

High-Value Crops for Better Nutrition and Income

A low-risk bridge from subsistence to better livelihoods

Fruits and vegetables are important for nutrition, providing vitamins, minerals, fiber, energy, and antioxidants. Because of their high market value in dry areas, sale of surplus produce is a vital source of income for poor households – even small quantities can be sold or exchanged at village markets.

ICARDA's research is based on a holistic view of dryland farming systems. Horticulture is an important component of rural livelihoods, and therefore a key research area. From its inception in 1977, ICARDA has worked on peas and faba bean, which are eaten as grain (harvested when fully mature) and as vegetables (harvested when green). As many as 58 improved varieties of peas and faba bean, developed by ICARDA and its partners, are grown in 14 countries. The current thrust on horticulture thus builds on three decades of research. In 2002, horticultural and other high-value crops were formally added to ICARDA's mandate, in response to recommendations by external experts and the Center's Board of Trustees. This is in line with the CGIAR's new research priority (3A) on reducing rural poverty through diversification of agriculture and exploiting the emerging opportunities for high-value crops and products.

ICARDA is located in the heart of the region where many dryland fruit trees and vegetable crops originated. Olive, almond, pistachio, apple, apricot, peach, hazelnut, grape, quince, fig, date palm, cucumber, melon.... all were first domesticated in the Near East, some 10,000 years ago. The region therefore has enormous genetic diversity of these species – providing research opportunities for crop improvement and selection for the benefit of growers worldwide.

ICARDA has world-class research staff and facilities, and close links with national research programs. Thus, it is ideally placed to develop and promote new horticultural technologies to suit small-scale farmers in dry areas worldwide.



Integrating crops and horticulture

ICARDA's research strategy is to select crops and varieties suited to diverse agro-ecologies; and develop appropriate low-cost management options (e.g., rotation, interplanting, husbandry methods, pest control).

A number of species have been identified for research, development, and promotional efforts:

- Fruit and nut crops: almond, pistachio, walnut, grape, fig, olive, jujube, pomegranate, date, cactus pear.
- Vegetables: green bean, sweet pea, edible-pod peas, cowpea, garlic, onion, tomato, eggplant, pepper, cucumber, melon.
- Herbs and spices: basil, cumin, mint, oregano, thyme, saffron.
- Medicinal plants: anise, cardamom, chamomile, coriander, marjoram, sage.

'Protected' horticulture

High-value crops, such as cucumber, tomato, strawberry, are grown in plastic houses, with improved husbandry methods. This approach has been used successfully in Oman, Saudi



Plastic houses in the mountain terraces in Yemen.

Arabia, Yemen, Pakistan and Afghanistan, leading to substantial increases in water-use efficiency and profitability.

Mint and cucumbers versus opium

A USAID-funded project in Afghanistan is promoting protected



Cucumber production in a plastic house in Yemen.

horticulture in Afghanistan. The returns are high enough to compete with Afghanistan's main cash crop, the opium poppy.



Afghan growers receiving hands-on training on crop handling and greenhouse management



H.E. Mohammed Sharif (second from left), Deputy Minister of Agriculture, Afghanistan, visits a farmer's mint field in Jalalabad, Afghanistan.

Pilot farmers have been provided material support and training. Over 35 greenhouses (size 270 m²) are operational in six provinces, producing cucumber, tomato, lettuce and peppers. At a demonstration greenhouse, the first harvest (1.7 tons of cucumbers) took only 75 days, and was sold for US\$1280. Economic analyses showed that, compared to field production, greenhouse production gives four times the output, five times the net income per unit of land, and nine times the net return per unit of water.

Mohamed Qasim, a grower from Helmand, said: "With opium, we can produce one crop per year and it requires lots of labor. But we can produce 2-3 crops of cucumber from a plastic house on a small piece of land with less labor and more income. I think if you give farmers a plastic house they will stop growing opium."

Scientists from ICARDA and Nangarhar University, Afghanistan are working with farmers to help them produce mint (*Mentha* spp.) commercially on a large scale, as a viable alternative to growing opium poppies. The project has set up research/ demonstration plots and trained farmers through field days and other means.

Project staff have also helped farmers set up plastic houses to produce mint using protected-agriculture technology. Four mint-water extraction plants are being installed. Mint producers' associations have been established in each target province.



Bottled mint water is a popular remedy for stomach problems. Sales are rising in Afghanistan, thanks to the project.

Growing plants without soil (hydroponics)

Hydroponics allows growers to carefully control the environment, and schedule their harvests precisely, thus improving yield, quality and price. ICARDA is studying different hydroponics systems at research centers in Oman, Saudi Arabia, Bahrain and Kuwait, to identify options (which crop, what management technique) for each region. Best-bet options identified at research centers are now being transferred to pilot growers for further on-farm studies. Growers have found that hydro-

ponics results in high water-use efficiency, large savings in fertilizer and water, increased production per unit area, better quality produce, earlier-maturing and more uniform plants, compared to production on soil.



Production of high-quality tomato in soilless culture, Rumais Research Station, Oman

Keeping figs virus-free

Figs are a valuable cash crop in Egypt and other countries – but sometimes prone to large-scale “die back”. A study in Egypt showed that die back was caused by a combination of factors. One was the fig mosaic virus, which is transmitted by the eriophyid mite *Aceria ficis*; feeding by a single mite is sufficient to transmit the virus to a healthy fig seedling. Other insect pests (scale insects and stem borers) were also important. But the key factor was lack of soil moisture. ICARDA has successfully introduced low-cost water-harvesting methods for fruit trees. For example, simple stone barriers can help retain scarce rainwater and increase fruit yields – and simultaneously reduce erosion.

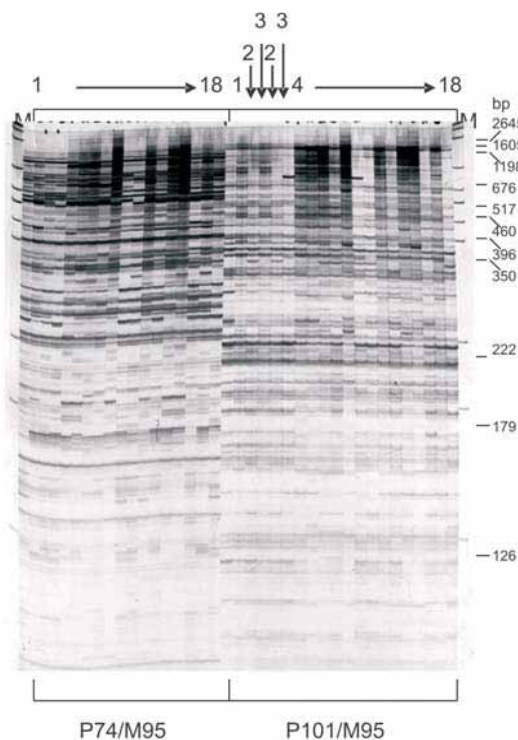


Die back of trees in a fig orchard in Egypt

Ongoing studies by partners (e.g., molecular studies of the virus) will benefit fig producers not only in Egypt but throughout West Asia and North Africa.

Genetics of date palm

Date palm is a major crop in the Middle East, important in both economic and cultural terms. ICARDA is leading a project in the Arabian Peninsula, initiated in 2004, that combines: research, technology transfer and capacity building. One priority is to document genetic diversity, as the first step to broaden the genetic base of cultivated date palm varieties, thus making them less vulnerable to disease and pest epidemics or to genetic erosion. Recent studies focused on Iraq – the world’s largest producer – where genetic diversity has collapsed as a result of war and drainage of marshes. Researchers extracted DNA from 18 reference varieties, and used amplified fragment length polymorphism (AFLP) markers to characterize the varieties and estimate their genetic relationships. The information will also help target specific varieties (or representative varieties from threatened groups) for conservation efforts.



AFLP banding patterns of 18 date palm varieties using primer combinations P74/M95 and P101/M95.

Combating land degradation

Planting fruit trees, such as olives, can help rehabilitate degraded hill slopes in low-rainfall areas. Ongoing

research in Syria is examining technical feasibility and likely impacts.



Planting olive trees can help prevent land degradation.

Medicinal and aromatic plants

A US-funded project involving the Institut des Regions Arides in Tunisia, ICARDA, and the USDA Agricultural Research Services, is helping to improve conservation and use of biodiversity. The project focuses on a number of medicinal and aromatic plants that are used in traditional medicine, and have considerable potential for commercial exploitation.



Cumin is not only a medicinal crop, but is also widely used in food preparations.



Safflower is a drought-resistant oilseed crop with great potential in Afghanistan.

Some of these species are endangered, for example *Allium roseum*, which is endemic to North Africa. Others have unique ecological value. For example *Acacia raddiana* is one of the few trees that grow in arid zones. Various parts and products – gum, dried bark, seeds, flowers, fruits, leaves – are widely used in traditional medicine. *Thymus* species are widely used in regional cuisine, and a large market exists.

Domestication of wild plants

Focusing on desert species, ICARDA is identifying varieties that combine drought resistance with high input-response; giving adequate yields under rainfed conditions in dry areas – and large yields with a little supplemental irrigation. Research is being initiated on medicinal plants (which can be harvested and sold), forage and woody plants to improve fodder supplies and soil quality, and fiber plants with industrial use.

Value-added products

ICARDA's project on conservation of dryland agrobiodiversity, funded by GEF/UNDP, in West Asia covers a number of horticultural crops, including garlic, onion, fig, olive, almond, cherry, pistachio, plum, and apricot. Production packages are being developed for various horticultural crops, and communities are being trained in home processing and other value-addition methods. The project has also established nurseries for multiplying wild indigenous species as well as cultivated landraces.

A "biodiversity fair" recently attracted over 2500 participants (more than half were women), and was inaugurated by the Princess of Jordan. The project now operates a weekly fair, where farmers sell jams, compotes, medicinal plants, and other value-added products.



Her Royal Highness Princess Basma Bint Talal of Jordan inaugurates the biodiversity fair in Jordan

Expert systems

An initial version of an expert system for protected horticulture (cucumber) in the Arabian Peninsula has been completed. Work is continuing on development of the expert systems and their integration with the weather information network

Creating an enabling environment

Horticulture is already a strong industry in many dryland areas.



Female health workers appointed and trained by the project, hold awareness and sales promotion meetings in Helmand and Nangarhar.



A smile of success: "I am helping the community by reducing suffering and pain while earning a licit income without guilt," said Gul Agha of Helmand (left) while marketing his products in Kabul.

Indigenous knowledge, farmer experience, markets, trade and supply chains, all exist. But small-scale producers, who struggle to access new technology and credit, benefit little or not at all. ICARDA seeks to build on the existing foundation to broaden income opportunities for these farmers, and create financially viable, ecologically sustainable options in horticulture.

Partnerships

ICARDA, with its long-standing links with NARS, R&D institutions, NGOs, and policy makers in over 60 countries, is ideally placed to build and strengthen such partnerships.

The World Vegetable Center (AVRDC) is a key partner in ICARDA's horticulture research and development. An agreement between the two centers spells out the mechanisms of collaboration geared towards promoting horticulture in the dry areas for the benefit of both growers and consumers. The other important partners are the University of California, Davis, USA, and CIRAD (Centre de Coopération Internationale en Recherche Agronomique pour le Développement, France).



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