

Project: UP GRADATION OF CENTRAL COTTON RESEARCH INSTITUTE SAKRAND AND COTTON PRODUCTIVITY ENHANCEMENT THROUGH CAPACITY BUILDING AND MANAGEMENT OF PBW IN SINDH UNDER PRIME MINISTER EMERGENCY PROGRAM

Objectives

1. Upgradation of CCRI Sakrand
2. Management of PBW through PB-Rope Technology
3. Capacity building of farmers and field staff of agri department in use of PB Rope
4. To monitor the development of resistance in PBW through bioassay technique.
5. To demonstrate and evaluate the performance of Leftover Boll Picking Machine developed by CCRI Multan for the management of PBW.
6. To develop and publish training brochures, leaflets and extension material and to disseminate the extension messages about PBW and cotton production using IT techniques (SMS, Social Media etc)

Description:

The adoption of biotech cotton in Pakistan provided relief from bollworms and offered an opportunity for farmers to divert their attention to counter the risk of Cotton Leaf Curl Virus disease by early sowing. However, this practice extended the crop period, which seriously disturbed the cotton agro-ecosystem while opening the door to other threats. The number of insecticide applications needed to control sucking insects plus the early sowing of cotton adversely affected non-target and friendly organisms, giving rise to new pest problems like insecticide resistance and pest resurgence. Meanwhile, climatic changes including high temperature and irregular rain fall pattern caused drastic increase in whitefly and pink bollworm population. In 2019-20, PBW and WF remained the significant pests and took toll of about 1-2 million bales. Development of resistance resulted in repeated application of pesticides and higher cost of production resulting in least or no return from cotton to quality farmers.

Pink bollworm, *Pectinophora gossypiella* (PBW) re-emerged as a serious threat to cotton after about a period of 15 years. Losses due to PBW infestations smeared out an estimated US\$1.2 billion (Rs. 187 billion) in annual cotton production (in monetary terms) in 2015/16. If the PBW is not managed properly and in a timely manner, it will entail a catastrophic crisis for 1.3 million cotton farmers in the country.

In Pakistan farmers rely exclusively on chemicals to control insect pests. More than 80% of US \$300 million spent on pesticides in Pakistan is used to manage cotton pests. Due to sole and un-judicious use of insecticides, whitefly has developed resistance to conventional insecticides (e.g. organophosphate, carbamate and pyrethroid) as well as to neonicotinoid and insect growth regulator (IGRs). Resistance in PBW has not been investigated in Pakistan until now, but if confirmed would pose further threats to the sustainability of current pest management practices. The first generation GMO used in Pakistan is no longer giving protection against PBW resulted in successive outbreak of PBW for the last three four years. Saving cotton sticks with PBW infested bolls for fuel further aggravated the situation as grower relying early sowing to escape from CLCV. The early emergence of PBW adults from the infested bolls on cotton sticks flourishes and builds population on early sown cotton to attack the seasonal cotton. This situation is threatening to cotton industry and also the national economy. So there is a need to develop a strategic plan for its timely and effective management for improving cotton yield. Male desperation technique is well proven in the management of PBW in many countries. CCRI Multan has recently developed a Mechanical Boll Picking Machine for removing the left over bolls (infested with PBW or sound bolls) from cotton sticks before their storage for fuel purpose. Sound bolls picked by the Machine give extra yield and round off the cost of running this machine whereas collection of infested bolls ensures less likely buildup of PBW population in early sown cotton.

Combing both eco-friendly techniques reduce the reliance on pesticides and enhance return. Such strategies, however, require substantial laboratory and field research to formulate, and considerable cooperation by researchers, policy-makers, industrialists and advisors to implement successfully.

Justification:

Pakistan Central Cotton Committee (PCCC) is an apex R&D organization giving research support to cotton producers, seed companies, growers and other stakeholders. PCCC has its two main Research Institutes in Multan (Punjab) and Sakrand (Sindh). These are multidisciplinary research institutes working on variety development, pest management, and dissemination of technology. The institute was established in 1976, in a

building of then Agriculture Collage built I 1937. The original building was two story which was damaged during earthquake and C&W asked to remove the upper story. Later on the ground floor was severely damaged due to floods of 2010 and 2012 and the building was categorized dangerous. Resultantly the building was vacated and staff and laboratories were shifted into a Pest management Block and in a residential bungalow. The space constraints restricting scientists to work at their potential. PCCC did some initial work of designing and estimation through consultant firm and proposed a 33200 sq ft covered area for office block and 25 million for furniture and fixture.

The institute has developed 12 varieties and two new varieties CRIS 585 and CRIS 543 were approved by Sindh Seed Council in 2020 for general cultivation. The institute is also hosting of the unique Wild Cotton Germ Plasm of over 23 cotton species. The institute also maintaining a seed germplasm of more than 3000 accessions in sub-zero conditions. Sindh province has lots of potential as its yield per unit area is much higher than Punjab and rest of Pakistan. The technical backup is always required in local environment to solve the emerging issues.

Severe attack of PBW and WF caused cotton production dropped to 9 million bales in 2020. The available pesticides fail to give an effective control. The PB Rope were available in limited quantity and proved to be very expensive to be used by majority of farmers. Restricting early sowing seems quite difficult to implement so is the hibernating larvae management in infested bolls of cotton sticks. Male disruption Technique had been in use for decades for the management of many insects. Its success mainly rely on proper installation, time of installation, monitoring of population buildup and duration of effectiveness of the chemicals. Missing any of the above mentioned factor could result failure of technology and heavy infestation of PBW. Repeated application of pesticides might have resulted in development of resistance, which needs to be explorer in various cotton growing areas of Sindh.

Considering above the present project was conceived to monitor the resistance level, demonstrate and evaluate the Boll Picking Machine, Capacity building of growers and field staff of AED in PB rope use, and dissemination of knowledge through IT based technologies.

Major Activities

Survey of cotton growing areas of Sindh: To determine population buildup of PBW, surveys will be conducted throughout the project period in cotton growing areas of Sindh. To see pink bollworm infestation 20 green bolls (14-28 days old) per acre will be collected from different district of Sindh brought back to laboratories at CCRI, Multan. After 3-4 days bolls will be dissected to see infestation.

Provision of PB Rope on subsidized price: Impact of PB ropes on pink bollworm incidence will be evaluated in 200,000 acres in Sindh. For this purpose PB ropes will be provided to farmers on subsidized rate (1000 Rs/acre). To evaluate pink bollworm infestation 20 green bolls (14-28 days old) per acre will be collected from PB ropes installed areas will be compared with those collected from untreated areas (no PB ropes).

Insecticidal resistance monitoring: To monitor resistance against different insecticides, bioassays will be conducted on its field collected (different districts of Sindh) and laboratory reared population. Susceptible strain of pink bollworm already available in CCRI Sakrand will be further reared on artificial diet to get desired numbers. Pink bollworm collected from cotton fields (different districts of Sindh) will be bio-assayed and the most resistant strain will be kept as a resistant line for further selection and insecticide being used against Pink bollworm to generate highly resistant strain for further biochemical, genetic, binding and fitness cost studies.

Performance of Mechanical boll picker: Performance of mechanical boll picker by managing pink bollworm in leftover bolls in different districts of Sindh will be evaluated. For this purpose 10 machines will be manufactured in two years, and provided research facilities and AED for demonstration to farmers. Infestation in the areas, where left over bolls from cotton sticks removed by mechanical boll picker will be compared with the infestation in areas where manual cutting of stick having left over bolls as well as with the infestation in areas where grazing by sheep and goats is common practice.

To make cotton production cost effective for farmers: After providing subsidized inputs and subsidized machinery like PB-ropes and mechanical boll picker, evaluation will be made at the end of crop season. Cost-benefit analysis will be performed to make recommendations for cotton production cost effective for farmers.

Human resource development: Seminars and training programs will be arranged for farmers, academia, stakeholders, and extension workers. Trainings of the scientists of CCRI will be arranged for capacity building. Findings of the project will be disseminated via print and electronic media.

Project Implementation Strategy:

Disbursement of subsidy on PB Rope: Subsidy @ Rs. 1000 per acre for 200,000 acres will be disbursed in collaboration with BCI, through scratch cards placed in the product. Registered Cotton growers with BCI (over 100,000 cotton growers are registered with four implementing partners of BCI representing over 350,000 acres in 13 districts) will be selected through balloting early in the season. The PB Rope suppliers will be taken on board and supplied with scratch cards to place in their product offered for sale in Punjab. The successful farmers will be paid subsidy in two installments of 40 and 60% through scratch cards.

Fabrication and Demonstration of Boll Picking Machines: Central Cotton Research Institute, Multan and CCRI Sakrand through a competitive bidding, manufacture 5 machines for cotton boll picking and supply to CRS, Ghotki, CRS, Mirpur Khas, CRI, Tandojam, CCRI Sakrand and CRSS Kotdigi for demonstration and evaluation purposes. The staff will be trained in this regards by the CCRI Multan.

Survey and Studies on Insecticide Resistance: Field staff and the project staff will survey cotton growing area intensively and collect insect samples and field history. The Entomological Lab of CCRI Mutlan has already maintained a susceptible culture of PBW. The field collected samples will be reared and tested in comparison with susceptible population for development of resistance in various field population. The studies will be coordinated by CCRI Multan, unless the civil work is completed.

Training and Capacity Building Activity: Scientists of CCRI by engaging Provincial Government and Academia will setup a calendar of trainings during cotton season covering topics like: seed germination; weed management; fertilizer requirement; Crop Agronomy; Pest Management; PB Rope application; Spray Techniques; Clean Cotton; Crop Management; etc. for progressive growers, field staff of agriculture department and social workers of various civil societies and developmental workers.

Publication and IT based Extension Services: Publications for the above mentioned will be prepared in local language for awareness of growers. About 40 leaflets and brochures will be developed every year on various topic. Training Manuals for training of trainers will be prepared and provided to trainees for their use. SMS based extension messages on need bases and on emerging issues will be disseminated. Other social media platforms will also be utilized for awareness and training of farmers purposes.

Civil Work: For the construction of laboratory and office buildings, a consultant Alvi Associate has already been hired and the consultant has developed a drawings and will work with the contractors etc in preparation details of building. Other codal formalities will be followed as per standards. A committee with the approval of the Ministry will oversee the construction work at CCRI Sakrand.