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Cost and Changes of Cotton Insect Control in Mississippi 1992-1995

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Introduction

Controlling cotton pests has become a major cost in cotton production in the Midsouth. Mississippi has experienced increasing insect control costs during the last several years that may make changes in control approaches advisable. Control strategies for the future, especially area-wide activities such as boll weevil eradication, depend on these activities being favorable economically. To help make decisions about future

activities, some cost analyses are needed.

Analyses of insect control costs are complicated by the fact that the severity of any one pest species can change from year to year. For some species, these variations can be explained by severity of winter temperature and spring flooding conditions.

Information from the *Mississippi State Cooperative Extension Service Insect Newsletter* published each year illustrates the variations that occur from year to year. For example, a series of very mild winters experienced prior to 1995-96 winter might explain the severity of the insect attack during the 1995 season. The winter of 1991-92 was considered one of the mildest in the last 100 years. In late May of 1992, it was reported that the overwintered boll weevil captures were high in many counties. Again in 1993, boll weevil trap catches were high, averaging more than 500 per trap during a 2-week spring period in hill areas. In 1994, boll weevil trap captures were down from the previous year but still high enough to be a serious threat. Tarnished plant bug numbers were extremely high during the 1994 season and remained in cotton throughout the growing season. The 1995 growing season saw a low plant bug population that was very slow to develop in cotton. Boll weevil populations continued to be high during the 1995 season.

In 1995, the majority of the cotton acreage experienced heavy aphid infestations. Control failures were experienced with recommended insecticides. Furadan® was granted a Section 18 exemption on June 30 for aphid control. In many instances, aphid populations damaged cotton when not controlled.

Bollworms/tobacco budworm infestations during late June 1995 were considerably higher than the previous 2 years. Bollworm/budworm eggs and larvae are extremely difficult to find on cotton heavily infested with aphids. The worm situation the following week was somewhat in a lull and this continued throughout the state through the week of July 14. On July 21,1995, it was reported that low to extremely high egg counts were occurring throughout most of the state. Extremely heavy tobacco budworm pressure was experienced in much of the hill area during this time, with some fields sustaining more than 80 to 90 percent boll damage.

At the present time, insecticide resistance is present in tobacco budworm, plant bug, aphid, and beet armyworm populations. Repeated applications of insecticides made to control resistant insects is costly. Elzen (1992) documented that certain strains of tobacco budworms in Mississippi were resistant to pyrethroids, carbamates, and organophosphate insecticides. Elzen (1995) reported that the level of resistance of the tobacco budworm to pyrethroids appears to be increasing, with increasing tolerance to methomyl and thiodicarb.

Snodgrass (1994) documented resistance of the tarnished plant bug to pyrethroids. Snodgrass and Scott (1995) reported that pyrethroid resistance in plant bugs was widespread throughout the Midsouth. Levels of resistance increased from 57.7 percent in the spring to 84.7 percent in the fall. At the present time, Provado® is registered on cotton for aphid and plant bug control and effectively controls resistant plant bugs.

In 1997, we anticipate an EUP permit of Fipronil® for cotton. Fipronil is also very effective in controlling boll weevils and resistant plant bugs (Scott et. al. 1996).

Pirate® insecticide may be available to Mississippi cotton producers under a Section 18 exemption by EPA for emergency uses against tobacco budworm and beet armyworm. Other promising insecticides for resistant tobacco budworm control will be available for 2 or more years. This report attempts to collect information associated with increased cost of controlling cotton insects during the last several years.

Materials and Methods

Sampling procedures were developed by Mississippi Agricultural Statistics, an affiliate of the National Statistics Service (NASS). Personal interviews of cotton producers were chosen as the means of data collection in 1992. The questionnaire was designed to collect information on the class and rate of each insecticide used and method of application. Four hundred-eighty usable questionnaires were received statewide in 1992 from the survey.

Because of the high cost of personal interviews, the survey was mailed to producers statewide in 1993, and responses were strictly voluntary. Recipients returned only 138 questionnaires in 1993, which accounted for 10.3 percent of the harvested acres. This was considered to be an unreliable sample and these data are not reported.

The number of Boll Weevil Management Districts was reduced from six to four in 1994 and 1995. Data collected in 1992 will be reported by district and the term "district" will be used. Data collected in 1994 and 1995 will be reported by zone and the term "zone" will be used (see Figures 1 and 2.) A survey using personal interviews was chosen as the method of data collection in both years. A list of producers was obtained from ASCS offices in each county included in the survey.

Two hundred forty-five usable questionnaires were obtained in 1994 -- 107 in the South Delta, Zone II, and 138 in the North Delta, Zone I. Usable interviews were obtained from 131 producers in the Delta area (Zones I and II) in 1995. Interviews with 187 producers were obtained in Zones III and IV. Data obtained for each region in both 1994 and 1995 were expanded to include average insect cost for all acreage in each region in addition to the information obtained in 1992.

In 1992 and 1994, farmers interviewed were asked to select one field on their farm that in their judgment was representative of the insect control for that farm and that year.

In 1995, farmers were asked to give data on one field severely damaged by tobacco budworm infestations and one field that was less severely damaged. In the Delta, since no severely damaged fields were reported, those farmers were asked to select a field representative of the farm. All data reported in this study were weighted by the acres in the field reported by the farmer in 1995.

Results

Mississippi was divided into six boll weevil management districts in 1992. The districts were delineated by the Mississippi Boll Weevil Technical Advisory Committee and approved by the Mississippi Boll Weevil Management Corporation (Figure 1).

1992

The North Delta (District I) had the lowest boll weevil control cost in Mississippi (Table 1) in 1992. Total expenditures for boll weevil control in Districts II - VI strongly indicate that the boll weevil had established itself to become a widespread problem throughout the majority of the state. Organophosphates were the most widely used insecticides statewide for boll weevil control, but pyrethroids were used to some degree for boll weevil control and were used against multiple pests in all districts (Table 2). District III in the South Delta showed the highest pyrethroid use against boll weevil.

The cost of controlling bollworm/tobacco budworm was the highest in the North Delta, followed in descending order by District III (South Delta), Districts VI, II, V, and IV (Table 3). Pyrethroids and organophosphates were the materials of choice for bollworm/tobacco budworm control throughout the state in 1992 (Table 4). Combined usage of organophosphate and carbamate insecticides were less than total pyrethroid use statewide. The highest use of pyrethroids was in Districts II, IV, and V in 1992.

Organophosphates were the material of choice for aphid control (Table 5). Pyrethroids were used quite extensively on aphid populations in Districts II, IV, and VI.

The percent of insect control expenditure partitioned for boll weevil, bollworm, tobacco budworm, and other pests is shown in Table 6. The highest expenditures were for bollworm and tobacco budworm throughout the state. These data indicate that the boll weevil was a problem statewide in 1992. The total cost to control all cotton pests in 1992 is shown in Table 7 for each district. The highest expenditures were in Districts I and III (Delta districts).

1994

Zones I and II of the Mississippi Delta were the only areas surveyed in 1994. There were important differences between the 1992 and 1994 studies. The 1992 study covered the entire state (six districts). District boundaries were redrawn prior to the 1994 survey, resulting in only four zones (Figure 2). The North Delta was designated as Zone I and District I both years. The South Delta included the hill portion of Holmes and Yazoo counties designated as District III in the 1992 study. This area became Zone II in 1994, but did not include the hill areas of Holmes and Yazoo Counties.

Average insect control in Zone 1 (North Delta) are shown in Table 8. The same information for the South Delta is presented in Table 9. When comparing the costs with those of 1992, an increase in control cost for boll weevil occurred in both districts. The increase was probably because of high boll weevil survival over the mild winters experienced between 1992 and 1994. The 1994 cost for controlling bollworm/tobacco budworm was lower than in 1992. Control costs for aphids, tarnished plant bugs, and thrips showed large increases in 1994. Costs associated with these pests almost doubled from 1992 to 1994. The total cost of insect control showed a slight increase in 1994 in the North Delta, $96.29 as compared to $91.25 in 1992. Total insect cost for the South Delta increased significantly from $87.16 in 1992 to $107.05 per acre in 1994.

1995

Boll weevil control costs in 1995 (Table 10) for the Delta (Zones I and II) were lower than the average for the two Delta zones in 1994 (Table 8 and 9). Bollworm/tobacco budworm cost was slightly lower in the Delta in 1995 than 1994. The average cost of Delta cotton insect control in 1995 (Table 10) was $108.76 per acre.

Additional funding from the Mississippi Agricultural and Forestry Experiment Station was made available to extend surveys on possible causes and costs related to the 1995 *Heliothis virescens* outbreak in the hill areas of Mississippi. Therefore, 1995 control costs are presented for Zone III north of Interstate 20 and Zone IV (current eradication zone). Control costs for major insect pests and total insect control for Zone III are presented in Table 11. Boll weevil cost in 1995 was $24.12 per acre and cost of controlling bollworm/tobacco budworm averaged $84.20 per acre. This is a considerably higher cost of bollworm/tobacco budworm control than previously reported for this area of the state (Beltwide Cotton Conference Proceedings, 1980-1995).

The boll weevil cost in Zone IV represents projected eradication cost, with a few additional costs associated with other materials for the boll weevil. Cost for controlling the bollworm and budworm for Zone IV in 1995 was $104.96 per acre, which is also considerably higher than it has been in Zone IV area of the state, reported previously (Beltwide Cotton Conference Proceedings, 1980-1995).

Inflation in costs of commonly used insecticides is shown in Table 12. The largest increase of any one insecticide over the 6-year period was for Vydate®. The price of 1 pound of active ingredient (AI) more than doubled from 1990 to 1996. The price of pyrethroids also increased considerably during this time.

Conclusion

Cotton insect control costs observed in the 1992 survey showed higher costs in the two Delta districts than in the four hill districts. The higher Delta cost was particularly applicable to bollworm/tobacco budworm control costs.

Boll weevil control cost was much lower in the North Delta, District I, in 1992 than in other areas, including the South Delta, District III. District III and District VI boll weevil control costs were similar in 1992, and were lower than other hill areas (Districts II, IV, and V).

Total cotton insect control costs for all areas surveyed in 1994 and 1995 were higher than costs observed in 1992. Hill areas of Mississippi surveyed in 1995 showed higher total cotton insect control cost than Delta

areas. These data are the first ever to show hill cotton insect control costs greater than those in the Mississippi Delta.

Many factors have contributed to inflation of insect control costs between 1992 and 1995. The most important factors probably are (1) a series of mild winters, which have favored overwinter survival of insect pests, especially boll weevil, and (2) increased levels of insecticide resistance in the tobacco budworm.

Other factors known to have contributed to the cost increase between 1992 and 1995 are inflation of insecticide prices and repeated insecticide applications made to resistant insect populations other than the tobacco budworm (tarnished plant bug, aphid, and beet armyworm) (Stennis, 1991; Lee, 1994).

Other factors that are suspected, but which are difficult to qualify, are crop management practices that affect earliness of crop development, insect pest management practices relative to selection of insecticide chemistry and timing of applications, and extent of use and level of competence of scouting and professional entomology service.

Higher cotton insect control costs in 1995 in the hills of Mississippi than in the Delta were particularly significant because they represent a much greater increase in 1995 for the hills, relative to previous years, than was seen in the Delta. The cause of this increase in the hills is being investigated through an intensive survey being conducted by the Mississippi Agricultural and Forestry Experiment Station. Determination of whether the Boll Weevil Eradication Program in Zone IV contributed to the tobacco budworm outbreak is one objective of that survey.

Boll weevil eradication remains an important issue for Mississippi cotton producers in spite of questions about its impact on secondary pest infestations. Inflationary trends in cost of boll weevil control will probably continue. Thus, the value of boll weevil eradication will increase each year after it is achieved, especially for the South Delta and all hill areas. The North Delta zone has lower boll weevil control costs so the value of eradication is less. Therefore, the North Delta may require an eradication plan that prepares for and uses the boll weevil suppression effects of a harsh winter.

Transgenic Bt cotton varieties will reduce insecticide use for bollworm/tobacco budworm control and may result in increased boll weevil infestations. The importance of boll weevil eradication will increase statewide as the transgenic Bt cottons are adopted by growers and planted in large acreages.

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References

Elzen, G.W., B.P. Leonard, J.B. Graves, E. Burris, and S. Micinski. 1992. Resistance to pyrethroid, carbamate, and organophosphate insecticides in field populations of tobacco budworm (Lepidoptera: Noctuidae) in 1990. J. Econ. Entomol. 85: 2064-2072.

Elzen, G.W. 1996. Changes in tolerance to insecticides in tobacco budworm populations. *In* 1996 Proceedings Beltwide Cotton Prod. Conf., Nashville, TN (In Press).

Lee, John E., et al. 1994. Cotton 1995 planning budgets. MSU, MAFES/MCES, Agricultural Economics Report 65.

Snodgrass, G.L. 1996. Insecticide resistance in field populations of the tarnished plant bug (Heteroptera:

Miridae) in cotton in the Mississippi Delta. Journal of Econ. Entomol. (In Press).

Snodgrass, G.L., W.P. Scott. 1996. Seasonal changes in pyrethroid resistance in tarnished plant bug populations in the Mississippi Delta. *In* 1996 Proceedings of Beltwide Cotton Prod. Conf. Nashville, TN (In Press).

Scott, W.P., G.L. Snodgrass, and D.A. Adams. 1996. Mortality of tarnished plant bug and boll weevils to Provado® and different formulations of fipronil. In 1996 Proceedings of Beltwide Cotton Prod. Conf. Nashville, TN (In Press).

Stennis, Earl A., et al. 1991. Cotton 1992 planning budgets. MSU, MAFES/MCES, Agricultural Economics Report 44.