CHAPTER 6

Agricultural Extension, Education & Outreach Programs

CASE STUDY OF INTEGRATED PEST MANAGEMENT PROGRAMS IN CENTRAL ASIA

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Executive Summary

Since independence from the former Soviet Union, countries of Central Asia are putting concerted efforts to enhance agricultural productivity, food security, and livelihoods of mountain communities. Rebuilding extension and outreach programs for effective transfer of advisory services and technologies has been one of the key components of agricultural and rural development programs. In this context, Michigan State University (MSU) in collaboration with local institutions and international organizations implemented a 10-year program of integrated pest management (IPM) from 2005 to 2014 focusing on food security crops. The project was implemented in three countries: Kyrgyzstan, Tajikistan, and Uzbekistan. This paper describes innovative extension and outreach programs implemented to empower local farmers and students through farmer field schools (FFS), student field schools (SFS), and on-farm demonstrations as well as the lessons learned from these programs. Continued efforts and investments will be required to enhance and sustain extension and outreach programs in Central Asia.

Introduction

Central Asia consists of five countries of the former Soviet Union: Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, and Turkmenistan. Since independence from the former Soviet Union in 1991, these countries are working to rebuild their agricultural research education, extension, and outreach systems to enhance agricultural productivity, food security, and livelihoods. Central Asia with a total population of about 74 million and a land area of 3,926,790 km2 (worldometer.com, 2020), which occupies about 10% of the Asian continent, represents an important geostrategic region of the world.

During the former Soviet Union rule, the agricultural food system was centrally planned with each country specializing in specific crops (Babu & Pinstrup-Andersen, 2000; Hofman, 2018). The policy reforms during the past 25 years have led to land reforms from state-owned cooperative farms (known as *sovkhoz* and *kolkhoz*) to family-owned private farms (Abazov, 1999). Agriculture continues to play a key role in the economic revitalization of the region. Kyrgyzstan and Tajikistan are both mountainous countries with less than 10% of arable land for farming. In Kyrgyzstan, agriculture, forestry, and fishing contributes to 11.6% gross domestic product (GDP), while in Tajikistan, agriculture, forestry, and fishing contributes to 19.2% GDP (World Bank, 2018). Moreover, the mass migration (more than 2 million people) of the able-bodied population has devastated the country and hampered the development of agriculture. Currently, mainly women, children, and elderly people work on the family farms.

For the past several years, the national government and international development agencies are putting concerted efforts toward rebuilding research, education, and outreach systems to develop and disseminate new technologies and provide technical assistance and advisory services to family-owned private farms and support diversification agricultural systems for enhancing food security and family livelihoods. In the post-Soviet era, in the absence of government-supported extension programs, nongovernmental organizations (NGOs) have played a dominant role in providing advisory services and technical assistance to family-owned farms. The policy reforms, however, are encouraging development of extension programs through government-supported institutions, local universities, and civil society organizations. In this way, new technologies and knowledge generated by public institutions can effectively reach local farmers and end users.

To contribute to government efforts to develop and enhance agricultural extension and outreach programs, MSU, in partnership with the International Center for Agricultural Research in the Dry Areas (ICARDA), designed and implemented a regional program in IPM in Central Asia. Through the support from the U.S. Agency for International Development (USAID) IPM Innovation Lab and MSU, this collaborative research, educational, and outreach program was implemented in three countries from 2005 to 2014 covering Kyrgyzstan, Tajikistan, and Uzbekistan. The program focused on development and implementation of ecologically based IPM packages for three food security crops: potato, wheat, and tomato.

The regional IPM program focused on bringing new knowledge and approaches for ecologically based IPM including landscaped ecology,

conservation biology, biological control, and resistant varieties as well as cultural practices for pest management. The project focused on development and delivery of IPM packages for potato, wheat, and tomato through on-farm demonstrations, FFS, SFS, and other approaches (Maredia & Baributsa, 2007; Maredia et al., 2016).

Participatory Approach to Design Development & Implementation of IPM Extension & Outreach Programs in Kyrgyzstan

In 2005, the first stakeholder`s forum took place in Tashkent, Uzbekistan. In 2008–2009, as part of the ICARDA–MSU project, a field study was conducted in Kyrgyzstan to reflect farmers' knowledge on some elements of management of soil, plant pests, and irrigation practices. Such type of work was carried out as part of the project activities in Tajikistan in 2009–2010.

Figure 6-1. Participants at the 2005 Central Asia IPM Stakeholder Forum in Tashkent, Uzbekistan.

The study included a survey of the farms' owners by applying a random-selection method. The selection of households was carried out in the following way: if a village had up to 100 households, then every tenth household was interviewed; if a village had from 100 to 300 households, each fifteenth was surveyed; if a village had from 300 to 500 households, then each twentieth was surveyed. A total of 105 household owners were interviewed, including 96 men and nine women.

The study outcomes revealed that in Kyrgyzstan, mainly middle-aged and older people practice agriculture, which is typical for the whole region. Young people generally study in the higher and secondary educational institutions and move to the cities.

In rural areas of southern Kyrgyzstan, people who work in agriculture are from 46 to 58 years old, whereas, in northern Kyrgyzstan people who work in agriculture are from 36 to 44 years old. Members of their families on average consist of seven people in the southern regions and six people in the northern regions. To have sufficiently good harvest on their land shares, on average, five to six adults and two to three children work. In recent years, the interest of young people wishing to stay in the rural areas and to engage in agricultural activities declined sharply. Many of them grow tobacco and vegetables by leasing land in Russia and Kazakhstan. They also raise livestock, engage in construction work, run small businesses, and work in other capacities. This is largely due to the limited arable land and the socio-economic situation of the republic. In southern Kyrgyzstan, a medium farmer has from 0.3 to 1.4 hectares, while in the north, a medium farmer has 1.2 to 2.2 hectares of irrigated land.

Farmers mainly grow several types of crops on their fields, but the third part of the land is usually reserved for wheat. Onion, potato, cucumber, and tomato are the main vegetable crops for cultivation. The goods produced are sold at the local market or directly from the field to middlemen or traders. These crops account for 80% of the total income of the rural population. The price of the produce in the market earns from 6 to 20 kgs or 0.1 to 0.2 USD. Farmers of the northern region of Kyrgyzstan grow mainly potato, garlic, wheat, cabbage, perennial herb, bean, and medicinal herb. The produce they sell earns on average 8 to 20 kgs or 0.3 to 0.25 USD per 1 kg to middlemen or dealers from Kazakhstan and Russia. Farmers rarely sell directly to the wholesale markets.

The study's outcome revealed that the main decisions in the farms in the northern region are made by men. For example, a decision to purchase pesticides in a household is usually made by a man. Perhaps this is due to cultural norms. However, in southern Kyrgyzstan, decisions are often made by women. This might be explained by the great migration of men from southern Kyrgyzstan to Kazakhstan and Russia. While in the north, the main decisions are made by men, since the migration in this region is much less compared to the southern regions of Kyrgyzstan (see Table 6-1).

Table 6-1. Who purchases pesticides in households, by region.

#	Region	Husband Purchases	Wife Purchases	Both Purchase
1	North region of Kyrgyzstan	66	27	54
2	South region of Kyrgyzstan	44	63	46
3	Total	100	100	100

All the interviewed farmers realize that pesticides detrimentally affect the health and environment, but none of them gave arguments or examples of family members having some health problems associated with the use of pesticides. However, the majority of farmers indicated in the questionnaire that pesticides might contaminate the water, which in turn contributes to its losing taste and clarity. In their views, only application of the large quantities of pesticides affect the quality of agricultural products. Farmers

from the southern region of Kyrgyzstan compared to the northern region use different types and more varieties of pesticides.

The interviewed farmers get information about sale of seeds from various sources. According to the survey, 22% of farmers received information from the FFS where they took part, 25% of farmers from advisory services, and 44% from their neighbors. Thus, vegetable growers have more confidence in their neighbors than in other sources. Farmers often do not apply to the government agencies to get information and knowledge. They are more satisfied with the information received from the neighbors, FFS, and advisory services.

Figure 6-2. Students preparing soil for planting tomato seedlings in the SFS Field, Bishkek, Kyrgyzstan.

Knowledge About Vegetable Crop Pests

Kyrgyz farmers who were interviewed reported they have problems with pests such as aphids, Colorado potato beetle, cotton and winter cutworm, cabbage white butterfly, slug, thrips, onion fly, and spider mite. They mainly use chemicals to control these pests, with the exception of only a few farmers in the northern region who said that they use botanical pesticides (for example, extract from the tomato tops, potato, garlic, and hot pepper with soap emulsion). Given the importance of knowledge and information for farmers, the Central-Asian IPM project has released a brochure in the Kyrgyz, Uzbek, and Tajik languages. The Proven Folk Medicine describes more than 40 recipes of botanical pesticides. To control pests of vegetable crops, 49% of farmers reported using chemicals, while 30% use traditional/folk methods, including botanical pesticides; 12% have an idea of the biological method; and 9% do not know of any of the previously mentioned methods.

Knowledge About Beneficial Insects

It was interesting to find that 62% of farmers surveyed agreed with the general opinion of farmers that pesticides increase or help to increase crop productivity, and at the same time, they confirmed that the natural beneficial insects on the fields treated with pesticides are reduced by 8 to 10% or 3 to 4 times per cropping season, whereas 25% of them did not agree with this opinion.

The respondents, 86% of whom were older (age 50 and older) agronomists-farmers had a fairly good knowledge of natural beneficial insects. They listed three or four species of beneficial insects such as lacewing, lady bird, ground

beetle flies, and Trichogramma. The older (age 50 and older) farmers (who were former employees of the collective and state farms) could name two beneficial insects such as Trichogramma and lacewing. Young (younger than 50) farmers were able to name only one type of beneficial insects—lady bird.

While inspecting the fields, the majority of farmers focus on the growth of plants, the presence of pests, or diseased plants. Many of them do not even think of visual observations of beneficial insects either by type or simply by their presence in their fields. This largely is caused by the inaccessibility of information and insufficient knowledge of farmers about beneficial insects. However, they could easily list the names of pesticides and their use.

More than 85% of the farmers surveyed, with the exception of the older (age 50 and older) agronomists, believe that the destruction of beneficial insects in their fields does not lead to the spread of pests, and 14% did not observe or hear about such allegations. Four regional biological laboratories function in Kyrgyzstan; however, out of the interviewed farmers, only 7 to 12% use biological products from these laboratories. Sixty-five percent of the surveyed farmers from the northern and southern regions of Kyrgyzstan control pests of vegetable crops by the use of chemical pesticides; 10% of farmers use irrigation methods; 14% of the farmers use resistant varieties; and the rest of the farmers control pests by traditional methods.

Farmer Field Schools in Kyrgyzstan & Tajikistan

The FFS built on the previous experiences and other programs of NGOs in Central Asia. In the absence of an organized extension system, the FFS approach was most suited to empower local farmers and disseminate information and best practices through training of farmers.

FFS in Kyrgyzstan and Tajikistan had the following tasks: (1) transfer technologies; (2) develop human capital, including technical and management skills and knowledge in all categories of farmers; (3) create and develop a social capital, or unite farmers into the groups in various production areas, including forming groups of the rural youth aiming at sharing experiences, for example, experience of the United States; and (4) educate farmers on sustainable management of natural resources to mitigate the consequences of the climate change.

Over the past 10 years, the methods and approaches for dissemination of the agricultural advisory services in Kyrgyzstan underwent changes. The establishment and expansion of the FFS played a big role. The FFS experience was introduced in the Gissar region of Tajikistan in 2006 through the ICARDA–MSU project, and with NGOs such as Public Association AgroLead and Training and Extension Center (Saidov et al., 2007). The IPM program through FFS (IPM/FFS) has been successful and widespread in more than 90 countries around the world because of demonstrating effectiveness in improving farmers economic situation by increasing yields via sustainable agriculture (Kaseeva & Geraedts, 2007).

In 2007–2008, the ICARDA–MSU project demonstrated and provided the FFS farmers from the Chui region and the Alai, Chon-Alai region of Kyrgyzstan and the Kyrgyzstan Mountain Societies Development Support

Programme (MSDSP KG)/Aga Khan Foundation (AKF) with pheromone traps from Uzbekistan and MSU to be used against cutworm and cotton worm. It was the first step in introducing and promoting methods of pest control in Kyrgyzstan (https://bit.ly/3oxl1CJ). Gradually, FFS have been introduced in all regions of Kyrgyzstan. In 2008, a network of IPM trainers was established with the official name Public Association "Talaa Mektebinin Trenerleri" (Trainers of Farmer Field School), which had received an official registration in the Ministry of Justice of the Kyrgyz Republic as a legal entity. Moreover, the trainers developed their brand "Altyn Tushum" (Golden Harvest) and logo: "Trenerlerdin emgegi—Altyn tushum bergeni." (Trainers' labor results in golden yield.). In total, in Kyrgyzstan, more than 10 consulting biological companies have been engaged in training of farmers on the approaches of the IPM/FFS program. Some of the companies successfully proceeded with implementing this program and continue to do so.

One of the main components of the FFS program is to perform icebreakers and games. Given the importance of this component, the Training of Trainers (ToT) in Kyrgyzstan with the support of the ICARDA–MSU project published a collection of icebreakers and warm-ups titled *The Group Dynamics and Team Building*, the collection was distributed to other FFS in all regions of Kyrgyzstan.

In a 2006–2008 collaborative project by ICARDA–MSU, Dr. Utto (The German Academic Exchange Service Deutscher Akademischer Austauschdient) and Dr. Chylpakova (The National Academy of Sciences, Kyrgyzstan) implemented a master's project "Physiological Observation of Nectariferous Plants in the Conditions of Chui Valley," which was done by Ms. Duishenaliva a student from the Kyrgyz National Agrarian University (KNAU). Her master's research aimed to impart research skills to the KNAU students and to study the attractiveness of beneficial insects in the local nectariferous plants with different flowering periods. ICARDA–MSU gave an opportunity for KNAU students to work on 1 ha of the experimental plot in the Botanical Garden of the National Academy of Science.

The FFS farmers have never received direct answers to their questions from the facilitators and trainers. Instead, the farmers analyze the situations, conduct experiments, and receive answers to their questions as a result of their own studies. In 2008, ICARDA–MSU supported FFS MSDSP KG/AKF in the mountainous region of Kyrgyzstan (2300 m above sea level) by providing 14 varieties of seed potatoes from MSU. At the beginning, in the middle, and at the end of the physiological season of potato production, ICARDA–MSU conducted three field days for farmers in which the participants became acquainted with the new potato varieties developed by the scientists from MSU. The participants shared their experiences, tasted chips made from all the potato varieties, and took the initiative to organize an annual festival, Potato Day, in the mountain regions. The ICARDA–MSU staff members for the first time introduced and showed farmers how to manage potato fields by intercropping of nectariferous plants and other crops based on the results of master's work.

For the first time in FFS, the farmers have seen the principles and approaches in constructing the flower-nectariferous conveyor for additional nutrition of beneficial insects in agro-pastoralism. During the first year, FFS farmers have established a flowering nectariferous conveyor, planting such plants as cumin, dill, fennel, coriander, and buckwheat and by using the principle of multiple planting dates. Plants have been planted with double

sowing dates with 7 to 10 days intervals in every 10 rows of potato. In the first and the second year, the FFS farmers conducted an agro-ecosystem analysis and obtained the following results: cumin, dill, fennel, and coriander are able to extract a large amount of nectar in the mountain regions, and thus, they attract beneficial insects during the day. However, buckwheat is not nectariferous below 15 °C and above 25 °C, and does not attract beneficial insects at all.

The FFS farmers and participants of the field days have learned how to use nectariferous plants along with the potato plants and have benefits from both plants. The farmers have seen two simple methods for inspecting soil quality and in the future, they will be able to do it themselves. The first method is to roll out the wet soil between the fingers. The second method is to dig out a hole, then to put the soil back into the hole, and if the soil is good, then it will not fit into the hole. This method was taught by researchers from the University of California–Berkeley. Thus, during the field day, farmers realized that humans are not able to stop the flow of dust alone, but they can help and initiate its start. It was a new FFS approach of the ICARDA–MSU.

IPM MSDSP KG/AKF has been developing the entire value chain: from eliminating the restrictions in the field of regulation to facilitating the farmers' access to credits, resources, and equipment necessary for production. The program is implemented in accordance with the integrated approach that allows improving the agronomic systems, to reduce costs and to enhance the ability of farmers in marketing of their produce.

Thus, the key reason for the success of FFS in Central Asia is creation of "social capital," expressed in the experience of human resources, which have been developing over the past 12 years. With increasing the number of trainers and experienced farmers, as well as enhancing their skills in each of the countries, the potential of the IPM program is increasing too, which after the expansion and improvement could become an important regional factor in supporting agricultural development in all its diversity.

In 2006 and 2007, the ICARDA–MSU project in Kyrgyzstan and Uzbekistan took photos of the diseases, pests, and weeds in potato and tomato plants, which subsequently were used in creating a pocket book for farmers. In 2007, the experience of Kyrgyzstan was introduced in Tajikistan, with the support of the ICARDA–MSU project. The project has trained six national trainers from the Scientific-Research Institute of Plant Protection of the National Academy of Sciences of Tajikistan, which established three FFS with the support of the ICARDA–MSU researchers (Aitmatov et al., 2007).

In 2011–2013, the ICARDA–MSU project in partnership with the University of Central Asia (UCA) conducted the study on monitoring and scientific research activities carried out at demo plots within the frameworks of the project "Increasing Biodiversity and Economic Development in Mountain Areas of Kyrgyzstan."

Due to growth of social vulnerability and reduction of biodiversity in the areas of the Pamir-Alay and the Tien Shan, two agencies, including MSDSP KG/AKF and the UCA proposed objectives on implementation of the project. These objectives were aimed at collection of information and knowledge as well as at performance of experiments in uplands with regard to planting of aboriginal ethno-crops. This was for the purpose of improvement of nutrition quality and stimulation of economic development of the population of mountainous regions.

With the help of the Aga Khan Foundation and in cooperation with local experts, the MSDSP KG/AKF and scientists of the republic performed analysis, collection, and documentation of aboriginal fruit-and-berry plants as well as shelter break plants, inherent to conditions of the Pamir-Alay and the Tien Shan on the basis of literature resources.

Based on the recommendations of experts, at the end of April, the MSDSP KG/AKF through its program "Mountain Societies Development Support" performed planting of the recommended, economically and ecologically expedient plants on five demonstration plots of Alay, Chong-Alay, and Naryn.

Fruit-and-berry plants, presented and recommended by experts, are valuable; the most actively used types were introduced into culture as cultivated cultivars, which are vegetative propagated clones or mixtures of clones.

The demonstration plot is located in the Boz-Karagan village of Alay Region in the household plot of farmer Mr. Matiev.

Student Field School at Kyrgyz Agrarian University, Kyrgyzstan

The governments in Central Asia have been encouraging local universities to play a role not only in teaching and research but also in outreach to farmers and local communities, as well as in the building of the next generation of leaders for service to society. In this context, a novel concept of the SFS was introduced at KNAU based in Bishkek, Kyrgyzstan. First, the SFS was launched in 2008 with a group of five students. Several faculty members from KNAU were engaged in SFS programs, providing their expertise to students in various areas of IPM. The goal was to apply basic principles of IPM to a real-world field situation using tomato crop as a case study.

SFS included three interrelated educational components: (1) **general component**, where students were provided with general knowledge on agriculture, entomology, research design, methodology, and plant protection; (2) **practical component**, where students' training was based on experiments, observations, discussions, decision-making, skills enhancing, and preservation of the biodiversity of agricultural landscape by applying the FFS-IPM approaches; and (3) **ToT component**, which was aimed to show students trained as specialists in agriculture to train some categories of farmers (adult trainees). Courses had two target groups: teachers-trainers of the university and students. In 2007, the first group consisting of five teachers completed the full program of seasonal ToT/IPM/SFS course through the ICARDA–MSU project at KNAU.

The outcome of the SFS was significant. A total of 32 students completed SFS, receiving a certificate of completion. Students were able to do hands-on field research experiments to enhance their classroom knowledge. Their research results were reported at conferences and meetings and also gave students opportunities to interact with students, farmers, representatives from NGOs, and researchers from national and international universities and intuitions. The new approach that was used in the SFS motivated 13 students to continue their studies in graduate school. Five students successfully completed their master's degree at local universities and one student was selected to study in the U.S. Lastly, six post-graduate SFS

students organized one-month short-term ToT at Tajik Agrarian University, Institute of Zoology and Parasitology of the Academy of Sciences of Tajikistan, and Plant Protection and Plant Quarantine Institute, which led to establish new FFS in Tajikistan. At the end of the program, students received a certificate of completion. Moreover, through the FFS project, a number of books, pocket books, field guides, terminology manuals and dictionaries on diseases as well as pest manuals and training manuals were developed and published both in local Kyrgyz and Russian languages.

Figure 6-3. Students planting tomato seedlings in the SFS field, Bishkek, Kyrgyzstan.

Lessons Learned & the Way Forward for Enhancing Agricultural Outreach & Extension Systems in Central Asia

This decade-long project produced remarkable results and impacts in the Central Asia region. The key achievements of this long-term project included:

- **Broken isolation from the global IPM community:** The project helped reconnect IPM specialists and other stakeholders in the region with the U.S. and global IPM community.
- **Ecologically based IPM packages for food security crops:** The ecologically based IPM packages were demonstrated to local farmers in Central Asia for wheat, potato, and tomato systems where these crops are traditional food security and staple crops.
- **Empowerment of local farmers, scientists, and students:** The project empowered more than 1,500 participants through FFS and advisory services. More than 15 students from Central Asia underwent training at research and demonstration sites through collaboration with local universities. Three students from Tajikistan, Kyrgyzstan, and Uzbekistan received opportunities to earn graduate degrees at MSU. Sixteen scientists from countries in the Central Asia region attended International Agroecology, IPM, and Sustainable Agriculture short courses at MSU.
- **Publications and sharing of information with stakeholders:** The project team prepared more than 100 publications and extension

materials such as leaflets, bulletins, brochures, proceedings, scientific papers, posters, crop calendars, and book chapters on various aspects of IPM in tomato, wheat, and potato crops. These materials were widely distributed to more than 5,000 Central Asian stakeholders (researchers, students, extension specialists, and farmers) during extension and outreach programs such as FFS, SFS, farmer field days, workshops, and five regional IPM forums in Central Asia. The majority of publications were made available in Russian and local languages. More information on the project is currently available at https://bit.ly/2TwukEw.

At the end of the project, a regional workshop was organized in Tajikistan in August 2014 to share its results and achievements with stakeholders and seek their input for future collaboration. The workshop participants produced the following recommendations:

- Conduct additional research and provide extension services on IPM for horticultural crops, with a special emphasis on apricots, grapes, melons, and apples.
- Enhance extension and advisory services for farmers, including use of cellphones and other information and communication technology tools.
- Establish pest diagnostic laboratories/clinics and centers in various countries of Central Asia, possibly including mobile diagnostic units.
- Strengthen crop improvement programs and seed systems for providing good-quality seeds and enhancing seed delivery systems.
- Assess the impact of climate on agricultural pests and develop IPM programs to adapt to and mitigate the impacts of climate change.
- Collect, publish, and disseminate information on traditional pest control practices and traditional knowledge.

This decade-long regional project established an excellent network of IPM specialists and institutional linkages in the Central Asia region. The project demonstrated the value of collaborating and partnering with regional and international organizations such as the Consultative Group for International Agricultural Research, other international centers, international NGOs, and U.S. land-grant universities.

With an excellent IPM knowledge network and linkages established through this project, the collaborative research, education, and outreach programs with local researchers, extension specialists, and other stakeholders in Tajikistan, Kyrgyzstan, and Uzbekistan have continued. The research scientists and extension specialists of MSU and other partners are continuing to collaborate programs with local institutions and programs in the Central Asia region with emphasis on continued strengthening of human and institutional capacity for research, extension and outreach; development of a critical mass of well-trained human resources in diverse areas of agricultural research and development; continued networking, exchange programs, and exposure visits; and long-term collaborations to facilitate access to new technologies, knowledge, and scientific innovations from the global community.

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