery cabbage – a highly nutritious traditional vegetable cultivated by South Pacific communities – which is threatened by rising sea levels.

AVRDC works with both the public and private sectors. What are the benefits of this?

The public sector sets policy that can push agriculture in specific directions. We aim to influence policy makers to support initiatives that will benefit small-scale farmers, for instance, by strengthening seed production and distribution systems so that farmers have access to good quality seed at the right time for planting, or by establishing transparent regulations for the release of new vegetable varieties.

The private sector is an important and influential partner. Private companies have the distribution channels to ensure farmers can obtain seed and other inputs. They establish the markets and processing facilities to move the harvested product from the field to the consumer. To go beyond subsistence farming and improve their incomes, small-scale farmers must understand how the private sector works. They can then be active participants in the vegetable value chain. AVRDC has projects to help young, unemployed school-leavers become small-scale entrepreneurs in the horticultural sector.

Why is greater involvement of women in the research process important for reducing malnutrition?

In most of the countries where the Center is active, women are responsible for growing, processing and marketing vegetables. They are often the decision makers regarding what their family eats each day. AVRDC strives to provide appropriate advice and education targeted toward women, to encourage them to consume more vegetables, and ensure their family members eat a balanced diet rich in fruit and vegetables, especially nutritious leafy greens.

Young women of childbearing age must be well-nourished. An undernourished woman is at risk of complications during pregnancy and her baby is likely to have a low birth weight. These infants have a higher risk of contracting infection and dying, they have low body stores of micronutrients that may result in disorders such as anaemia, they develop slowly and may be less able to learn, work and earn as adults. It is important to break this intergenerational cycle of malnutrition and increasing vegetable consumption is the simplest and most effective means to do so.

First International Symposium on Moringa

Jointly organised by AVRDC and the Moringaling Philippines Foundation under the auspices of the International Society of Horticultural Science, the Symposium will be held from **19-22 November 2015** in Manila, the Philippines. The event will focus on recent advances in research and development of the vegetable tree moringa. Topics covered include ethnobotany and germplasm, crop management, nutritional benefits and medicinal properties, commercial and industrial utilisation and the role of moringa in food security and poverty alleviation.

The need for dietary diversity

Access to sufficient nutritious foods can be limited in many areas of the world. **AVRDC – The World Vegetable Center** in Taiwan is identifying plants with nutritional benefits, while improving what people put on their plates by informing farmers' and consumers' views of vegetables

IN RECENT DECADES, nutrition has become a divisive topic. Opinions about what constitutes a healthy diet are wide-ranging and constantly changing. Diets also vary greatly around the world and between different groups in society, with eating behaviours being shaped by cultural and geographical influences.

Regardless of the different factors at play, it is hard to refute that vegetables are an essential part of maintaining good health and a balanced, nutritious diet. Eating a diet rich in vegetables can have profound health benefits, and may even protect against certain types of cancers. Consuming vegetables rich in fibre may reduce the risk of heart disease, obesity, and type 2 diabetes, while those with high amounts of potassium have been shown to lower blood pressure, and may also cut the risk of developing kidney stones and help to decrease bone fragility and bone loss.

In many areas of the world, however, access to nutritious vegetables is limited. In developing countries in particular, vegetable supplies can be deemed inedible due to the presence of pesticides or microbial infestation. Most modern crops have been developed from a very narrow genetic base, which makes them more vulnerable to new strains of insect pests and diseases. This can significantly compromise food supplies and, in serious instances, lead to major losses of human life from hunger and starvation. Without access to a reliable supply of nutritious foods, people replace vegetables with carbohydrates and fatty foods, leading to obesity and other associated health concerns.

PROMOTING HEALTH

Looking to improve the nutrition of millions of people, AVRDC – The World Vegetable Center seeks to alleviate poverty and malnutrition in the developing world through the increased production and consumption of nutritious and health-promoting vegetables. The Center comprises approximately 300 staff with around 50 internationally recruited scientists and professionals who lead and take part in projects throughout Asia, Africa, Central America and Oceania.

AVRDC conducts both research and development to improve vegetable production and consumption, and its work spans the entire vegetable value chain: managing germplasm, developing new varieties, improving production and enhancing consumption. This research benefits greatly from the Center's location in southern Taiwan – the region's tropical climate and heavy rainfall allow crops to be tested for their suitability under extreme weather conditions. The area is also ripe for pest and diseases, meaning produce can be selected for resilience.

PROFILING PLANTS

The Center is home to the world's largest public vegetable germplasm collection, which boasts more than 60,000 accessions from 156 countries. The gene bank is a vital tool to furthering AVRDC's goals and allows researchers to identify plants that demonstrate highly desirable traits such as disease resistance, stress tolerance or high nutritional value. Using this information, the genes can then be introduced to existing varieties during the conventional breeding process to create improved plants.

Knowledge sharing is a key aspect of the Center's work and the bank has therefore been made accessible and searchable to anyone in the world through the AVRDC's Vegetable Genetic Resources Information System (AVGRIS). Dr Andreas Ebert, who leads the Center's research on germplasm, explains the vast amount of data available through the gene bank: "Passport data include the scientific name, common name, subtaxa, origin, donor and registration date of each accession. Characterisation data describes a plant's morphological characteristics, and evaluation data include 20 different criteria of nutritive value as well as 15 criteria of resistance to pests and diseases".

SEED PACKING

SEED SECURITY

One of the Center's core goals is to increase the supply of safer vegetables that are able to grow using minimal amounts of pesticides and fertilisers. To do this, the researchers are developing vegetable lines with an inbred resistance to disease as well as promoting integrated crop management strategies. Ebert expands on this approach: "We combine monitoring of pest populations, trap crops, pheromone traps, growing crops under cover, grafting, biocontrols, concentrated starter solutions, and other techniques to help farmers eliminate or significantly reduce the amount of pesticides and chemical fertilisers they use".

AMARANTH TRIAL PLOTS

UNDERUTILISED INDIGENOUS/ TRADITIONAL VEGETABLES FOR SUSTAINABLE FOOD PRODUCTION AND NUTRITIONAL SECURITY

OBJECTIVES

- Crop diversification to enhance resilience to biotic stress by supressing pests and diseases and abiotic stress by buffering production systems against climate variability, thereby reducing the risks in food production, especially by smallholders
- Many traditional or indigenous vegetables have high nutritional value and are a valuable source of essential vitamins, micronutrients, proteins and phytochemicals for disease prevention. Educating consumers about the nutritional benefits of these vegetables and convincing them to include a range of these crops in their diet will lead to enhanced nutritional security and more balanced diets

PARTNERS

Agricultural research and extension systems (NARES), including universities and their equivalents in the health sector • regional and sub-regional research organisations and networks • international and local NGOs • private sector partners • international agricultural research centers (IARCs) • advanced research institutions • farmers' and women's groups • civil society • community-based organisations

FUNDING

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AVRDC
The World Vegetable Center

TRAINING IN CAMBODIA, MAY 2014

In addition to improving the safety of vegetables, the Center also concentrates on increasing the security of crops. Access to seed is one of the most important elements to support reliable, healthy crop production. Smallholder farmers often procure their seeds through informal systems, such as exchanges with other farmers, local seed and grain markets and community seed banks.

AVRDC works with local communities to ensure they have access to seeds and the resources to grow safe, nutritious food. The Center takes an active role in strengthening the formal and informal seed sectors through training and policy support. "AVRDC is undertaking a series of international and in-country training courses to strengthen community-based seed production of traditional vegetable crops and varieties under threat of genetic erosion," Ebert describes. "This includes simple pre- and post-harvest technologies for the production and medium-term conservation of quality seed as well as training in community seed bank management."

NUTRITIOUS AND DELICIOUS

As well as improving the production of food, the Center is also enhancing knowledge about vegetable consumption. From the Center's research efforts, a number of previously undervalued vegetables have proved highly nutritious.

AVRDC collected and analysed more than 150 species of vegetables indigenous to tropical Asia and Africa which were shown to have high values of vitamins A, C and E, folates, iron, calcium and antioxidants. Certain species – in particular leafy vegetables such as amaranth, drumstick tree or moringa, sweet potato leaves, slippery cabbage and spider plant – were noted for their high levels of anti-inflammatory phytochemicals such as flavonoids and other antioxidants, which are important for the prevention of noncommunicable diseases.


SEED CLEANING AND SORTING IN PACKING ROOM

Two vegetables that have been overlooked for years but are gaining more attention as a result of the Center's work are the mungbean and *Cleome gynandra* or spider plant. The first is at the centre of a project called 'Beans with benefits' which targets smallholder farmers in Pakistan and Uzbekistan who rely on a very narrow range of crops. Research has revealed that mungbean possesses high amounts of protein, minerals and vitamins, which when included in a diet can help to reduce malnutrition. The plant is also of interest to farmers because of its ability to increase profitability and sustainability of their farms, as Ebert asserts: "Including mungbean as a catch crop can provide additional income to farmers and improve soil fertility".

Similarly, the spider plant has significant health benefits because of its strong antioxidant and anti-inflammatory properties. As a C4 crop, the spider plant is more effective under high temperatures, making it of interest to the scientific community: "It can contribute resilience to agricultural production systems in the West and East African market and bolster food security in hot, dry areas," Ebert explains. "The genome of spider plant has been published and genomic tools can assist breeders in the development of improved cultivars."

IMPACT OF THE INVESTIGATION

AVRDC is working to take advantage of this newfound knowledge to encourage people to make greater use of often overlooked vegetables. "AVRDC is promoting their use through information campaigns, training and field days as well as policy briefs, especially for family farming in developing countries, to attain sustainable food production and diversified diets," Ebert highlights. Although the efforts primarily target developing areas of the world, the insights are valuable to everyone around the globe and can help to improve eating behaviours and contribute to a balanced, nutritious diet.