



75th Plenary Meeting of the INTERNATIONAL COTTON ADVISORY COMMITTEE

Report of the Chairman COMMITTEE ON COTTON PRODUCTION RESEARCH OF THE ICAC Sixth Open Session – Technical Seminar

Emerging Pests in Cotton and their Control

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The Committee on Cotton Production Research of the ICAC organized a Technical Seminar on the topic of 'Emerging Pests in Cotton and their Control.' Five papers were presented in the Technical Seminar by researchers from Burkina Faso, India, Pakistan and the USA.

Dr. Muhammad Naveed of the Pakistan Central Cotton Committee presented a paper on 'New pests, new challenges.' He stated that cultivation of biotech cotton in Pakistan distracted attention from bollworm control and increased focus on the control of the leaf curl virus disease. Farmers found an easy solution to minimize the leaf curl disease by adopting early planting. Earlier planting of cotton extended the growth period and disturbed the agro-ecosystem, while inviting new pests to emerge as major pests. The longer growth period demanded more insecticide applications against sucking insects and gave rise to new pests, such as the mealybug, red cotton bug and the dusky cotton bug. With regard to bollworms, the pink bollworm had not been a major pest on cotton in Pakistan for 15 years. Biotech cotton helped to control the pink bollworm. However, since biotech cotton had only one cry1Ac gene, the pink bollworm gradually developed resistance to the Bt toxin. Pakistan is reverting back to the proven cultural measures to control the pink bollworm, including stopping early sowing to protect bolls from short diapause emerging of the pink bollworm. In addition, work is also progressing on a forecasting model based on degree-days. Sex pheromone traps have been installed in each region to catch the pink bollworm moths and correlate them with meteorological data from the respective area.

In response to questions from the floor, Dr. Naveed stated that the whitefly is more prevalent in the Punjab compared to Sindh due to hotter and drier weather conditions. The most common use for cotton stalks in Pakistan is for fuel purposes and there are few, if any, uses for other byproducts. Biological control will be effective from the beginning, since the moth population will start diminishing, thus producing less population in the next generation. Responding to questions from the delegates from Burkina Faso and Zimbabwe, Dr. Naveed said that organophosphate chemicals are quite effective against mealybugs.

Dr. Omer Hema of Burkina Faso made his presentation on the redistribution of pests in Burkina Faso after the adoption of biotech cotton. Dr. Hema said that commercial adoption of biotech cotton in Burkina Faso caused a significant decrease in the infestation of bollworms, particularly *Helicoverpa armigera*, and a trend towards decreased levels of outbreak of some sucking pests, whitefly, *Bemisia tabaci*, and the aphid, *Aphis gossypii*. On the other hand, studies could not prove that the recent jassid and mirid infestations in the West African sub-region were necessarily linked

to the use of biotech varieties. The conclusions are based on the pest infestations prior to the adoption of biotech cotton in 2009 and five years later in 2014 when most area was planted to biotech cotton.

In response to a question raised, Dr. Hema stated that commercially grown varieties were transformed in the USA with the Monsanto Bollgard gene and then grown in Burkina Faso. No exotic variety was planted. The delegate of Burkina Faso added that biotech varieties were adopted in the country after meeting all the necessary legal and biosafety protocols. However, the staple length declined after the adoption of biotech varieties and Burkina Faso had to step back and reconsider growing of biotech varieties.

Dr. Shahid Mansoor, of the National Institute for Biotechnology and Genetic Engineering, Pakistan, presented a paper on the topic of engineering dual whitefly and cotton leaf curl disease resistance in cotton. The cotton crop in Pakistan faces many challenges. Cotton leaf curl disease, breakdown of resistance against pink bollworm against Cry1Ac and whitefly are the major concerns. Biotech cotton developed by the National Institute for Biotechnology and Genetic Engineering has stacked three genes for insect and herbicide tolerance in a single cassette. Transgenic cotton with three genes has shown complete resistance to the armyworm. In another development sources of natural resistance have been identified in a cotton line from USDA germplasm developed by researchers at Stoneville, Mississippi. This source of resistance has been incorporated in local elite germplasm. Several studies on use of RNAi for developing resistance to whiteflies have been shown in model plants. Transgenic cotton plants have shown good tolerance to whitefly under high pressure. The availability of these sources of novel traits will lead to cotton lines with multiple traits to boost cotton production and decrease the cost of production and the environmental footprint of cotton cultivation.

The delegate of Uganda asked if there was any risk of epistasis effects of newly inserted genes to protect cotton from the leaf curl disease and whitefly. Dr. Mansoor said that no negative effects of the new insertions have been noticed. The delegate of Burkina Faso was pleased to know the new developments to control whitefly, as the whitefly was also on the increase in his country.

Dr. Venkatesh Kulkarni presented a paper on Bt cotton and the pest scenario in India by teleconference. In India, 2015/16 was one of the worst years with respect to whitefly and the pink bollworm. The main reasons for widespread attacks were the susceptibility of hybrids to high-pressure of whitefly, late sowing, indiscriminate use of insecticides and unfavorable weather. The impact of pests losses was as high as 45% loss in yield in some areas, which upset growers. The pink bollworm developed resistance to *cry1Ac* and *cry2Ab*. The pink bollworm is not a regular pest and had recent epidemics in 1989, 1998, 2005 and 2015. Dr. Kulkarni stated that the next epidemic could be in 2021. He suggested that future options for the pink control are Widestrike, Bollgard III and BtEGII cotton expected to be released in 2017, 2019 and 2019 respectively. *Helicoverpa* and *Erias* have not shown any signs of resistance to biotech genes.

Dr. Akhtar Ali, Department of Biological Sciences, University of Tulsa, Oklahoma, USA focused his presentation 'Early warning and remedies for emerging pests with emphasis on viruses.' He said that emerging pests could be divided into three categories: invasive, evolutionary and resurgent (reintroduced). Viruses and fungi fall under the invasive category. The viruses can be RNA viruses causing diseases like cotton bunchy top, cotton blue disease, cotton leaf roll dwarf and mosaic diseases. But, the cotton leaf curl virus disease, which is causing damage in Pakistan and India, belongs to DNA viruses. Dr. Ali stated that for effective control against viral diseases a diversified package of recommendations, including cultural practices, resistant cotton cultivars, applications of insecticides, removal of alternate hosts of viruses and effective communications including weather forecast data is necessary. Early-warning systems provide timely forecasts for farmers.

The delegate from CIRAD observed that adoption of biotech cotton had consequences and in some cases even caused negative impacts to the environment. He asked all the presenters in the session about their preferences if they were to choose between better management or biotechnology, while considering the long-term benefits. How can negative consequences be avoided and should technology developers be involved in solving new problems? On behalf of all the speakers, the ICAC Secretariat replied that researchers and farmers should not rely on any one method of control, but rather use all possible control options. The technology developers, whether in the public or private sector, offer new technologies along with a package of recommendations to avoid consequences and make use of the technology for a long time. In most cases, the consequences develop due to violations of recommendations and technology developers cannot be held solely responsible for the emerging problems.

The Committee on Cotton Production Research of the ICAC decided to hold the 2017 Technical Seminar on the topic of 'Opportunities and Challenges for Technology Transfer in Cotton.'

Dr. Michel Fok, chairman of the International Cotton Researchers Association (ICRA), presented a report on the World Cotton Research Conference-6 held in Brazil in May 2016. He defined the objectives of ICRA as serving an international voice on cotton research, promoting and strengthening networking among cotton researchers. Dr. Fok advised researchers to visit the ICRA website (<http://www.icracotton.org>) for more details. ICRA is a new organization and Dr. Fok invited the cotton research community to join ICRA. The World Cotton Research Conference-6 was jointly organized with the International Cotton Genome Initiative (ICGI). The Conference comprised of two keynote speakers, eight plenary speakers, 28 specialized concurrent sessions. 471 participants attended the Conference. The World Cotton Research Conference-7 will be held in Izmir, Turkey, in May/June 2020.