Mega-Project 6

Knowledge Management and Dissemination for Sustainable Development in Dry Areas

Introduction

ICARDA established a Knowledge Management and Dissemination (KMD) Program in 2005, in response to concerns about the cost-effectiveness and impact of public investment in pro-poor research. The program's primary task is to integrate knowledge management and dissemination into ICARDA's overall research and capacity building agenda. The KMD Program aims to enhance equitable learning, sharing, and access to knowledge in order to contribute to ICARDA's goals of food security, poverty reduction, and the preservation of natural resources.

Specifically, the Program looks for ways to convert research outputs into national, regional or international public goods (IPGs), that can be scaled up and widely applied to benefit the rural poor. But it is much more than simply an aid to technology transfer. KMD seeks to develop a new paradigm to guide scientists as they benefit from – and build on – local knowledge, to generate demand-driven, feasible, pro-poor knowledge. Thus, KMD is designed as a practical approach that aims to capitalize and add value to ICARDA's past work, and maximize benefits from its future research. Activities include development of TIPOs (Technological, Institutional and Policy Options), individually and in 'packages', and provision of training in various disciplines.

The KMD Program also includes the Seed Unit, which is mandated to assist national programs maintain genetic purity of important varieties, produce high-quality source seed for multiplication programs, provide training and technical backstopping, and help promote an informal seed sector, such as community-based seed production, for the benefit of farmers.

Improving women's livelihoods in Afghanistan and Pakistan through better dairy goat production

A three-year project supported by IFAD is helping poor women in marginal and post-conflict areas of Afghanistan and Pakistan to improve their livelihoods by building their skills and knowledge in dairy goat production, milk processing and marketing.

Begun in June 2006, the project involves multidisciplinary teams of scientists and practitioners – from ICARDA, FAO, the national programs of both countries, NGOs from Afghanistan, and Pakistan's National Rural Support Program. The teams are working with women in targeted communities, using community-based, participatory approaches.

Project staff are using secondary data sources, rapid rural appraisal (RRA) and surveys to select and characterize sites. Community leaders and women have demonstrated their interest in participating in the project and establishing women's organizations where they do not already exist. Over the three years, the project will benefit 3,000 women. For the first year, 575 women from 29 villages in four districts in four provinces – Nangarhar and Baghlan in Afghanistan, and Punjab and Balochistan in Pakistan – have been selected.

Training is built into all project activities. This includes training at the local, national, and regional levels. Orientation workshops (2-3 days each) are held in each village to explain the roles and responsibilities of the female facilitators and participating women and to tell them about the project's objectives.

Project staff are gathering and recording local and scientific knowledge on goat production systems. This is based on

Project implementation is managed by specially trained women coordinators.

secondary data, the knowledge and experience of ICARDA scientists, and the findings of the technical committees, the RRAs, and the meetings with communities and women's groups. From the information already collected the researchers have shown that the major technical, institutional and policy options (TIPOs) for improving dairy goat systems are in the following areas: breeds; nutrition and feeding; health; fodder and rangeland; milk processing; and marketing.

During the first year, the project also conducted a baseline survey and a gender-based livelihood analysis to characterize systems, identify problems, and assess potential impact. Before carrying out the livelihood analysis, a training workshop was held. Market studies also began in mid-2006, using a range of research methods.

Participatory research and dissemination is focusing on improving local dairy-goat breeds, the use of feed concentrates, introducing improved fodder crops, planting fodder trees, and vaccination and de-worming. Does and bucks will be selected based on breed characteristics and the overall condition of the flock. The relevant institute or agency will provide quarantine facilities, and animals will be tested for brucellosis and tuberculosis and vaccinated against enterotoxemia and peste des petits ruminants (PPR).

International Assessment of Agricultural Science and Technology for Development

The International Assessment of Agricultural Science and Technology for Development (IAASTD) is a unique, global process that integrates local and indigenous knowledge with institutional and peer-reviewed scientific knowledge. Developed through consultations involving countries from all regions of the world, and over 400 participants, the IAASTD covers crops, livestock, fisheries, forest products, biomass, commodities, and other non-food crops. The Assessment is being conducted over the period 2005 to 2007, and ICARDA has been involved from the start.

The initiative aims to assess how agricultural knowledge, science, and technology can be used more effectively to reduce hunger and poverty, to improve nutrition, health, and rural livelihoods, and to help make development equitable and sustainable in environmental, social and economic terms. It is analyzing lessons from the past, assessing how the world may change over the next 50 years, and providing options for action.

The IAASTD is managed through a Secretariat shared by the World Bank, UNEP, FAO, UNESCO, and four regional institutes. The IAASTD has an intergovernmental governance structure, which resembles that of the Intergovernmental Panel on Climate Change (IPCC), but contains a Bureau similar to the Millennium Ecosystem Assessment's Board of Directors.

The IAASTD will produce one global assessment report, a global summary for decision makers, and a synthesis report. In addition, for each of five world regions, a sub-global assess-

ment report and a sub-global summary for decision makers will be produced. ICARDA acts as the coordinator and focal point for the sub-global assessment for the CWANA region.

The first four chapters of the CWANA sub-global assessment report cover the following: setting the scene, historical and current issues, the plausible future, and looking forward (to examine how policies, institutions and other factors can influence the development and application of agricultural knowledge, science, and technology). The fifth and final chapter examines the role of agricultural knowledge, science, and technology in meeting development and sustainability goals. This report, as well as the CWANA summary for decision makers, will be translated into Arabic and French. Around 60 independent experts, who are participating as volunteers, are helping to write the CWANA chapters, and their names will appear on the reports. The CWANA team is a multi-disciplinary group made up of well-known experts with valuable experience, as well as early- or mid-career authors with fresh ideas. The latter may well be the people implementing future changes arising from the IAASTD's findings.

Participants of the 3rd authors' meeting of the IAASTD's CWANA assessment, held at ICARDA-Cairo.

Opening session of the 3rd authors' meeting of the IAASTD's CWANA assessment, held at ICARDA-Cairo, December 2006. Left to right: Dr Khaled Makkouk, Coordinator, ICARDA-NVRSRP; Dr Hans Herren, IAASTD Co-Chair and Director of the Millennium Institute; Dr Haniya El-Etribi, President, Agricultural Research Center; and Dr Ahmed Sidahmed, Director, KMD, and ICARDA Focal Point for IAASTD.

Six of ICARDA's senior scientists and directors are contributing to the process. One is the official Focal Point, one is a 'co-ordinating lead author' (having overall responsibility for the chapters), and four are 'lead authors' of designated sections of the assessment chapters. There are also 'contributing authors' who prepare technical information in the form of text, graphs, and data for assimilation by the lead author.

Coordinating the CWANA sub-global assessment report is complex, as the IAASTD process involves six stages. Authors initially prepare a first draft of the report. This is then reviewed by experts and the governments involved in the IAASTD. Authors then prepare a second draft report, which is again reviewed by experts and governments. The final report is then prepared. Finally, the governments review and approve the summary for decision makers.

ICARDA has already held three authors' meetings for the CWANA sub-global assessment. These took place in November 2005 (at ICARDA headquarters), in June 2006 (Amman, Jordan), and in December 2006 (Cairo, Egypt).

The final drafts of the chapters, global and sub-global summaries for decision makers (SDMs), and the synthesis report will be submitted to the IAASTD Secretariat in November 2007 and then to governments and civil society organizations. The last step will be the Final Bureau and Plenary Meeting in January 2008 in Nairobi, where the chapters will be accepted, the SDMs approved, and the synthesis report adopted.

Establishing village-based seed enterprises in Afghanistan

In the absence of formal seed-supply systems in Afghanistan, ICARDA has set up 21 farmer-led seed production and marketing units. These village-based seed enterprises (VBSEs) are producing high-quality seed of improved crop varieties and making it more readily available to farmers.

Developed under the Rehabilitation of Agricultural Markets Program (RAMP), which is funded by the United States Agency for International Development (USAID), these alternative seed-delivery efforts ensure the availability, accessibility, and use of seed. They also encourage farmer-to-farmer diffusion and the adoption of new crop varieties. This, in turn, will raise crop yields, increase and diversify farm income in support of viable rural economies, and make rural households more food-secure. The project, which is fully integrated with RAMP's work to develop markets, has made remarkable achievements during the three years it has run.

The project consulted many different stakeholders and held in-depth discussions with groups of entrepreneurial farmers who were willing to invest in local seed production and marketing. VBSEs were then successfully set up in 21 districts of the target provinces of Ghazni, Helmand, Kunduz, Nangarhar, and Parwan.

Each VBSE comprises 10 to 15 members, giving a total of 254 farmer entrepreneurs. They multiply, clean, treat, and market seed of the improved crop varieties identified by ICARDA and its partners as appropriate for local seed production and marketing within and beyond the target districts and provinces. They also provide quality assurance for the seed they supply.

ICARDA and the agricultural development and extension services of the Ministry of Agriculture helped the VBSE members prepare business plans and market surveys. They also gave the members training in the technical, financial, and management aspects of the enterprises. In 16 training courses, 606 farmer-entrepreneurs as well as other stakeholders (from the ministry and NGOs) gained the knowledge and skills needed to ensure that the VBSEs performed well, and were profitable and sustainable. The project also organized 29 field days, as well as on-site field demonstrations to show how well the improved varieties performed. In total, 1692 farmers received direct training, while an estimated 2786 additional farmers were reached through extension agents.

Each VBSE has allocated, on average, more than 20 hectares of land for producing quality seed of wheat, rice, mung bean, and potato. The seed enterprises are now fully operational, with a total of 1460 hectares cultivated in 2006. This area is distributed among crops as follows: 46% wheat, 23% rice, 20% potato, and 11% mung bean. During 2006, 9855 tons of quality seed were produced, mechanically processed, packaged, tested for quality, stored, and sold directly to farmers, development agencies, and NGOs. Over the three years of the project, the VBSEs produced a total of 15,049 tons of wheat, rice, potato, and mung bean seed (Table 6.1).

Table 6.1. Seed produced by village-based seed enterprises (VBSEs) set up by ICARDA in Afghanistan.

Cropping season	No. of active VBSEs	Seed production (tons)				
		Wheat	Rice	Potato	Mung bean	Total
2003/04	6	753	525	na†	na†	1278
2004/05	17	2188	651	752	325	3916
2005/06	21	3533	2352	3784	186	9855
Total		6474	3528	4536	511	15,049

† VBSEs did not produce the seed of these crops

These low-cost, village-based seed production and marketing enterprises optimize the delivery and diffusion of seed of new varieties. They complement formal seed systems, and offer an alternative that is effective in reaching poor farmers in marginal areas who are beyond the reach of the formal public and private sectors. Farmers do not have to travel long distances, follow formalities, or even have cash in hand to obtain quality seed from the VBSEs. They are able, on the other hand, to identify the crop varieties they prefer, often making in-kind payments. What is more, the seed comes from trustworthy sources, such as fellow farmers in their communities.

Properly cleaned and packaged seed ready for marketing by VBSEs in Afghanistan.

Researchers also assessed the VBSEs' seed production capacity and profitability. They found a total net income of US$0.85 million from the 17 enterprises that were active in 2004/05 and US$2.3 million from the 21 enterprises active in 2005/06.

The VBSEs provided a continuous flow of quality seed of improved varieties at affordable prices, enabling other farmers to improve their yields and incomes. By the end of 2006, average yields for the target crops had risen by an estimated 10%. A total of 245,066 families (1,960,528 individuals) benefited from the quality seed. The multiplier effect of increased yields is expected to reach far beyond the lifetime of the project.

Key to creating awareness and exposing farmers to the new varieties were farmer field days and demonstrations of technical packages. These opened up markets for the seed produced by the VBSEs.

Although the project was very successful, seed demand assessments showed that some farmers do not value quality seed because low prices for their harvests and precarious farming conditions increase risks and uncertainty. Over time, this could undermine the VBSEs' successes and sustainability. For this reason, seed promotion and marketing activities should be at the center of seed operations.

Another key to survival is keeping costs low and profit margins reasonable, to make it possible to offer quality seed at affordable prices.

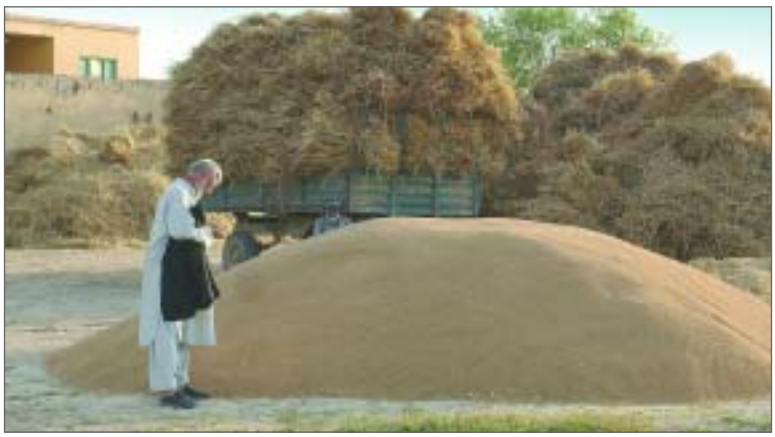
Continued technical support will be needed to allow the VBSEs to sustain their success over time, and develop into more formal business entities. The majority of the members still need to enhance their capacities in business organization and financial management, seed quality assurance, and seed promotion and marketing.

Impacts of emergency seed and fertilizer supply in Afghanistan

In 2006, ICARDA analyzed the social and institutional effects of supplying emergency seed and fertilizer in Afghanistan, and evaluated its economic impacts. The supplies were distributed in 2002 by the Future Harvest Consortium to Rebuild Agriculture in Afghanistan, which is led by ICARDA, with financial support from USAID.

The Consortium's relief efforts aimed to help overcome the widespread food shortages Afghanistan was facing. These had resulted from decades of civil war and several years of drought in the late 1990s, which had led to displacement of people and disruption of traditional farming systems. The efforts also aimed to quickly improve food and livelihood security by ensuring timely access to seed so as to revive agriculture, the main source of income for the poor.

The Consortium provided 3500 tons of emergency wheat seed for distribution to returned refugees, internally displaced people, or farmers who had lost their seed stocks. It trained farmers to locally multiply more than 5000 tons of quality seed of adapted wheat varieties, then used effective delivery systems to distribute the seed immediately to farmers. It also brought in 53 tons of foundation seed of new germplasm for on-station testing and large-scale evaluation. The International Fertilizer Development Corporation (IFDC) also distributed 50 kg of diammonium phosphate (DAP) and 50 kg of urea fertilizer to needy farmers.



An ICARDA staff inspecting a plentiful grain harvest following emergency seed distribution in Afghanistan.

After the relief operations had ended in 2002, questions remained unanswered. Was seed actually needed in the farming communities? Did the large-scale introduction of seed from outside contribute significantly to yield increases that translated into food security or at least economic gains for the beneficiaries? Have there been social or institutional impacts at the community or village level? Did aid contribute in any way to agricultural reconstruction and the long-term development of the sector?

To answer these questions, ICARDA researchers used a participatory impact assessment framework, based on discussions with stakeholders and focus groups, and surveys of beneficiary households. It applied a partial equilibrium economic surplus method to estimate gains and losses, as well as secondary estimates of demand and supply elasticity and impact attribution based on expert opinions. Simulations helped to estimate the economic impact of the 100% and 50% yield losses reported in a few communities.

The results showed that seed and fertilizer were just two of many household needs at the time. Because of their limited time frame, the relief operations did not directly contribute to strengthening networks among farmers, farmer organizations, and seed vendors. It also did not reinforce self-help mechanisms among beneficiaries. Furthermore, women farmers were not specifically targeted because of the socio-cultural conditions

that existed. Nonetheless, at the household level, there was an average wheat yield increase of 41% in the sample. Provincial sub-samples showed yield increases of 2% in Kunar, 5% in Bamyan, 21% in Herat, 38% in Uruzgan, 46% in Samagan, 47% in Badakshan, 49% in Parwan, and nearly 58% in Ghazni.

Net gains per household averaged from US$168 to US$287, with demand and supply elasticity calculated at –0.1 and 0.228 respectively. There was a variation in gains across provinces, explained by differences and changes in grain and straw prices, as well as in yields. When wheat supply was assumed to be more elastic (0.4), estimated surpluses ranged from US$95 to US$161 per household, representing a substantial injection of wealth under the precarious conditions that prevailed in Afghanistan. Crop failures experienced by beneficiaries translated into an average loss of US$60 per household when demand and supply were less elastic. On the other hand, consumption yielded positive gains of US$117 when supply was relatively more elastic (0.4). Based on the total number of beneficiaries, the net social gain estimated was between US$21.8 and US$37.3 million, which is greater than the project's cost. Surplus estimates were highly dependent on the choice of elasticity.

The results showed a wide range of household-level outcomes resulting from the distribution of seed and fertilizer in Afghanistan. The wide range of surplus estimates across households indicates that the poverty, food insecurity, and vulnerability that prevailed in the country at the time of the relief operations may have worsened without the interventions.

Several lessons were learned. First, it is important to take adequate pre-emptive measures. For example, if local seed-security stocks had been in place, this would have limited dependence on external (sometimes uncertain) seed sources. Second, educating the people targeted by relief efforts about the purpose of those efforts can enhance performance in the aftermath of conflicts or disasters. Similarly, intensive short-term training for village institutions and even NGO staff and facilitators would be appropriate in such situations. Third, and ideally, relief operations should include systematic monitoring and evaluation. This would produce indicators that can be used by a wide range of stakeholders, including implementing agencies, researchers, policy-makers, and trainers.

Understanding the lessons learned from these interventions can help improve the capacity of other emergency systems to respond to crises effectively. Because of the realities and conditions in Afghanistan, continuing aid is needed to rebuild agriculture, achieve lasting food security, and improve the livelihoods of the poor. This should include seed-system strengthening to sustain long-term development in this country, which is highly dependent on farming.

Seed treatment and foliar spray for reducing *Ascochyta* blight

Ascochyta blight, caused by the fungus *Ascochyta rabiei*, is a major disease of chickpea worldwide. In 2006, ICARDA conducted a greenhouse experiment to evaluate the combined effects of host plant resistance and seed treatment in reducing yield loss and the number of foliar sprays needed.

Seeds of a susceptible local check ('Baladi'), and moderately tolerant ('Ghab-2') and highly tolerant ('Ghab-3') kabuli chickpea varieties were inoculated with a spore suspension of a mixture of fungal pathotypes I, II, and III at a rate of 800,000 spores/ml. The seeds were then treated with two systemic fungicides: Vitavax 200 FF (20% carboxin + 20% thiram) and Dividend 30 FS (difenoconazole) and grown in a greenhouse. When 10 cm high, chickpea seedlings were sprayed twice with the foliar fungicides Bra (chlorothalonil) or Ort (azoxystrobin). After 24 hours the seedlings were artificially inoculated with an *A. rabiei* spore suspension of pathotype III, at a rate of 500,000 spores/ml. Plants were covered with plastic cages to main-

tain relative humidity at more than 80%, and the temperature was kept at 20°C for 72 hours. A second fungicide spray was applied before flowering.

The effect of disease inoculation on initial germination and emergence, the effect of seed treatment on infection during early vegetative growth, and the effect of one or two foliar sprays on biological yield and disease severity (using a 1-9 scale, where 1 = least severe and 9 = most severe) were assessed at later growth stages (Figs 6.1 and 6.2).

Seed dressing with systemic fungicides significantly increased the germination of infected seeds in the local check and 'Ghab-2' only. The germination rates for the local, moderately and highly tolerant varieties were, respectively, 73%, 92%, and 100% for treated infected seeds, compared with 57%, 83%, and 97% for non-treated infected seeds. The overall mean germination for infected seeds treated with Dividend 30 FS and Vitavax 200 FF was 94% and 92%, respectively, compared with 88% for the control.

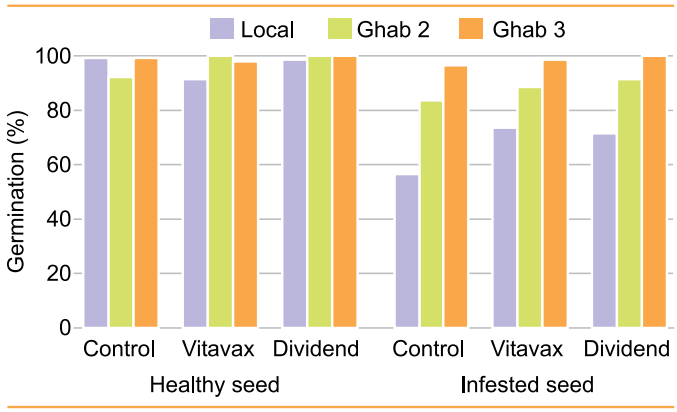


Fig. 6.1. Percentage germination of healthy and inoculated seed with the fungus **Ascochyta rabiei** *for three chickpea cultivars with varying levels of tolerance that were treated with two fungicides (Vitavax and Dividend).*

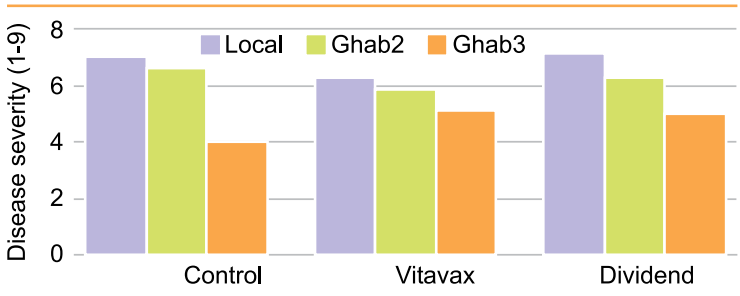


Fig. 6.2. Effects of two fungicides (Vitavax and Dividend) on **Ascochyta rabiei** *disease severity on three chickpea cultivars with varying levels of tolerance, scored 45 days after germination. Local: susceptible; 'Ghab-2': moderately tolerant; 'Ghab-3: highly tolerant. Disease severity score: 1=most severe, 9=least severe. Control: no fungicide.*

Seed dressing with Vitavax significantly reduced *Ascochyta* blight severity up to 45 days after emergence (Fig. 6.2). The mean disease severity score for plants of the susceptible local check and the moderately tolerant 'Ghab-2' was 6.25 and 5.86 from treated seeds, compared with 7.00 and 6.62 for non-treated seeds, respectively.

The biological yields from healthy seeds treated with Vitavax and Dividend were 4.02 and 3.53 g/plant, respectively, while the yield of non-treated plants was 3.72 g/plant. Yields with Vitavax were significantly better than with Dividend. Both fungicides increased biomass significantly in plants from infected seeds, but there was no significant difference between fungicides.

Foliar applications of chlorothalonil or azoxystrobin significantly reduced *Ascochyta* blight, and the low disease severity scores were consistent with increased biomass. Disease severity ranged from 6.93 in controls to 2.56 for two sprays with azoxystrobin, and 3.48 for two sprays with chlorothalonil. The biomass was 2.38 g/plant in non-sprayed controls, compared with 4.74 g/plant (99.2% increase) for two sprays with azoxystrobin, and 3.94 g/plant (65.5% increase) for two sprays with chlorothalonil.

Apart from significant protection against pre- and post-emergence damping-off seedling diseases, the fungicides also prevented early vegetative infections by *Ascochyta* blight. Moreover, seed treatment resulted in both significantly stronger vegetative growth and consequently higher biomass yield.