



Capacity building of sugarcane farmers regarding Integrated Pest Management in Punjab

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Abstract

Extreme changes in climate affecting the environment very adversely. Among many reasons behind these climatic variations such as hot weather, unexpected rainfall and a higher concentration of carbon dioxide. Blind use of pesticides is one of the main reasons for climate change which directly affects the food safety and human nutrition. It is happened due to unawareness and no adoption of integrated pest management (IPM). Therefore, the current project is planned for the capacity building of sugarcane farmers regarding integrated pest management in Punjab. The project was conducted at two tehsils of Punjab province named Sadiqabad and Chiniot. Tehsil Sadiqabad was selected from District RYK whereas tehsil Chiniot was selected from Faisalabad division. From each of the selected Tehsils, two villages were selected randomly. In this way, a total of four (4) villages were selected randomly through this procedure. Thus, from each of the villages, 30 farmers were selected which were later trained by experts (through seminars) for particular awareness. In this way, a total of 120 sugarcane farmers was given training through this project. Through this project, sugarcane farmers were able to come to know about the concept and importance of IPM and they were also convinced to treat the setts of sugarcane with a recommended fungicide. As well as through the capacity building of sugarcane farmers by this project they were aware of the importance of cultural/agronomic measures in the context of pest management. Similarly, they were able to easily identify the sugarcane pests and they came to know about the proper installment of Trichogramma cards.

Keywords: climate change, Pesticides, IPM, Awareness, Sugarcane Farmers

Introduction

Sugarcane is one of the important crops around the world likewise in Pakistan. In addition to being the main source of sugar its harvesting provides essential ingredients for board, paper, chemicals, plastics, paints, synthetic fibers, insecticides and the detergent industries. Despite its importance the production of sugarcane is not matched to its potential and resultantly income of sugarcane farmers is on decline due to various factors.

One of the dominant factors that make an effect on the production of sugarcane is insufficient pest

management practices. The pests continue to damage the crop from the first growth phase to the harvest. It is estimated that common insect pests of sugarcane as borers, grasshoppers, sugarcane pyrrilla, bugs, thrips cause losses up to 30-40% in the production of the crop due to improper management. Improper pest management is mainly due to lack of knowledge regarding these practices. Generally chemical control is used to combat insect pests but now-a-days the use of Biocontrol is also in progress in which parasitoids and entopathogens are used to control harmful insects (Hajek and Eilenberg, 2018). Awareness regarding identification and control of pest attack is a gap for the related management.

Pest scouting allows rapid detection of all pests and diseases for timely implementation of management practices. The success of farmers in management of pests of sugarcane is hidden behind timely and proper detection of pests before reaching to Economic Injury Levels (EIL). It is quite possible that if sugarcane growers are able to identify the prevalence of pests on their sugarcane crop, they will manage it in a good way by themselves or with the consultation of experts. For another case, even if the farmers become successful in detecting the related pests at Economic Threshold Levels (ETL) they don't use appropriate methods to control pests of their crops. Instead chemicals are sprayed on their field to manage the prevailing pests. Harmful chemicals are indiscriminately applied on the crop which has proven to be harmful for the health of living beings and also for the climate of earth. Judicious use of pesticides against the pests is the recommended strategy in this regard.

Integrated Pest Management (IPM) is one of the strategy which promotes sagacious use of different methods in combination for management of pests rather than relying only upon chemical solutions. Pest level in crops can be reduced through IPM which has proven to be effective and is a knowledge based integration method used to control pests and diseases in the sugarcane crops. It is also an environmentally sensitive approach to pest management (Ingle *et al.* 2017) that focuses on a combination of common-sense practices. It is used to manage pest damage by the most economical means and with the least possible hazards to people, property and the environment. In short, long-term prevention of pests through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, introduction of resistant varieties and pesticides is achieved through it. In addition, the consequent damages on eco-system are reduced through the use of the techniques.

There are different methods which are used to control pests through integrated pest management like agronomic, biological and chemical as well as many other practices that sugarcane growers adopt to eliminate pest attack for ensuring good quality and high production of crop (Ahmad *et al.*, 2008). But at the same time, such methods involve high cares and considerations to be effective against pests and in absence of such delicacies, the methods remain unsuccessful for pre-determined purpose. Therefore, such methods lose the preferences and trust of farmers.

Farmers don't generally adopt integrated control methods to stop pest attack on their crops due to their perception that such methods are less effective, more complex and take more time than direct supply of chemical sprays on their fields. In wake of the related easiness they prefer to adopt conventional chemical solutions for coping pest related threats of sugarcane. Spraying of chemicals for coping pests of crops is not an appropriate option as it has tendency to spoil habitat of living beings permanently by adding different pollutions into it.

Therefore, it is a dire need that farmers' perceptions are converted in favor of IPM due to its long-term effectiveness. Building the capacity of sugarcane farmers regarding IPM practices is a good strategy that can enable farmers to manage their crop and environment sustainably against the production related threats. At the same time, performance and growth of sugarcane industries are also dependent upon farmers' knowledge and skills. Hence, this project was designed to enhance knowledge and skills of sugarcane farmers regarding integrated pest management.

Climatic changes adversely effect on environment. There are many reasons behind the climatic variations such as hot weather, unexpected rainfall and higher concentration of carbon dioxide. Among these, blind use of pesticides is also one of the causes of climate changes which affects to food security and nutrition of human beings as well. At the same time, excessive use of pesticides develops resistance against those chemical among the pests and resurgence of new pests in addition to environmental pollution and public health risks (Gibbons *et al.*, 2015). Resultantly, the infestation of pests in field is increased which plays a negative role in decreasing sugarcane production also in Pakistan.

In past, blind use of pesticides was a normal practice and it was suggested for handling the insect pest. But, with the awareness of destructive impacts of pesticides on living beings, high use of dangerous chemicals is discouraged. An approach to effective, economic and environment friendly reduction of damages caused by sugarcane pests is started (Wijnands, 2012). Agriculture extension department has been engaged to assist farming community for increasing production of sugarcane and improving living standards through training of sugarcane farmers regarding IPM (Abbas *et al.*, 2009; Farooq *et al.*, 2010). IPM methods and organic farming has been introduced in different forms

to avoid overuse of pesticides. For example, Trichogramma and Chrysoperla cards bearing the eggs of useful insects have been developed. These cards are given to sugarcane farmers to fix under the leaves of sugarcane plants present in field. After hatching from the cards these insects' larvae feed on harmful insects. It is important to have information regarding sugarcane pests before launching an IPM campaign against such pests (Gul *et al.*, 2010; Mahela *et al.*, 2002).

Methodology

The project was conducted at two tehsils of Punjab province named Sadiqabad and Chiniot. Tehsil Sadiqabad was selected from District RYK whereas tehsil Chiniot was selected from Faisalabad division. Both of these tehsils are found in huge diversity also regarding agro-ecological conditions. The details of the selected tehsils are as under;

Tehsil Sadiqabad which is selected for this project is a tehsil located in Rahim Yar Khan District placed at border of Sindh and Punjab. It is considered agricultural city in district Rahim Yar Khan where majority of population is linked with agriculture. It is a fertile area which produces large quantity of sugarcane, cotton, wheat, mango and many other crops. It is also famous due to production of Mangoes and Kinnows in the province of Punjab. Sugarcane crop and its related business is a prominent feature of agriculture in this area. Main sugar mills located in this area are JDW (JamaldinWali), Etihad Sugar mill, Hamza Sugar mill and Rahim Yar Khan Sugar mills Limited.

Tehsil Chiniot which is also selected for this project is a tehsil located within Faisalabad division. Chiniot city is located at left bank of Chenab river and has small rocky hills. It has largely hot semi-arid climate. It produces important products as sugar, wheat, rice, silk, cotton, milk and wooden furniture. Three famously known Sugar Mills are working in the said tehsil; Madina Sugar Mills Ltd., Ramzan Sugar Mills and Safina Sugar Mills.

From each of the selected Tehsils two villages were selected randomly. In this way total four (4) villages were selected randomly through this procedure. From tehsil Sadiqabad two selected villages were 152/p and Rahimabad while from tehsil Chiniot two selected villages were named as 127 J.B. and Rajoa Sadat. The villages were selected by using simple random sampling method from the respective tehsils.

The data regarding needs of the farmers pertaining to integrated pest management were collected through interviews from officials and farmers. The collected information was complemented and confirmed by conducting focus group discussions among the farmers and diagnostic visits. Later on, the farmers were given trainings within groups. Each group was selected from sampled village by using simple random sampling technique. Thus, from each of the villages 30 farmers were selected which were later trained by experts (through seminars) for particular awareness. In this way, total 120 sugarcane farmers were given training through this project. The complete organogram showing the selection of trainees from the research areas is given in Fig 1.

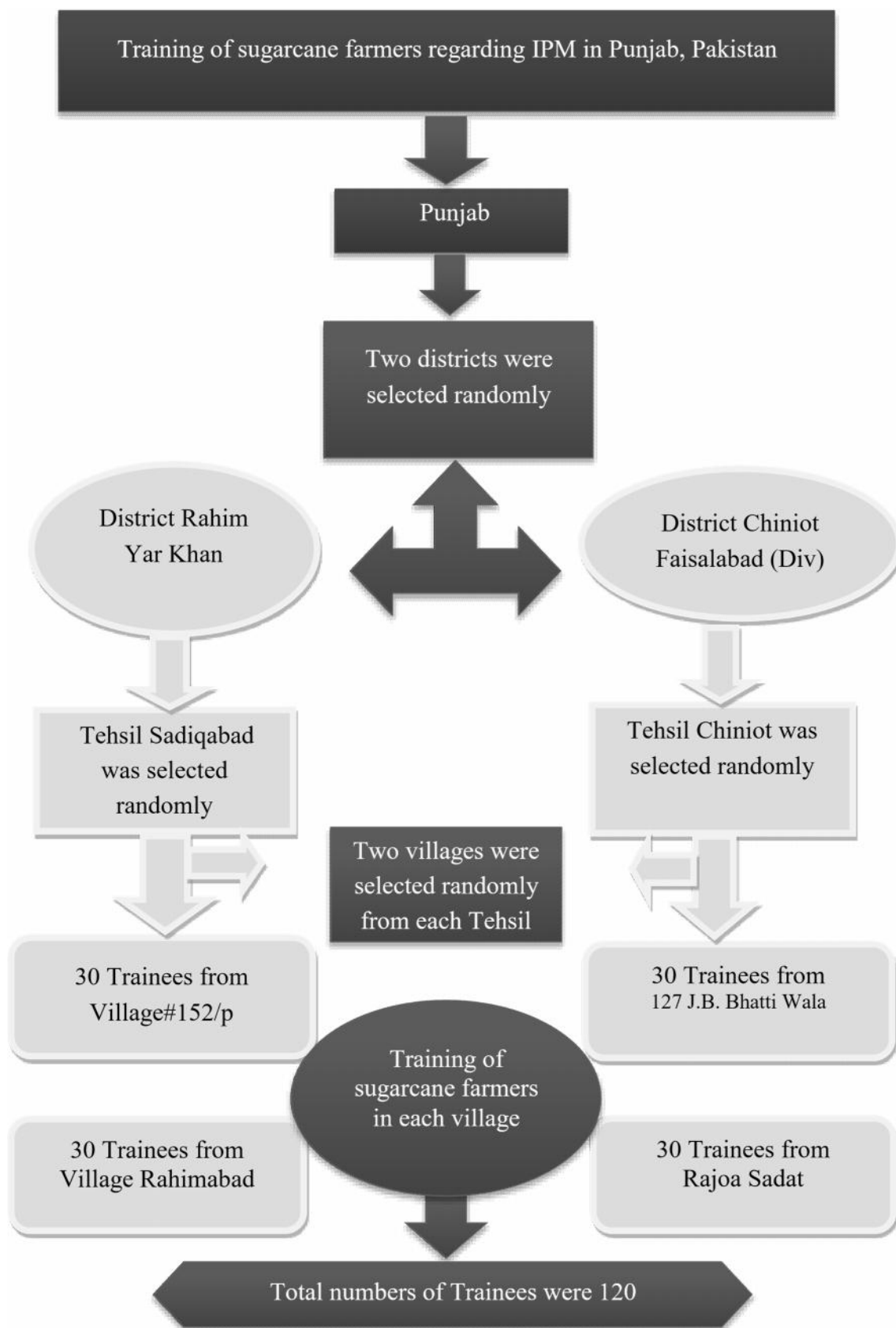


Fig. 1: Organogram of selection of trainees from the area

Project activities

The details of interaction with the farmers according to the tasks and duration of activities is depicted in the below given table;

Sr. #	Tasks	Duration
(i)	Need assessment of sugarcane farmers	2 weeks
(ii)	Training of the farmers	6 weeks
(a)	30 sugarcane farmers (1 st village of tehsil Sadiqabad)	1.5 weeks
(b)	30 sugarcane farmers (2 nd village of tehsil Sadiqabad)	1.5 weeks
(c)	30 sugarcane farmers (1 st village of tehsil Chiniot)	1.5 weeks
(d)	30 sugarcane farmers (2 nd village of tehsil Chiniot)	1.5 weeks
(iii)	Seminars and Workshops	2 weeks
(iv)	Documentation and Reports	2 weeks

Results and Discussion

Need Assessment of sugarcane farmers

a. Meeting with officials

The research team conducted meetings with the officials of agriculture department appointed at the target areas. The official discussed different prevailing methods with the project team which were used to control pests like chemical, agronomic, biological as well as many other practices that sugarcane growers adopted to eliminate pest attack from their crop. Furthermore, they also shared miscellaneous reasons of low adoption of integrated pest management by the farmers to control pest attack on their crop due to which they were facing a lot of problems regarding pest control/management. It was taken into consensus that the awareness and training of farmers regarding integrated pest management can enhance their ability to deal with the pests of sugarcane crop. The officials also appreciated the project due to its usefulness in the following words;

“this is a good project, if such information will be provided to the sugarcane farmers, then they would start following it.... It is a best way to reduce the use of pesticides and save our environment as well”.

The official agreed with the information shared by the resource person that most pathogens survive in soil season to season or on seed setts cause destructive damage in the sugarcane crops. Therefore, proper crop rotation for 3-4 years is recommended for a sugarcane farmer. Many insects, parasites and pathogens are directly killed from heat and drought. Pest level in crops can be reduced effectively through IPM that is knowledge based, long-term and integrated method used to control pest and disease in the sugarcane crops. Diseases damage the crops from the first growth phase to the harvest. Proper inspection/scouting allows rapid detection of all pests and diseases for timely implementation of management practices. Therefore, the training of farmers has tendency to provide skills in terms of IPM and all basic knowledge related to the sugarcane diseases.

Researcher also collected basic information from the agriculture officials about the previous trends of farmers regarding adoption of IPM in Tehsil Sadiqabad. It was explored that adoption was very low in this regard. The list of villages with respect to the area under cultivation of sugarcane was obtained from the officials. The list gave detail information of villages regarding their Tehsil, Markaz, land occupation, area under sugarcane cultivation.



Fig. 2: Office of Deputy District Officer Agriculture Sadiqabad (Ext.)

b. Meetings with sugarcane growers

Visits of experts were conducted to farmers in both the districts. There were different problem in these areas but the significant problems were related to sugarcane pest attack and shortage of water. During the visits to the sugarcane growers the experts informed them about the purpose of the project. The project team also explored the existing situation of advent of pests on sugarcane crop and its related strategies/ management adopted by the sugarcane growers. Furthermore, the experts also inquired the adoption of IPM among the farmers in the target areas. In response to intervention made by the research team, the farmers reported that

management of pests on sugarcane crop by using IPM is a novel trend to them although before that they have heard about the concept of IPM for cotton crop. Few respondents were aware of the use of IPM on sugarcane crop. As, one of the interviewees replied in the following affirmative words;

“the kind of project was started from the private companies or from sugarmills in Tehsil Sadiqabad.....only one sugarmill provided Trichogramma card to sugarcane farmers.... and because the farmers did not have any specific information about it, they wasted these cards”.



Fig. 3: Meeting with sugarcane farmers Chak No (village) 152/p

c. Focus group discussions

From group discussion found that several sugarcane farmers were not aware regarding IPM and did not have proper information regarding pest attack and their damage on sugarcane crop. Farm and home visits were made in the selected villages to probe-out the basic issues of sugarcane farmers. Meetings were arranged in the randomly selected union councils of Tehsil Sadiqabad. The Tehsil was visited for the identification of the problem being faced by the sugarcane farmers in the union council 152/p. Farmers were not satisfied with the government policies because they were facing a lot of problems regarding sugarcane sowing like pure and good quality seed, irrigation, pesticides, sugarcane permits, not receiving the payment at time and different disease that adversely damage the economic returns of the crop

that ultimately reduce per capita income of farmers. There are many pest attack like root borers and shoot borers and natural disasters like rain, smog and diseases like red rot having adverse effect on sugarcane crop. Due to shortage of water, farmers were giving preferences to other crops over sugarcane to avoid economic losses.

d. Diagnostic visits

Visits were arranged to the farmers with special focus upon diagnosis of diseases and pests on sugarcane crop. The farmers were very excited and satisfied by observing serious endeavor of solving their problem by experts and they themselves lead experts to their field and even pointed out the areas where the diseases and pests' attack was occurred.



Fig. 4: Pest scouting in the presence of local sugarcane farmers Village# 152/p

Training of Sugarcane farmers

(a) Training at Village#152/p tehsil Sadiqabad

Problems of local area

During visit to the above mentioned village, it was noted that maximum output/ production of sugarcane was 500 to 800 maunds/acre. The production of sugarcane was insufficient for the farmers especially in the area of 152/p and quality of the sugarcane crop was also decreasing day by day due to different

diseases like red root and may be due to several pests like: root borer, shoot borer and sugarcane pyrilla in Punjab.

Main sources of information

1. Fellow farmers
2. Pesticide agents
3. Sugar mill agents
4. Agriculture Department
5. Radio/ Television

Experts' suggestions during training sessions

The farmers were given training regarding integrated pest management. Complete method of treatment of red rot by treating the setts (seed) of sugarcane with fungicides was explained in front of the farmers. Those methods were imparted to farmers through which they could maintain the population of those insect which were enemies of harmful insects. Not only proper information was provided to the farmers regarding IPM to overcome the mentioned issues but also motivation was given to the farmers for sowing of disease resistant varieties of sugarcane (CP-77400, HSF-240, HSF-242, SPF-247, SPF-248). The detail information about the disease resistant varieties in sugarcane was provided to the farmers as well. On the other hand, some cultural control methods were also imparted to the farmers in which planting of sugarcane crop in rows, application of organic manures, intercropping with suitable crops and removal of affected plants were important. Adoption of integrated pest management approach after enhancing their knowledge and skills related to disease and pest for sugarcane crop was also encouraged.

(b) Training at Village Rahimabad Tehsil Sadiqabad

Problems of target area

There were different problems in these areas but major issue was related to damage done by rodents (rats) and a disease i.e. red rot in sugarcane. Meeting was arranged in randomly selected village of Tehsil Sadiqabad to explain the importance of sugarcane in agriculture. Farmers described that they have a lot of problems related to sugarcane insect pests. The first problem was that they did not have any information related to sugarcane pesticides. So, farmers purchased pesticides on instructions of pesticide dealer. They also described the situation of the purchasing and application of these pesticides on their crop of sugarcane. The situation seems to be disappointing for the farmers as indicated from the following comment of one of the farmers:

"we have no idea what they (pesticide agents) gave us, we just used their products on our sugarcane crop..... we are mainly affected by the attacks of rats on our crop. These rats damage sugarcane crop that fell down drastically".

At the same time the farmers were worried about the red rot disease at their farms. Some of the farmers

even confirmed the disease during field visits by picking the affected plants within their field.

Main sources of information

1. Fellow farmers
2. Pesticide agents
3. Sugar mill agents

Experts' suggestions during training sessions

The IPM experts, visited with the team, provided the related training to farmers pertaining to their needs for pest management. They educated the famers and disseminated the information related to sugarcane insect pests based on their needs. For that purpose, the farmers were gathered at DeraAjmal. The farmers were educated about the way with which they could overcome their pest problems for keeping minimum impact of pesticides on environment.

The experts suggested the farmers to practice clean cultivation in which they should grow weed free field to reduce hide points of rodents. They also told them to practice locally available rat traps. Furthermore, they suggested the farmers to identify rodents burrows and smoke these burrows for 2-3 minutes. The chemical solution that the experts suggested to farmers in response to the problems integrating with the cultural management was use of *Phosphide tablets* in the burrows and covering of the burrows for some time against the attack of rats. But the solution suggested by the experts was not welcomed by the farmers and they told experts that the Phosphide tablets were not easily available from the market due to following narrated reason;

"we (farmers) do not have a shop from where we can get phosphide tablets, for this purpose we have to go to city at least 32 km away from our village. Even when we go to shopkeepers, they do not give us phosphide tablets and use to say that Government does not allow us to sell the tablets because these tablets are harmful for human health".

Experts further recommended other pesticides to control rats with some standard management measures which may be found in easy access of the farmer's/ sugarcane growers. They recommended that the farmers should apply Chlorpyripos @ 2 liter/acre. But as part of integrated pest management approach the experts recommended the farmers to install traps in their field so that the effects of pesticides on environment may be reduced.

As far as the management of red rot is concerned the best way to deal with the disease as a part of integrated pest management approach recommended by the experts was that sugarcane growers should select varieties free from red rot like CP-77400 HSF-240 HSF-242, SPF-247 and SPF-248. They should also keep their field clean and free from weeds. The infected plants should be plucked out and wasted away from the field. Moreover, the setts of sugarcane should be treated with Arton and Benlate (0.2% solution) 100 GRAM / 50 liter water before sowing and sugarcane setts should be dissolved and dipped for five minutes.

(c) Area of Training=127 J.B. Bhatti Wala & Rajoa Sadat Tehsil Chiniot

Problems of target area

The problems of sugarcane farmers at tehsil Chiniot were more or less similar with the farmers of tehsil Sadiqabad. Two villages were selected from tehsil Chiniot. There were selected 30 farmers from 1st village i.e. 127 J.B. Bhatti Wala (Appendix-III) and the same number of trainees from 2nd village i.e. Rajoa Sadat (Appendix-IV). The major complaints of farmers in tehsil Chiniot regarding the sugarcane problems was presence of lethal disease called red rot of sugarcane on their crop. At the same time, they were worried about the attack of insect pests on their crop especially leafhopper and borers.

Main sources of information:

1. Fellow farmers
2. Pesticide companies
3. Sugar mills
4. Social media
5. University of Agriculture, Faisalabad
6. Ayyub Agriculture Research Institute, Faisalabad

Experts' suggestions during training sessions

In the presence of the mentioned threats at the sugarcane crop the experts gave them solutions which could ensure sustainable production of sugarcane with least impact on the environment. The experts recommended that the farmers should prepare land properly. For this purpose, one time rotavator or disk harrow may be used to mix the crop residues of previous crop in soil. One deep plough may also be used with chisel plough or sub-soiler and 4-5 subsequent ploughs should be done followed by planking. Sugarcane disease resistant and high

yielding varieties should be selected for sowing like CPF-246, HSF-240, HSF-242 and CPF-247 in the province of Punjab. Likewise, other important cultural cares that should also be followed to avoid infestation of pests of sugarcane in the field are as under;

• Sowing Time

Spring sowing: Mid Feb 15, Mid-March
September sowing: Full month of September

• Sowing Method

After land preparation made 10-12 inches deep furrow of 4 feet away. All doses of phosphorus and potash fertilizer are broadcasted in those furrows. Then sow two (2) lines of setts in each furrow in such a way that the corner of setts are attached with each other.

• Seed Rate

17000-20000 setts/acre or
12-16 Marlas /acre or
100-120 maunds/acre

• Fertilizer

Fertilizer applied at proper amount to get the maximum production of the sugarcane. All doses of phosphorus and potash apply at sowing time and N apply in split-form.

Proper amount of fertilizers in kg/acre are given below:

N	P	K
92	46	50

Fertilizers' amount recommended in kg/acre for ratoon crop is as under:

N	P	K
120	60	65

• Irrigation

Proper irrigation required for maximum production of sugarcane are given below:
Number of Irrigations required=6-20

• Biological Practices

Trichogramma Chilonies is one of the important Parasite of insect pests of sugarcane. It can be released in the sugarcane field at the rate of 20,000 per acre at ten days interval for six times. Entopathogenic nematodes

is used to control Termites and Root Grabs in sugarcane. Trichogramma cards are easily available from sugarmills and one can easily install it in the sugarcane field. It is an effective method to control sugarcane pests. Traps are one of the mechanical methods which were used to control pests of sugarcane borer. In this method light traps are used to

control pest of sugarcane. Different traps are installed in sugarcane field to control rodents which cause most destructive damage for sugarcane crop.

• Post-harvesting

Experts suggested some cultural practices to farmers like removal of previous stubbles through deep ploughing, intercropping operation and timely irrigation for minimizing the insect pest attack.

Impact of this project on common men as comparative statement in tabular form

Sr. #	Pre-training situation	Post-training benefits for common man
1	Local sugarcane farmers did not know about Integrated Pest Management and its importance before this project.	Local sugarcane farmers came to know about the concept and importance of IPM.
2	The farmers did not treat the setts of sugarcane crop with recommended fungicides suggested by research experts before its sowing.	The farmers were convinced to treat the setts of sugarcane with recommended fungicides after the project.
3	The farmers were not aware of the importance of cultural/ agronomic measures in context of pest management	The farmers became aware of the importance of cultural / agronomic measure in context of pest management.
4	The growers were unable to identify the pest attack on their crops.	They started to identify the pests that were attacking on their crops.
5	They did not know the proper installment of Trichogramma cards	They came to know about the proper installment of Trichogramma cards.
6.	Only large farmers were focused by the extension workers and other agents	Small farmers were intentionally interacted through this project to mollify their grudges

Number of beneficiaries

The project made direct effects on the selected groups of sugarcane growers. Each group contains 30 farmers and thus the total number of beneficiaries of this project was 120 farmers in total.

Overall outcome of the project

The farmers were given education regarding integrated pest management who previously were not aware with the importance of IPM during this project. Due to the unawareness they did not adopt integrated pest management approach on their farms. This project also facilitates sugarcane farmers towards getting good

production of their crop. Thus, economic standards and life styles of the rural communities are raised through trainings of sugarcane farmers regarding training about the control measures against sugarcane pests which ultimately has tendency to increase per capita income of the farm families. The farmers were benefitted mainly in the following ways;

1. They started to identify the prevailing pests of their crop.
2. They got awareness regarding preventive measures during pest management which were specific to different life stages of pests.
3. Trainings regarding harmful effects of pesticides on environment were conducted.

4. The main information sources which were providing information to the farmers were identified. Moreover, other information sources used by the farmers were also ranked as per frequency of related uses by the farmers.
5. Direct intervention into previously adopted strategies of the farmers expected to improve their sugarcane production.
6. Farmers started to reinstate their lost trust into the governmental agencies for getting valuable information at their doorstep.

Sustainability of the project

The approach imparted to farmers i.e. Integrated Pest Management (IPM) is useful for environment as it has least effect on the environment which maintains balance ecosystem and ensures conducive environment for living beings. The low cost to deal with the pest also saves capital of the farmers. Furthermore, it also reduces the use of pesticides which is an environment friendly approach. In this way, environmental pollution is likely to be reduced in which water and air pollution was dominant. Loss of beneficial insect will be reduced and as the project deals with combating life with life so the population of beneficial insects will be promoted. The project also focused upon the possibility of permanent interaction with the selected farmers who are taken into loop of communication. In this way the farmers would be benefitted with upcoming information explored by the researchers in future as well. Small farmers who comprise major portion of farming communities are directly interacted through this project which will increase agricultural productivity.

Project benefits to the community

The project is beneficial for the farming community through many ways as it has tendency to increase sugarcane production which is the main focus of the growers. The production targets would be achieved by reducing the infestation of pests and diseases from the crop that ultimately would help to increase the income levels of farming community. With the rise in production and income of the farmers the project has tendency to decrease pollution especially at farm and village level because of sagacious and wise use of pesticides through integrated pest management. It is another way of saving the invested cost of farmers. Through this project the huge capital invested which is invested by the farmers on application of pesticides on

their farms can be saved. The pest management is purely based upon the mixing of biological and chemical controls which lead to least dependence on chemicals and as a result organic farming would be promoted. Promotion of biological pest control would increase the friendly insects within the ecosystem of crops that would lead to natural and sustainable way of pest management.

Conclusion

Conclusion:

Sugarcane has become one of the important crops around world. Pakistan ranks at fifth position among the sugarcane producing countries. In addition to being the main source of sugar, harvesting of the crop provides essential ingredients for board, paper, chemicals, plastics, paints, synthetic fibers, insecticides and the detergent industry. The production of sugarcane in Pakistan is on decline due to many factors like attack of pests which arises mainly due to poor management of sugarcane farmers. Insufficient pest management practices in sugarcane are mainly due to lack of knowledge and skills regarding IPM that ultimately reduces level of income of farmers. Such awareness of farmers provides skills in terms of IPM and all basic knowledge related to sugarcane and its pests' management.

The farmers in the research areas were not familiar with the proper management of red rot and other insect pest like root borers, shoot borers, stem borers, top borers, sugarcane Pyrilla, rodents and termites. Therefore, the study focused upon education of sugarcane farmers to enhance their skills related to problems of pest management. The farmers were given training in this regard by the experts at their doorstep. The experts suggested different control measures to the farmers especially by using integrated pest management approach in which biological and cultural control methods were advocated over chemical control.

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