COTTON BOLLWORM CONTROL IN NORTH CHINA IN 1996

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Abstract

The cotton bollworm continued to be the most serious pest of cotton and other crops in China. In 1996, it occurred at medium levels in most areas in North China (the Yellow River Valley Cotton Region), much lower than in 1992 and 1993. The cumulative number of eggs on 100 cotton plants (ca. 15-19 square meters) were 200-4,000, 50-400, and 500-3,000 during the 2nd, 3rd, and 4th overlapping with 5th generations, respectively. However, the population densities were very high in Xinjiang Autonomy in the Northwest Cotton Region and Jiangsu Province in the Yangtze River Valley Cotton Region. It is believed that the weather conditions affected greatly on the densities among the regions this year. Research progresses in the control strategy and tactics were made. The community-wide control strategy was extended in an even larger (about 2/3 of the total) area resulted in sound control in North China. But in Xinjiang Autonomy, the farmers suffered a heavy loss by the pest. It is estimated that the national lint yield was 3.5-4.0 million tons for the season.

Introduction

The cotton bollworm, *Helicoverpa armigera* (Hubner), has become the No. 1 pest in China since 1992. In the following, we report in brief the occurrence and control in North China and some other China's cotton regions in 1996.

Occurrence in 1996 - As a whole, the bollworm occurred at medium to high levels in North China in 1995, lower than in 1992 and 1993, but higher than in 1994 (Sheng, 1996a). The high densities of the 4th overlapping with 5th generation were seen in 1995. In some areas the number of cumulative eggs in the late season was 2,000-4,000 on 100 plants (ca. 15-19 square meters). The weather conditions were normal in most areas in the 1995 winter and 1996 spring. That gave a normal survival percentage of diapausing pupae.

Generally speaking, the bollworm occurred at medium levels in most areas in North China in 1996. The numbers of cumulative eggs on 100 cotton plants during the 2nd generation (largely in middle to late June) were 200-5,000, a little lower that that in 1995 (Table 1). In Shandong Province, the highest number for this generation was 13,458 in 1995 and 5,100 in 1996. There were heavy rains in most areas, from Anhui, Shandong to Hebei Provinces, in the North China in 1996 July with rainfall being 500-800mm. A part of the cotton and other fields were flooded. The pupae, eggs and small larvae experienced high mortalities. So, the 3rd generation level was relatively low. The number of cumulative eggs on 100 cotton plants was 50-400 in 1996 compared to 200-500 in the previous year.

The weather in the fall was favorable for the cotton bollworm and the populations recovered rapidly. The 4th overlapping 5th generation (largely in late August to early October) occurred at the medium-to-high level in most areas in the North China in 1996. The number of cumulative eggs on 100 cotton plants was 500-3,000, a little lower than that (1,000-4,000) in 1995 (Sheng, 1996a).

The notable change in the bollworm density among the areas in the North China Cotton Region was seen again in 1996. During 1960 to 1992, Dezhou and Liaocheng Prefectures in the northwestern area in Shandong Province, Hengshui and Shijiazhuang Prefectures in the southern area in Hebei Province, and Anyang and Xinxiang Prefectures in the northeastern area in Henan Province formed a center of the outbreaks. However, since 1994, the density difference between the central and outside areas became smaller and smaller. For example, the highest numbers of cumulative eggs of 2nd generation on 100 cotton plants in Shandong and Shaanxi Provinces in 1992 were 40,730 and 5,450, respectively. But, the numbers in these two provinces became 13,458 and 12,544 in 1995 and 1,242. and 425 in 1996, respectively (Sheng, 1996a; 1996c). In addition, the bollworm densities in the late season in the northern part of Jiangsu Province, the most southeastern area in the North China region, were much higher than that in Shandong Province.

In the other four cotton regions, the bollworm populations tended to increase. This was particularly true in Xinjiang Autonomy. In fact, the growers in this autonomy experienced their most serious damage in 1996. According to Xinjiang Plant Protection Station, the acreage infested by the bollworm was 0.36 million ha, or 45% of the total cotton acreage, equal to 7 fold of that in 1980's in the autonomy. In Turpan Prefecture, the infested area was 18,000 ha, or 82% of the total in the prefecture. Among these infested fields in the autonomy, 52,000 ha were damaged very seriously with 20-40% yield loss. About 4,000 ha of the ruined fields were abandoned entirely. In the late season, the number of the bollworm larvae was 5-25 sampled on 100 cotton plants (ca. 5-8 square meters due to very high plant densities in the autonomy). The highest larval number was 45 in Turpan Prefecture and 82 in Shache County in Kashi Prefecture. In October, the highest number of diapausing pupae was 119 per square meter found in a late-maturing cotton field in Bachu County in Kashi Prefecture. One could collect 1 kg of pupae by hand from the field in a day.

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We think that there were three major factors of the heavy occurrence in Xinjiang in 1996. The basic factor should be the dramatic increase in the cotton area and total yield (Sheng, 1993). Lint yield in this autonomy was 0.08, 0.19, 0.64, 0.68, 0.99 million tons in 1980, 1984, 1991, 1993 and 1995, respectively (Sheng, 1996b). The same yield as the previous season is expected for 1996 season, which will account for 1/4 of the national total. A second major factor would be that the growers did not spray insecticides for the bollworm, simply because they worried about the aphid problem. A lot of eggs and small worms escaped from killing by human beings --- the largest enemy of the bollworm (Sheng , King and Namken., 1994). A third major factor came from weather. There was a rainy season in the great desert. The rainfall during February to August in Kashi Prefecture was 120-180 mm, 3-4 fold of normal. Weather is a random factor although it is important (Sheng, 1993).

Control in 1996 - In search of the solutions, we presented the community-wide control strategy for the bollworm (Sheng, Tu and Guan, 1994). The major reasons for this strategy were that the large-scale control failures were related largely to incorrect application timing and backwardness of application methods rather than lack of new insecticides. The government plays an important or a critical role in IPM especially in a small crop owner country (Sheng and Xuan, 1996a). Fortunately, the Chinese government accepted this suggestion through the State Paper [1993] 70. Then, we demonstrated this strategy in Wenshang County, Shandong Province in 1993 and obtained excellent control of the pest (Sheng, King and Namken, 1994).

This strategy has several patterns or development levels depending largely on how well the local government performs its functions. The first level could be a unified technical guidance in an administrative division. At this level, the field operations are done by the individual growers. The second level could be organized actions carried out by a specially-grouped growers' team within the same administrative division. The third level could be achieved by a commercial company, or "crops hospital". This kind of companies made agreements with other parties needed .

Four growing seasons passed. This strategy has proven highly effective. In 1995 season, Community-wide unified control covered about 1/3 of the cotton acreage in the country. Control efficiency increased from about 50% in 1992 to 80% in 1995. Control cost decreased from US$ 150/ha in 1992 to US$ 110/ha in 1995. Cotton lint yield recovered from 660 kg/ha to 825 kg/ha (Sheng and Xuan, 1996b). In 1996, the application area was extended to 1/2 cotton acreage. A 50% of increment of the area in 1996 year was reported from Jiangsu Province. Most growers like this strategy.

Community-wide unified control also benefits many other parts. The extension organizations at the county level or below obtained some income from their technical service. Insecticides of inferior quality were largely reduced and the total amount of insecticides were reduced, too. New techniques including new designs of sprayers were much easier to put into use. The poisoning accidents were eliminated. In addition, the experience in bollworm control had a great impact on other pest control, even crop growing practices (Sheng, 1996d).

In 1996, 21 main cotton counties (with cotton acreage being over 20,000 ha each) were selected by the MOA (Ministry of Agriculture) to be pilot divisions to extend the industrially-based community-wide unified control. In this pilot area, compared to that in 1995, the number of sprays was requested to be reduced by 3 times. Control cost was decreased by 20%. None of poisoning accidents in bollworm control would happen (Sheng, 1997).

From the standpoint of "pure" technique, research progress in control measures was made in 1996. These measures included improved trapping with sex pheromone (Fan et al., 1996) and high voltage mercury lamp (Peng and Zhang, 1996). Bt solution was sprayed on a large scale (Wang 1996; Zhong, 1996). Transgenic Bt cotton was developed (Dong et al. 1996). *Trichogramma chilonis* Ishii was mass reared and released (Wu et al., 1996). Insecticide resistance continued to be monitored and managed (Li et al., 1996).

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Table 1. Number of cumulative eggs of 2nd generation bollworm sampled on 100 cotton plants (ca. 15-19 square meters) in North China Cotton Region in 1995 and 1996. (Data from the six Provincial Plant Protection Stations) (Sheng, 1997).

Province	Stations	Mean Cumulative No. of Eggs*	
		1995	1996
Hebei	13	2,085	870
Henan	11	791	241
Shandong	12	1,905	1,242
Shanxi	7	535	367
Shaanxi		?	425
Jiangsu	4	728	215
Anhui	2	798	360

* Second generation egg counts on 100 cotton plants (ca. 15-19 square meters) in North China Cotton Region in 1995 and 1996. Egg number averaged over 2-14 monitoring stations in a province. Data from seven provincial Plant Protection Stations.