A brief statement on the studies of the ecological impact of Bt cotton conducted by Dr. Kongming Wu's lab, Institute of Plant Protection, CAAS

Dr. Kongming Wu is an entomologist who has been engaged in the study of cotton insect pests since 1985 and the ecological impact of Bt cotton since 1996. He is a professor and director of the Department of Agricultural Entomology, Institute of Plant Protection, Chinese Academy of Agricultural Sciences (CAAS), Beijing, China; a member of the National GMO Biosafety Committee; and Chief Scientist of the National High-Tech Program on the ecological safety of Bt cotton in China. His laboratory is one of four mentioned by the Greenpeace-published Report on the environmental impact of Bt cotton in China. The following is Kongming Wu's brief statement.

When the report "A Summary of Research on the Environmental Impact of Bt Cotton in China" written by Prof. Dayuan Xue, Nanjing Institute of Environmental Sciences, was published by Greenpeace in early June 2002, I was in USA as a visiting scholar. Some friends sent me the report by e-mail, I just read the abstract because my computer was failed to open the PDF attachment. After carefully reading the report when I was back to Beijing on June 21, I amazedly found that our studies on ecological impacts of Bt cotton were summarized incorrectly by the author. In fact, our results strongly oppose the major conclusions in Green Peace's report and do not support their views. On behalf of my laboratory, I would like to make a statement for clarification our research results.

Supported by the National High-Tech Program, the Basic Research Program and the State Key Project of the Ministry of Science and Technology of China, and a Special Project for Development of Cotton Production from the Ministry of Agriculture, China, a series of ecological safety studies of Bt cotton have been conducted by the Cotton Insect Research Group, Institute of Plant Protection, Chinese Academy of Agricultural Sciences since 1995, which include efficacy of Bt cotton against *Helicoverpa armigera* (CBW), field abundances of natural enemies, impacts on non-target insect pests, arthropod community structure in the Bt cotton ecosystem, baseline for CBW resistance to Cry1Ac protein, resistance monitoring, selection of resistant strains of CBW and resistance inheritance, resistance mechanisms, evaluation of natural refugia function, and the biology of CBW in relation to resistance evolution. The major results related to the report are listed as follows.

1 Several Bt cotton varieties, developed by the Biotechnology Research Institute, CAAS and Monsanto Co. were evaluated for resistance to *Helicoverpa armigera* during 1997-2001. The results showed that Bt cotton possessed high levels of

field-efficacy against *H. armigera*, with about 80-95% control in different years. In a general year of CBW occurring, damage from CBW on cotton was controlled effectively.

2 Influences of Bt cotton planting on the population dynamics of cotton aphid, *Aphis gossypii* Glover, another key insect pest of cotton in China, were investigated during 1998-2001. The results showed that population densities of cotton aphids were significantly higher in plots of conventional cotton with both pyrethroid and organophosphate insecticide applications than in Bt cotton fields because of the resistance of cotton aphids to the majority of insecticides used for control of *H. armigera* and lower densities of predators in late June and early July caused by insecticide use. , This suggests that Bt cotton planting not only played an important role in the control of *H. armigera*, but also efficiently prevented cotton aphid resurgence that would have occurred with insecticide applications for control of *H. armigera*.

3 *Lygus lucorum* Meyer-Dür, *Adelphocoris fasciaticollis* Reuter and *Adelphocoris lineolatus* (Goeze) (Hemiptera: Miridae) are important secondary insect pests in cotton fields in northern China. The seasonal dynamics of their mixed populations on a transgenic variety expressing the insecticidal Bt protein Cry1Ac and a cotton line expressing the proteins Cry1Ac and CpTI (cowpea trypsin inhibitor gene) were compared with non-transgenic varieties from 1998 to 2001. The results indicated that there were no significant differences between the population densities of these bugs on unsprayed normal cotton and unsprayed transgenic cotton. However, mirid densities on sprayed transgenic cotton were significantly higher than those on sprayed conventional cotton because of the greater number of insecticide applications against *Helicoverpa armigera* on the conventional cotton.

4 Field abundances of insect predators on Bt cotton were evaluated in 1997-2001 at two sites in northern China. The results indicated that, in comparison with the normal cotton plots where insecticides were regularly used against cotton bollworm, the population densities of predators in Bt cotton plots were significantly higher.

5 Arthropod community structure in the Bt cotton ecosystem was investigated in 2000-2001. Three treatments, including Bt cotton (no sprays), normal cotton (no sprays), and normal cotton (regular spraying), were included. Arthropods were collected using a portable suction device. The results indicated that the diversity of arthropod communities in Bt cotton plots was higher than that in the other treatments.

6 Geographical variations in sensitivity of cotton bollworm to the Bt protein Cry1A(c) was studied in 1997 to establish a geographical baseline for comparing future population responses to increased use of Bt products in agriculture in China. More than 20 bollworm populations were collected from 5 cotton-growing regions of China, and

the dose responses to Cry1A(c) protein in terms of mortality and growth inhibition were evaluated. On the basis of the baseline study, sensitivities of field populations of *Helicoverpa armigera* to Cry1A(c) were monitored during 1998 – 2001. A total of 55 strains were sampled, and most of them were collected from Bt cotton planting regions. It was determined that the field populations sampled during the 4 year's study were susceptible to Cry1A(c) protein, and no development of resistance was apparent.

7 Function of natural refuge was evaluated during 1999-2001. Although growth and development of *H. armigera* on Bt cotton was much slower than on common cotton, there was still a high probability of mating between populations from Bt cotton and other sources due to the scattered emergence pattern of *H. armigera* adults, and overlap of the 2^{nd} and 3^{rd} generations. In a cotton and corn growing region, early and late planted corn provided a suitable refuge for the 3rd and 4th generations of *H. armigera*, but not for the 2^{nd} generation. In a cotton and soybean/peanut mixed system, non-cotton crops provided a natural refuge for the 2^{nd} to 4^{th} generation *H. armigera*, but the function of the refuge was closely depended on the proportion of Bt cotton.

General Conclusion

Cotton bollworm is one of the most important agricultural pests in China. Both synthetic pyrethroids and organophosphate insecticides have been used over the past 20 years to control it. Since the late-1980s, applications of chemical insecticides have caused a series of serious issues, such as the insect resistance and resurgence, decrease of farmer's income, pesticide residue and environment pollution.

By several year studies, we conclude that Bt cotton possesses a high efficiency for control of *H. armigera*, and its planting in China has the advantages of reducing the use of chemical insecticides for control of two key insect pests, cotton bollworm and cotton aphid, which would benefit for decreasing environmental pollution and related costs from the insect control in cotton, prolong the useful time of pyrethroid and organophosphate insecticides by reducing the area sprayed and frequency of sprays, and increase the potential for natural and biological control of cotton insect pests.

For further reading please refer to the following papers:

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