Integrated Crop Management through FFS under FATA Rural Development project in Khyber Agency

July, 2010
Acknowledgement

All praises to Almighty Allah for His showering countless bounties upon me to complete this sort of report. With out His help, I would not be able to complete a single thing.

CABI South Asia is greatly thankful to FATA Rural Development Project (FRDP) for the provision of financial support to run the ICM activities through FFS operation. The support without which ICM/FFS project was just a dream only. Here it is worth mentioning to express thanks to FRDP & Extension department staff especially, Mr. Masood Khan Bangash (Project Director, FRDP), Mr. Zaki Ullah (NRM Coordinator, PMU FRDP), Mr. Arif Rauf (APM, PIU Khyber Agency), Mr. Assar Khan (NRM Consultant, PIU Khyber), Fazal Rabi (AAO, Extension department), Mr. Shafqat Ullah (AO FRDP Khyber), Mr. Irfan (Accountant PIU Khyber) for their continuous help and cooperation.

Special thanks to CABI team including Mr. Adil Naseer (Agri. Expert), Mr. Haroon Rashid (Agri. Expert) and Mr. Shezad (Report Writer/FA) for their continuous effort made during the entire period of project. Without this team, outcome of the project was difficult to achieve in time.

Many thanks to Dr. Ashraf Poswal for his guidance, valuable suggestions, constant encouragement & support regarding management of the project. Also special thanks and appreciation extended to Mr. Zeeshan Butt (Account Manager, CABI) and Mr. Muhammad Afzal (Systems Engineer) for their respective technical support.

Last but not the least; I am very thankful and grateful to Mr. Gouhar Ayub (Ex. Team Leader for ICM/FFS project) for his time to time guidance, sincere cooperation and help.
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Executive Summary

CABI is determining to help green sector across the world through research and development activities. Currently, besides other development projects, CABI South Asia is playing key role in capacity building of agricultural professionals and farmers of Khyber Agency under FRDP Project, where agriculture is predominantly main source of livelihood. Furthermore, the environmental and food security would remain the key issues confronting mankind in the new millennium. Therefore, efforts to increase the food production to feed the expanding population must rely on eco-friendly approaches to crop management. The integrated crop management concept is the hope of the future and would provide a pathway to sustainable agriculture.

Since farmers had been doing the subsistence agriculture for centuries, there was a huge potential to introduce new crops, advance technology, farmers’ led training programs like Farmers Field School (FFS) approach that can provide tremendous opportunity to train them in a new system of produce management, post harvest management, and marketing for commercial agriculture. Thus, FRDP Project has responded to this positively and initiated a project entitled “Integrated Crop Management (ICM) through Farmers Field Schools (FFSs) approach” in Khyber, Mohmand and Bajaur agencies in close collaboration with CABI South Asia to build the capacity of Agriculture staff and farming community.

Therefore being a pioneer of Farmers Field School (FFS) approach in Pakistan since 1997 and to start FFS operation in Khyber Agency, CABI South Asia has been given the mandate to establish & run 10 Farmers Field Schools in Khyber Agency under above FRDP funded project entitled “Integrated Crop Management (ICM) through Farmers Field Schools (FFSs) approach”. In this context, numbers of activities were completed successfully like establishment of all 10 FFS, monthly planning & coordination meetings with FRDP & Extension department officials, conduction of much needed special topics, nursery establishment for tomato crop, feedback session among CABI staff, conduction of training on ICM/FFS for FRDP & Extension department officials etc. This report depicts overall activities done by CABI in the period from October, 2009 to July, 2010 of the project.

Thus, subsequently CABI South Asia and Project Implementation Unit (PIU), Khyber Agency of FRDP Project were playing noteworthy role in the development of agriculture through Good Agricultural Practices and Farmers Field School (FFS) approach. During the entire span of project as per mandatory task to use Farmers Field School (FFS) approach, total 10 FFS were established while more than 250 farmers were trained and equipped with the good agricultural practices (GAPs) and integrated crop management (ICM) techniques in Khyber Agency. To build the capacity of agricultural professionals and farmers, CABI South Asia organized and conducted a series of trainings & workshops like training on Agro Ecosystem Analysis (AESA), nursery raising & establishment management, training on seed germination techniques, off-season vegetables production under plastic tunnel technology, fertilizer management, integrated pest management (IPM), disease management, training on different trials development, and harvest & post harvest management, etc.

Before imparting ICM/FFS training, farmers of the urea used 2-3 doses of fertilizer (urea) during the nursery raising stage. Due to this practice their seedlings normally reach to 22-24 inches height at a time of up-rooting of the nursery. In a result, they practice to cut-off the leaves to bring seedlings to a height of 5-6 inches. The CABI experts facilitated them that above mentioned practices are not recommended for nursery raising. They compared the ICM nursery with farmer raised nursery and demonstrated practically that there is no need to use the fertilizers (Urea) in nursery. They shared with farmers that in ICM nursery, seeds were sown 20 days later from that of farmer’s one but still difference is significant in terms of healthy and proper height of seedlings at the time of transplantation. Therefore, this good agricultural practice reduce the costs of production and extra time and labour required for cutting-off the leaves.

To learn more and to expose agriculture sector even better, an inland tour/exposure visit was also arranged for the field staff and farmers of the PIU Khyber Agency to Islamabad/Rawalpindi. They
learned a lot and share their experiences with the officials of National Agriculture Research Centre (NARC), Islamabad and CABI South Asia. During this visit, they also visited Dhoke Tahlian Dam of Chakwal district and observed different activities under Command Area Development (CAD) of Small Dam Project, a joint venture between Extension Department Govt. of Punjab and CABI South Asia. Agriculture Officer Mr. Hafiz Baksh and farmers of CAD Small Dam Project shared their experiences with them. They also highlighted the purpose and need of the project in the area. Tour participants gained and learned a lot especially from tomato and cucumber production under high tunnel and squashes production under low plastic tunnel technology.

First time, farmers of the area trained on establishment of raised bed nursery while practically involved in the good agricultural practices done during nursery stage. They were in viewed that such practices during nursery not only minimize the attack of damping-off disease and other diseases but also the seedlings are vigour and healthy.

Rodents were effectively controlled with the application of biscuit bait having ingredients like zinc phosphide, wheat flour, maize flour, rice, oil and water. On the other hand surf soda oil application also gave good result i.e. thrips population started decreasing significantly from 1st week (22 thrips per plant) to 4th week (3 thrips per plant)

First time, early production of vegetable (squashes) introduced under walk-in tunnel technology at farm level. Although it was started bit late but still average production was satisfactory (1,850 Kg/kanal) which shown better result in terms of net income i.e. Rs. 13,000/- Hence cost benefit ratio is 1:1.8. If this activity starts at proper time, then there is potential to increase production and net income of the farmers.

Trained farmers not only changed their cropping system but also eager to adopt more new ideas and innovations about farming. They are shifting their agriculture pattern from conventional to modern and hence they are willing to change their ancestor’s old farming system to that of new modern technology.
Introduction

Khyber Agency

is named after the world famous Khyber Pass, which has served as the corridor connecting the Asian sub-continent with the Central Asia through Afghanistan. The location of this pass has given the agency and its people worldwide recognition and has made it the focus of attention of historians interested in this part of the world. Khyber is an agency in the FATA region of Pakistan. Khyber has an area of 2,576 km² and a population according to the 1998 census, of 546,730. The headquarters of the agency is located at Peshawar. The Political Agent is the head of the agency. He functions as a District Magistrate and Session Judge and also as a Coordinator who coordinates the functions of all the nation building departments in the agency. The agency has three Sub Divisions viz Landi kotal, Jamrud and Bara with three Assistant Political Agents, seven Tehsildars and a number of other administrative functionaries. The headquarters of the Political Agent is at Peshawar but has also a Camp Office/Residence at Landi Kotal. The Assistant Political Agents have their headquarters at Landi Kotal, Jamrud and Bara respectively.

Agriculture is the mainstay of the local economy. However, FATA is deficit in food supply and has to rely on Khyber Pukhtoonkhwa Province and the rest of Pakistan for its food requirements. Only 6.5 per cent of the area is cultivated with low cropping intensity and low yields. Livestock play a very important role in the local subsistence pattern but do not constitute an adequate substitute for cereals. The major crops are wheat, maize, barely, rice, rapeseed, peanuts, peaches, apricots, pears, apples, walnuts and vegetables, with the cropping pattern varying from region to region. A large portion of the tribal population is engaged in the transport business and a considerable number is working abroad. FATA falls far behind the rest of the country in almost all socio-economic comparisons. The economy is predominantly agrarian, but the marginal land allows only subsistence agriculture. The backwardness of FATA was recognized in the 6th Five Year Plan, in which it was declared as the least developed area of Pakistan.

Apart from lack of awareness among farmers about new technology of agriculture in the Khyber Agency, several other factors are also contributing to lowest return in agricultural production e.g. poor management practices, lack in farmer’s capacity to manage the crop issues like insect pest and disease attack, time of sowing, poor quality of seeds, poor storage facilities and less knowledge of grading, packaging and marketing etc.

The information about FATA & Khyber Agency profile is taken from the following sites;


2) http://www.khyber.org/pash toplaces/fataareas.shtml
FRDP being a community participated project is aimed at improving the production potential of watershed, strengthening the capacity of the communities and supporting the implementing capacity of line departments to operate in more socially inclusive manner. The total target area of the project is 6162 square km and the targeted population is 1.48 million. The sectors in which the project intervenes are Communication, Irrigation, Agriculture, Forest, Drinking Water Supply, Livestock and Fodder Production besides Skill Development and Plantation. As being community participated project, 1400 Community Organizations have been established and involved in various phases of development schemes. This five years FATA Rural Development Project as informed was initiated in the financial year 2006-07 and would continue till the year 2011-12.

To boost up agriculture sector and to focus on all the issues relating to agriculture in FRDP working Agencies for the purpose of sustainable development, the FATA Area Development Project (FRDP) has the mandate to develop the farming communities in three upper agencies namely Khyber, Mohmand & Bajaur of FATA through Farmer Field School (FFS) approach. The project has invited and involved CABI to introduce FFS operation in FATA for the first time. In this connection, CABI South Asia has been successfully implemented FFS activities in all three agencies with the closed coordination of Project Implementation Units (PIUs) of each agency, Agency Agriculture extension departments and the organised communities in the area since its inception in 2006-07. During the period October, 2009 to July, 2010 CABI South Asia has successfully established and run 10 FFSs in Khyber Agency. This report will illustrate the activities done by CABI South Asia under Integrated Crop Management (ICM) through Farmers Field Schools (FFS) approach Project in the period of October, 2009 to July, 2010.

Also the introduction of cash crops will certainly enhance the per capita income of the poor farming community of the Barani area and reduce poverty. The project is spared over Rawalpindi division of the Punjab province and focuses on sustainable production of fruits, vegetables and crops. It is executed through command area of small dams of district Rawalpindi, Attock, Jehlum and Chakwal each headed by Agriculture Officer of the extension wing. Over all project is headed by Project Director and supported by an Expert Field Facilitator (EFF) representing the CABI. The project was launched on ground a little late and Training of Facilitators (TOF) activities could start in March - April, 2007.

**Introduction to Integrated Crop Management (ICM)**

- ICM is a sustainable approach to manage crop right from bed preparation till marketing or end consumer in a such a way that minimizes ECONOMIC, HEALTH and ENVIRONMENTAL Risks
- To managing pests by combining biological, cultural, mechanical, physical and chemical tools
- Combination of Conventional methodologies and scientific knowledge
Principles of ICM

Detail of all above mentioned principles is given below;

**Grow Healthy Crop**
Healthy plants are stronger and thus better equipped to withstand attack by pests and diseases. Many factors have an effect on the health of the crop;

- Healthy seeds and healthy seedlings and good variety
- Land preparation
- Correct spacing
- Soil improvement
- Fertilizer management
- Water management
- Crop rotation

**Understand and conserve defenders or Natural Enemies**
- The term “defender” is sometimes used instead of “natural enemy”, because a natural enemy of a pest is a defender of the crop. In Integrated Production Management farmers:
  - Know defenders and understand their role through regular observations of the agro ecosystem
  - Avoid the use of poisonous chemicals that kill the natural enemies of pests

**Observe the Field Regularly**
- In Integrated Crop Management farmers manage the crop (based on information about the actual field situation). They don’t use “calendar spraying” to control pests. Therefore farmers:
  - Monitor the field situation at least once a week
  - Make decisions based on the field situation
  - Take direct action when needed (e.g. collect egg masses, remove infested plants etc)

**Farmers become Experts**
- Farmers have to make daily decisions about the management of their crops. ICM farmers have learned to make these decisions based on observations and analysis of the field situation. But as field conditions continue to change and new technologies become available, farmers will need to continue improving their skills and knowledge:
  - Farmers are capable of improving farming practices by experimenting
  - Farmers can share their knowledge with other farmers
Justification of ICM through FFS Approach

Integrated Crop Management (ICM) programs based on the Farmer Field School approach are being implemented in many countries. Their benefits have been recognized by a broad range of stakeholders, including farming communities, local and national governments, NGOs and donors, who are now supporting such programs. ICM provides an environment in which farmers acquire knowledge and skills to be able to make sound crop management decisions (CMD) and sharpen farmers’ abilities to make critical and informed decisions that make their farming activities more profitable and sustainable.

The design and management of our agricultural systems need re-examining. We’ve come to accept routine use of biological poisons in our food systems as normal. But routine use of synthetic chemicals represents significant energy inputs into the agricultural system, and carries both obvious and hidden costs to the farmer and society.

IPM/ICM, as it was originally conceived, proposed to manage pests though an understanding of their interactions with other organisms and the environment. Actions are taken to restore and enhance natural balances in the system not to eliminate species. Regular monitoring makes it possible to evaluate the populations of pest and beneficial organisms. The producer can then take steps to enhance natural controls (or at least avoid or limit the disruption of natural controls) of the target pest(s).

Therefore in IPM/ICM approach, it is an understanding that the presence of a pest does not necessarily constitute a problem. Before a potentially disruptive control method is employed, appropriate decision-making criteria are used to determine whether or not pest management actions are needed. In fact a consideration of all possible pest management options before action is taken.

It is obvious that in ICM/FFS approach, a wide range of pest control techniques is available to farmers. Some of them are as old as agriculture itself for example rotating a crop to avoid a build-up of host-specific pests. Some are new – in recent years, genetic engineering has opened up many possibilities in pest control that were unavailable to agriculturalists even a decade ago. But farmers using ICM don’t hang their hats on any single technique. The simple philosophy is that control will be more effective and resistance will be less likely to build up when a range of measures is deployed against a pest.

• Subsistence Agriculture…..OKAY

THEN

• Then New Era (New varieties, chemical Fertilizers, Chemical used for pest control, Green Revolution)…..good result in terms of production and ultimately demand increased

THEN

• Pest Resistant, Chemicals leached down…..beneficial organisms suffered….human health in danger

THEN

• Scientist Thought…..Developed new IDEA called IPM (Pest) but IPM too specific to pests

THEN

• More Innovation and in a Result Integrated Production Management (IPM) or Good Agricultural Practices (GAP) through FFS process

Most of the 77 definitions for IPM listed in The Database of DIR>, despite some differences in emphasis, agree with this idea and have the mentioned elements in common:

IPM Resources (DIR) website,
It is the advantage of an ICM program that it provides skill enhancement/capacity building opportunity to farming community in the shape of Farmers Field Schools (FFS) as skilled human capital contributes a lot in any sustainable development program.

One of the major constraints in increasing crop production is lack of crop production management skills at the farmers end. Poor management skills lead towards low productivity & low return. In order to amplify their capability & potential in terms of production and return, farmers require intensive training in the shape of Integrated Crop Management (ICM) through Farmers Field Schools (FFS) approach. In ICM, running & establishing of FFS program is pre-requisite which provide basic foundation for farmers discovery learning process. ICM leads to farmers empowerment which simply enhance the capacities of farmers to manage and solve their own field problems at the local level. Hence, it is farmers centered approach where they identify & resolve their relevant problems.

In addition, ICM is the conceptual framework in which crop management decisions (CMD) are based on Agriculture Ecosystem Analysis (AESA) which is the cornerstone of the IM program. It is the AESA where farmers involved in three steps i.e. OBSERVATION, ANALYSIS and DECISION which ultimately provides decision making tool used for management of crops. Operationally, ICM/FFSs are typically organized around a season-long series of weekly or fortnightly meetings focusing on biological, agronomic and management issues, where farmers conduct AESA, identify problems and then design, carry out and interpret field and post harvest experiments. This experiential learning approach provides participating farmers with a deeper understanding of crop ecology and observational, analytic and problem solving skills, which help them, evaluate the importance and applicability of their existing and innovative practices.

Following a national IPM programme in Indonesia in 1989, in response to a major pest out-break caused by the misuse of pesticides on rice farms, this IPM/FFS approach has been successfully conducted in different countries especially in the member countries of the FAO. CABI South Asia has also successfully established and run IPM through FFS program on different crops like apple, cotton, guava, tomato, wheat, maize, onion, peaches, off-season vegetables production under plastic tunnel technology etc since 1997. Under this program, CABI South Asia enhanced the capacity of agriculture technical staff and farming community. It has been learned that IPM/ICM through FFS approach is the best way to improve the production technology of farmers field. During the 1990s an estimated 2 million farmers were trained through the FFS in South and South East Asia (An Introduction to Sweet Potato Farmers Field Schools).

The majority of studies measured the immediate impact of training through aggregated data, and reported substantial and consistent reductions in pesticide use attributable to the effect of training. In a number of cases, there was also a convincing increase in yield due to training. Most studies...
focused on rice. Pesticide reduction and farm-level returns were higher in non-rice crops (vegetables and cotton) than in rice.

A number of studies described broader, developmental impacts of training often using qualitative methods, and in some cases involving farmers in identifying and describing the impacts. Results demonstrated remarkable, widespread and lasting developmental impacts, which have been best documented for Indonesia. It was found that the FFS stimulated continued learning, and that it strengthened social and political skills, which apparently prompted a range of local activities, relationships and policies related to improved agro-ecosystem management.

It is recommended that future studies combine diverse perspectives to evaluation, and pay more emphasis to participatory approaches to evaluation. Further, it is proposed that the IPM/ICM/Farmer Field School is placed in a broader sectoral perspective, because benefits also accrue to other sectors such as education, environmental protection and public health.

This is the beauty of the ICM program that the trained and empowered farmers can easily adopt and share their experiences with other farmers and hence transfer of production technology knowledge from one farmer to other is on-going process. Therefore it is a need of the hour that farmers should educate according to the field situation that they must be able to solve their own problems.

Considering the above facts, it is recommended & suggested that farmers should adopt crop production technology through ICM and FFS approach. For this they need technical assistance and training to improve the management production technology for crops at their field level. Hence the rationale for the strategy development should be based on institutionalizes ICM at local level and farmers should have given opportunity to get training on integrated crop management (ICM) techniques.
Objectives

The objectives are:

- To improve the livelihood of the target group (watershed/working area farmers) through capacity building in Khyber Agency
- To establish & run 10 Farmers Field Schools (FFS) in Khyber agency for effective demonstration of participatory Integrated Crop Management (ICM) methodology
- To ensure rational use of pesticides and reduce environmental and health hazards problems through Integrated Crop Management (ICM) training/methodology
- To strengthen the capability & self-reliance of the farmers of working area for a more profitable & ecologically sound crop management
- By introducing new technologies like off-season vegetables production under tunnel
Strategy & Methodology

Farmers participatory training & research methodologies would have been adopted for the implementation of FFS activities. These include;

- Participatory selection of the crop & FFS plot for the whole activity
- Participatory group work, discussion, brainstorming and presentations to generate Good Agricultural Practices (GAP) with the local knowledge.
- Observe field regularly and doing Agro Eco-system Analysis (AESA) for crop management decisions
- To conduct Insect Zoo (To discover the role of insects in the ecosystem)
- Timely implementation of proposed module
- Delivery of special topics etc
- To keep the participants live & to promote the participatory learning environment, different group dynamic exercises and energizers will also be the part of training

Targets & Achievements

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<th>S #</th>
<th>Activities</th>
<th>Target</th>
<th>Achieved</th>
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<tr>
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<td>Monthly Planning Meeting with FRDP &amp; Agri. Extension department officials</td>
<td>9</td>
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<td>2</td>
<td>Establishment of 10 Farmers Field Schools</td>
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<td>3</td>
<td>Sessions during FFS</td>
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<td>4</td>
<td>Special Topics</td>
<td>Depends upon the outcome of the Crop Management Decision during AESA</td>
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<td>5</td>
<td>Major Problems identified being faced by farmers</td>
<td>Depends upon the field situation</td>
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<td>6</td>
<td>Trials develop</td>
<td>Developed according to field needs and situation</td>
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<td>7</td>
<td>Exposure Visit</td>
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<td>8</td>
<td>Monthly Progress Report</td>
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<td>Monthly Planner</td>
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<td>10</td>
<td>Closing Ceremony</td>
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<td>11</td>
<td>Final Report</td>
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CABI Team

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<tr>
<th>S #</th>
<th>Name</th>
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<tbody>
<tr>
<td>1</td>
<td>Muhammad Zahir Shah</td>
<td>Team Leader</td>
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<tr>
<td>2</td>
<td>Mr. Adil Naseer</td>
<td>Agriculture Expert</td>
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<td>3</td>
<td>Mr. Haroon Rashid</td>
<td>Agriculture Expert</td>
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<td>4</td>
<td>Mr. Shezad Khan</td>
<td>Report Writer/Field Technician</td>
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Activities

Activities carried out by CABI South Asia component of CAD Small Dam Project, during the third year 2008-09 of the project are given below;

1) Monthly Planning & Coordination Meetings

The purpose of monthly planning & coordination meetings was to develop good liaison between implementing partners of the project. In this connection, first week of every month was scheduled for the meeting. Three main stakeholders, CABI South Asia, PIU Khyber Agency FRDP and Office of Agency Agriculture Extension Department were actively participated. Ongoing project activities were shared with each other and focus given on the basis of what went right and what needs improvement and then strictly adopted the addition & deletion suggestions of the participants of the meeting in the best interest of the project.

Regular coordination meetings with PMU, FRDP was also held. Mr. Zaki Ullah NRM coordinator at PMU level was the focal person for these meetings. In every meeting, he incorporated his valuable suggestions in the on-going activities of the project. CABI team was very much satisfied with him regarding act of bridging between CABI staff and FRDP officials. Monthly planner for each month as per mandate of CABI team was also discussed & shared with the participants during every meeting. Hard copies of each monthly planner submitted in given time frame to PIU Khyber Agency and Agency Agriculture Officer office. Format of monthly planner is given in table: 1.
Table: 1 (Tentative monthly planner for the month of May, 2010 shared with them)

<table>
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<th>Localities to be visited</th>
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<td>Monthly Meeting with FRDP &amp; Extension officials</td>
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<td>CABI Team, PIU officials and AAO</td>
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<td>Coordination meeting with PIU officials</td>
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<td>CABI Team, PIU officials</td>
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<td>Feedback session among CABI staff</td>
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<td></td>
<td>CABI Team</td>
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CABI Team Leader: __________________
Signature: __________________

NRM PIU Khyber Agency: __________________
Signature: __________________
2) Establishing & Running of Farmers Field School (FFS)

As per mandate, CABI South Asia successfully run & established 10 Farmers Field Schools (FFS). Social organization unit of PIU Khyber Agency and Agriculture Extension department Khyber Agency helped CABI in this regard to establish FFS in the already formed Flahi Ghwnda’s (FGs) or male community organizations (MCOs). Detail of organizational structure of each FFS is given below in table: 2.

Table: 2

<table>
<thead>
<tr>
<th>S #</th>
<th>Name of FFS</th>
<th>Crop</th>
<th>Number of Farmers</th>
<th>Host Farmer</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>FG Abdur Razaq Kalay (Pirano)</td>
<td>Onion (seed Production)</td>
<td>18</td>
<td>Ahmad Shah</td>
</tr>
<tr>
<td>2</td>
<td>FG Rasool Khan Kalay (Lashora)</td>
<td>Onion Yield Production</td>
<td>20</td>
<td>Yar Akbar</td>
</tr>
<tr>
<td>3</td>
<td>FG Hasham Khan Kalay (Gudar)</td>
<td>Onion Yield Production</td>
<td>24</td>
<td>Rambel Kaka</td>
</tr>
<tr>
<td>4</td>
<td>FG Talam Khan</td>
<td>Walk-in Tunnel (Tinda)</td>
<td>20</td>
<td>Abdul Rehman</td>
</tr>
<tr>
<td>5</td>
<td>FG Pump Korona (Ghwandai)</td>
<td>Walk-in Tunnel (Tinda)</td>
<td>22</td>
<td>Nawabsher</td>
</tr>
<tr>
<td>6</td>
<td>FG Sajid Khan Kalay (Shakas)</td>
<td>Tomato</td>
<td>20</td>
<td>Ismail Khan</td>
</tr>
<tr>
<td>7</td>
<td>FG Khanay Mola Kaly (Shakas)</td>
<td>Tomato</td>
<td>20</td>
<td>Sher Nawaz</td>
</tr>
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<td>8</td>
<td>FG Mian Morcha</td>
<td>Tomato</td>
<td>26</td>
<td>Gul Muhammad</td>
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<td>9</td>
<td>FG Akhtar Islam Kalay (Sherbruj)</td>
<td>Tomato</td>
<td>21</td>
<td>Sajid</td>
</tr>
<tr>
<td>10</td>
<td>Sakhipul</td>
<td>Tomato</td>
<td>23</td>
<td>Abdur Rehman</td>
</tr>
</tbody>
</table>

FFS formation is under way
2.1) Why Farmers Field Schools?

Do not against extension department but needs some INNOVATION because of following sayings, “Give a man a fish and feed him for a day. Teach a man how to catch a fish and feed him for life”. and “Tell me and I will forget. Show me and I may remember. Involve me, and I will understand”

In the past years generation and dissemination of knowledge through Agriculture Knowledge Information System where mechanism as under Fig: 1

![Diagram of Farmer, Research, Extension](image)

But then new millennium, agricultural research reform agenda and revival of policies reached that research organizations to be

- Outward looking
- Client oriented
- Impact driven
- To take responsibility for their knowledge and technology to be applied by the poor

And hence “generation diffusion and application of knowledge”

2.2) Historical Background of FFS

- Came from Indonesian term “Sekolah Lapangan” meaning just field school with educational goal i.e. the course takes place in the field.
- First time in 1989 in Indonesia…..in response to a major pest outbreak (brown plant hoppers), caused by the misuse of pesticides on rice farms….a national integrated pest management (IPM) programme began….attempted to improve the organizational & management skills of farmers.
- CABI South Asia started in 1997 in Vehari on cotton crop……..and then a number of series of FFS operation.

2.3) Objectives of Field Schools

- To bring farmers together to carry out collective and collaborative inquiry with the purpose of initiating community action in solving community problems
- To empower farmers with knowledge and skills to make them experts in their own fields.
To sharpen the farmers ability to make critical and informed decisions that render their farming profitable and sustainable.
To sensitize farmers in new ways of thinking and problem solving
Help farmers learn how to organize themselves and their communities

2.4) Principles of FFS
- Farmer-centered
- Discovery learning
- Competent facilitators
- Empowerment of farmers
- Self help

2.5) Condition of Successful FFS
- Well trained facilitators
- Well defined priority problem
- Organized community that is dedicated/committed and willing
- Clear understanding of the concept and procedure by all stakeholders
- Support and goodwill of the authorities at various levels
- Availability of appropriate technology
- Adequate resources and logical support
- Proper identification of site/area
- Proper identification and selection of participants
- Flexible and dynamic farmer group that is well organized and structured
- Farmers with common interest
- Proper and guaranteed supervision, monitoring and evaluation of the activities

2.6) Schedule of FFS
- Agenda of the FFS Session
- Review of the previous session
- Agro-ecosystem analysis data collection
- AESA presentation & discussion
- Implementation of a “special topic”
- Conducting Insect Zoo
- Group Dynamics
- How to implement CMD?
- Planning for the next Sessions
- Evaluation of the day

2.7) Criteria for FFS Site Selection
- Accessible
- Suitable for the particular activities to be done.
- Within or next to the community
- Should be acceptable to all the farmers (Every member of the group have to agree about it)
- Should be centrally located among the farmers
- Should have a data processing site
- Security

2.8) FFS Curriculum
- Growth stage of the crop
• Insect pest and beneficial numbers and weeds and disease levels.
• Weeds and disease levels
• Weather conditions
• Soil Condition
• Overall plant health

3) Agro Ecosystem Analysis (AESA) during FFS Sessions

Total 70 sessions were held during the entire period (Oct, 2009 to July, 2010) of the project. During this period of the project, CABI South Asia successfully conducted a series of AESA for the best interest of farmers. Detail is given below;

3.1) Understanding of the Ecosystem of the Crops while Conducting AESA

The crops production system is subject to biotic and a-biotic factors which cause adverse effect on the growth of the crops. Therefore it is very much important to study and understand these biotic and a-biotic factors and their interaction (ecosystem). It is the Agriculture ecosystem analysis (AESA) process which provides a platform to understand the crop ecosystem. Ecosystem Analysis is a way of assembling what we are studying and place into a process useful for decision making based on many factors.

Biotic Factors:

• Plant / crop
• Pests
• Insects
• Diseases
• Weeds
• Natural enemies
• Predators
• Parasitoids
• Pathogen

A-biotic Factors:

• Weather
• Soil
• Water

3.2) Agriculture Ecosystem Analysis (AESA)

The ecosystem Analysis provides a method to integrate the many aspects of the crop ecosystem into one drawing that can then be discussed and analyzed. VESA is the backbone of the FFS methodology. This is the establishment by observation of the interaction between crop and other biotic and a-biotic factors co-existing in the crop field. It is the main decision making tool used in IPM and FFS approach and involves regular observation of the crop usually weekly, fortnightly or monthly depending on study activity. The process is holistic and farmers usually work in sub-groups of 4-5 under the guidance of the facilitators to enhance the participatory learning methodology.
3.3) **Steps involved in AESA**

AESA is a four stage process starting with observation and ended with the collective decision making.

**Observation:**

During this stage the sub-groups learn to sample the crop and carry out their structured observations of their crop. Growth stage, insect pests, predators, soil condition and any other factors that have a bearing on the crop performance are all recorded in the field observation.

**Detailing the Field Observations on a Presentation Size Paper (Analysis):**

This step reinforces field observations and creates a record of field activities. Each sub-group prepares their presentations with a summary of data, picture of the field situation and decisions from the group as to the management required in the field. The master trainer role is to move from group to group asking questions and making additional observations.

**Presentations:**

The third is where each sub-group presents their results and decisions, and responds to observations or comments made by the other sub-group. This presentation by participants strengthens presentation skills and requires groups to defend their decisions with ecological arguments.

**Collective Decision Making:**

The last but not the least is where the whole group synthesis the presentations for collective decision making. The master trainers role during this stage is to guide farmers to arrive at informed decisions and help farmers harmonize the different decisions from different sub-groups.

Farmers own experience is incorporated into all stages of the analysis. Drawing and self-presentation during this process reinforce learning. This is done throughout the season as the problems and decisions being studied overlap with similar issues in participants own field. The VESA usually takes 2 hours per session.

The purpose of this exercise is for the farmers to learn to make regular field observations and analyze problems and opportunities encountered in the field. Through observation, drawing and discussion, farmers analyze what is observed in the field and come up with management decisions.
based on these findings. This helps improve farmer’s decisions-making skills. By doing this exercise regularly in the IPM and FFS sessions, participants and farmers develop a mental checklist of indicators to be observed when monitoring their crops.

3.4) AESA Methodology

The following basic methodology is used to do agriculture ecosystem analysis (AESA). For different crops, the approach could be slightly different, but the basics are the same.

- Go to the field in groups (about 5 farmers per group)
- Walk across the field and choose 5 plants randomly.
- Observe keenly each of these plants
- Record your observation

4) Special Topics

- This activity was linked to the stage of growth of the crop and specific local issues.
- Main objective was to build the capacity of TOF/feedback sessions participants.
- With the help of these topics, participants were able to understand the crop related issues and faced no difficulties during facilitation skills while sharing with farmers in the field.

During FFS sessions, participants suggested for arranging special topic on the following topics; Hence, as per their demand, special topics were arranged for them during FFS sessions. Main topics are given below;

- Onion nursery establishment
- Agro Ecosystem Analysis (AESA) (backbone of the approach)
- Farmers Field Schools history, principles, characteristic etc
- Tunnel Technology generally and Walk-in Tunnel Technology in specific
- Practical demonstration of Seed Germination Test
- Role of fertilization Application
- ICM/FFS/AESA approach
- Tomato nursery establishment
- Tomato production management
- Pest Management in tomato crops

Examples of detail special topics being delivered during FFS sessions are given as under;
4.1) Nursery Establishment & Management

A joint FFS session on Tomato nursery establishment & raising technique was held at FG Sakhipul in which the farmers of all the five established FFS sites FG Sajid Khan Kalay (shakas), FG Mian Morcha, FG Akhtar Islam kalay (sherbruj), FG Khanay Moula and Sakhipul participated. It was relatively large gathering and farmers shown keen interest in the session.

It was delivered by the CABI team leader Mr. Zahir Shah. On this occasion Mr. Shafqat Ullah (AO, PIU Khyber Agency) and Sharafat & Shindi gul (Field Assistants, Extension department Khyber Agency) were also present and shared their experiences regarding nursery raising. During special presentation, Team Leader CABI discussed in detail the nursery raising & establishment technique as under;

It is recommended that nursery should be raised & established for those crops/vegetables which grow slowly during initial stages e.g. tomato, sweet pepper, hot pepper and brinjal etc

**Importance of nursery**

i. Seeds grow fast due to proper environment
ii. Control use of seeds and hence cost of production minimized
iii. Management of seedlings of crops/vegetables is easy due to small beds
iv. Weeding is comparatively easy.
v. Plants are more healthy and grow fast after transplantation

**Site selection for nursery raising**

i. Land should be evenly leveled
ii. Avoid saline soil
iii. Well drainage system
iv. Near to dwell.
v. Near to transplantation field
vi. Open place not under the shadows of trees

**Soil Type**

i. Upper surface of the soil mostly up to 6-12 inch must be fertile as plants take nutrients & water from this limited surface
ii. Soil must be soft as it helps in smooth growth of the roots
iii. Loamy soil gives good result
iv. Selected site for nursery raising should be free from soil born diseases.
v. Do not miss the soil test
vi. The remains of previous crops must be buried and destroyed.
Land Preparation and sowing methodology for Tomato Nursery Establishment

i. Select fertile and loamy soil with good drainage system.
ii. One month prior, level the land and use rotten Farm Yard Manure (FYM)
iii. Avoid fresh FYM during nursery raising.
iv. At least three days before sowing, apply NPK according to land requirement.
v. Now prepare at least 6 inch raised bed having dimension (20ft length and 3ft width).
vi. Then take silt and pass through mesh.
vii. Now spread the meshed silt over bed and form layer up to 3 inch and then level the surface.
viii. Now take stick and press it on the surface of bed to draw lines for sowing. Line x Line distance should be 3 inch.
ix. Bed is ready for sowing.
x. Just sow tomato seeds with out any pressing on the line at a distance of 3 x 3 inch.
xi. After sowing of seeds, apply mixture of well rotten FYM and silt with the help of mesh thoroughly on bed.
xii. To protect the seeds from birds and keep optimum moisture level, cover the bed with the help of dried plant parts (Parali or sooka).
xiii. At first showering, add insecticide (Chloropyriphos @ 3gm/lit) to protect seedlings from termites and other hidden insects.
xiv. Irrigate the nursery at least two times during the 24 hours up to 3-4 days and after that water should be given on need basis.
xv. Check regularly the nursery and remove the dried parts of the plants (Parali or sooka) very carefully if germination occurs even of a single seed.
xvi. Stop irrigation after 2-3 weeks of germination for the purpose of Harding of the seedlings. This will boost the resistant mechanism of the seedlings against unsavory condition like drought etc.

Nursery Uprooting/Transplantation of Seedlings:

i. Irrigate the nursery just 24 hours before transplantation to ensure easily up-rooting.
ii. Use small spade (kurpa) for up-rooting. Avoid up-rooting through hand, it may cause injury to the roots of the seedlings.
iii. Always transfer healthy seedlings.
iv. Do not delay transplantation after up-rooting, it may effect negatively on the health of the seedlings.
v. Treat and dip properly up-rooted seedlings in a fungicide (Redomil, Mencozeb, Diathane M-45 etc @3 gm/lit) solution for at least 45 minutes.
vi. Irrigate the ridges of the field before transplantation of the seedlings.
vii. Make sure that seedlings are transplanted in that area of the ridges where moisture level reached.
viii. Stay away the stem and roots of the seedlings from direct contact of the water during transplantation.

4.2) Seed Germination Test

Farmers were trained during FFS sessions about seed germination test process. Following steps were discussed in detail;
Seeds Germination Test in %age:

Before sowing of seeds, it is very much important to test the seeds with regard to germination capability of seeds. Process of germination is given below:

Steps:

i. Take a piece of soaked cloth (jute).
ii. Placed 100 numbers of seeds in line on soaked cloth
iii. Then cover seeds with another fold of jute cloth
iv. Now placed them in a shadow place at room temperature.
v. Showering water at least two time in twenty four hours
vi. After 4-6 days, germination occurs.
vii. Now count number of germinated seeds (say 80 numbers of seeds are germinated)
viii. This means that 80 seeds out of 100 are germinated and hence %age is 80%.
ix. Almost 80-85 % germination occurs which is required germination %age rate.

4.3) Role of fertilization application in plastic tunnel Technology

CABI team successfully conducted special topic on fertilization requirement and role of fertilization in FFS sessions being established on walk-in tunnel (Tinda). Participants were educated about the role of fertilization in the cropping system accordingly;

1st Dose of fertilization in walk-in tunnel (Tinda crop) at the time of bed preparation

Urea 10 Kg per half kanal
DAP 10 Kg per half kanal
Potash 05 Kg per half kanal

While during 2nd & 3rd dose of fertilization, dose should be applied at each dose as under;

DAP & Urea (2-3 Kg per furrow) while Potash 1 Kg per furrow.

Generally, role of Nitrogen, Phosphorus and Potash in the cropping system was also shared with farmers;

Nitrogen:

- Promote rapid vegetative growth
- Gives plant healthy and green colour

If there is nitrogen deficiency, following symptoms occurred;

- Stunted growth
- Pale yellowish color
- Burnings of tips & margins of leaves starting at the bottom of the plant

Phosphorus:

- Stimulate early growth & root formation
- Hasten maturity
- Promotes seed production
- Make plant hardy

Symptoms:
- Small root growth
- Delayed maturity
- Dying tips of leaves (older one)

**Potash:**

- Improve resistance to disease and cold
- Aids in the production of carbohydrates
- Regulate transportation of water

**Symptoms:**

- Slow growth
- Weak stalk

5) Problems Identified during FFS Sessions

During FFS sessions, CABI team identified following problems. Detail of each problem is also mentioned here.

- Termites
- Thrips attack on onion crop
- Tomato fruit worm
- Cucurbitae fruit fly
- Cut worm
- Damping-off during nursery stage
- Downey Mildew
- Tomato Late Blight Disease
- Rodents
- People of the area use fresh Farm Yard Manure (FYM)

5.1) Termites

The termites, commonly called white ants, are among the most insect pest belonging to the order Isoptera. They are found abundantly and widely in tropical and sub-tropical regions. They live in large communities. The termites are social insects and their colony organization is based on a caste-system. In a colony, there are numerous workers, lots of soldiers, one queen, and a king. They live deep in the soil and destroy plant roots by eating. They are serious in sandy soils.

In Khyber Agency, termites are found in abundance because of fresh FYM placed a side in the cultivated field and plantation of popular plants in the area.

**Life Cycle**

Active in rainy season when atmospheric conditions are favourable. The queen is capable of laying many millions of eggs during her life, which is very difficult to estimate.

**Host Plants**
Tomato
Cucumber
Tinda gourd
Squashes
Chilies
Apple
Tea plant
Rubber
Mango etc

**Integrated Pest Management (IPM) of Termites**

1) When a colony is established, it is not so easy to eradicate the pest. The only sure method is to reach the centre of the nest and kill the queen and the workers. However, in the mound forming species of termites, it is much easier to locate the centre which lies in the mound or just below it. *(Agricultural pests of South Asia and their management, A.S. Atwal and G.S. Dhaliwal, 2004)*

2) To avoid the attack of white-ants in cultivated field, care should be taken not to use green manure or raw farmyard manure.

3) Use well rotten FYM

4) Irrigation reduces attack

5) Adding organic composites and manure to the planting area is recommended as this will produce healthier trees and crops. Whereas, inorganic fertilisers encourage fast growing soft tissue which is more likely to be attacked by termites

6) Apply manure prepared from Bio-Ab solution being mixed with gur sharbat, slight urea and bit fresh FYM in a pit

7) Plants which are suffering from disease or lack of water are generally more susceptible to termites than healthy plants. It is therefore important that plants are kept healthy and watered

8) Planting the same crop on the same land year after year reduces soil fertility and structure. Crops growing in such conditions will be weaker and susceptible to termites. Crop rotation can play an important role in reducing termite attack

9) Termites have many predators, including spiders, beetles, flies, wasps and especially ants. Other predators including frogs, reptiles, birds and mammals such as aardvarks, pangolins, bats, monkeys and humans

10) Apply recommended pesticides (Chlorpyriphos) with irrigation @ 2-3 lit/acre

11) NIFA-Termaps, which is best control strategy against termites

**5.2) Thrips**

Thrips belong to order Thysanoptera are tiny, slender insects with fringed wings. They feed by puncturing their host and sucking out the cell contents. Most adult thrips are slender, minute (less than 1/20 inch long), and have long fringes on the margins of both pairs of their long, narrow wings. Immature (called larvae or nymphs) are similarly shaped with a long, narrow abdomen but lack wings. Most thrips range in colour from translucent white or yellowish to dark brown or blackish, depending on the species and life stage.

**Life Cycle**

Thrips have several generations (up to eight or more) a year. The life cycle from egg to adult may be completed in as short a time as 2 weeks when the weather is warm. The thrips life cycle includes the egg, two actively feeding larval (nymphal) stages, non feeding pre-pupil and pupil stages, and the adult. Thrips
have a metamorphosis that is intermediate between complete and gradual. Last-instar larvae change greatly in appearance, and they are often called pupae even though thrips do not have a true pupal stage.

Thrips eggs are elongate, cylindrical to kidney-shaped, and relatively large in relation to the female. Females of most plant-feeding species insert their tiny eggs into plants, commonly into leaves or buds where larvae feed.

**Host Plants**

Onion thrips are extremely polyphagous. They inhabit leaves, shoots, and flowers of many plants. It prefers to feed on onions but feeds on many field crops, vegetables, various flowers, and bedding plants. It may cause heavy damage to chrysanthemums etc.

**Damage**

Generally feeding of onion thrips cause yellowing or dropping of leaves, buds, or flowers. High infestation results in stunted growth, brown blisters, white blotches, silvery whitish areas or feeding scars. Young terminal leaves frequently show malformation when heavily attacked. Young buds may be killed as soon as they come out. In addition, they freely feed within flowers, attacking the tender portions.

**Integrated Pest Management (IPM) of Thrips**

1. Use of healthy seeds and crops usually tolerate thrips damage
2. Monitor thrips adults and larvae by branch beating or shaking foliage or flowers onto a sheet of paper or a beating tray or sheet. Adult thrips can also be monitored using bright yellow sticky traps
3. In small field, thrips can be knocked off plants with a spray of water
4. Predatory thrips and other beneficial insects and mites, including minute pirate bugs and predaceous mites, help to control certain plant-feeding thrips species
5. Use of Surf Soda Oil (SSO) is very effective against thrips
6. Use only recommended pesticides with consultation of Agriculture Experts
7. Do not cultivate garlic crops near to onion field as it can be shifted from garlic to onion.
8. Practice clean cultivation

**5.3) Tomato Fruit Worm (Helicoverpa armigera)**

Tomato fruit worm or borer is one of the most destructive pests of tomato. The larvae are variable in color, ranging from pale yellow, to red, to green, to brown with pale stripes running lengthwise. The larvae have four pairs of pro legs and are densely covered with microscopic spines that make the larvae feel rough.

**Life Cycle**

The moths lay eggs at night on leaves near green fruit at the outer edges of the plant. The dome-shaped eggs are white when first laid and develop a reddish brown band before hatching. After the egg hatches, the larva feed for a short period of time on the foliage before attacking the fruit. They prefer to feed on green fruit and usually do not enter ripe fruit.

**Host Plants**
The tomato fruit worm has a wide host range and the attractiveness of tomatoes for egg laying varies with the time of year. Early fruit worm generations attack corn, particularly when it is silking. But tomatoes are preferred for egg laying over corn when the silks turn brown and dry. Other than these crops, this pest also feeds on potato, chillies, gram, brinjil etc.

**Damage**

The most severe damage is caused by the attack on reproductive parts such as flower buds and flower heads. Damage consists of deep watery cavities frequently in the stem end of the fruit. During its development, one larva may injure several fruit. One caterpillar is capable of destroying 2-8 fruits.

When still very young and small, the caterpillars burrow deep into tomatoes and are overlooked in peeled fruits intended for canning, thus causing a high rate of commercial losses.

**Integrated Pest Management (IPM) of Tomato Fruit Worm**

1. Management of tomato fruit worm requires careful monitoring for eggs and small larvae
2. When control is needed, it is essential to treat before large numbers of larvae enter fruit, where they are protected from sprays
3. Trichogramma parasites and other natural enemies often destroy significant numbers of eggs, so it is important to check for parasites before making treatment decisions
4. Use of light trap from March to November
5. Crop rotation i.e. avoid to cultivate potato after tomato crop
6. Use of marigold as trap crop
7. Application of Ememactin Benzoate and endosulfan as pesticide can be used
8. Practice clean cultivation

---

**5.4) Fruit Fly (Cucurbitae)**

A large number of population and symptoms of fruit fly were observed on squash crop in two FFS namely FG Talam Khan and FG Pump Korona where squashes were cultivated inside the walk-in tunnel. Fruit Fly (Bactrocera cucurbitae) is very common and most destructive pest of squash and other cucurbits throughout Pakistan. Only the maggots cause damage by feeding near ripe fruits and polluted the pulp.

**Life Cycle**

The pest is active throughout the year, but the life cycle is prolonged during winter. The adult flies emerge from pupae in the morning hours and mate at dusk. It takes a few days for the eggs to mature inside the body of a female which starts laying them within 14 days. The female on an average lays 80-95 eggs.

**Damage**

The maggots pollute and destroy fruits by feeding on the pulp. The damage caused by this fruit fly is most serious in squashes and after the first shower of the monsoon, the infestation often reaches 50 percent. The attacked fruits become useless and decay due to secondary bacterial infection.

**Integrated Pest Management (IPM) of Fruit Fly**

1. The regular removal and destruction of the infested fruits helps in the suppression of the pest
2) Ploughing the infested field after the crop is harvested can help in killing the pupae.
3) Traps contain Cue lure to attract the Bactrocera. Cucurbitae should be installed at field site.
4) Use Protein Hydrlysate @ 300 cc, poison @ 30 cc and water @9670 cc in 10 lit tank pump machine. Apply 100 cc of this mixture at every 10 meter distance for at least one meter leaves and trucks. Repeat this practice after 10 days.
5) Apply the bait spray containing 50 ml of malathion 50 EC + 0.5 kg gur/sugar in 50 lit of water per ha. When the attack is serious, it should be repeated at weekly intervals.

5.5) Cut worm (Agrotis Spp.)

This is a pest of world-wide occurrence. The larvae or caterpillars of some moths are called cutworms (Agrotis, Amathes, Peridroma, Prodenia spp.) because of the manner in which they cut down young plants as they feed. Cutworms feed at night on the stems of seedlings and transplants, severing them or sometimes consuming the entire seedling. They spend the daylight hours below the surface of the soil.

Life Cycle

These cutworms become active from Oct to April and begin feeding as the weather warms in spring, remaining hidden under debris or in the soil and feeding at night. Many species continue to feed well through June, and then pupate in the soil to emerge later as moths. Normally there is only one generation per year. The hatching larvae feed until cold weather and then hide for the winter in a sheltered, dry place.

Host Plants

- Tomato
- Potato
- Peas
- Wheat
- Maize
- Gram crops
- Mustard
- Tobacco

Damage

- Damage is caused by the caterpillars only.
- Generally they destroy more of the plant than they eat.
- Nocturnal in habit

Integrated Pest Management (IPM) of Cut Worm

1) Dig in the soil around damaged or adjacent plants in the row and destroy the cutworm.
2) For the management of cut worm the wet gunny bags with gur solution and potato pieces can be used.  
3) Use of light traps  
4) Irrigate the field  
5) Mix one kg carbaryl in 20 kg sieved bran (Chan Bora) and place them around the field just near to plants  
6) Also a chemical Cypermetherin may be suggested for the control of cutworm  

5.6) Damping-off disease

The single term used to describe underground rots of seedlings due to unknown causes is damping-off. The term actually covers several soil borne diseases of plants and seed borne fungi as under;

Rhizoctonia root rot (Rhizoctonia solani)

It is a fungal disease which causes damping-off of seedlings and foot rot of cuttings. Infection occurs in warm to hot temperatures and moderate moisture levels. The fungi is found in all natural soils and can survive indefinitely. Infected plants often have slightly sunken lesions on the stem at or below the soil line. Transfer of the fungi to the germination room or greenhouse is easily accomplished by using outdoor gardening tools inside or vice versa. The germination room should not be used for mixing potting soils or transplanting seedlings as a general rule.

Pythium Root Rot (Pythium spp.)

It is similar to Rhizoctonia in that it causes damping-off of seedlings and foot rot of cuttings. However, infection occurs in cool, wet, poorly-drained soils, and by overwatering. Infection results in wet odorless rots. When severe, the lower portion of the stem can become slimy and black. Usually, the soft to slimy rotted outer portion of the root can be easily separated from the inner core. Species of Pythium can survive for several years in soil and plant refuse.

Phytophthora root rot (Phytophthora spp.)

They are usually associated with root rots of established plants but are also involved in damping-off. These species enter the root tips and cause a water-soaked brown to black rot similar to Pythium. These fungi survive indefinitely in soil and plant debris.

Black root rot (Thielaviopsis basicola)

It is a problem of established plants. It does not occur in strongly acid soils with a pH of 4.5 to 5.5. It usually infects the lateral roots where they just emerge from the taproot. The diseased area turns dark brown and is quite dry. The fungi survive for 10 years or more in soil. Hence the need for the collective term known as damping-off.

Symptoms of Damping-off

Seeds may be infected as soon as moisture penetrates the seed coat, which rot immediately under the soil surface. This condition results in a poor, uneven stand of seedlings, often confused with low seed viability. Infection results in lesions at or below the soil line. The seedling will discolor or wilt.
suddenly or simply collapse and die. Weak seedlings are especially susceptible to attack by one or more fungi when growing conditions are only slightly unfavorable.

Above ground symptoms of root rot include stunting, low vigor and wilting on a warm day. Foliage of such plants may yellow and fall prematurely starting with the oldest leaves. The roots of a diseased plant will have some shade of brown or black and evidence of water-soaking. Healthy roots are fibrous appearing and are usually white in color. These symptoms are easily confused with severe mite, aphid, and scale infestations, root-feeding by nematodes or insect larvae. Environmental factors such as accumulated salts in the soil, insufficient light or nitrogen etc can be eliminated only by examination of the roots.

Integrated Pest Management (IPM) of Damping-off Disease

1) Purchase disease free plants and seeds. Know your supplier. Do not be afraid of fungicidal coatings on seeds.
2) Seed borne disease can also be avoided by soaking the seeds for 15 minutes in bleach soak (one teaspoon per quart of water) prior to sowing.
3) Use well drained soil mediums.
4) Avoid excess watering.
5) Avoid over-crowding and over feeding of plants. It is important to maintain constant levels of growth through proper lighting and complete control of the growing environment.
6) Avoid working with plants when the soil is wet.
7) Avoid spreading soil from infested areas or tools which have been used out of doors. Disinfect tools and containers with one part bleach in four parts water or with 70 percent rubbing alcohol (isopropyl).
8) Rotate plantings on a 2 to 3 year schedule using plants from different families in order to starve out existing pathogens.
9) Provide constant air movement not tied in with the light timer. Air should move freely 24 hours per day but not directly aimed at the plants. This helps the seedlings to aspirate and excess soil moisture to dry. If you do everything else right but do not provide plenty of air movement you will still get damping-off.
10) Treat and dip properly up-rooted seedlings in a fungicide (Redomil, Mencozeb, Diathane M-45 etc @3 gm/lit) solution for at least 45 minutes.

5.7) Downey Mildew Disease

Downy mildew caused by the fungal organism *Pseudoperonospora cubensis* is most destructive to cucurbits and other vegetables. Symptoms first appear as pale green areas on the upper leaf surfaces. These change to yellow angular spots. A fine white to grayish downy growth soon appears on the lower leaf surface. Infected leaves generally die but may remain erect while the edges of the leaf blades curl inward. Usually, the leaves near the center of a hill or row are infected first. The infected area spreads outward causing defoliation, stunted growth and poor fruit development. The entire plant may eventually be killed.

The fungus is easily carried by wind, rain splash, farm implements, the hands and clothes of farm workers. It is favored by cool to moderately warm temperatures but tolerates hot days although long periods of dry hot weather can suppress the spread of the disease. Unlike powdery
mildew, it requires humidity to flourish. Therefore, downy mildew is most aggressive when heavy dews, fog, and frequent rains occur.

**Integrated Pest Management (IPM) of Downey Mildew Disease**

1) Crop rotation and sanitation have a limited effect on the incidence of downy mildew. Still, there are several things that growers can do to suppress the disease. Growing vigorous plants, capable of withstanding or repelling disease attack is the first step.

2) Along with resistant varieties, fungicides are considered the principal means of downy mildew control in cucurbits. There are several alternatives to synthetic fungicides. Be convinced to use all pesticides, synthetic or natural according to label instructions.

3) Destruction of diseased plant debris

4) Weed control

5) Seed treatment

6) Application of surf + soda + oil mixture (Mix 1 tbsp of backing soda, 1-2 tbsp of detergent and 1 tbsp of dormant oil or vegetable oil with 4 lit of water)

7) Application of copper (Add 3 ½ tbsp of copper sulphate and 10 tbsp of hydrated lime in 1 gallon (4 litres) of water)

8) Treat and dip properly up-rooted seedlings in a fungicide (Redomil, Mencozeb, Diathane M-45 etc @3 gm/lit) solution for at least 45 minutes

**5.8) Late Blight Disease**

Late blight of potato, caused by the fungus Phytophthora infestans, has the potential to be an extremely destructive disease of tomato & potato. It attacks both tubers/stem and foliage during any stage of crop development. Brown to black water soaked spots develop at the corners of leaves which enlarge and become chlorotic while stem spots eventually girdle the stem and result in stem or plant death.

When conditions are favorable, the fungus can spread rapidly through the foliage and is capable of causing complete blighting of foliage within a very short time. If no controls are implemented, entire fields can be destroyed.

Because of the high potential for loss, crops should be monitored for this disease and control should be implemented as disease risk increases.

**Integrated Pest Management (IPM) of Late Blight Disease**

1) Cultural practices are the first line of defence against this disease. Avoid introducing late blight into a field by planting only disease-free seed tubers, preferably Certified seed

2) Avoid frequent or night-time overhead irrigation of tomato crops. This practice maintains leaf wetness and high humidity in the plant canopy, which is favourable for the disease.
3) Application of surf + soda + oil mixture (Mix 1 tbsp of backing soda, 1-2 tbsp of detergent and 1 tbsp of dormant oil or vegetable oil with 4 lit of water)

4) Application of copper (Add 3 ½ tbsp of copper sulphate and 10 tbsp of hydrated lime in 1 gallon (4 litres) of water)

5) Crop rotation and sanitation have a limited effect on the incidence of downy mildew. Still, there are several things that growers can do to suppress the disease. Growing vigorous plants, capable of withstanding or repelling disease attack is the first step

6) Along with resistant varieties, fungicides are considered the principal means of Late Blight

7) Destruction of diseased plant debris

8) Weed control

9) Seed treatment

10) Application of fungicide (Redomil, Mencozeb, Diathane M-45 etc @3 gm/lit)

5.9) Rodents

Rodents are members of the mammalian order Rodentia, characterized by front teeth adapted for gnawing and cheek teeth adapted for chewing. The Rodentia is by far the largest mammalian order nearly half of all mammal species are rodents. They are worldwide in distribution and are found in almost every terrestrial and freshwater habitat, from the shores of the Arctic Ocean to the hottest deserts. They are variously adapted for running, jumping, climbing, burrowing, swimming and gliding.

Rodents are found in abundance in Khyber Agency and farmers were very serious concerned about the damage they done to their field crops and dwell materials. Rice, wheat, vegetables, fruits and stored agricultural products are severely damaged by cutting and eating. Water channels and plastic sheets are destroyed. To get rid of rodents, CABI team responded positively and shared management practices with the farmers of area.

Control:

Single control method is generally not effective. Integrated approach by using different techniques is more effective and useful. Detail is given below;

Cultural Control

- Destroy weeds and other unnecessary plantation near crops
- Avoid storing wheat “Bhoosa” and plant debris
- Don not kill cats, jakals and owls as they are very good predators of rats
- Use catching or trapping devices to check their population by using “Chal” and cages
Chemical Control

Fumigate rats holes with one Phastoxin tablet per hole and plug its openings with mud and straws. Before tablet application, all rats should be blocked with soil in the evening. Next day only fresh holes may be treated.

Chemical Baits

1. **Zinc Phosphide Bait (Biscuit)**
   - Zinc Phosphide……………………5 gm
   - Wheat flour……………………..100 gm
   - Maize flour…………………….100 gm
   - Rice break seeds……………….50 gm
   - Edible oil……………………..2 gm
   - Sugar (Gur or Shakar)……….15 gm

**Method of Preparation**

Mix all the ingredients with small quantity of water to make pellets or biscuit. Use the pellets or biscuit as fresh as possible because hard pellets are not generally consumed by the rats or rodents.

2. **Recumin Tablets**
   - Recumin………………………10 gm
   - Wheat flour……………………100 gm
   - Edible oil…………………….2 gm
   - Sugar or gur………………….15 gm

**Method of Preparation**

Mix all the ingredients with small quantity of water to make pellets or biscuit. Use the pellets or biscuit as fresh as possible because hard pellets are not generally consumed by the rats or rodents.

5.10) **Use of Fresh Farm Yard Manure (FYM)**

It was observed that farmers of the Khyber agency used fresh FYM which is very dangerous for the crops. Direct application of manure or other raw animal wastes is not recommended because:

- Fresh manure may contain diseases
- Can burn plants and lead to toxic levels of nitrates
- Regular supply of fresh manure leads to lower pH
- Enhances the attack of termites

Therefore, they were trained about decomposed organic matters. Detail is given below;

**Organic Matter (OM)**
The use of compost (decomposed organic matters resulting humus), green manure, well rotten farm yard manure (FYM) or other organic materials, which release nutrients to crops in order to grow and produce. Organic matter (OM) can be added while using compost, cover crops, green manure, organic mulch etc.

**Role of Organic Matter (OM)**

- It increases the ability of soil to hold nutrients in an available state.
- Addition of organic matter to the soil stimulates the activity of the many small beneficial organisms that live in the soil. These micro-organisms make nutrients available to plants by producing humus (decomposition) and by releasing nutrients (mineralization).
- Vegetables and other crops grow well in a pH range of about 6.0 to 7.5 (almost neutral instead of acidic & alkaline). Application of lots of organic matter (OM) into soil is a good and more permanent solution to neutralize soil pH.
- Organic matter increases soil water-holding capacity especially useful for areas without irrigation facilities.
- It helps Trichoderma spp. (An antagonists fungus) that can control several fungus species that cause damping-off disease in nurseries.

**Use of Bio-Ab as organic matters**

The use of Bio-Ab and its advantages was discussed in detail. The farmers of the area are normally used fresh farm yard manure (FYM). To avoid this practice, CABI team suggested that Bio-Ab must be used while preparing FYM. By doing this one can easily get rotten FYM in a one month time period. The Bio-Ab speed-up the decomposition mechanism in the shape of ready food provided for the beneficial micro-organisms.

**How to apply Bio-Ab?**

Following are the steps:

- Dig a pit having 2 ft each length and width while 3 ft deep.
- Applied fresh FYM
- Pour slight layer of urea
- Apply solution of 1 lit of Bio-Ab and 2 lit of Sugar (Gur Sharbat).
- Then repeat the above steps and cover the pit with the help of plastic sheet.

**Compost and Its Role in ICM**

**Advantages of Composting**

- Most popular practice for improving soil fertility
- Composting increases the decomposition process of organic matters
- It involves mixing of various organic materials like crop remains and manure and leaving it to decompose
- The main purpose of composting is to make raw organic matter into humus which is an important source of nutrients
- Mature composting is brown-black materials called humus.
- Good compost can be rich source of both macro & micro nutrients
- Can use locally available materials like plant materials, organic waste.
- It provides food to beneficial organisms inside the soil.
- It reduces rely on chemical fertilizers.
- Along with increasing fertility of the soil it also helps in water holding capacity of the soil.
- Reduce soil erosion etc

**Requirements of Composting**

- Comparatively hot place as hot weather increase the process of composting.
- Avoid strong wind hit place
- Protect compost from direct light of sun
- Well drainage system
- Near to field and easy to access
- Avoid Garla because it hinders oxygen availability for micro-organisms and hence affects their decomposing process
- Nitrogen increases the process of organic matter.
- Green parts of the plants, manure, grasses etc are good source of nitrogen.

**Materials should used while making compost**

- Carbon (dry materials) & nitrogen (fresh materials) elements should use while making compost by 4 to 1 ratio.
- Leaves
- Soft & fresh weeds
- Cutting grasses
- Crop residue and fresh manure
- Wood Ash (well chopped into smaller pieces)
- Card board
- Newspaper & tissue paper
- Husk of fruits & vegetables
- etc

**Materials should not used while making compost**

- Meat, fish & things made from milk
- Bread, eggs, biscuit
- Cooked food
- Diseased leaves of plants & weeds
- Waste of dogs & cats
- Plastic
- Plants on which pesticide applied recently
- etc

**Steps involved in making piles for composting**

- First of all make a 7.6 cm layer of branches, maize straw and other such kind of materials which help a lot to provide air and drainage.
- Then make a 2nd layer having height of 23 cm, mostly consist of carbon materials like dried leaves, dried organic matters, dried grasses, well chopped wood ash etc
- If source of fresh materials is limited, than can use chemical nitrogen @ 1/3 to 2/3 cup of tea per 1 square meter area.
- If old compost is available, then use them in each & every layer, it will help microorganisms to decompose materials quickly and fast.
- Apply required water in each layer during preparation.
- Tied the pile with plastic sheet.
- The compost pile should be turned 2 to 3 times. Turning supplies air and also mixes the materials from the outside of the pile into the hot centre.
- It takes about 3 to 4 months for decomposition (the warmer the quicker).

Compost is Ready
6) Trials Developed during FFS Sessions

- Surf Soda Oil (SSO) application for thrips
- Application of red pepper in powder form for thrips
- Garlic extract application
- Raised Bed Vs Flat Bed for damping-off disease
- Line Sowing in nursery Vs farmers broad casting
- Lime/choona applied around the nursery for ants control
- Dollar Vs local variety used in tomato nursery establishment
- Biscuit baits (Zinc Phosphate + wheat + maize + rice + oil) used for the control of rodents

6.1) Surf Soda Oil Application for Trips Control

Severe attack of Thrips was observed on onion crops in Khyber Agency. CABI expert team developed trial of application of surf soda oil (SSO) for the control of thrips. In order to observe the effect of surf soda oil application on thrips, an experiment carried out at FG Rasool Khan Kalay (Lashora) FFS plot. Five lines each selected for both treatments i.e. SSO and control (without application of SSO).

In each treatment, 5 plants (As replication) as per parameter of thrips per plant would have been selected and tagged for study and analysis. Detail is given below in table: 3 and Fig: 2

Table: 3

<table>
<thead>
<tr>
<th>Parameters/Week</th>
<th>T1 (Application of SSO)</th>
<th>T2 (Control)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PI 1</td>
<td>PI 2</td>
</tr>
<tr>
<td>Thrips per plant/1st week</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Thrips per plant/2nd week</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Thrips per plant/3rd week</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Thrips per plant/4th week</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Result shown in (Fig.2) that population of Thrips started increasing from 1st week in case of control treatment. It reached at peak in 4th week while in case of SSO application, thrips population started decreasing significantly from 1st week to 4th week.

Figure 2: Effect of SSO Application on Thrips
6.2) Raised Bed with line sowing Vs Flat bed with broad cast sowing for Damping-off Disease

Damping-off disease was also one the most major problems during the nursery stage of onion crop in Khyber Agency. This is because of flat bed used by farmers for nursery establishment. This is not the end but they also practicing methodology of broad casting instead of line sowing at the nursery stage. In order to minimize damping-off disease during nursery stage, CABI expert’s team developed trial of raised bed Vs Flat bed. In order to observe the effect of both types of beds on damping-off disease, an experiment carried out at FG Hasham Khan Kalay (Gudar) FFS plot. Two beds selected of having same size (10 ft length X 3 ft width) and same variety. During nursery establishment period, seedlings were regularly checked in both beds. In the end, number of effected seedlings were counted and observed. Detail is given in figure: 3.

Damping-off disease normally occurs due to dense population and water standing in the nursery and so was the case in flat bed. That is why, it was observed that numbers of seedlings were more exposed to damping-off disease as compare to raised bed.

7) Exposure Tour

In a progression of capacity building of farmers and PIU Khyber staff, CABI South Asia arranged two day an exposure/inland study tour to Islamabad and Chakwal district as per given schedule in table:4.

Table: 4

<table>
<thead>
<tr>
<th>S #</th>
<th>Date</th>
<th>Activity</th>
<th>Time</th>
<th>Persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>29-03-10</td>
<td>Departure for Rawalpindi</td>
<td>08:00 AM</td>
<td>AAO &amp; FAs of Extension department Khyber Agency, NRM Specialist &amp; FAs of PIU Khyber Agency Farmers, CABI Team</td>
</tr>
<tr>
<td>2</td>
<td>29-03-10</td>
<td>Visit to Livestock Research Station, NARC Islamabad</td>
<td>10:30 AM to 12:30 PM do</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>29-03-10</td>
<td>Visit to Bio-control/rearing lab at CABI South Regional Office -Lunch</td>
<td>-1:30 PM to 2:30 PM -2:30 PM do</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>30-03-10</td>
<td>Visit to Dhoke Tahlian dam, Chakwal regarding low tunnel activity -Lunch -Back to Peshawar</td>
<td>09:00 AM to 1:00 PM -1:00 PM do</td>
<td></td>
</tr>
</tbody>
</table>
Objective of the an Exposure Tour

- Experience sharing with farmers and different agricultural based institutions
- To study and learn more about different agriculture activities with special emphasis on off-season vegetables production under plastic technology.
- Exposure to on-going research & development activities of CABI South Asia Regional Office, Pakistan.
- To become skilled at dynamic knowledge regarding agriculture.

Summary of the Inland Tour to Islamabad

As per schedule, tour team visited mentioned places and shared their experiences. First visit made to Livestock Research Station (NARC, Islamabad) and met with Dr. Aman Ullah. He welcomed the participants and briefed them about the station. He also brought the participants to livestock farm and shown them different breeds. He emphasized not only about proper management of livestock but also stressed that adequate feed should be given to livestock if farmers want to increase their milk and meat production.

On the same day after NARC, tour team visited CABI Regional office. They visited different laboratories like biological control lab, preserve insect lab and Biotechnology lab. Before laboratory visits, Team Leader CABI, Mr. Muhammad Zahir Shah gave a brief introduction about CABI to the participants and then according to schedule they were briefed about each laboratory. They observed the culture of natural enemies like beneficial enemies of mealy bugs, Trichogramma, and nematodes etc. Participants were also visited insect lab and observed all those beneficial and harmful insects being preserved by the CABI. Participants shown their keen interest and understood the role of different insects as seeing is believing.

On 30th March, 2010, tour team visited Dhoke Tahlian dam Chankwal. Team Leader CABI, briefed the participants about the Small Dam Project and its activities. They were informed as description given below;

- Government of Punjab initiated a project entitled Command Area Development of Small Dams in Rawalpindi Division in close collaboration with CABI South Asia to build the capacity of Agriculture staff and farming community and to increase the productivity of farmers of command areas. The project is spared over Rawalpindi division of the Punjab province and focuses on sustainable production of fruits, vegetables and crops. It is executed through command area of small dams of district Rawalpindi, Attock, Jehrlum and Chakwal each headed by Agriculture Officer of the extension wing. Over all project is headed by Project Director and
supported by an Expert representing the CABI. The project was launched on ground a little late and Training of Facilitators (TOF) activities could start in March - April, 2007.

- Apart from scarcity of water in the Potohar region several other factors are also contributing to lowest return in agricultural production e.g. poor management practices, lack in farmer’s capacity to manage the crop issues, time of sowing, poor quality of seeds, poor storage facilities and less knowledge of grading, packaging and marketing etc.

- To focus on all the issues relating to agriculture in command areas of small dams in Rawalpindi division and to widen agriculture pattern for the purpose of sustainable development of said command area. In this regard, CABI South Asia has been given the mandate to provide technical support for the implementation of Farmer Participatory Technology Development & Dissemination (FPTDD) and Integrated Crop Management (ICM) under Command Areas Development Small Dams Project with emphasis on capacity building of extension staff and farmers by effective execution of Training of Facilitators (TOF) & Farmers Field School (FFS) approaches for production of fruit, vegetable and crops in the project area. Hence CABI South Asia and Extension department CAD Small Dam Project were playing significant role in the development of agriculture through transfer of latest package of technology especially off-season vegetable production under plastic tunnel farming.

- Farmer-led season long participatory training was conducted in Regional Office of CABI South Asia from April 2007 to June 2008 successfully. Initially, 17 Master trainers are being trained from the agriculture extension in first cycle of Training of Facilitator (TOF) training while during the second phase 20 farmers are trained in TOF. Total 30 practicing Farmer Field Schools (FFS) are established which trained 410 farmers in a “learning by doing system” over a full cropping season, these master trainers and trained farmers gained a much better understanding of the problems relating to their crops and providing solutions through the mutual discussions and sharing of experiences in participatory way.

- Through the programme, CABI helped address these issues within the context of the social and cultural climate of the local communities. Bench mark survey has been conducted to get a more detailed breakdown of the problems being faced, crops grown in the area, production methodologies, knowledge gaps, socio-economic status and other related information in the command areas of the project.

- First time, spring maize was introduced by the project in the command areas. It was not only spring maize but sada behar chara (fodder) and potato crop were also introduced first time in their cropping system which proved better result in terms of production and income. With the help of introduction of the above crops, project was successfully achieved its one
of the objective to change or divert the minds of the farmers from old traditional cropping system towards new technology. The farmers of the command area become very happy with this versatile fodder which not only increased the production of milk but also increased the fattening of the animals. It produced more yields in those days when scarcity of fodder could observe through out the Barani area. Due to its tremendous effect in re-sprouting replaced the old traditional Sorghum, Bajra and Desi Maize in the command area. This produced more than double production as compare to local one. Apart from these, different varieties of winter & summer vegetables and autumn maize were also sown or cultivated and results were discussed with farmers. Comparatively new to the region, farmers were also trained in growing off-season vegetables under plastic tunnels. In the first trial season the participating farmers found that this new technology is extremely productive and profitable, although the vegetables were found to be extremely sensitive to fluctuations in temperature and humidity inside the tunnels.

In the end they were visited to different field of the command area of Dhoke Tahlian dam and observed high and low tunnels activities. They shared their experiences regarding off-season vegetables production under plastic technology.

Outcome of the Inland Tours

- All the places visited according to the plan.
- Achieved objectives of the inland tour
- Participants shown keen interest and shared their experiences with the concerned staff of the visited places.
- Exploration of off-season vegetables production under low plastic tunnel technology at Chakwal Dhoke Tahlian dam helped a lot regarding understanding of this activity.
- The inland tour was very informative and farmers and staff of the PIU Khyber Agency, FRDP got a chance to explore on going research and development activities of agriculture sector.
- Participants relaxed for a while to got some excursion during this tour which ultimately effects positively their work ability.

8) Monthly Progress Report

As per mandate, CABI team submitted monthly progress report of each month successfullly to PIU, Khyber Agency with a copy to Project Director and NRM Coordinator PMU FRDP. Format and example of one of the monthly progress report is given below;

<table>
<thead>
<tr>
<th>Monthly Progress Report of Khyber Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subject</strong></td>
</tr>
<tr>
<td><strong>Project Code</strong></td>
</tr>
</tbody>
</table>

1. Purpose & Objective:
• To run on-going activities of ICM/FFS under FRDP project
• Effective dissemination of Integrated Crop Management (ICM) through Farmers Field Schools (FFSs)
• To coordinate and plan Project activities with FRDP staff at PIU & PMU level
• To develop liaison between FRDP, CABI and Agriculture Extension department regarding project activities.

2. Background
CABI South Asia has been given the mandate to establish 10 Farmers Field Schools in Khyber Agency under project entitled “Integrated Crop Management (ICM) through Farmers Field Schools (FFSs) approach”. In this context, numbers of activities were completed successfully like establishment of all 10 FFS, monthly planning & coordination meetings with FRDP & Extension department officials, conduction of special topics, nursery establishment for tomato crop, Feedback session among CABI staff, conduction of training on ICM/FFS for FRDP & Extension department officials etc. This report depicts overall activities done till now in generally while activities done in the month of April specifically. Detail is given below;

3. Activities Completed till Now

<table>
<thead>
<tr>
<th>S #</th>
<th>Activities</th>
<th>Target</th>
<th>Achieved</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Monthly Planning Meeting with FRDP &amp; Agri. Extension department officials</td>
<td>9</td>
<td>9</td>
<td>Good liaison developed with Extension department &amp; FRDP officials</td>
</tr>
<tr>
<td>2</td>
<td>Establishment of 10 Farmers Field Schools</td>
<td>10</td>
<td>10</td>
<td>Ground work completed &amp; all targeted 10 FFSs established. Different crops selected i.e. 1 FFS on onion crop (seed production), 2 FFS on onion crop (yield production), 2 FFS on walk-in tunnel (Tinda) while 5 FFSs on tomato crop. Till now 7 sessions held at each FFS on onion (both seed &amp; yield production) &amp; walk-in tunnel based FFS while on tomato based FFSs, 4 sessions held at each FFS</td>
</tr>
<tr>
<td>3</td>
<td>Sessions during FFS</td>
<td>70</td>
<td>55</td>
<td>FFS session are going-on and remaining sessions will be completed till the end of May, 2010</td>
</tr>
<tr>
<td>4</td>
<td>Special Topics</td>
<td>Depends upon the outcome of the Crop Management Decision during AESA</td>
<td>9</td>
<td>Onion nursery establishment Agro Ecosystem Analysis (AESA) (backbone of the approach) Farmers Field Schools history, principles, characteristic etc Tunnel Technology generally and Walk-in Tunnel Technology in specific Practical demonstration of Seed Germination Test Fertilization Application ICM/FFS/AESA approach</td>
</tr>
</tbody>
</table>
4. Activities done during the month of April

The summary of activities for the month of April, 2010 with regard to ICM through FFS, Khyber Agency under FRDP Project is given below;

7th April, 2010

Monthly planning meeting held in the office of Agency Agriculture Officer at Khyber bazaar. NRM Specialist and CABI team were participated. Following were the outcome of the meeting;
- Action pictures of the activities and detail of organizational structure of each established FFS were handover to NRM Specialist.
- Time table for special topics was finalized with NRM Specialist PIU FRDP i.e. when to be held topics

8th April, 2010

- The CABI team visited FG Hasham Khan Kalay (Gudar) for regular session of Onion Yield Production.
- The FFS terminology and AESA was refreshed shortly. The outcome of AESA was prepared on charts and then presentation made accordingly. Crop Management Decision taken on the basis of AESA as below;
- Some problems like thrips were identified and discussed. For the control of thrips, trials were developed of Surf Soda Oil (SSO) application, application of Red Pepper in powder form and Garlic extract application.
- Another problem was cutworm, for its control farmers were advised to use pieces of gunny bags and put it in different places in the field. As the cut worm take shelter from sun under these pieces so it will be easy to find them and kill them. Another method of control is to use Annja extracts in the irrigation.

9th April, 2010

- CABI expert team made a visit to FG Rasool Khan Kalay (Lashora).
- The FFS terminology and AESA was refreshed shortly. After the brief discussion, AESA was practically performed and the participants presented the charts.
- Thrips and cutworm were the problems here as well; therefore CABI team repeated the same techniques as done in Hasham Khan Kalay.
- Rodents are the major pests of this area. Therefore after detail discussion, it was suggested by facilitators that to get rid of rodents we should come-up with the use of biscuit bait.

12th April, 2010

- Visit made to Pump Korona (Ghuandai) for regular session of FFS on walk-in-tunnel.
- Farmers requested to give information on maize crop like recommended seed, fertilizer applications, sowing time etc. They were told that in the next session, CABI team will discuss in detail the maize crop management practices in the best interest of the farmers.
- During AESA cutworms were also found in the fields which were kept in insect jar for insect’s zoo. After brief discussion on cutworm, effective management practices for the control of cutworm were discussed in detail. One of the good agriculture practices for the control of cutworm is soaking of seeds in the Annja solution for 1-2 hrs. This practice helps a lot to minimize cutworm.
- For the rodents control biscuits baits were made.

13th April, 2010

- Visit made to FG Talam Khan Kalay for regular session of FFS on walk-in-tunnel.
- Briefly refreshed the previous FFS sessions.
- Farmers were very happy with the result of biscuit baits. In this regard, one of the farmers informed CABI team that 16 different types of rodents were killed in his field.
- The use of Bio-Ab and its advantages were discussed in detail and practically analyzed by the CABI team.

16th April, 2010

- Meeting held with Mr. Zaki Ullah (PMU, FRDP) and discussed in detail the on-going activities of the project.
- On the same day CABI team visited to NRM Specialist (PIU) office but he was out of office due to some other official assignment. CABI team submitted paid vouchers in the Accountant office.

17th April, 2010

- CABI team made a visit to FG Abdur Razak Kalay (Pirano) for the FFS session on Onion Crop (seed production).
- Crop was mature so CABI team suggested that there is no need of further recommendation just needs time to time irrigation.
- The use of Bio-Ab and its advantages were discussed in detail and practically analyzed by the CABI team.

20th April, 2010

- The CABI team visited FG Sajid Khan Kalay (Shakas) for regular session of Tomato Yield Production.
- AESA done and outcome prepared on charts and then presented accordingly.
- During CMD, it was decided that main problem of the area is cutworm therefore for its control; farmers were advised to use pieces of gunny bags or potatoes and...
put it in different places in the field. As cut worm take shelter from sun under these pieces so it will be easy to find them and kill them. Anther method of control is to use Annja extracts in the irrigation.

- Another problem was aphids. For the control of aphids CABI team suggested surf soda oil on weekly bases. Yellow color is the loving color for the aphids, so yellow plastic sheets were lubricated with some lubricants as once aphids touch the plastic it could be difficult for them to fly again move due to sticky lubricants and hence attack of the aphids can be minimize.

21\textsuperscript{st} April, 2010

- Visit made to FG Khanay Mola Kalay (Shakas).
- Farmers were advised the easiest way of control for the cutworm, aphids and termites by the CABI team as described above.
- Infected fruits should be discarded and buried away from the field.

22\textsuperscript{nd} April, 2010

- CABI experts made a visit to Sakhipul for the FFS session on Tomato.
- During ASEA first time fruit borer was found in the field and kept in jar for further examine the pest in front of farmers. Later on it will analyze accordingly.

23\textsuperscript{rd} April, 2010

- The CABI team visited FG Mian Morcha for regular session of Tomato Yield Production.
- Former did not differentiate the symptoms of diseases, for Early Blight and Late Blight they call them in their local language e.g. Dagh, Wachaie, Ziaridal, Wochakay, Ochedal, Takay, Ziary and Wachor etc,
- Recommendation for Early Blight and Late blight was given as under;
  - Surf soda and oil (weekly)
  - Dithane M.

23rd April, 2010

- On the same day, visit made to FG Akhtar Islam Kalay (Sherbruj).
- Early blight and Late Blight were the problem as above in Mian Morcha, Therefore CABI team repeated above mentioned recommendation here as well.
- Another big problem was the Leaf Curl Virus, it was advise to discard the effected leaves from the field as there is no such effective control of this through pesticide application. White fly is the vector for this disease.
- Shumla (Lassi) spray can minimize the effect of the disease.

CC:
- Regional Director CABI South Asia
- Project Director, FRDP Project
- NRM Coordinator, PMU, FRDP
- APM, PIU Khyber Agency, FRDP
- NRM Specialist, PIU Khyber Agency, FRDP
- AAO, Extension Department, Khyber Agency
9) Cost Benefit Ratio of early production of vegetables under Walk-in Tunnel Technology

Early production of vegetables under walk-in plastic tunnels started as on-farm participatory research activity at FG Talam Khan and FG Pump Korona FFS Plots. The detail is given below;

At each FFS 15 marlas area was selected for early production of vegetable (Squash or Tinda) under walk-in plastic tunnel. But here calculation was made as per kanal area. Cost of production is given below in table: 5.

Cost of production

Table: 5

<table>
<thead>
<tr>
<th>S #</th>
<th>Expenditure of walk-in tunnel/kanal</th>
<th>Rs/kanal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Rs 40,000 per structure of walk-in tunnel. This structure can be used for 10 years hence this rate squeeze to Rs. 4000 if we divide by 10.</td>
<td>4,000</td>
<td>4,000</td>
</tr>
<tr>
<td>3</td>
<td>30 Kg plastic sheet @ Rs.165/Kg = Rs. 4950/= but sheet can be used for the next season hence this rate squeeze to half</td>
<td>2475</td>
<td>2475</td>
</tr>
<tr>
<td>4</td>
<td>5 Kg Rope @ Rs. 75/Kg</td>
<td>375</td>
<td>375</td>
</tr>
<tr>
<td>5</td>
<td>900 Seeds @ Rs 1.8/Seed</td>
<td>1620</td>
<td>1620</td>
</tr>
<tr>
<td>6</td>
<td>Fertilizer (DAP 10 Kg @ 65/Kg + Urea 20 Kg @ 15/Kg + Potash 10 Kg @ 28/Kg)</td>
<td>1230</td>
<td>1230</td>
</tr>
<tr>
<td>7</td>
<td>Pesticide</td>
<td>700</td>
<td>700</td>
</tr>
<tr>
<td>8</td>
<td>Labour Charges</td>
<td>3000</td>
<td>3000</td>
</tr>
<tr>
<td>9</td>
<td>Tractor</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>10</td>
<td>Irrigation</td>
<td>800</td>
<td>800</td>
</tr>
<tr>
<td>11</td>
<td>Miscellaneous</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td></td>
<td>Total cost of production</td>
<td>15,700</td>
<td></td>
</tr>
</tbody>
</table>
Average production, average rate, gross income and net income of squash under walk-in plastic tunnel technology/kanal at each each FFS

Detail is given below in table 6;

**Table: 6**

<table>
<thead>
<tr>
<th>S #</th>
<th>Name of FFS</th>
<th>Cost of Production</th>
<th>Production in Kg/kanal</th>
<th>Average Rate/Kg</th>
<th>Total Income</th>
<th>Net Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FG Talam Khan</td>
<td>15,700</td>
<td>1800</td>
<td>15</td>
<td>27,000</td>
<td>11,300</td>
</tr>
<tr>
<td>2</td>
<td>FG Pump Koroona</td>
<td>15,700</td>
<td>1900</td>
<td>16</td>
<td>30,400</td>
<td>14,700</td>
</tr>
<tr>
<td></td>
<td><strong>Average Production &amp; Rate</strong></td>
<td></td>
<td><strong>1850</strong></td>
<td><strong>16</strong></td>
<td><strong>28,700</strong></td>
<td><strong>13,000</strong></td>
</tr>
</tbody>
</table>

Cost Benefit Ratio (CBR) of early production of vegetables under walk-in plastic tunnel technology

Result shown in the (Fig.4) that there is significant difference between cost of production (Rs. 15,700) and total income (Rs. 28,700) and hence average net income (Total income – Cost of Production) in above one kanal tunnel is recorded slightly better i.e. Rs.13000/= while total average production is 1850 Kg. This activity started bit late if it started in time then the CBR would more significant.

Cost benefit ratio (CBR) is a simple calculation that depicts the total financial return for each Rupee in the low tunnel technology. Hence cost benefit ratio of the low tunnel technology is as under;

Cost of Production = Total Financial Returns (Total income)/Total Cost of Production

As per above Fig.4 Total Financial Return is Rs. 28,700/- and Cost of Production is Rs. 15,700/- Therefore Cost Benefit Ratio = 28,700/15,700 = 1.8 = 1:1.8

In other words, for every one Rupee spent as cost of production for walk-in tunnel production, it returned Rs. 1.8
10) Group Dynamics

This activity provides an opportunity to develop and enhance cohesion among the participants as a learning group. Whether it is done as an unfreezing activity or structured learning exercise, group dynamics highlight the importance and interdependence of individual group members’ performance in the process of achieving a common goal. A number of exercises and activities were carried out to achieve this objective while holding the FFS sessions. The list of the group dynamic exercises undertaken during the sessions is given as under:

- 9 dots Game
- Water bridge
- Putting step on an object

NINE DOT EXERCISE

When is this exercise: During the first meeting
Time: 30 minutes.

Learning objectives:
- To become aware of concepts, Objectives, and approach of FFS
- To relate the concept, objectives, and approach to problems and issues of farmer in the local area
- To compare IPM approach with our experience in crop production

Materials: paper, tapes and markers.
Steps:

Draw nine dots on a sheet like this:

```
  ●  ●  ●
  ●  ●  ●
  ●  ●  ●
```

Ask participants to try to join all of nine dots with only four (4) straight lines, without lifting the pen from the page.
Ask farmers to share their results. The solution will be something like this.
Ask farmer what was difficult to find a way to do this at first? How did we overcome such problem? Discuss how this relates to solving other problems. (e.g. very often we need to look outside things that we think are problems, to understand real causes before we can go about solving them). In this game, we have to look outside a square to find a solution.

Tell farmers that these nine dots can present the nine most important problem of this area. All problems begin with P. Ask them to help you list them. Adopt what is discussed to fit into nine categories, all beginning with P. This list would be something like this.

- Poor quality seed (low percent of seed germination)
- Pests
- Pesticides (public health and pollution)
- Poverty (profit are low)
- Programme (that are not good)
- Politicians (don’t help them)
- Post harvest (lack of dryers and processing facilities)
- Product transformation.

The facilitators then use each of these nine problems to lead the explanation of some central concepts and crop problems. Here are some vital things one can mention about the programme during the discussion.

- In FFS we explore the way to solve poor production, problem of pests and diseases, low profits, pesticides resistance and pesticide poisoning.
- The program is based on what farmer need and want to learn. Farmers decide what we will do in FFS.
- The field school is based on what is happening in farmer field school and so we look to real problems that are happening now.
- We learn to explore possible solution together as a group. By working together, we can discover how to start working on problem that is too much big for one person.
- By becoming a strong group. We will be able to get more support and attention from local government or other organizations that we want to influence
- The fields are a part of local environment and a community, so we also look at effects that our action have on things outside our field.
- The facilitator guide a discussion on how target crop (vegetables) FFS differ from our experiences and ideas of past vegetables programme.
Water Bridge Game

**Objective:** To manage everything properly.

**Materials:** Two baskets, two glasses, water

**Duration:** 5 minutes

**Steps:**

A. Fill the both baskets/buckets with water.

B. Now make two groups of participants and make them to stand in two rows facing each other.

C. Place the baskets at the end of both of rows and glasses in the beginning of the rows.

D. Now each group has to fill the glasses by taking water from the baskets in such a way that one participant at the end will take water from basket and will give to adjacent one in hands and then so on. Who fill the glass first, will be the winner of the game.

In conclusion, tell them that why they filled the glass first than the loser? Because they managed themselves and made plan before starting the game.

11) Insect Zoo

Conducting of the insect zoo using locally available material play an important role in helping farmers gain a deeper understanding of insect pests and natural enemies in the area. This knowledge is useful for them for informed decision making. The field management decisions through ecosystem analysis, of which insects form a major part, is considered pivotal in the execution of the FFS approach. In this regard, example of insect zoo is given below;

- Lady bird beetle & aphids

**Exercise**

**Ladybird beetle & Aphids Relationship**

**When this exercise is:** At each FFS, CABI team and farmers did this activity.

**Learning objectives:** To develop a conceptual/practical description of beneficial organisms while feeding on pests or to observe predation habits of natural enemies.

**Materials:** Jar, cotton piece of cloth, aphids, leaves on which aphids feeding and lady bird beetle.

**Steps:**

- FFS members at each FFS, collected aphids along with leaves from nearby crop field. They also collected ladybird beetle from the field.
- Then, they counted all the aphids and placed them with leaves in the jar where one ladybird beetle already positioned and then tide the opening of the jar with piece of cotton cloth for aeration. Time noted at the time of placement of mentioned living things in the jars.
- After one hour, farmers observed that numbers of aphids were less than that of actual number and hence they realized that ladybird beetle acted like predatory and minimized the number of aphids.
- CABI team then formulated discussion guide for each FFS to answer their field observation. Like what is relationship between ladybird beetle and aphids? How they behaved? How to observe predation habits of natural enemies? etc
12) Closing Ceremony

In the end, CABI South Asia has successfully organized a joint closing ceremony of ICM/FFS Project under FRDP of all three agencies namely Khyber, Mohmand and Bajaur. The event was held on 14th July, 2010 at 10:00 AM in the Information Hall of Agriculture Training Institute (ATI) Campus, Peshawar. CABI South Asia invited Mr. Fazlullah Pir Muhammad Khan (MPA and Chairman Standing Committee for Environment, Khyber Pukhtunkhwa) as the chief guest for the event. It was a huge event in which a large number of farmers from all the agencies, officials from FRDP project, PIUs APMs, NRMs, AOs and FAs, officials from extension department and officials from FATA Agriculture were participated. Agenda of the closing ceremony is as under:

**Agenda of the Closing Ceremony to be held on 14th July, 2010**
**Organized By**
CABI South Asia-Pakistan

<table>
<thead>
<tr>
<th>Activity</th>
<th>Responsibility</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guest Arrival</td>
<td>CABI Team</td>
<td>10:00 AM</td>
</tr>
<tr>
<td>Participants to be Seated</td>
<td>CABI Team</td>
<td>10:05 AM</td>
</tr>
<tr>
<td>Recitation from the Holy Quran</td>
<td>Shezad Khan, CABI</td>
<td>10:10 AM to 10:15 AM</td>
</tr>
<tr>
<td>Opening Remarks &amp; Introduction of ICM/FFS Project under FRDP</td>
<td>Muhammad Zahir Shah, Project Manager CABI South Asia</td>
<td>10:15 AM to 10:40 AM</td>
</tr>
<tr>
<td>Inauguration Remarks</td>
<td>Mr. Masood Bangash, Project Director FRDP Project</td>
<td>10:40 AM to 11:00 AM</td>
</tr>
<tr>
<td>Presentation of Mohmand, Khyber and Bajaur Agencies Activities</td>
<td>Mr. Islam Gul (Team Leader, Mohmand), Mr. Badsha Alam (Team Leader, Bajaur) and Adil Naseer (Agri. Expert, Khyber)</td>
<td>11:00 AM to 11:45 AM</td>
</tr>
<tr>
<td>Views of farmers regarding ICM/FFS Project</td>
<td>FFS farmers of all agencies</td>
<td>11:45 AM to 12:10 PM</td>
</tr>
<tr>
<td>Way-forward of the event</td>
<td>Mr. Zaki Ullah (NRM PMU FRDP) and M. Zahir Shah CABI</td>
<td>12:10 PM to 12:30 PM</td>
</tr>
<tr>
<td>Closing Remarks</td>
<td>Mr. Fazlullah Pir Muhammad Khan, MPA &amp; Chairman Standing Committee for Environment, KPP</td>
<td>12:30 PM to 01:00 PM</td>
</tr>
<tr>
<td>Lunch</td>
<td>CABI Team</td>
<td>01:00 PM</td>
</tr>
</tbody>
</table>

As per agenda, event was started with the Recitation from Holy Quran by Shezad Khan (CABI SA). Mr. Islam Gul (Team Leader for Mohmand Agency) facilitated the event as stage secretary and he welcomed all the participants. After that Mr. Muhammad Zahir Shah
addressed the opening remarks & introduction of ICM/FFS project under FRDP. He thoroughly explained the objectives and achievements of the project. He told that CABI South Asia has successfully established 44 FFS since 2007 in all agencies. Till now, 1000 farmers were fully equipped and trained with the approach of ICM through FFS by CABI South Asia under FRDP funded project.

After that Mr. Zaki Ullah NRM Coordinator PMU, FRDP highlighted the objectives and future plan of the FRDP Project. His detail remarks in this regards is given in the Statesman newspaper coverage as attached herewith. CABI South Asia then shared its activities done during the period from October, 2009 to July, 2010 through power point presentation. In this connection, Mr. Badshah Alam (Team Leader for Bajaur), Mr. Islam Gul (Team Leader for Mohmand) and Mr. Adil Naseer (Agriculture Expert for Khyber) presented and shared the achievements of their respected agency.

In the end, chief guest appreciated the work done by CABI South Asia under FRDP project and he emphasized that such kind of project should be extended to other areas of Khyber Pukhtoonkhwa province. Later, the chief guest distributed shields among the participants.

Different newspaper coverage team was also present on the occasion and reported the event in their respective newspaper. Cuttings of different newspaper are given below as Annexure 1 & 2;
FATA farmers trained on insects, plant diseases

PESHAWAR: CABI South Asia, Pakistan has trained 1,000 farmers of Bajaur, Mohmand and Khyber agencies of the tribal region in prevention of pests, insects and plant diseases. CABI South Asia implemented its Integrated Crop Management (ICM) through Farmers Field Schools (FFS) under FATA Rural Development Programme (FRDP) Project in tribal agencies.

The closing ceremony of ICM held at Bureau of Agricultural Information was attended by Project Manager, Muhammad Zahir Shah, Project Coordinator, Mian Zakiullah a large number of farmers from the tribal areas with Fazalullah Khan, MPA, as chief guest on the occasion. Addressing the seminar, Zahir Shah told that CABI has started work on three kinds of tunnel farming for production of off-season vegetables.

Similarly, he said that plan for exit strategy has been submitted under which best lot of 45-45 each farmers would be selected for training.

It would be training of the trainers to well equip them with the technicalities of the farming, which would play the role of task force in future.

For increasing the capacity of farmers, CABI has established more than 44 Farming Fields Schools (FFS) to benefit the farming community in FATA. Zakiullah told the participants that the project was started in light of the joint survey of CABI and FRDP conducted in 2002.

He informed that Asian Development Bank was extending 70 per cent financial assistance the remaining is carried by the government and community itself.

The five-year project has been started in 2006 and will continue till December 2011. The objective of the project is the development of infrastructure establishing farm to market link, promotion of agriculture, forest and livestock and capacity of the farmers.

The project is working in Bajaur, Mohmand and Khyber agencies.

The FRDP is being run on participatory basis and 1,400 to 1,500 committees (jirgas) have been constituted for it.

The participation gave ownership of the project to the people that make FRDP different from other projects.

The project has introduced the idea of the FFS that is bringing revolution in the agricultural development.

Badshah Alam, Cab Team Leader, Bajaur Agency, Adil Nasem (Khyber Agency), Ahmad Khan (K-Team) and other farmers from the agency also spoke on the occasion.

Later, the chief guest distributed shields among the guests. - APP
13) Way Forward of the ICM/FFS Project Activities

To continue farmers field schools approach and to develop an exit strategy for the market oriented capacity building of farmers as post farmer field schools, a comprehensive training program on establishing & running of Training of Farmers (ToF) is needed to improve existence capacity of the farmers field school farmer. In this connection, proposed idea of TOF for FRDP working area would be adopted as it is an effective mechanism for transferring of knowledge and technical skills.

Using post farmers field schools training programme for the farmers will help the farming community once the on-going FRDP project came into end. Training of Farmers (ToF) participants are the driving force for the dissemination of farmers field school approach. Training is the process of acquiring the knowledge, skills, and attitude that are needed to fill the gap between what people want to do and what they are able to do now. The purpose of this ToF is to pass knowledge to farmers of the area. In order to train a trainer how to train well, a ‘learning by doing’ approach is best. For example, it is very difficult to make the farmers to believe about the preying habit/capacity of a natural enemy, results of participatory trials like plant compensation, fertilizer management etc, unless there is some practical demonstration in the field through the process of learning by doing. So they can learn and share all these in ToF after practical involvement. Normally, 15 participants are trained in each season long ToF training. In each agency three season long TOF training would be established.

Furthermore, numbers of crop related issues and problems were identified during regular farmers field school sessions which need further elaboration in the shape of participatory technology development trials during Training of Farmers (ToF) training program. Detail is given below;

- During regular FFS sessions, it was observed that thrips attack on onion crop is serious problem and needs further PTD to overcome & address this issue.
- It was observed that Damping-off is normally occur during nursery stage of tomato and onion crops due to poor management especially bed preparation for nursery raising & establishment and hence needs PTD to develop trial on raised bed Vs flat bed.
- Downy Mildew disease is one of the major problems in all three agencies and still need management practices in the shape of PTDs.
- Late Blight disease in tomato crop is a common disease and farmers need further assistance & help to get rid of it.
- Termites are found in abundance in all three agencies as most of the area of these agencies are rain fed because in rain fed soil, termites can move easily to collect & carry food items to their colonies as compare to irrigated area. Therefore this issue is still alarming one and needs management assistance in the shape of PTDs.
- For the control of aphids some management practices are needed in the shape of yellow sheet installation and application of surf soda oil solution.
- People of the area use fresh FYM instead of rotten form therefore a comprehensive PTD on compost making is needed to aware farmers about organic matter and its importance.
- Most of the farmers of FRDP working area were complaint about Rodents and in this connection biscuit bait trial will be kept as PTD for the effective control of rodents.
- Onion root white grub (beetle) was observed as serious problem in Bajaur & Mohmand Agencies and hence needs management assistance.
- Purple blotch disease on onion crop was also one of the identified problems during FFS sessions in all agencies and farmers need assistance & help in this regard. Therefore PTD can be developed to resolve this issue.
- Fruit borer (Helicoverpa Armigera) in tomato crop identified as major pest and needs further management practices.
- Leaf curl viral disease in tomato-a comprehensive PTD is needed to minimize his problem.
• Weeds especially in wheat crop are one of the major problems being identified during FFS sessions and hence need development of PTD approach to control weeds in target crop field.

**Objectives**

1. To train the FFS farmers as master trainer with regard to situation when FRDP is completed and have no activities in the project area.
2. Farmers learn how to run and establish Farmers Field School (FFS) in absence of donor funded project.
3. Strategy development for sustainability of FFS program in the area.
4. To establish a chain of trained farmers to sustain and increase the income per unit area with minimum losses through multiplier effect.

**Outcomes of the Post FFS Program**

At the end of these training activities under post farmers field school (PFFS) program for FRDP upper working area, 45 farmers at each Agency will be in a better position to;

• Understand the concept, approach, principle & methodologies and importance of FFS with specific reference to tomato, onion and wheat crops.
• Run & establish season long training on different crops
• Adopt modern, low-cost technologies for the improvement of existing vegetable production system
• Build the capacity of other farmers with regard to implementation of quality production management of crops through FFS approach
• Develop standardized good agricultural practices to ensure quality and safe products of crops.
• Identify solutions to relevant problems and constraints pertaining to crops.
• Design & plan experiments in the field to observe the effects of different treatment in the production system of vegetable crops.
• Understand & develop facilitation, communication, and presentation skills.
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