COST OF COTTON INSECT CONTROL IN THE MISSISSIPPI DELTA IN 1992, 1994, AND 1995

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Introduction

Controlling cotton insect 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 temperatures 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 the 1995 production season might explain the severity of the insect attack which occurred. The winter of 1991-1992 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 two-week spring period in Hill areas. In 1994, boll weevil trap captures were less than 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 a problem 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.

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At the present time, insecticide resistance is present in tobacco budworm, plant bug, aphid and beet armyworm populations. Repeated applications of insecticides for control of resistant insects is costly. Elzen (1992) documented that certain strains of the tobacco budworm in Mississippi were resistant to pyrethroids, carbamates, and organophosphate insecticides. Elzen (1996) reported that the level of resistance of the tobacco budworm to pyrethroids appears to be increasing with increasing tolerance to methomyl and thiodicarb. Snodgrass (1996) documented resistance of the tarnished plant bug to pyrethroids. Snodgrass and Scott (1996) 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 1998 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 may not be available for two or more years. This report attempts to collect information associated with increased cost of controlling cotton insects during 1992, 1994, and 1995.

Materials and Methods

Sampling procedures in 1992 were developed by Mississippi Agricultural Statistics, an affiliate of the National Agricultural 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 state-wide in 1992 from the survey. The survey was mailed to producers statewide in 1993 due to the high cost of personal interviews, and responses were strictly voluntary. Recipients returned only 138 questionnaires in 1993, which accounted for 10.3 percent of the harvested acres and was considered to be an unreliable sample. Thus, 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. While state-wide surveys were conducted in 1992 and 1995, no data for the Hill areas of Mississippi are reported in this paper.

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 a lower boll weevil cost than the South Delta in 1992 (Table 1), and the lowest boll weevil control cost in Mississippi in 1992. Organophosphates were the most widely used insecticides for boll weevil control, but pyrethroids were used to some degree for boll weevil control where targeting multiple pests in both districts. District III in the South Delta showed the highest pyrethroid use against boll weevil (Scott, Cooke, et al 1996).

The cost of controlling bollworm/tobacco budworm was the highest in the North Delta, followed by South Delta (District III), Table 2. Pyrethroids and organophosphates were the materials of choice for bollworm/tobacco budworm control in 1992.

The percent of insect control expenditure partitioned for boll weevil, bollworm, tobacco budworm, and other pests is shown in Table 3. The highest expenditures were for bollworm and tobacco budworm throughout the Delta. These data indicate that the boll weevil was a problem in 1992. The total cost to control all cotton pests in 1992 is shown for Districts I and III in Table 4.

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 costs in North Delta (Zone I) are shown in Table 5. The same information for the South Delta is presented in Table 6. When comparing the 1994 costs with those of 1992, an increase in control cost for boll weevil occurred in both districts. The increase was probably due to high boll weevil survival over the mild winters of 1992 and 1993. The 1994 cost for controlling bollworm/tobacco budworm was lower than in 1992. Control costs for aphid, tarnished plant bug and thrips showed large increases in 1994 as compared to 1992. 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 $91.05 in 1992. Total insect cost for the South Delta increased significantly from $86.42 in 1992 to $107.50 per acre in 1994.

1995: Boll weevil control costs in 1995 (Table 7) for the Delta (Zones I and II) were lower than the average for the two Delta zones in 1994 (Tables 5 and 6). 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 7) was $108.76.

Inflation in costs of commonly used insecticides is shown in Table 8. The largest increase of any one insecticide over the six-year period was Vydate. The price of 1 lb AI more than doubled from 1990-1996. 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.

Total cotton insect control costs for all areas surveyed in 1994 and 1995 were higher than costs observed in 1992.

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. 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 quantify, 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 services.

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 the 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 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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Table 1. Cost of boll weevil control by district, 1992.

District	Material Costs	Application Costs	Total Costs
	Dollars/Acre		
I	5.14	3.39	8.53
III	11.93	7.76	19.69

Table 2. Cost of bollworm/tobacco budworm control by district, 1992.

District	Material Costs	Application Costs	Total Costs
	Dollars/Acre		
I	56.42	12.39	68.81
III	43.41	10.57	53.98

Table 3. Percent of expenditures attributed to control of boll weevil, bollworm/tobacco budworm and other insects, 1992.

District	Material Costs	Application Costs	Total Costs
	Dollars/Acre		
I	9.37	75.57	15.06
III	22.78	62.46	14.98

Table 4. Cost of control of all insects by district, 1992.

District	Material Costs	Application Costs	Total Costs
	Dollars/Acre		
I	71.57	19.48	91.05
III	63.63	22.80	86.42

Table 5. Average insect control costs for all acres of target insect, Zone 1 (North Delta), 1994.

Target Insect	Material Costs	Application Costs	Total Costs
	Dollars/Acre		
Boll Weevil	9.02	4.40	13.42
Aphids	3.98	1.35	5.33
White Fly	.14	.04	.17
Cut Worm	1.79	.43	2.23
Beet Armyworm	4.84	.96	5.80
Loopers	.62	.14	.76
Tarnished Plant Bug	5.99	2.73	8.72
Bollworm/ TBW	39.50	9.10	48.60
Thirps	6.24	4.03	10.27
Fall Armyworm	.64	.11	.75
Other	.19	.04	.23
Total	72.95	23.34	96.29

Table 6. Average insect control costs for all acres of target insect, Zone 2 (South Delta), 1994.

Target Insect	Material Costs	Application Costs	Total Costs
	Dollars/Acre		
Boll Weevil	15.22	10.72	25.94
Aphids	1.07	0.45	1.53
White Fly	0.04	0.02	0.06
Cut Worm	4.82	1.47	6.30
Beet Armyworm	8.10	1.69	9.79
Loopers	0.68	0.15	0.83
Tarnished Plant Bug	7.80	2.84	10.65
Bollworm/ TBW	32.35	8.34	40.69
Thrips	6.14	3.60	9.74
Fall Armyworm	0.81	0.21	1.02
Other	0.67	0.29	0.96
Total	77.73	29.78	107.50

Table 7. Average insect control costs, 1995, Zones 1 and 2.

Target Insect	Material Costs	Application Costs	Total Costs
	Dollars/Acre		
Aphids	6.52	2.39	8.91
Beet Armyworm, Fall armyworm	2.92	.40	3.32
Boll weevil	6.02	3.72	9.74
Bollworm	6.47	1.26	7.73
Plant bugs, fleahoppers, lygusbugs	4.29	1.80	6.09
Spider mites	.32	.06	0.38
Budworm	51.90	8.56	60.46
Thrips	10.24	1.17	11.41
Other	.62	.10	0.72
Total	89.30	19.46	108.76

Table 8. Price of 1 lb/AI of commonly used insecticides for cotton insect control, 1990-1995.

Insecticide	Class*	1990	1991	1992	1993	1994	1995
		Dollars/Pound AI					
Dimethoate	OP	6.80	6.93	6.68	6.58	6.44	6.37
M. Para.	OP	4.18	4.15	4.74	5.34	5.66	5.85
Vydate	C	14.70	14.06	16.50	17.96	31.78	29.97
Bidrin	OP	8.14	8.74	9.24	9.76	9.62	10.82
Orthene	OP	8.07	7.55	7.97	8.71	9.36	9.72
Larvin	C	13.76	13.94	13.89	14.25	14.47	14.77
Lannate	C	17.89	21.39	24.60	24.39	25.34	25.18
Curacron	OP	12.73	9.65	10.27	11.40	11.33	11.39
Bolstar	OP	7.91	8.41	9.13	9.66	9.72	10.28
Karate	P	174.64	187.90	208.70	220.88	226.87	223.14
Baythroid	P	154.17	166.31	184.98	193.28	198.19	198.83
Scout	P	238.04	260.13	283.65	299.18	304.20	301.11
Asana	P	142.22	152.53	166.80	178.86	183.90	185.54
Temik	C	17.38	17.61	18.40	19.60	19.68	20.31

*P = Pyrethroid
OP = Organophosphate
OC/OP = Organochlorine/Organophosphate
C = Carbamate
BT = Biologicals

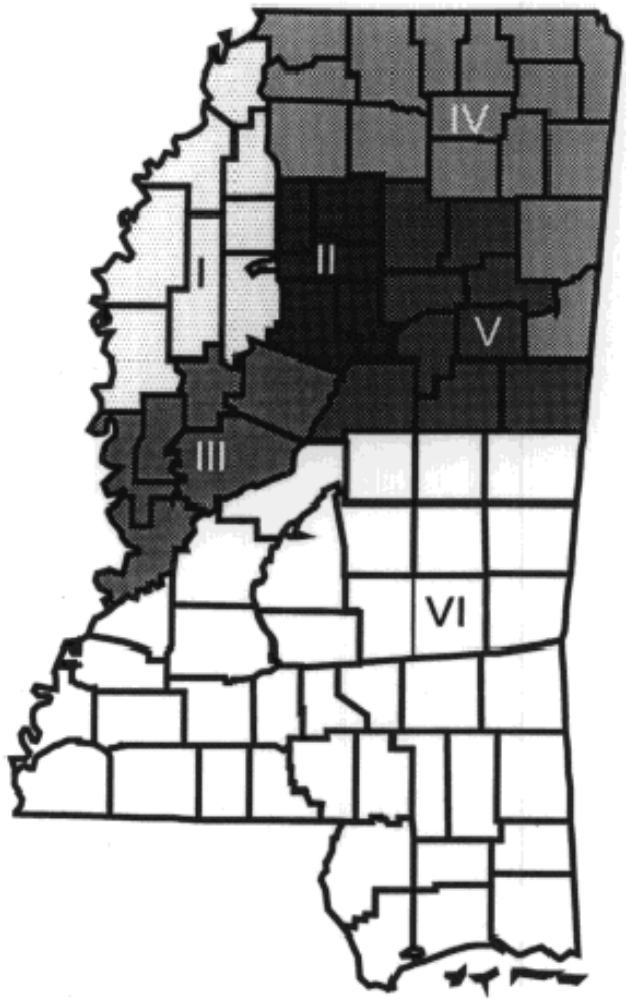

Figure 1. Boll weevil management districts in 1992. Miss. Boll Weevil Management Corporation.

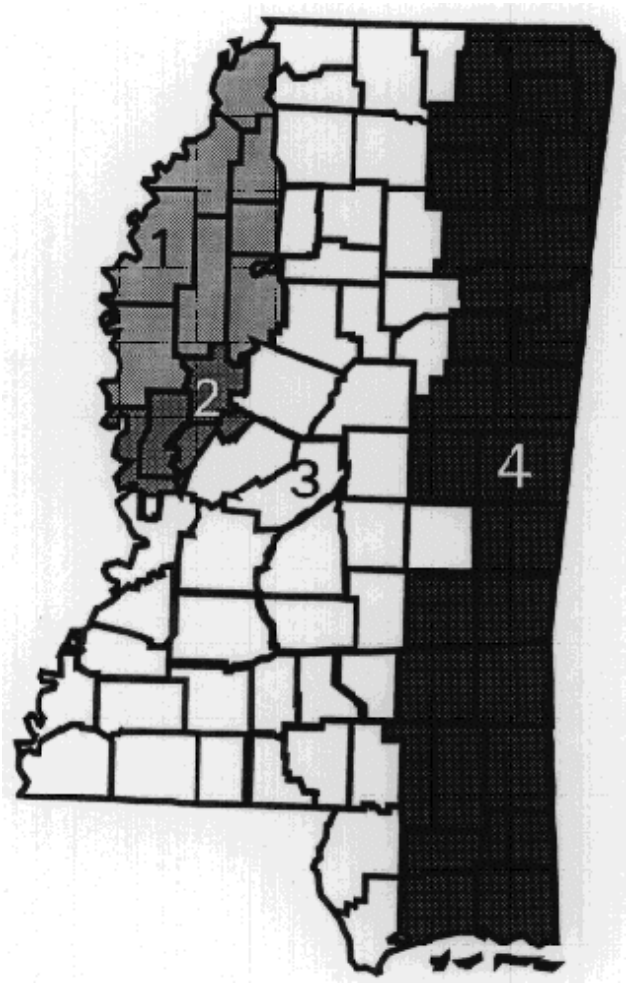

Figure 2. Boll weevil eradication zone (APHIS)