

Development and Delivery of Ecologically-based IPM Packages in Central Asia

Central Asia Regional IPM Program – Year 3 Work plans (October 1, 2011 – September 30, 2012)

Project Management

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Michigan State University (MSU) in partnership with the University of California-Davis, Kansas State University, ICARDA, AVRDC, and several local research and academic institutions and NGOs is implementing a regional IPM program in Central Asia. The three host countries include Tajikistan, Uzbekistan and Kyrgyzstan.

The technical objectives of the Central Asia Regional IPM Program are as follow:

1. Develop ecologically based IPM packages for wheat, tomatoes and potatoes through collaborative research and access to new technologies.
2. Disseminate IPM packages to farmers and end-users through technology transfer and outreach programs in collaboration with local NGOs and government institutions.
3. Build institutional capacity through education, training and human resource development.
4. Enhance communication, networking and linkages among local institutions in the region and with U.S. institutions, international agricultural research centers, and IPM CRSP regional and global theme programs.
5. Create a “Central Asia IPM Knowledge Network” encompassing a cadre of trained IPM specialists, trainers, IPM packages, information base, and institutional linkages.

The proposed activities for the period covering October 1, 2011 to September 30, 2012 are linked to the above five technical objectives.

Objective 1. Develop ecologically-based IPM packages for wheat, tomato and potato cropping systems through collaborative research and evaluation of new technologies and approaches.

Activity 1: Establish IPM Applied Research and Demonstration Sites for testing and evaluating the existing and new approaches and technologies for IPM packages for wheat, potatoes and tomatoes in three host countries (Tajikistan, Kyrgyzstan, and Uzbekistan).

This work will include cultural practices, botanicals and biopesticides, biological control agents/products, resistant varieties, pheromone traps, sticky traps, chemical pesticides, etc. The locations for the research and demonstration sites have been selected and detailed plans have been developed (see more description in the following sections). For Wheat IPM, the project is focusing in Tajikistan; for Potato IPM, in Kyrgyzstan; and for Tomato IPM, in Uzbekistan.

Participating scientists/institutions: N. Saidov, B. Tashpulatova and M. Aitmatov, IPM CRSP project coordinators in Central Asia with collaborators from ICARDA, AVRDC, and the United States. In addition, collaborators include local scientists from research institutions and universities in host countries.

Expected output: IPM applied research and demonstration sites will be established and IPM Packages demonstrated to local farmers in host countries for wheat, tomato, and potato crops.

Time line: October 2011 – September 2012

Activity 1A: Wheat IPM Research/Demonstration in Tajikistan

In the year 2011-12, the wheat IPM project will focus in Tajikistan. The framework that is developed in Tajikistan can be extended to colleagues in Uzbekistan and Kyrgyzstan through workshops, trainings, printed materials, etc. There will be one site in the northern part of Tajikistan where yellow rust, Sunn Pest and cereal leaf beetle are the key pests, and two sites close to Dushanbe, for example in Hissor, where yellow rust and cereal leaf beetle are the key pests. All three sites will be used both for research and for demonstration (farmer field schools). At each site we will compare an IPM Package and the local farming community standard practices (i.e. two treatments).

IPM Package:

- Variety resistant to yellow rust (Ormon, from ICARDA and local breeder collaboration)
- Appropriate seeding rate
- Planting date (north: early to avoid Sunn Pest)
- Fertilizer (rate and timing)
- Weed control (timing, before competition)
- Harvest date (harvest early for Sunn Pest avoidance)

Farmer Standard Package:

- All of the characteristics above to be determined by a pre-season meeting with the land owner and local farming community.

Plot lay-out: At each site we will compare the IPM package with the farmers' standard package (FSP) in randomly assigned replicated plots (see example below, each site to e separately randomized). The wheat plots will each be 10 x 10 meters in size with 1 meter of bare (maintained by hoeing) alleyway in between for access.

Replicate 1	Replicate 2	Replicate 3	Replicate 4
IPM	FSP	FSP	IPM
FSP	IPM	IPM	FSP

Wheat Research Data Collection in South

In the south the data will be collected by a local graduate student supervised by Anvar and Nurali Saidov.

- In mid-April and again in mid-May, we will assess yellow rust damage, using a visual severity scale, on 50 plants per plot (all four reps in the IPM plots and all four reps in the farmer standard, n=400 plants).
- On the same 50 plants per plot, we will collect any cereal leaf beetle eggs or larvae and bring them to the lab to rear for parasitoids. We will record the number of eggs, larvae (total) and the total number with parasitoids.
- We will harvest each of the four IPM and Grower Standard plots to obtain the average yield.
- We will run statistics to compare IPM yield versus the farmer standard.

Wheat Research Data Collection in North

The data will be collected by a local graduate student.

- In mid-April and again mid-May, we will assess yellow rust damage, using a visual severity scale, on 50 plants per plot (all four reps in the IPM plots and all four reps in the farmer standard, n=400 plants).
- On the same 50 plants per plot, we will collect any cereal leaf beetle eggs or larvae and bring to lab to rear for parasitoids. We will record the number of eggs, larvae (total) and the total number with parasitoids.
- In each of the four IPM plots and each of the four grower standard plots, we will establish one 1x1 meter area to assess Sunn Pest egg masses. This will occur two weeks after insects migrate to the field. In May, we will go back and estimate parasitism of the eggs (by color).
- We will harvest each of the four IPM plots and get an average yield. Also, we will determine the percent of grain infested by Sunn Pest. This will be done separately for each of the four IPM plots.
- We will harvest each of the four IPM and Grower Standard plots to obtain average yield.
- We will determine the percent of grain infested by Sunn Pest for each of the four reps and take an average.
- We will run statistics to compare IPM yield versus farmer standard.

Additional Research: Shahlo Safarzoda's Graduate Research at MSU

Due to the direct overlap of MSU's spring semester classes with the critical periods of cereal leaf beetle and Sunn Pest development in Tajikistan, the team has determined it unfeasible for Tajik graduate student, Ms. Shahlo Safarzoda, who is currently at MSU to conduct her research in-country. Given this situation, we are developing a US-based research project for Ms. Safarzoda that is directly applicable to the Sunn Pest, cereal leaf beetle systems in Central Asia. At present we are exploring options to investigate parasitoid use of floral nectar to enhance parasitism. This topic is applicable to both pest systems and knowledge/technologies she develops would be transferable to other crop/pest systems in the region.

Activity 1B: Potato IPM Research/Demonstration in Kyrgyzstan

Our potato IPM research sites include one location in the Alay region of the Osh area in Kyrgyzstan and another in Chui Oblast of the Sokuluk region, Scientific Research Institute of

Livestock and Pasture of the KNAU named after K.I. Skryabin, Kyrgyzstan.

At these sites the project will focus on the Colorado potato beetle (*Leptinotarsa decemlineata*), late blight (*Phytophthora infestans*) and potato cyst nematodes (*Globodera* spp.). Weeds in potatoes at these sites include various weeds such as swine's-bane (*Chenopodium rubrum L.*) and houndsberry (*Solanum nigrum L.*).

IPM Package Components

At these research and demonstration sites we will test the following IPM package components:

- Test three local potato varieties and U.S. potato varieties for resistance to late blight (*Phytophthora infestans*). Additionally, evaluate potato varieties from Michigan (USA) for resistance to insect pests and *Globodera* spp. (April – August 2012)
- Continue to evaluate the agronomics of U.S. potato varieties brought from Michigan (in 2011) in seed-trial ground of the Ministry of Agriculture of the Kyrgyz Republic in Issyk-Kul region. (April – August 2012)
- Biological control of potato fungal pathogens will include the use of potato seed inoculation with the biopesticide *Trichoderma*. (April – August 2012)
- Application of immune-response modulating agents Baikal, Fosstim-3 (bacterial fertilizer), and Serhosil to enhance root development. These preparations will be used with a reduced (50%) amount of mineral fertilizers. (April – August 2012)
- Monitoring of potato pests will be conducted at both research/demonstration sites throughout the growing season and during post-harvest storage.
- Evaluation of trap crops and polyethylene-lined trenches will be tested at both sites in side-by-side rotated potato plantings for control of Colorado potato beetles.

Names of local scientists and collaborators: Dr. M Aitmatovo (IPM CRSP/ICARDA), D. Douches, G. Bird, W. Pett from MSU, and Dr. Anara Chakaeva from the Laboratory of Phytopathology Scientific Research Institute of Livestock and Pasture of the KNAU named after K.I. Skryabin, and MSDSP-Aga Khan Foundation in Kyrgyzstan.

Additional Research: Sultanat Mambetova's Graduate Research at MSU

Ms. Sultanat Mambetova, who is currently at MSU, will receive training in potato tissue culture, greenhouse seed production, seed certification, and potato breeding variety testing. Her research topic will include late blight and virus resistance in Kyrgyzstan potato production.

Activity 1C: Tomato IPM Research/Demonstration in Uzbekistan

Tomatoes are grown in the open field in summer and in protected culture such as greenhouses in winter. Research will be divided into greenhouse and open field studies.

GREENHOUSE - Participating scientists and institutions: Collaborative research will be conducted with the Institute of Microbiology, Uzbek Academy of Sciences.

There are three plantings a year - we will select the winter-spring term to conduct demonstrations at two sites for greenhouse cultivation.

- Selection of seedlings - remove infected seedlings.
- Preventative cultural practices for disease control - water management.

- Biological control of soil diseases with 4 replicates + control.
- Treat transplants with *Bacillus subtilis* suspension (concentration: 3×10^7 titre of spores).
- Experiment with use of biological preparation - “Serhosil”: foliar treatments
- Insect monitoring - yellow sticky traps for whiteflies and aphids; blue sticky traps for thrips; pheromone traps for tomato fruitworms.
- Biological control of whiteflies with *Encarsia* releases.
- Botanical or microbial pesticides as needed.
- Grafted tomato lines study (AVRDC)
- Monitoring of virus diseases

Expected outputs for the year:

- Improved method for transplant treatments with *Bacillus subtilis* and “Serhosil.”
- Develop technique for “Serhosil” preparation foliar use on tomatoes in both open field and greenhouses.
- Develop methods for rearing and releasing the whitefly parasitoid *Encarsia formosa*, and identify how to integrate it with other means of biological control.
- Publish articles on use of gossypol-related compounds in local agricultural journals.
- Prepare a guide on rearing of *Encarsia formosa*.

OPEN FIELD - Participating scientists and institutions: Collaborative research will be conducted with the Uzbek Research Institute of Plant Protection and the Institute of Microbiology, Uzbek Academy of Sciences.

We will conduct research/demonstration at one open field cultivation site.

- Selection of seedlings - remove infected seedlings.
- Preventative cultural practices for disease control - water management.
- Biological control of soil diseases.
- *Bacillus subtilis* treated transplants.
- Experiment with use of biological preparation - “Serhosil” foliar treatments with 4 replicates + control.
- Insect monitoring - yellow sticky traps for whiteflies and aphids; blue sticky traps for thrips; pheromone traps for tomato fruitworms.
- Biological control of whiteflies with *Encarsia* releases and fruitworms with *Trichogramma* releases.
- *Trichoderma lignorum* release on soil before tomato planting (*4 replicates + control);
- Grafted tomato lines study (AVRDC).
- Disease resistance lines study (AVRDC).
- Monitoring of virus diseases.

Expected outputs for the year:

- Improved method for transplant treatments with *Bacillus subtilis* and “Serhosil.”
- Develop technique of “Serhosil” preparation foliar use in tomatoes for both open field and greenhouses.
- Develop rearing and release methods for the whitefly parasitoid *Encarsia Formosa*, and integrate with other means of biological control.

- Improved method of soil treatments with *T. lignorum*. Develop technique for *T. lignorum* use on tomato crops in the open field and greenhouses (in vivo and in vitro).
- Determine presence of virus disease.

Collaborative research will be conducted with the Uzbek Research Institute of Plant Industry (UzRIPI) to screen tomato varieties/lines to primary diseases. We will obtain permission to collect, quarantine (if needed) and ship disease-resistant tomato varieties and lines from AVRDC gene bank and breeding unit to the partner institute in Uzbekistan. Introduced germplasm seeds will be sown in greenhouses in January - February 2012 to produce seedlings for a varietal trial that will be initiated in May 2012. Screening of germplasm will be conducted during the 2012 field season.

With the Tashkent State Agrarian University, AVRDC tomato germplasm seeds will be sown in a greenhouse in November 2011. Tomato seedlings will be grafted in December 2011 and planted in a greenhouse in January 2012. Research of this method will be conducted in a greenhouse in January-May 2012.

The study of grafted tomato varieties will also be conducted at an open field site. Seeds will be sown in greenhouses in January - February 2012 to produce seedlings for additional grafting. Screening of grafted tomato varieties will be conducted in an open field during the field season in 2012. This will be the first time innovation research of tomato grafting and its adoption will be conducted in Uzbekistan for further introduction into vegetable production in the republic and to neighboring countries.

We will collaborate with the Uzbek Research Institute of Plant Protection and Tashkent State Agrarian University to develop a method for rearing *Encarsia Formosa* in the greenhouse. A greenhouse will be equipped to make favorable conditions for growing whitefly host plants. Whiteflies will be multiplied on tobacco plants and used for rearing *Encarsia Formosa*. An experiment on integrating the use of *Encarsia formosa* together with yellow sticky traps will be conducted. The method for using *Encarsia formosa* on tomato crops in both the open field and greenhouses together with other means of biological control will be developed.

Additional Research: Graduate Research

- Master's thesis research on whitefly control in tomato greenhouses.
- Master's thesis research on tomato grafting.
- Present scientific program on tomato grafting for postgraduate students in Tajikistan and Kyrgyzstan.
- Initiate Master's thesis on tospovirus survey (in conjunction with Naidu Rayapati).
- Mr. Bahodir Eshanov, will continue graduate studies at MSU and will work jointly with Drs. Frank Zalom (UC Davis) and George Bird (MSU). His research will be linked to the tomato IPM package by contributing identification and IPM-compatible controls for nematodes and leafminers.

Objective 2: Disseminate IPM packages to farmers and end-users through technology transfer and outreach in collaboration with local NGOs and government institutions.

Activity 2: Establish Farmers Field Schools (FFS) at IPM Demonstration sites in each country to transfer knowledge and demonstrate existing and new IPM technologies to local farmers.

Participating scientists/institutions: N. Saidov, B. Tashpulatova and M. Aitmatov in collaboration with local agriculture ministries, local NGOs, universities, ICARDA regional program, AVRDC regional program, and U.S. Collaborators. As outlined in Objective 1, the sites have been selected in each country and plans are being developed for the next planting season. FFS will be established at each site/country. These farmers will meet regularly to learn about how to produce a good wheat, potato or tomato crop. They will also learn about the biology of pests, diseases and weeds, and the damage they cause, the economic threshold, natural enemies, and cultural practices, and safe use of pesticides.

Expected output: Farmers Field Schools established at IPM Demonstration sites for wheat, tomato and potato in each of the three countries, and information shared with local farmers and NGOs (20 -30 farmers per FFS).

Timeline: October 2011 – September 2012.

Activity 2A: Wheat IPM Outreach in Tajikistan

The wheat research sites will be used for farmer field schools where we will hold several meetings per year, such as:

- Pre-plant (August or September) to discuss varieties, planting rate, etc.
- At planting to see planting rate, method of site preparation and planting.
- Two or three times in spring to see insects, rust, flowering plants, etc.

We will hold separate trainings for men and women and use a female trainer or translator.

In conjunction with the Ministry of Agriculture, local farmers will be trained and encouraged to remove overwintering sites of Sunn Pest, a group of insects that causes damage by feeding on leaves, stems and grains. Along with reducing yields, the insects also inject chemicals that greatly reduce the baking quality of the dough made from the wheat.

Activity 2B: Potato IPM Outreach in Kyrgyzstan

Eight farmer field schools will be launched in the Alay region in the Osh area of Kyrgyzstan (April 2012). These schools will address IPM, the project research and production practices that support IPM and a healthy potato crop.

A manual on Potato IPM will be developed for trainers (September 2011 – May 2012).

Activity 2C: Totato IPM Outreach in Uzbekistan

We will train students and young specialists on tomato grafting (August 2011 or March 2012). Farmers Field Day will be conducted in the demonstration field with grafted and non-grafted tomato lines in July 2012. We will also train farmers, students and young specialists on biological control of tomato diseases using the soil and foliar biological agents *Bacillus subtilis*, “Serhosil” and “Baikal” M1.

In partnership with the Uzbek Research Institute of Plant Industry, Tashkent State Agrarian University, AVRDC-CAC, and MSU-IPM-PFU-Uzbekistan, we will develop these publications:

- A booklet and leaflet on tomato grafting.
- Booklets on botanical pesticides; biological control of tomato diseases; biological control of whiteflies.
- Articles on tomato grafting; biological control of diseases; biological control of whiteflies.
- Guides for tomato grafting; rearing and applying *Encarsia Formosa*.

Objective 3: Build institutional capacity through training and human resource development.

Activity 3A: Graduate student training in IPM in wheat, tomato and potato:

In collaboration with local agrarian universities in Tajikistan, Kyrgyzstan and Uzbekistan, opportunities will be provided to at least 6 graduate students for collaborative research at IPM CRSP sites in the three host countries.

The three graduate students who are currently at MSU – Ms. Shahlo Safarzoda from Tajikistan for Wheat IPM, Mr. Bahodir Eshchanov from Uzbekistan for Tomato IPM, and Ms. Saltanat Mamabetova from Kyrgyzstan for Potato IPM – will continue their graduate program. More details are included in the research section of this plan (Objective 1).

Participating scientists/institutions: D. Landis, F. Zalom, D. Douches, G. Bird, W. Pett, M. Kennelly, K. Maredia, M. Bohssini, R. Mavlyanova, B. Tashpulatova, N. Saidov, M. Aitmatov, and faculty members of local universities in Central Asia.

Expected output: Masters and Ph.D Degree training for Central Asian young scientists.

Timeline: October 2011 – September 2012.

Activity 3B: Pest Diagnostics and Viruses

In collaboration with two global theme programs, Dr. Naidu Ryapati will conduct a two-week regional survey for viruses in potatoes and tomatoes for the Central Asia region. This will be carried out in collaboration with host country institutions in Tajikistan, Kyrgyzstan and Uzbekistan. Symptomatic samples from potatoes and tomatoes will be tested using virus-specific immunostrips and ELISA kits, and select number of samples will be spotted on FTA cards and nitrocellulose membranes. The FTA cards and nitrocellulose membranes will be brought to Washington State University and processed for accurate identification of viruses by cloning and sequence analyses. During these visits, Dr. Rayapati will give lectures on virus diseases and their management at local research institutions and universities in Tajikistan, Kyrgyzstan and Uzbekistan.

Participating scientists/institutions: N. Saidov, B. Tashpulatova, and M. Aitmatov in collaboration with global theme programs in pest diagnostics and viruses (Sally Miller-OSU, N. Rayapati-WSU, Sue Tolin-Virginia Tech).

Expected output: Enhance viruses and pest diagnosis skills of local scientists and NGOs, and efficient diagnosis of viruses in potato and tomato.

Timeline: January 2012 – September 2012.

Activity 3C: Gender Issues in IPM: Addressing gender issues is an important component of the IPM CRSP project. Given that the Project is focusing on developing specific IPM packages and on building local capacities to carry out demonstration sites and use of IPM packages, the work of the gender team will be limited to three dimensions.

First, the IPM Central Asia team will endeavor to take gender into account as they develop the IPM packages and will continue to try to locate a gender specialist in Tajikistan who can work with the country coordinator to integrate gender into the research and outreach.

Second, a paper on gender and food security will be developed for publication; it will draw on bibliographical research and visits to Tajikistan in years one and two of the project.

Third, Dr. Linda Racioppi will oversee the completion of an undergraduate student thesis on women and agricultural development in Tajikistan.

Participating Scientists and Collaborators: L. Racioppi, Z. Jamal, M. Elisa Christie.

Expected Output: Increased awareness on gender issues and gender equity in IPM programs in Central Asia.

Time Line: October 2011 to September 2012.

Activity 3D: Impact assessment of IPM CRSP project activities in Central Asia: Given the early stages at which the project is on the "research-to-development" continuum, the impact assessment component of this project will focus on the following activities in FY 2012. We will conduct and complete a baseline survey in Tajikistan in collaboration with the Tajik Academy of Agricultural Science, Institute of Agricultural Economics (Dr. Tanzila Ergasheva). The component PIs plan to implement a baseline survey of farm households in locations representative of the IPM pilot sites in Tajikistan. The survey will help assess the status of wheat production conditions and constraints in Tajikistan. The size, scale and scope of the survey will be a function of the potential adoption sites and resources available.

The baseline data to be collected will include:

- Data on input, output, and price;
- Crop management practices including the use of biological, cultural, chemical, etc. and their associated costs;
- Farm household characteristics and demographic data;
- Farmer perspective on potential constraints to adoption of IPM technologies;
- Gender role in the cropping systems of focused commodities.

Baseline data (primary and secondary) will be also collected in the other two countries, Kyrgyzstan and Uzbekistan, with a focus on potatoes and tomatoes.

Collaborating Scientists and Institutions: R. Bernsten and M. Maredia, Michigan State University; T Ergasheva, Agricultural Economics Division of the Tajik Academy of Agricultural Sciences; Host Country PIs/Research Fellows (B. Tashpulatova, M. Aitmatov, and N. Saidov) and other U.S. and host country collaborators.

Expected Outputs: Data and preliminary analysis of the baseline assessment.
Start and end-date: October 2011 to September 2012.

Activity 3E: Participation of five local scientists from host countries in International IPM short courses organized by MSU and ICARDA.

Participating scientists and institutions: Scientists and NGO representatives from Central Asia, MSU and ICARDA.

Expected output: Increased knowledge in ecologically-based IPM and in design and management of IPM research and demonstration sites.

Timeline: October, 2011 – September 2012.

Activity 3F: Organize local workshops and training programs for trainers and local farmers in host countries on IPM in wheat, tomatoes and potatoes during the growing season.

Participating scientists/institutions: IPM CRSP Team members, local NGOs, Government research institutions, local Universities

Expected output: At least 50 farmers and 5 trainers trained in IPM in wheat, potato and tomato production.

Timeline: October 2011 – September 2012.

Objective 4: Enhance communication, networking and linkages with U.S. institutions, international agricultural research centers, and IPM CRSP regional and global theme programs to access IPM technologies, information and expertise.

Activity 4: Participation in International Meetings and workshops: Facilitate participation of IPM CRSP coordinators and local scientists from host countries to interact with IPM CRSP Regional Programs and other international meetings and workshops.

Participating scientists and institutions: N. Saidov, B. Tashpulatova and M. Aitmatov

Expected output: Enhanced linkages and collaborations with IPM CRSP regional programs, and other international programs.

Timeline: October 2010 – September 2011.

Activity 2: Participate in International IPM Symposium: Dr. Karim Maredia (PI of Central Asia IPM CRSP Project) will attend the 7th International IPM Symposium “IPM on the World Stage” in Memphis, Tennessee from March 27 – 29, 2012 and moderate a session on Development of IPM Packages for Vegetables Crops in Developing Countries.

Participating scientists and institutions: K. Maredia and J. Landis, MSU.

Expected output: International outreach and sharing of information on IPM CRSP experiences with the global IPM community

Timeline: March 2012.

Objective 5: Create a “Central Asia IPM Knowledge Network” encompassing a cadre of trained IPM specialists, students, IPM packages, information base, and institutional linkages.

Activity 1: Update, expand and enhance the website of the Central Asia regional IPM program in collaboration with project team members. Use social networking and other means to publicize on-going activities of the project. The website address is:

<http://www.ipm.msu.edu/central-asia.htm>

Participating scientists/institutions: J. Landis, MSU.

Expected output: Enhanced communication with stakeholders, expanded access to resources and knowledge developed in other activities, greater publicity for IPM CRSP project impacts.

Timeline: October 2011 – September 2012.

Activity 2: Develop communication pieces about the Project's work and activities. Develop flyers about components of the project such as gender issues, success stories, or other communication resources

Participating scientists/institutions: J. Landis, MSU, and U.S. and Central Asia collaborators.

Expected output: Enhanced communication with stakeholders, increased awareness of the Project's impact.

Timeline: October 2011 – September 2012.

Activity 3: Develop flyers on IPM Packages. One-page flyers that explain the key pests being addressed in wheat, tomatoes and potatoes.

Participating scientists/institutions: J. Landis, MSU, and U.S. and Central Asia collaborators.

Expected output: Project information will be shared more broadly with Central Asian farmers and stakeholders.

Timeline: October 2011 – September 2012.

Activity 4: Prepare and Display Project Poster with an overview of the project and its activities.

Participating scientists and institutions: J. Landis and U.S. and Central Asia collaborators.

Expected output: A poster highlighting the Central Asia Regional IPM Program activities for presentation at multiple events where others working in IPM will network.

Timeline: January 2012.

Activity 5: Update the Directory of IPM Specialists and Stakeholders in Central Asia to include recent participants in workshops, seminars and other events where groups interacted.

Participating scientists and institutions: J. Landis and U.S. and Central Asia collaborators.

Expected output: Increased ability for those working in IPM to network and share information.

Timeline: November 2011 - January 2012.