Annual Report FY 2009-10
Oct0ber 1, 2009 to September 30, 2010

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

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Michigan State University (MSU) in partnership with 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, tomato and potato 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 following activities were implemented during the FY 2009-10 covering the period from October 1, 2009 to September 30, 2010 linked to the above five technical objectives. The current political situation in Kyrgyzstan and its impact in the region and travel restrictions imposed by the U.S. State Department have slowed/delayed the planning and implementation of the project activities in the region.

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

One of the main activity of the Central Asia IPM CRSP program is to establish IPM Applied Research and Demonstration Sites for testing and evaluating the existing and new approaches and technologies for IPM packages for Wheat, Potato and Tomato in three host countries (Tajikistan, Kyrgyzstan, and Uzbekistan). This 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 details in the following sections).

Wheat Crop: Wheat is the main staple crop in Central Asia. A team of scientists consisting of Dr. Doug Landis (MSU), Dr. Megan Kennelly (KSU), Dr. Moustapha Bohssini (ICARDA) and Dr. Nurali Saidov (Tajikistan) worked together and developed a plan for establishing the Wheat IPM applied research and demonstration sites in Tajikistan. Dr. Karim Maredia, Dr. Megan Kennelly, and Dr. Mustapha Bohssini traveled to Tajikistan from May 31 to June 4 and worked with Dr. Nurali Saidov in selecting the location of the sites in Tajikistan. The two sites include:

Site #1: Wheat IPM Package for Northern part of Tajikistan

a. Name and Location of this site: Farm of Mr. Ilhom Boimatov located in the Spitamen district of Sogd region.

b. Key Pest Problems: At this site the key pests include the Sunn pest (*Eurygaster integriceps)* and diseases include the wheat rusts: yellow rust (*Puccinia striiformis*) and brown rust (*Puccinia recondite*). The key weeds in wheat field include; oat grass (*Avena fatua*), *s*hepherd's purse (*Capsella bursa-pastoris),* pigweed or lambsquarters (*Chenopodium album)* and bermuda grass (*Cynodon dactylon*).

c. IPM Package Components: In this demonstration sites, the research team will test the following IPM package components:
1. Resistant Varieites: Plots of 10 X10 m planted to a resistant variety to yellow and brown rusts, 4 reps with two strips of flowering plants including coriander *(Coriandrum sativum L.),* dill *(Anethum graveolens L.),* sweet basil *(Ocimum basilicum L.),* ziziphora *(Ziziphora interrupta* Juz.), marigold *(Calendula officinalis L.)* and winter cress (*Barbarea vulgaris)* along side the wheat plots to enhance Sunn pest egg parasitoids.
2. Cultural practices (planting date, seed rate, fertilizer application, and weed control) will be as recommended in the country.
3. Hand collection of Sunn pest adults during 2-3 weeks beginning at the time of migration to wheat fields.
This package will be compared to farmers' practices in the same area.

d. Planting and harvesting time for wheat at this site: Wheat will be planted in November 2010 and harvested in June 2011.

e. Names of the local scientists and collaborators: Dr. Anvar Jalilov and Mr. Tavakal Mirzoev from Institute of Plant Production "Ziroatparvar" of Tajik Academy of Agricultural Sciences and Mr. Vokhid Nazirov a scientist from Institute of Zoology and Parasitology the Academy of Science of Tajikistan and students from IPM wheat class from the National University of Tajikistan (biology faculty) and Tajik Agrarian University.

Site #2: Wheat IPM Package for Southern part of Tajikistan

a. Name and Location of this site: Andreevka village in the Durbat Jamoat of the Hissor district.

b. Key Pest Problems: At this site the key pests include the cereal leaf beetle *(Lema melanopus)* and diseases include the wheat rusts: yellow rust (*Puccinia striiformis*) and brown rust (*Puccinia recondite*). The key weeds in wheat field include; oat grass (*Avena fatua*), *s*hepherd's purse (*Capsella bursa-pastoris),* pigweed or lambsquarters (*Chenopodium album)* and bermuda grass (*Cynodon dactylon*).

c. IPM Package Components:

1. Biological Control: Plots of 10 X10 m planted to a resistant variety to yellow and brown rusts, 4 reps with two strips of flowering plants including coriander *(Coriandrum sativum L.)*, dill *(Anethum graveolens L.),* sweet basil *(Ocimum basilicum L.),* ziziphora *(Ziziphora interrupta* Juz.), marigold *(Calendula officinalis L.)* and winter cress (*Barbarea vulgaris)* along side the wheat plots to enhance cereal leaf beetle parasitoids.
2. Cultural practices (planting date, seed rate, fertilizer application, and weed control) will be as recommended in the country.
3. Weed management with cultural practices and application of low toxic herbicides.
This package at these pilot sites will be compared to farmers' practices in the same area.

d. Planting and harvesting time for wheat at this site: Wheat will be planted in November 2010 and harvested in June 2011.

e. Names of the local scientists and collaborators: Dr. Anvar Jalilov and Mr. Tavakal Mirzoev the scientists from Institute of Plant Production "Ziroatparvar" of Tajik Academy of Agricultural Sciences and Mr. Vokhid Nazirov a scientist from Institute of Zoology and Parasitology the Academy of Science of Tajikistan and Students involved in IPM wheat class from the National University of Tajikistan (biology faculty) and Tajik Agrarian University.

Specific Research conducted in 2009 – 2010 related to wheat IPM package components:

Research Activity 1. Screening of wheat varieties for resistance to Cereal leaf beetle (CLB)
In the last decade, cereal leaf beetle (*Oulema melanopus L.)* became one of the most dangerous pest in wheat crop fields in Central Asia (photo 1). Through breeding programs, researchers at ICARDA have developed different wheat lines that may be resistant against the pest. Therefore the objectives of this study was an identify sources of resistance to Cereal leaf beetle, which will be used in breeding programs to develop resistant cultivars to this pest. This activities was third year jointly ICARDA and IPM CRSP MSU research program on Screening of wheat varieties for resistance to Cereal leaf beetle (CLB). We received wheat seeds from Biodiversity and Integrated Gene Management Program (BIGMP) of Entomology section from ICARDA. The Research plot on "Screening of wheat lines resistance to Cereal Leaf Beetle (CLB)" for 2009-2010 seasons was designed according received scheme on the a 130 Bread wheat lines (CLB) and susceptible checks repeated after every nine entries. The wheat seeds were planting in November 28-29, 2009 on research plot site of Research Institute of Farming "Zemledeliya" of the Academy of Agricultural Science of Tajikistan. In the capacity of control we used a local variety of wheat "Sadoqat".

A total of 130 wheat entries were screened for CLB (*Oulema melanopa L.)* resistance, and some lines have shown resistance to cereal leaf beetles. The evaluation of resistant of wheat lines to CLB in 2008-2010 determines that the following lines shown high resistance against to CLB: lines Erythrospermum13, Erythrospermum 1185\1, Erythrospermum 760\1, Odesskaya krasnokolosaya, Frunsenskaya 60, Lutescencs 1207\1. Program have intended to continue a study on screening of wheat lines for resistance to CLB in collaboration with wheat breeders in 2011-2014 seasons in Tajikistan.

Photo 1. CLB in wheat field, Hissor district, Tajikistan, 2010.

Activity 2. Sunn pest monitoring: For identification of current distribution of Sunn pest in Tajikistan program conducted monitoring of wheat crop fields in different region of Tajikistan during May-June 2010. The result of monitoring indicated that in Tajikistan currently sunn pest distributed only in North region of Tajikistan (Table 1).

Table 1: Sunn pest distribution monitoring in wheat crop fields in the North region of Tajikistan, May 21-23, 2010

Districts/Location and date	GPS data	The sunn pest abundance in the 1 m^2 wheat field			Number of damage ears of wheat in 1 m^2
		Egg	Larva in the different phase	Adult	
Panjakent 21.05.2010	N 39.50820 E 067. 49311 Altitude: 924m	16	0	0	0
Istaravshan 22.05.2010	N 39.98263 E 069. 01879 Altitude: 823m	0	0	1	7
Istaravshan 22.05.2010	N 39.99459 E 069. 02714 Altitude: 794m	0	0	0	8
Zafarobod 22.05.2010	N 40.15412 E 069. 25397 Altitude: 402m	0	0	0	3
Spitamen 22.05.2010	N 40.12606 E 069. 25081 Altitude: 451m	0	1	0	4
Spitamen	N 40.12798	0	0	0	4

22.05.2010	E 069. 26469 Altitude: 465m				
Spitamen, farmer Ilhom Boimatov 22.05.2010	N 40.13420 E 069. 31091 Altitude: 464m	0	5	3	5
Isfara, Jilgazi village 23.05.2010	N 40.15337 E 070. 71998 Altitude: 822m	0	3	3	4
Isfara 23.05.2010	N 40.16642 E 070. 74240 Altitude: 812m	0	2	5	4
Isfara, Bogiston village 23.05.2010	N 40.17256 E 070. 80219 Altitude: 809m	0	2	3	3
Konibodom, Madaniyat village 23.05.2010	N 40.22377 E 070. 27560 Altitude: 378m	0	0	0	0
Konibodom 23.05.2010	N 40.24834 E 070. 09825 Altitude: 358m	0	3	0	3
Konibodom, Karakjikum village 23.05.2010	N 40.24790 E 070. 08578 Altitude: 358m	0	2	0	2
Bobojon Gafurov 23.05.2010	N 40.21531 E 069. 92989 Altitude: 361m	0	5	0	2

Activity 3. Farmer awareness on Sunn pest control: The one of the main objective of IPM wheat program in Tajikistan is support local farmers on effective control of sunn pest in the wheat field (photo 2). Therefore for strengthening of farmer knowledge on sunn pest control the IPM program distributed to 500 local farmers a Leaflet on sunn pest control in local tajik language (photo 3).

Photo 2. Sunn pest in wheat, Isfara, Tajikistan.

Photo 3. Leaflet distribution to farmers, Spitamen district, 2010.

Activity 4. Wheat disease monitoring.

The MSU, Kansas State University and ICARDA members of the IPM CRSP team visited Tajikistan from May 30 to June 3. The objectives visit was to conducting monitoring on wheat disease and identification crucial wheat disease for future focusing of IPM program and as well as support Tajikistan scientist counterpart on wheat pest monitoring (photo 4).

Photo 4. MSU, KSU and ICARDA mission to Tajikistan in June 2010

Potato Crop: Potato is the main staple crop in Central Asia. A team of scientists consisting of Dr. David Douches (MSU), Dr. George Bird (MSU), Dr. Walter Pett (MSU) and Dr. Murat Aitmatov (Kyrgyzstan) worked together and developed a plan for establishing the Potato IPM applied research and demonstration sites in Kyrgyzstan and Tajikistan. The U.S. collaborators could not travel to Kyrgyzstan due to the travel advisory of the U.S. State Department.

The two sites selected by Dr. Murat Aitmatov include the following:

Site #1: Potato IPM Package for Issyku-Kul Region of Kyrgyzstan

a. Name and Location of this site in Kyrgyzstan: Frunze village, Tupski district of Issyk-Kul region.

b. Key Pest Problems at this site include the Colorado Potato Beetle (*Leptinotarsa decemilineata*) and diseases a late blight of potato *(Phytophthora infestans) and* Potato leafroll viruses M, S, X, and Y. Potato cyst nematodes (*Globodera rostochienses* and *G. pallida*) and root-knot nematodes (*Meloidogyne chitwoodi* and *M. fallax*). The key weeds in potato at this site include: weeds such as swine's-bane *(Chenopodium rubrum L.)* and houndsberry (*Solanum nigrum L.).*

c. IPM Package Components for this site: In this research and demonstration sites we will test the following IPM package components:
   1. To test three potato varieties for resistance to diseases and particularly resistance to late blight of potato (*Phytophthora infestans*); evaluate different potato varieties for resistance to insect pest and nematodes; Evaluate new potato varieties for adaptation to Issyk-Kul region condition.
   2. Biological control of potato spring inoculation of potato seeds and of field soil with Biopesticides such as Thrihodermin, Strepmaitis and Bacilus thurengiensis; Application of immune-response modulating agent as “Baikal” type; Application of “Bacillus subtilis”; Application of “Biolegnin”
   3. Potato Post-Harvest Storage: Identified local traditional knowledge’s on potato post-harvest storage; Application of biological control; Application of botanical pesticides.

d. Planting and harvesting time for potato at this site: The trials consist two parts: The first experiments is storage of potato seeds in October 2010 within testing of Biopesticides such as Thrihodermin, Strepmaitis and Bacilus against of potato disease *Bacterial ring rot and Black scurf of potat;* And second experiment prior to potato seed sowing in the end of April 2011and till of potato harvest in the end of September 2011.

e. Names of the local scientists and collaborators: Dr. Tinatin Doolotkeldieva, local Ph. D students, Saikal Bobysheva and Mahabat Konurbaeva from a Laboratory of Phytopathology and Entomology of Faculty of Agriculture at Kyrgyz-Turkey University name after “Manas”. Mr. Janibai Tumanov, Director of the Kyrgyzstan Central Biolaboratory, Bishakek, Kyrgyzstan.

Site #2: Potato IPM Package for Osh Region of Kyrgyzstan

a. Name and Location of this site in Kyrgyzstan: Uson Kyshnak village, the Osh area of Alaisky region.

b. Key Pest Problems at this site include the Colorado Potato Beetle (*Leptinotarsa decemilineata*) and diseases, late blight of potato *(Phytophthora infestans) and* Potato leafroll viruses M, S, X, and Y. Potato cyst nematodes (*Globodera rostochienses* and *G. pallida*) and root-knot nematodes (*Meloidogyne chitwoodi* and *M. fallax*) are also limiting factors. The key weeds in potato at this site include: weeds such as swine's-bane *(Chenopodium rubrum L.)* and houndsberry (*Solanum nigrum L.).*

c. List IPM Package Components identified for this site (example - Resistant Variety, Cultural Control, Biological Control, etc). In this demonstration sites will test the following IPM package components:

1. Test different potato varieties for resistance to diseases and particularly on late blight of potato (*Phytophthora infestans*); Test different potato varieties on resistance to insect pest and nematodes; To test new potato varieties in the Issyk-Kul region condition.
2. Biological control of potato spring inoculation of potato seeds and of field soil with Biopesticides such as Thrihodermin, Strepmaitis and Bacilus thurengiensis; Application of immune-response modulating agent as “Baikal” type; Application of “Bacillus subtilis”; Application of “Biolegnin.”
3. Potato Post-Harvest Storage: Identification of local traditional knowledge’s on potato post-harvest storage for pest control; Application of biological control; Application of botanical pesticides.

d. Planting and harvesting time for potato at this site: The trials will consist two parts: The first experiments is storage of potato seeds in November 2010 within testing of Biopesticides such as Thrihodermin, Strepmaitis and Bacilus against of potato disease *Bacterial ring rot and Black scurf of potato;* And second experiment prior to potato seed sowing in the end of April 2011and till of potato harvest in the end of September 2011.

e. Names of the local scientists and institution that will collaborate at this site: Dr. Tinatin Doolotkeldieva, local PhD Students Saikal Bobysheva and Mahabat Konurbaeva from a Laboratory of Phytopathology and Entomology of Faculty of Agriculture at Kyrgyz-Turkey University name after “Manas”. Mr. Talant Joldoshev - specialist from the MSDSP Kyrgyzstan Program of the Aga Khan Foundation.

<u>Specific Research Activities conducted on Potato IPM in Kyrgyzstan in 2009-10</u>

Activity 1: Assessment of prevalence of diseases and pests of potato in mountainous areas of Northern and Southern regions of Kyrgyzstan. For monitoring, the approaches/methods utilized included: Meeting with farmers and inhabitants of villages, trips to seed-growing co-operative societies, the field assessments, meeting with employees of consulting services, and

workers of department of agriculture, and the analysis of the collected potato samples from various farms.

The Issyk-Kul area, and Alay district of Osh region in Kyrgyzstan have both soil and environmental conditions optimum for growing commercial and seed potato crops. The area occupied under potato cultivation varies from 48 - 76% from a total area of land-holdings of the Kyrgyz republic. Low productivity remains a key issues because of different varieties of potato grown, absence of crop rotation, lacks of access by farmers of good-quality seed/planting materials. As a result of monoculture of potato crop, the post-harvest losses of seed materials due to pests and diseases have increased.

Currently, the NGO, Mountain Society Development Support Programme (MSDSP) is working to create association of seed farms in the mountainous regions of Kyrgyzstan through the formation and participation in Farmer Field Schools (FFS).

Activity 2: Results of monitoring of potato pest problems: By results of the visual analysis of areas under cultivation, it is necessary to notice that on potato fields remains infested with heavy Late blight of potato (10 - 35%), and also to 5% bacterial diseases, such as Bacterial ring rot and a Black leg.

The key fungal diseases during the vegetative phase are Macrosporium leaf spot, Alternaria leaf spot, Black scurf of potato, Late blight of potato to 30-50%, on potato leaves, especially the main problem for farmers is the Late blight of potato. These Fungus diseases cause heavy damage in more damp weather conditions and non-observance by farmers for optimum irrigation, it is flooded or irrigation at the end of a potato field season, it is possible to note and see about 60% of rotten tubers. Almost all the farmers harvest potatoes with stains of fungus diseases, they do not use any fungicides or other methods of pest control. Before storage, almost 80% of the affected farmers do not treat seed materials, and 20% use chemical method. The importance of biological method, in particular Trihodermin or Baikal M-1, is not well understood, they do not know how to use and did not hear or do not trust the biological methods.

Potato grades. On area farmers sow different grades of a potato. Varieties grown are: Picasso, Neva, Mondial, the Drag, Sante, the Symbol, Latona, Chelpek, etc. By data of Ubytaevoj. In (2009), the following potato varieties showed resistance to late blight: Picasso, the Symbol, Nur, Latona, Neva, Dzhelli, Beluga, less steady have appeared - the Drag, Sante, Mondial. In 2009, the area under Fungal diseases had appeared more in comparison with other years. For example, in regiones like Issuk-Kul and Alai areas under infestations by Late blight of potato reached to 40%.

The least area of infestation of potato crops was noticed in seed-growing co-operative society Shajma-Shaj and was approximately 5% as the given co-operative society implemented timely preventive measures against the pests of potato, and also selected higher grades of potato planting materials that are free of fungal and bacterial diseases, for example, Dzhelli, Marabella, Nur, Beluga, the Agave and the Symphony.

Late blight of potato puts the big harm during the rainy months of the year, in July and August.

The key pests : Colorado bugs, they cause a huge damage to farms. The area of their distribution and to hot weather they every year increase in the given region with three full generations. For struggle against them, farmers actively use, chemical pesticides, but very dangerous preparation GAUCHO to environment.

Recommendations of experts:
1. To place a potato no more than 3rd years on one field.
2. Replace potato seed/planting material every 3-4 year.
3. The Seed material before putting is necessary for drying and to sort to remove undesirable materials through grading
4. For filed irrigation, having watered strictly in furrows, not to flood; irrigation no more than 3-4 times depending on weather conditions.
5. To make experiments on application and action of trihodermin and Baikal M-1 on distributions of Fungus disease during vegetation of plants.

Tomato Crop: Tomato is an important vegetable crop widely grown in Central Asia. A team of scientists consisting of Dr. Frank Zalom (UC-Davis), Dr. Razva Mawlanavova (AVRDC) and Dr. Tashpulatova (Uzbekistan) worked together and developed a plan for establishing the three tomato IPM applied research and demonstration sites in Uzbekistan. Dr. Frazk Zalom traveled to Uzbekistan in early September 2010 to work with Uzbek collaborators in selecting the three sites.

Site #1: Tomato IPM Package for Greenhouse Farm in Tashkent

a. Name and Location of this site - Farmer, Mr. Tojibaev Jasur, Tashgress area, Kibray District, Tashkent Region 100140, Uzbekistan.

b. Key Pest Problems: Insects: aphids *(Aphis gossypii*, *Myzus persicae* and *Aphis craccivora),* leaf miner *(Lyriomyza sativa),* whitefly *(Trialeurodes vaporarium)*; Diseases: *Fusarium oxysporum*, *Phytophthora infestans;* Weeds: Perennial plants: *Rumex crispus; Taraxacum officinale.*

c. IPM Package Components: Yellow sticky trap, use of microbiological preparations and fertilizers, ecological safety pesticides (fungicides, insecticides and herbicides).

d. Planting and harvesting time of the crop at this site: Planting from September - October and harvesting in May –June.

e. Names of the local scientists and collaborators: Dr. Djumaniyazova Gulnara; Mr. Zaripov Rustam - Institute of Microbiology Academy of science; Mr. Baijanov Bahodir - Research Center “Baykal”:

Site # 2: Tomato IPM Package for Greenhouse Farm at the Tashkent Agrarian University

in Tashkent

a. Name and Location of this site: Tashkent State Agrarian University, 2 Universitetskaya Str., Kibray district, Tashkent region, 100140, Uzbekistan.

b. Key Pest Problems at this site:
Insects: Leaf miner *(Lyriomyza sativa),* whitefly*(Trialeurodes vaporarium)*;
Diseases: *Cladosporium fulvum Cooke;*
Weeds: Perennial: Rumex crispus L., Cyperus rotundus L., Convolvulus arvensis

c. List IPM Package Components for each site:Yellow sticky trap, use of microbiological preparations and fertilizers, ecological safety pesticides (fungicides, insecticides and herbicides) and Grafting.

d. Planting and harvesting time for the crop at this site: Planting from September - October 2010 and harvesting in May – June 2011.

e. Names of the local scientists and collaborators:
Dr. Rashidov Murod; Dr. Suleimanov Botir – Biolaboratory Center "Biomarkaz" at Tashkent Agrarian University;
Mr. Pulatov Zarif – Uzbek Research Institute of Plant Protection
Dr. Shukhrat Asatov, Tashkent Agrarian University
Mr. Bakhtiyor Karimov, Tashkent Agrarian University.

Site # 3: Tomato IPM Package for <u>Open Field Culture</u> in Tashkent Region

a. Name and Location of this site: Uzbek Research Institute of Vegetable-Melon Crops and Potato Production, Tashkent region 111172, Uzbekistan

b. Key Pest Problems (insect, diseases, viruses, nematodes, weeds) that will be addressed at this site
Insects: White fly *(Trialeurodes vaporarium),* Fruitworm *(Heliothis armigera),* Leaf miner (*Lyriomyza sativa),* Russet mite *(Aculops lycopersici);*
Weeds: Annual: *Amaranthus retroflexus L., Amaranthus I., Xanthium strumarium, Setaria veridis, Enchinochloa crus-galli (L.) Et.Sch;* Perennial: *Circium ochrolepidium Juz. Plantago major* L;

c. IPM Package Components for each site: Pheromone trap, yellow sticky trap, use of microbiological preparations and fertilizers, ecological safety pesticides (fungicides, insecticides and herbicides).

d. Planting and harvesting time for the crop at this site: Planting from May-June harvesting in July-August-September;

e. Names of the local scientists and collaborators: Dr. Ganiev Farhod - Uzbek Research Institute of Vegetable-Melon Crops and Potato Production; Dr. Djumaniyazova Gulnara and Dr. Zaripov

Rustam - Institute of Microbiology Academy of science;

Specific Research Activities conducted on Tomato IPM in Uzbekistan in 2009-2010:

Tomato (*Solanum lycopersicum* L. [syn. *Lycopersicon esculentum* Mill.]) is a perennial plant but it is grown as an annual crop in temperate regions (Rubatsky, 1997). Tomato originated from the dry coastal desert of Peru (Tomato, 2001). In Uzbekistan it is the fourth most important vegetable after pepper, onions and potato (Rashidov, 2008). Tomato is mostly destined for the local market, used fresh as salad, juice and dry, processed for the paste industry. A minor proportion is exported to regional countries. The potential of growing tomatoes in Uzbekistan is great because it is labor intensive and thus generates rural employment; further it expands exports, improves nutrition of the people, and increases the income of growers (Suleimanov, 2009). However, research aimed at the increasing tomato production, including research on plant protection and resistance, is locally given low priority in Central Asia compared to cotton and wheat.

In different regions many farmers use local derived from an ancient imported variety and present imported (from Netherlands and Israel) cultivars. The most popular variety "Avitsena" selected in the Uz. Res. Institute of Vegetable, Melon Crops and Potato (URIVMCP) is known for its good taste and tolerance to low and high temperature The currently most popular Uzbekistan cultivars Holland variety "Shannon" and local "Uysupovskiy", "Avitsena" and "Bull heart" ("http://www.agroserver.ru/doska/notice/30739.htm, **http://www.edicion.ru/index**').

Surveys of Pests in open and protected tomato cultures in Uzbekistan

a. Diseases: In Tashkent region in the area of 200 m^2 located at the Uzbek Research Institute of Vegetable, Melon Crops and Potato (URIVMCP) and in Kibray district farm area of 100 m^2 there were tomato field survey conducted to observe the main tomato pests and diseases. The purpose of observation of tomato fields was to assess the symptoms and take the samples of pathogens for making the further appropriate treatment. Tomato planting was started in early June and the crop harvested in August-September. During the tomato growth vegetation period there were no pesticides applied in the fields.

As it is known from literature Tomato problems in Central Asia may be caused by nutrient deficiencies, diseases caused mainly fungi and damages appeared from insects (Rashidov, 2008, Ochilov, 2007). That is why the survey on tomato in open fields was conducted twice a week during the whole tomato plant vegetation period. The spring and summer of 2010 was very rainy that is why during the observation there were following diseases occurred in the both field plots: in April-July Early Blight (EB) (caused by *Alternaria solani*), and in August-September at end of the season *Fusarium oxysporum* is appeared but randomly. The disease Late Blight (LB) (caused by *Phytophthora infestans*) and Downey mildew (caused by *Pseudoperenospora cubenis*) are appeared in plots of the Institute (URIVMCP) in August - September but in some places mainly in the border of the field.

In this report year EB disease plant symptoms are generally defined as general killing of leaves, flowers and stems. As it was noticed in this year tomatoes grown in outdoor plantings were very susceptible to Early Blight caused by the Alternaria fungus(*Alternaria solani*) and Leaf Mold in greenhouses caused by *Cladosporuim fulvum* Cooke. Symptoms of Alternaria disease, which are first seen on leaves, are dark brown, circular to oval spots, marked by concentric rings in a target pattern. These spots first appear on lower, shaded foliage, with spots growing together to blight a large portions or all of leaves. Cankers may form on older stems and blossom-drop may occur with loss of fruit. Blighted leaves are dark brown and die with foliage dying from the bottom of the plants upward. The dying leaves of course greatly reduce tomato fruit production.

Alternaria solani pathogen was easily isolated into pure Chapek's culture in Petri plates where it was developed at the temperature of 23-25º C. Colonies were grey, mycelium was high, and felt visible, substrate mycelium was a dark black color. Fast growing colonies completely covered Petri dish in 8 days after inoculation. Under microscope observation spores were good developed and conidia were eggs shaped in form, divided into 5-10 cells with horizontal and vertical septa. *Cladosporium* leaf mold is known as one of the principal leaf diseases in humid regions and in green-house conditions (Ochilov, 2005). This disease is characterized by the appearance of yellowish green spots on older leaves, which enlarge and coalesce. These spots turn brown to black, spread to the remaining younger leaves, and may cause defoliation and losses in tomato productivity (Ochilov, 2005).

Colonies of *Cladosporium fulvum* are rather slow growing, mostly olivaceous-brown to blackish brown but also sometimes grey, buff or brown, suede-like to floccose, often becoming powdery due to the production of abundant conidia. Vegetative hyphae, conidiophores and conidia are equally pigmented. Conidiophores are more or less distinct from the vegetative hyphae, are erect, straight or flexuous, unbranched or branched only in the apical region, with geniculate sympodial elongation in some species. Conidia are 1- to 4-celled, smooth, verrucose or echinulate, with a distinct dark hilum and are produced in branched acropetal chains. The term blastocatenate is often used to describe chains of conidia where the youngest conidium is at the apical or distal end of the chain.

It known from the literature that in Uzbekistan Late Blight (LB) caused by *Phytophthora infestans* Mont. de Bary can represent a serious threat to tomatoes only in rainy weather. In Central Asia its appearance on tomatoes is very limited and occasional because of the arid climate during the main growing season. In this wet season it has been observed mostly at the edges of open field plots of URIVMCP. *Phytophthora infestans* (Mont.) de Bary is not a true fungus, but rather is regarded as a fungus -like organism. This pathogen is currently classified as an Oomycete, which are members of the kingdom Chromista (Stramenopiles or Straminopiles). Oomycetes belong to one of two orders, Saprolegniales and Peronosporales. The order Personosporales contains *Phytophthora* species and a number of other very important plant-pathogenic genera, including the genus *Pythium.P. infestans* has worldwide distribution, but most severe epidemics occur in areas with frequent cool, moist weather uses relative humidity higher than 90% or Leaf wetness to estimate moist periods.

b. Insect and Mite Pests: Protected tomato culture survey was conducted from October 2009 to June 2010 in the experimental plots of Tashkent State Agrarian University and in Kibray district

farm. In Kibray district farm greenhouses there was “Yusupovskiy” tomato culture planted from April 2010 to September 2010 and for the University tomato greenhouses the crop seeds were bought in Israel Company. On survey tomato field plots and greenhouses there are various insects and mites were appeared that inflicted the big damages to the crop. In winter and spring seaons in both tomato greenhouses the most dangerous pests were leaf miner and whitefly. These insects caused the big damages to tomato greenhouses. In open fields in May on planted tomato emergences after two weeks there were whitefly noticed and in June –July whitefly population outreached on the whole field area. Also there were wholes on tomato fruits were appeared because of pest attacking of fruit worm *Heliothis armigera*. But the most big damages that significant reduced crop yield was inflicted with russet mites *Aculops lycopersici*.

Development of artificial diets for rearing of predator mite *Amblyseius mckenziei:*
Economic forces stand in the way of the natural extension of IPM to include the mass rearing and intentional release of natural enemies to provide increased control of pests. Although many beneficial arthropods have been identified and laboratory scale work has indicated promise for their use in such a program, their implementation in IPM has been minimal. Indeed, biological agents in general account only for about 1% of pesticide sales. Predator mites Phytoseiulus persimilis, Metaseiulus occidentalis, Amblyseius californicus and other natural enemies besides those preparations produced in fermenters are too expensive for use on most crops because of the high cost of producing them. In most cases, these natural enemies are grown on prey or host insects which must first be reared, often on a host plant. This process is very labor intensive and space intensive. Replacement of the prey or host with an artificial diet and development of associated mass production technology with decreased labor inputs could bring these costs down

Also, relaying to several references there are various attempts have been made to develop artificial diets for mites and other organisms. Reinecke (Kerkut and Gilbert, 1985), Singh Diets specifically designed for mites are described in McMutry and Scriven (1966) Shehata and Weismann 1972) Ochieng et al. (1987) Hanna and (1970). There has been no report of a low cost diet for effectively raising Phytoseiid mites.

The most data in the reference listed in the publications section are given about laboratory rearing of predator mites species as Amblyseius cucumeris and A. swirskii that can be cultured in the absence of prey (Kennett, C. E. and J. Hamai, (1980) . Instead, a plant is grown and infested with spider mites. Predator mites are then released to feed on the spider mites (Gilstrap, 1977) and thrips. The nutritional requirements for A. mckenziei mites have been firstly studied at the Uzbek research Institute of Plant Protection laboratory. 200 g of wheat bran with flour was used as rearing substrate, The substrate was added to 1 l glass jars to reach inside of each jar to 2 cm of level of substrate. Artificial diets were added to substrate in different quantity and proportion. Flour mites Acarus farris and Amblyseius mckenziei were obtained from cultures maintained on wheat bran with pollens.

At present time in the laboratory of Uzbek Research Institute for Plant Protection with assistance of my colleague I have been conducting research work on production of predator mite Amblyseius sp. in different artificial diets. There were 3 kind of artificial prepared that were marked as AD 1, AD2 and AD 3 where AD 1 in 1 l container consisted of 300g bran, 20 g yolk, 10 g sucrose, 0,01 g of vitamin mixture and 0, 03g streptomycin sulphate. Medium AD 2 is

nearly the same but instead of yolk we added east autolysate 10g. And composition of AD 3 consisted 300 g mixture bran with flour , 100g of sugar, 50 g of margarine and 50 ml of milk.

Our study showed that *Amblyseiuse mckenziei* developed successfully from egg to adult on different artificial diets. We have been studied the duration of the immature and adult stages, survival rates, mean eggs/female/day and oviposition ratios. During the research time we have noticed that the effect of different artificial diets of the various stages of the adult female of Amblisyseius mckenziei was much varied. AD3 showed the best results comparing to others where female longevity of *A.mckenziei* was 65 days, much longer then on AD1 (50 days), AD 2 (55 days) and on natural diet (37 days). Eggs showed no abnormalities; larvae fed on diets had normal development, and adults were comparable in size to individuals reared on a natural diet.

With consideration of natural and artificial diets compositions indicated in different papers we have modified natural and developed artificial diet associated with low cost Amblyseius mass production technology without using any equipment only materials, shelves and containers of different sizes.

Conclusions based on the specific research activities in Uzbekistan in Tomato crops

- Disease severity conducted in open field plots indicated that in this 2009-2010 report period of time fungus disease Early Blight caused by *Alternaria solani* was the most spread pathogen on tomato crop in Uzbekistan. Isolates of this fungus on Petri plates indicated of the possible presence of its various.
- In protected tomato culture only Leaf Mold caused by *Cladosporium fulvum* was occurred which is mainly appeared in greenhouses. The fungus isolated in Petri plates to find against it antagonists.
- Whitefly pest attacked tomato in both open and protected tomato cultures and cause significant damaged to the crop. The most significant damages were caused by whitefly, fruit worm and russet mites in open field plots and whitefly, leaf miner and aphids in greenhouses.
- At the laboratory condition in Uzbek Res. Institute of Plant Protection there was new technique for mass rearing predator mites Amblyseius mckensiei was developed that is associated on feeding predator mites with low cost artificial diets and using cheap materials. Cost-effective release of inundative amounts of phytoseiids has the potential for dramatically reducing use of conventional insecticides without increased crop loss.

Objective 2: Disseminate IPM knowledge and packages to farmers and students through technology transfer and outreach in collaboration with local NGOs, universities, and government institutions.

Farmers Field Schools and Student Field Schools: One of the important objective of IPM CRSP project is to transfer IPM knowledge and demonstrate existing and new IPM technologies to local farmers and students through the establishment of Farmers Field Schools (FFS) and Student Field Schools in collaboration with local agriculture ministries, local NGOs, universities.

Student field school on wheat crop IPM in Tajikistan: The project objective on IPM outreach and education focused on both academic and nonacademic stakeholders through student field schools (SFS) and farmers field schools (FFS) in collaboration with NGOs, government institutes and local universities in Tajikistan. To enhance university education, an inventory of IPM educational programs in Tajik National University was conducted. SFS on wheat IPM for 12 students (5 female and 7 male) of grade III in the Biological faculty was implemented. The program course curriculum was consisted on 22 hour class/theoretical an 16 IPM practical/field parts (photos 5-7).

Photo 5. Students scouting the wheat pest.

Photo 6. Trainer demonstrated to student the method of wheat disease field diagnostic.

Photo 7. Trainer demonstrated to student the method of wheat insect pest identification at laboratory condition.

Objective 3: 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.

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: Dr. Nurali Saidov, Team leader of the IPM CRSP project based in Tajikistan participated in the 13th Annual Meeting of the Steering Committee of the CGIAR Program for Central Asia and the Caucasus held in Ashgabat, Turkmenistan from June 13 – 15, 2010. Dr. Saidov gave a presentation on the "Ecologically-Based Participatory and Collaborative Research and Capacity Building in IPM in Central Asia Region" based on achievements 2009-2010. This meeting was attended by more than 50 senior administrators, high level government officials, and program leaders from 8 countries in Central Asia and Caucuses and international agricultural research centers.

Objective 4: Create a "Central Asia IPM Knowledge Network" - Information base

A. 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 Central Asia IPM CRSP project web site (http://www.ipm.msu.edu/central-asia.htm) was updated and maintained by Ms. Joy Landis at MSU to include:

- New program components, team members, and partners
- Latest reports, new publications
- Photos from team 2010 visit to Uzbekistan, Tajikistan
- The success story from Phase 1.

A success story was written about team member Dr. Murat Aitmatov's visit to the MSU Student Organic Farm. Aitmatov returned to Kyrgyzstan and organized a student farm where students are learning IPM practices like biological control and how to build small plastic structures (hoophouses) for protecting crops during an extended growing season. This success story was formatted into a handout and made accessible through both the IPM CRSP web site and the Central Asia IPM CRSP web site.

A press release was written in March 2010 about the start of Phase 2. The story was picked up by over 30 news outlets including The San Francisco Chronicle, US Ag Net, Sacramento Bee, My Fox Detroit, Kyrgyz Post and USA Today in Uzbekistan and Tajikistan.

A flyer was developed that explains the resulting work from Phase 1 and the plans for Phase 2.

B. Publications:

a) Articles in Refereed Journals

- Saidov N.Sh., A.U. Jalilov, D.A. Landis, A. Fiedler, V.K. Nazirov, T. Mirzoev (2010): Introduction the flowering plants in agricultural landscapes for increasing of efficiency of natural enemies. Bulletin of the Academy of agricultural sciences of the Republic of Tajikistan, Dushanbe-2010, 10 p., in the press (in Russian).

b) Brochures, Bulletins, non-referred papers

- Saidov N., D. Landis, A. Fiedler**,** M. Bouhssini, V. Nazirov (2010): Introduction of native flowering plants in agro landscapes for attracting beneficial insects. Brochure, Dushanbe-2010, 14 p., published copies 500 unit (in Tajik).

- Tashpulatova B.A., Frank Zalom, Rashidov M.I., Suleimanov, 2009, Methodological recommendations on rearing of predator mites (Phitoseiidae family) for biological control of greenhouse pests -ICARDA-MSU and Tashkent Agrarian University. Tashkent-, 18 p, published copies 70 units (in Russian and in Uzbek).
- Brochure Food Security and Climate Change in CAC, 2009, ICARDA –CAC, Tashkent, p. 25-27 (English) – (Tashpulatova, B. Co-author).
- Tashpulatova B., Rashidov M.I., 2009, Test of a new pheromone against fruit bollworm (Helicoverpa armigera), Bulletin of Agrarian Science, # 1-2, p. 33-35 (Russian).
- Brochure Phytoncide plants as field, orchard and garden crops protectors, Tashkent-2010, published copies 100 (in Russian and in Uzbek).
- Brochure Botanical pesticides in agriculture; Tashkent 2010, published copies 100 (in Russian and Uzbek).
- Success Story: Central Asia IPM CRSP Project Outreach and Education - http://www.ipm.msu.edu/asia/success.html
- Compendium on Farmers Field Schools in Kyrgyzstan – 170 pages

Objective 5: Build institutional capacity through training and human resource development.

I. Long-term Training:

Under the Phase II of the Central Asia IPM CRSP Project, three students, one from each of the three host countries (Tajikistan, Kyrgyzstan, and Uzbekistan) will receive the Ph.D Long-term Training at Michigan State University in collaboration with UC-Davis, KSU, and International Agricultural Research Centers (ICARDA, AVRDC, and CIP). The Ph.D Thesis research will be tied to the applied research and IPM demonstration sites for Wheat, Potato and Tomato IPM packages. In November 2009, applications were invited from potential students from the three host countries. A total of 19 applicants applied for the Ph.D Degree programs in Wheat, Potato and Tomato IPM Program. Through a competitive process, the following three students were selected by the Central Asia IPM CRSP Team in consultations with the host country collaborators.

1. Ms. Shahlo Safarzoda (Female), Tajikistan - Wheat IPM Ph.D Program in Department of Entomology at MSU from Fall 2010 (expected date of Graduation December 31, 2014) – Major Professor, Dr. Doug Landis.

2. Mr. Bahodir Bahodir Eshchanov (Male), Uzbekistan – Tomato IPM Ph.D Program in Department of Entomology at MSU in collaboration with UC-Davis from Fall 2010 (expected date of Graduation December 31, 2014) - Major Professors, Dr. George Bird and Dr. Frank Zalom.

3. Ms. Saltanat Mambetova (Female), Kyrgyzstan – Potato IPM Ph.D Program in Department of Crop and Soil Sciences at Michigan State University from Spring 2011 (expected date of Graduation December 31, 2014) - Major Professor, Dr. David Douches

II. Short-term Training:

1. IPM Short Course at Michigan State University: Three young scientists were invited to received short term training in IPM at Michigan State University in June 2010. Of the three, two scientists, Ms. Shahlo Safarzoda (Female) from the Farming Institute in Tajikistan and Mr. Edil Kalmanbetov (Male) from the Biololaboratory in Issikul in Kyrgyzstan attended the International Agroecology, IPM and Sustainable Agriculture short course at MSU from June 13 – 26, 2010. This program provided hand-on training on various aspects of ecologically based IPM practices on field crops, vegetable and fruit crops and was taught by more than 20 faculty members at MSU working on various aspects of IPM programs design, implementation and outreach.

2. Plant Virus Diseases Workshop at TNAU, Coimbatore, India: Two scientists with background and experience in Plant Viruses were invited to received the training the workshop organized by the IPM CRSP Global Theme on Plant Virus Diseases at Tamil Nadu Agricultural University, Coimbatore, India from July 12 – 16, 2010. Of the two scientists invited, Dr. Kadovora Zarifa (Female) from Uzbekistan attended this training workshop focusing on the review of the current status of virus diseases of vegetable crops in Asia and to learn about the diagnosis and management of plant viruses.

3. Training on rearing of Amblyseius mckenziei and application in open fields and greenhouses in Uzbekistan: Mass production and application of entomophagoes requires the special knowledge, skills and nuance, which the workers of biolaboratories and specialists on plant protection should possess. For this purpose under the Institute of plant protection Government organization on consultation and checking product quality “bisifat” under the Tashkent State Agrarian University including big biolaboratory and classes so called “biomarkaz” was established where annually in winter and early spring seasons scientists, docents and cathedral educators of Institutes and Universities conduct trainings for specialists of biolaboratories and plant protection to enhance their skills and knowledge on biocontrol methods. In spring 2010, “biomarkaz’ offered the educational program with a new theme on introduction of predator mites Ablyseiuses (*Amblyseius mcktnziei*). Dr. Barno Teshpulatova presented the method of rearing and utilizing of predator mites amblyseiuses on cotton and other crops against spider mites and thrips.

4. Four-Field Days for Farmers in Kyrgyzstan focusing on Potato Pest Management in August 2010; 43 farmers attended these filed days (14 female farmers).

5. Training of Trainers (ToT) in Alai Region of Kyrgyzstan for the tanagers working with the Mountain Society Development Programme (MSDSP) in February (4 days) and April (4 days); trained 13 trainers.

Objective 6: Links with Global Themes:

Gender Issues in IPM: Addressing gender issues is an important component of the IPM CRSP project. Dr. Linda Racioppi and Dr. Zahra Jamal are providing support towards the gender component of the project in collaboration with the Global Theme Leader Ms. Maria Elisa

Christie from Virginia Tech University. Their initial activities were preparatory to a site visit and research work. Because of State Department restrictions on travel to Kyrgyzstan and Uzbekistan, the decision was taken to focus project efforts in the gender arena on Tajikistan. The specialists began then by reviewing the existing literature on women and rural development in Tajikistan and by gaining knowledge of basic practices in IPM with regard to wheat, the main crop focus for the IPM CRSP project in Tajikistan.

Dr. Racioppi and Dr. Jamal attended a full day training workshop with Dr. Maria Elisa Christie at Virginia Tech University in May. The workshop provided them with a model of best practices in gender training and with sample training materials and exercises. The specialists also made a site visit to Tajikistan in July and August. They meet with more than 20 individual experts and development groups, to engage in three focus groups in three villages in two different districts, and to undertake a Rapid Gender Assessment for each site. During the visit to Tajikistan they were able to identify Ms. Shoira Pahlavonova from Tajikistan to serve as the coordinator of the gender related activities in the region and to assist with networking and gender related training programs. In addition to the specialists' preliminary bibliographic work and their travel to Blacksburg and Tajikistan, they have also involved two MSU students in US-based research. They have located partial funding to take one of these students, who is studying Tajik language, to Tajikistan during the next research trip in Spring/Summer 2011.

Impact assessment of IPM CRSP project activities in Central Asia: As an input in to the planning of the impact assessment (IA) activities in Years 2 - 5, an impact pathway analysis worksheet was developed by the IA research team (Dr. Mywish Maredia and Dr. Richard Bernsten from MSU). This impact pathway analysis will be completed by the impact assessment team based on a one-on-one consultation with the project PIs. The outcome will be 'impact pathways' for wheat, potato and tomato IPM research components in Central Asia. The goal is to help the researchers lay out the vision of success (impact goal) and: a) make them aware of the consecutive steps needed to achieve that vision of success; and b) incorporate these steps as much as possible in their workplan for the remainder of the grant period.

In addition, based on the interactions between the global impact assessment project PI (George Norton) and one of the team members of this component (Mywish Maredia), the following is the summary of decisions made to guide impact assessment activities in the coming years:
1. Collect baseline information on current pest control practices in targeted crop/country. Given the travel restrictions for Kyrgyzstan and Uzbekistan, it was decided that a major focus of 'field' activities will be in Tajikistan. This may be appropriate given the FTF status of Tajikistan (from USAID's perspective).

2. Develop a 'farm budget' template and give that to researchers to record information related to input costs and outputs from their field trials/experiments. This will help assess treatment effects in terms of socio-economic parameters.

Towards these action points, George Norton has shared templates and instruments that will be adapted for data collection for the type of research conducted in the Central Asia IPM CRSP

project.

Performance Indicators:

Beneficiaries

Training

Male participation in short-term training: 1
Female participation in short-term training: 2
Male participation in Long-term training (Selected for Ph.D Degree Program at MSU): 1
Female participation in Long-term training (Selected for Ph.D Degree Program at MSU): 2

Potato Crop Management: Photos taken at Farmers Field Days – Kyrgyzstan 2010


СЕЗОНДУК КАЛЕНДАРЬ