CWANA Chapter 5 Figures

Figure 5.1 Increasing wheat yields in Syria by reducing irrigation: The effect of deficit irrigation on yield and water productivity. Source: Oweis and Hachum, 2001.

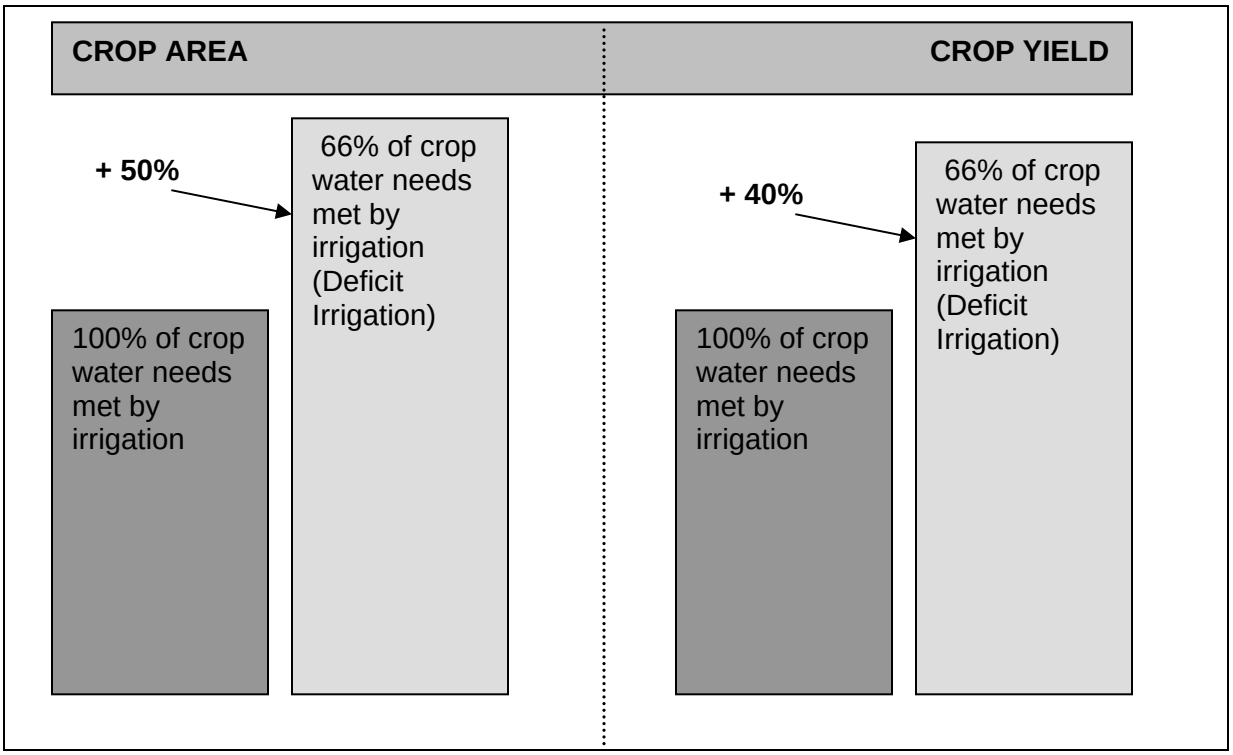


Figure 5.2 Integration of education, research and extension **.**

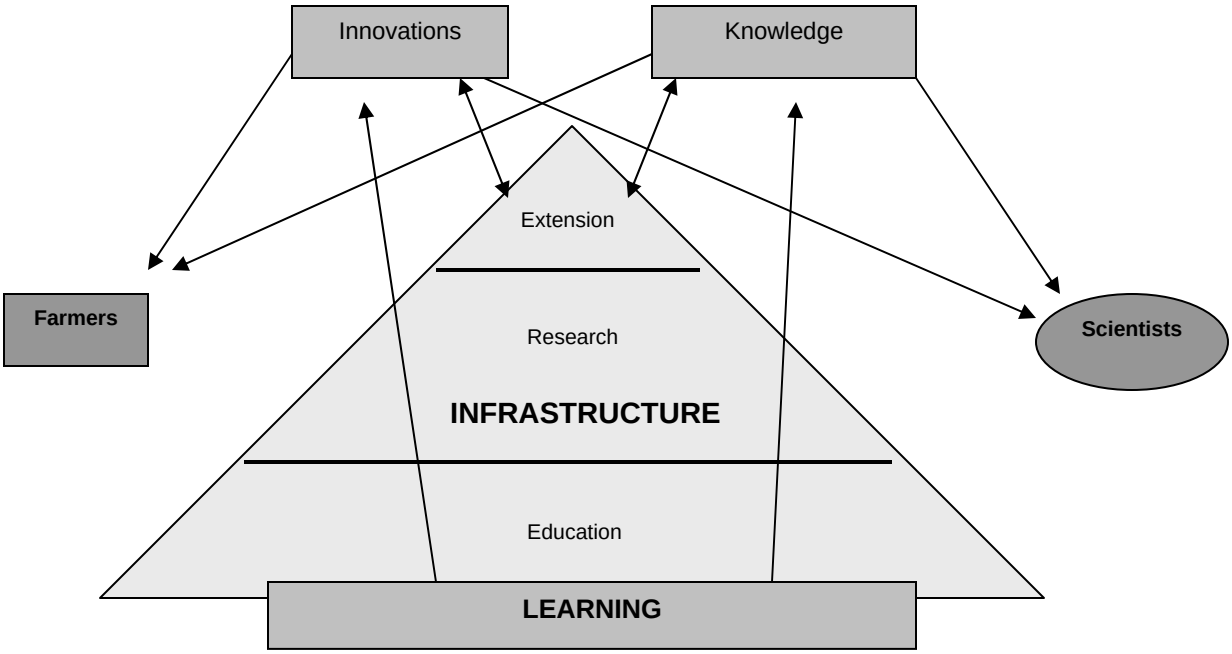
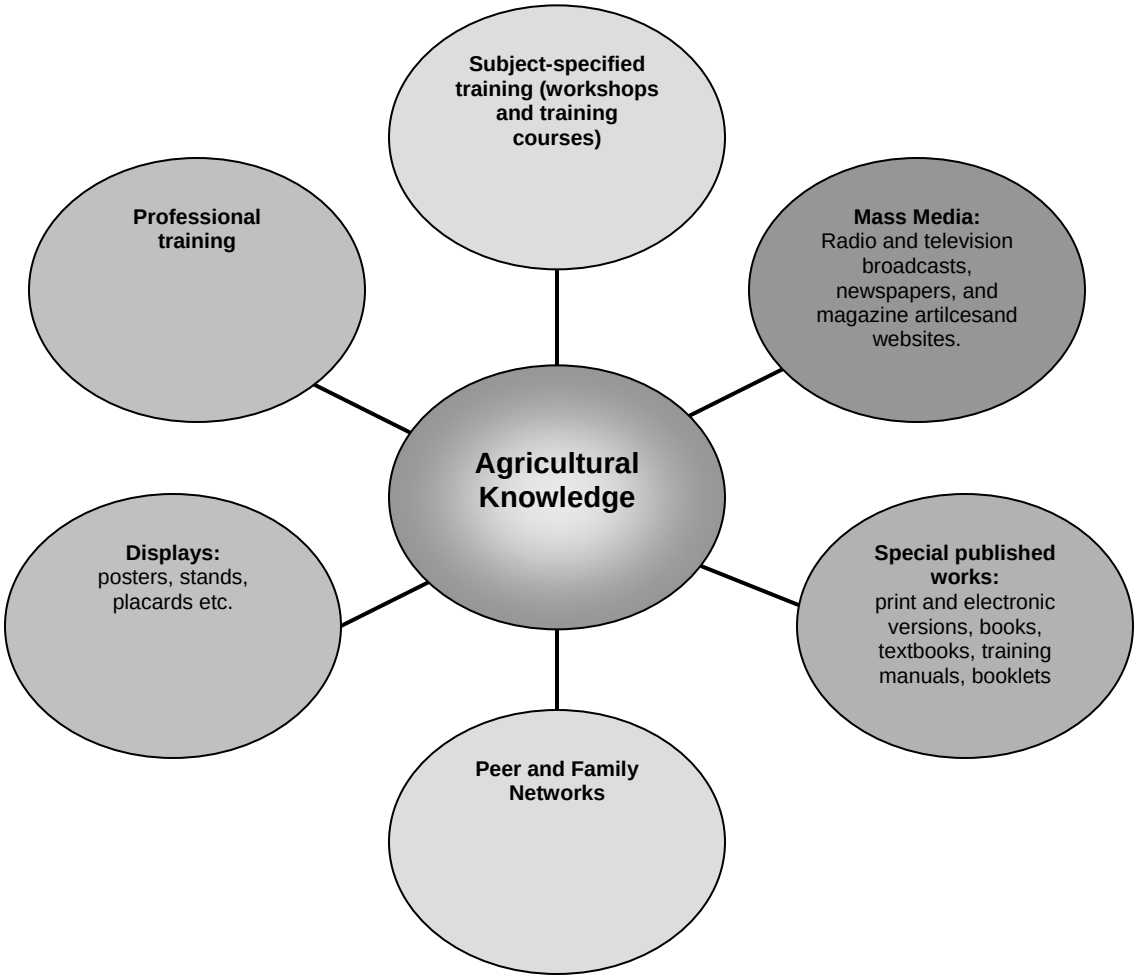


Figure 5.3 Channels for dissemination of Agricultural knowledge and information.



Box 5.1 Changes in the innovation process in Central Asia

The innovation process presents itself as a process of creating and spreading innovations and consists of three components: (1) innovation as a new idea, knowledge, a result of research; (2) introduction of innovations in practical activities; (3) diffusion of innovation, spreading innovation through products, services or technology in new places and conditions.

The analysis of the situation in the Central Asia and Caucasus (CAC) region as a whole has shown that countries follow principally new policy reforms in the process of transition to market economy. The innovation development in the region is through creating national innovation systems in all sectors including agriculture. What is the national agricultural innovation system (NAIS)? NAIS is a collection of legal and economic aspects involving research innovation, their introduction, dissemination, use and realization into national policy. The system (NAIS) is based on close-fitting intercoupling data. These processes were reflected on the development of agriculture as a whole and the breakup of the old centrally planned economic relationships. They have brought about a sharp decline in production of agricultural products. When structural reforms are completed, the economic situation will be normalized.

What are the reasons behind economic dependency on agricultural development? The economic dependency of the CAC countries on agriculture is primarily for food security as well as inputs for processing industries and employment for rural population. The well-being of nearly half of the population depends on agriculture in the countries of CAC. Climate and environmental conditions favor agricultural development. Efficient agricultural innovation systems are a guarantee for the economic growth and stability of agricultural development. This was also experienced by the developed countries. Similar processes exist in the countries of the Eastern Europe, where these processes started early. The process of reform and restructuring were reflected in the innovative sphere of agriculture first of all.

The previous command system affected all areas of innovation systems. In education, the study and introduction of production scientific research achievements was introduced through planned command. The enormous facilities financed scientific institutions according to the plan made for developing the science. However, due to a lack of working mechanisms for introducing these actions appropriately and adequately with respect to the desire and interest of the producers, many achievements did not find any use – even though many of them received patents. The coefficients of success of their introduction and returns were occasionally reduced to zero. The chief thing was to report.
Today the situation and incumbent relations have changed, but problems have not decreased. For example, system competitive grants are present in nearly every country. Their principles are competition, priority setting, urgency, usefulness, cost performance, etc. Specific approaches are employed: (1) selecting the best innovation projects for introducing farming facilities; (2) building on the readiness of today's farmers to introduce innovations by undergoing the necessary process of education and consultation; and (3) introducing the proposed innovation project to confident farmers and other agricultural commodity producers in case the project realizes.

Box 5.2 Using ICT in CWANA Region

In 1987, officials at the Egyptian Ministry of Agriculture and land reclamation recognized expert systems as an appropriate technology for speeding development in the agricultural sector. To realize this technology, in 1989, the ministry initiated the Expert Systems for Improved Crop Management Project (ESICM) in conjunction with the Food and Agriculture Organization of the United Nations (FAO) and the United Nations Development Programme (UNDP). The project began in mid-1989 and the Central Laboratory for Agricultural Expert Systems (CLAES) joined the Agricultural Research Center (ARC) in 1991. Through the development, implementation and evaluation of knowledge-based decision support systems, CLAES is helping farmers throughout Egypt optimize the use of resources and maximize food production. A dozen expert systems have been developed for horticulture and field crop management.

In 2000, the Virtual Extension and Research Communication Network (VERCON) project was funded by the FAO Technical Cooperation Program (TCP) to develop a Web-based information system to strengthen the link between research and extension (CLAES, 2002; FAO, 2003). Several expert systems have been made available on this network in addition to other modules. Two expert systems on the diagnosis of the sheep and goat (CLAES, 2006a) and bovines (CLAES, 2006b) are available on the CLAES Web site.

In collaboration with ICARDA, CLAES has developed three regional expert systems for wheat (CLAES, 2006c), faba (CLAES, 2006d) and barley (ICARDA, 2006).

CLAES also developed the National Agricultural Research Management Information System (NARIMS) through a project funded by FAO/TCP. This system has five modules: Institutes Information System, Researchers Information Systems, Projects Information Systems, Publication Information System, and National Research Program Information System (CLAES, 2007). The Association for Agricultural Research Institutes in the Near East and North Africa (AARINENA) plans to implement this system in all member countries (AARINENA, 2004).

Table 5.1 Agroforestry options and related opportunities in dry areas of CWANA

Agroforestry option	Opportunities
Production of livestock feed/fodder	Trees and shrubs (particularly leguminous species) may contribute to filling in the lack of nitrogen and protein in dry areas, supplying green fodder during the dry season. Trees and shrubs may be scattered in grazing land or be planted in "fodder banks" (fodder production during the dry season, "cut and carry"). Potential problem: lower palatability and digestibility due to tannins and other compounds.
Fruit production	Combining cropping and fruit production is traditional in the dry areas of CWANA; it is particularly attractive for areas where (supplemental) irrigation is possible. Nondemanding species such as *Ziziphus, Annona* and mango in the semiarid tropics, or olives, pomegranate and pistachios in the dry subtropics are intercropped with vegetables or cereals. Plastic tunnels and modern (drip) irrigation systems may render such systems quite productive and water efficient.
Wood production	Wood is used for fuel, construction, tools, art, fencing, etc.. Production of firewood may substitute for livestock manure, which can thus be used to enhance and maintain soil fertility. Village woodlots are one approach.
Production of other goods	Trees can produce nontimber products such as traditional and modern medicines, gum arabic, fiber, dyes, cosmetics, oils, pesticides, silk (silkworm rearing). Diversifying production reduces risk and generates incomes, contributing to reducing poverty and improving livelihoods (Leakey et al., 2005).
Use of otherwise not usable water resources	Low-quality water may be used to increase productivity of agroforestry systems. Treated sewage effluent that cannot be used to produce food crops may be still suited to produce woody species, as certain trees and shrubs tolerate higher salt content than herbaceous plants (apply increasingly saline water to successively more salt-tolerant plants Jorgensen et al., 1993).
Biodrainage	Deep roots of trees and shrubs may achieve good groundwater control, particularly at a local scale (see e.g. Schofield et al., 1989 or Raper, 1998). This can considerably reduce the threat of salinization when groundwater tables come too close to the soil surface.
Soil fertility enhancement	Trees and shrubs may provide valuable additions to the soil by maintaining or increasing organic matter, by biological nitrogen fixation, through more efficient nutrient uptake (association vesicular arbuscular mycorrhiza) or by enhancing atmospheric nutrient input (dust and wet deposition). Trees may reduce loss of nutrients and organic matter. protecting the land against wind and water erosion by covering the soil surface with litter, reducing raindrop energy and wind velocity, providing physical barriers and protecting streambanks, or by retrieving nutrients from deep soil horizons.
Protection of soils against degradation, reclamation of degraded land	Protection measures using trees and shrubs include constructing contour vegetation strips, enforcing structural conservation measures such as stone bunds or terraces, protecting waterways, and stabilizing erosion gullies and sand dunes (Rocheleau et al., 1988; Baumer, 1990). Tree and shrub plantations on marginal lands prone to degradation may protect these resources from being cropped.
Protection of water resources	Contour buffer strips (reducing erosion, increasing sediment deposition, and facilitating water conveyance), riparian forest buffers (to reduce runoff and nonpoint source pollution from agricultural activities), and filter strips (vegetation for removing sediment, organic matter, and other pollutants from runoff and waste water) help in protecting water resources from pollution; use of excess and wastewater by trees; streambank protection; floodplain management ("waterbreaks").
Living hedges and fences	Protection of crops from freely roaming livestock through hedges and fences of indigenous thorny multipurpose trees and shrubs; use of large stem cuttings (e.g. of *Gliricidia sepium*) that quickly root and produce additional benefits (such as forage, green manure, or fruit) for fencing.
Reduced wind velocity (windbreaks)	Reduced wind velocity raises the relative humidity in the microclimate, which may reduce evapotranspiration. Windbreaks lessen wind erosion and sand shear, reduce loss of flowers in crops and deposition of dust (and thus nutrients) and snow (particularly important in the dry areas of Central Asia). The trees produce fuelwood, poles, fruit, fodder, mulch, etc. Potential problem: competition with crops for water and nutrients (Smith et al., 1997).
Provision of shade	Shade reduces energy expenditure of livestock for thermoregulation (cooling) in hot environments, thus increases productivity. It alters the microclimate and provides shelter.

Agroforestry option	Opportunities
Protection and conservation of biodiversity and wildlife	Trees provide a habitat for numerous forms of life and thus help in protecting and conserving biodiversity and wildlife. Trees on marginal lands may protect these areas from degradation, thereby helping conserve biodiversity.
Carbon sequestration	The introduction of agroforestry systems, together with grazing land management, is seen to represent a major opportunity to increase carbon sequestration in agriculture (IPCC, 2000).
Landscaping and beauty	Woody perennials may be used to order the landscape, by breaking monotony, furnishing landmarks (Baumer, 1990).

Table 5.2 Approaches to conserve biodiversity. Source: Street and Khalikulov, 2004

Intervention	Description
Move toward sustainable agriculture	Develop means to support sustainable agricultural production that minimizes negative effects on natural biodiversity
Keep bioregional perspective	Adopt a broader perspective of agriculture to capitalize on shared regional opportunities offered
Share inventories and information	Survey, inventory and disseminate information for enhancing agricultural development
Conserve genetic resources	Develop national ex situ storage facilities
Manage plant genetic resources on farm	Enhance on-farm management of genetic diversity (landraces and traditional breeds of livestock) and explore ways to manage this diversity in a more efficient and durable way.
Broaden the genetic basis of crops and livestock	Efforts are needed to widen the genetic base of modern cultivars, usually very narrow.
Conserve biodiversity in natural ecosystems	Natural and seminatural ecosystems contain wild species, races and populations of great importance for food and agriculture; efforts need to be developed to strengthen maintenance of these ecosystems across the region.
Broaden cultivated crop portfolio	Efforts need to be directed toward widening diversity of farm crops and breeds to promote agricultural sustainability