BOLL WEEVIL STATUS IN THE TEXAS HIGH PLAINS

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Abstract

In 1992, the boll weevil invaded the Texas High Plains cotton production region for the 3rd time since it entered the United States 100 years earlier. This latest incursion has resulted in the spread of the boll weevil into all areas of the High Plains. The fall suppression program, which was initiated in 1964 to check the 1st boll weevil invasion, has been unable to stop this latest foray due to its enormity and the limited program funds available to address it. It is thought that five consecutive mild winters coupled with greatly expanded overwintering sites in the form of CRP grasses has been largely responsible for this latest boll weevil problem. In spite of increased funding obtained under the Texas Boll Weevil Eradication Foundation, the spread of the boll weevil across the area has at best been slowed. A pending decision by the Texas Supreme Court and the ongoing recall effort threaten the future of the present eradication effort in the High Plains of Texas. Cold winter weather or summer drought might dramatically suppress weevil numbers in a given year, however, the boll weevil has become a resident pest of the area.

Introduction

The boll weevil entered the United States near Brownsville, Texas in 1892. During the next 20 years the boll weevil spread rapidly across much of the southern cotton belt (Hunter and Pierce, 1912). Movement westward occurred at a much slower rate because of drier climatic conditions. By 1906, the western limit of the boll weevil was defined by a line extending northeastward from near Del Rio across central Texas into southern Oklahoma. While the boll weevil quickly became an economic pest throughout the southern states, cotton production in west Texas did not at first appear to be threatened. Each year, an inflow of boll weevils into the western and northern regions occurred as the result of late season movement. And each year, weevils failed to become established. A dry climate, high elevation, harsh winters and comparatively scarce overwintering sites were often cited as reasons for the failure of the weevil to become established in the Llano Estacado cotton production region (Pierce 1913, Hunter 1914). It was the opinion of some entomologists at the time that the boll weevil had reached the limit of northern and westward expansion. It was reported that in 1906, boll weevil infestations north of Dallas appeared to have been eliminated by extremely cold temperatures during February, 1905. It is now clear that the gradual northward and westward expansion of the boll weevil continued as the species gradually adapted to drier and colder conditions.

First Invasion

W. L. Owen Jr., a former Experiment Station entomologist at Lubbock, reported that in 1936, isolated infestations of boll weevils were observed in the Rolling Plains counties which bordered the Texas High Plains. However, these infestations did not persist into the next year. Localized but damaging infestations were found in Collingsworth County, in the southeastern Texas Panhandle in 1952 (J. C. Gaines, personal communication) and damaging weevil infestations were observed in Presidio, Texas in 1953 (Robertson 1957). The boll weevil did not reach the eastern edge of the Texas High Plains until 1959.

The first confirmed boll weevil infestations on the Texas High Plains were found in Crosby and Dickens counties in the fall of 1959 by the Dickens County Extension Agent, R. S. Conner. By 1961, damaging infestations of boll weevils were found in some fields above the Caprock along the eastern edge of the High Plains. The Llano Estacado cotton production region could no longer be considered a safe haven for cotton growers escaping the ravages of the boll weevil to the east. In 1961, damaging boll weevil infestations were found in some fields above the Caprock in the eastern portions of Briscoe, Floyd, and Crosby counties. Surveys conducted in the fall of 1963 revealed heavy boll weevil infestations extending along the eastern edge of the High Plains with scattered infestations reaching almost to the Lubbock County line.

In 1964, a cooperative boll weevil suppression program was initiated by Plains Cotton Growers, Inc. The objective of the program was to stop the westward spread of the boll weevil and prevent its establishment as an economic pest in the High Plains by suppressing the fall population before weevils could move to overwintering sites. The program was financed through a voluntary assessment of a maximum of $.50 a bale, collected at the compress. A series treatments were to be made in a broad area along the margin of the Texas High Plains and Rolling Plains. These treatments would consist of 12 ounces of ULV malathion applied every 7 to 10 days beginning when diapausing weevils began appearing in the population and continued until a killing frost eliminated the boll weevil's food supply. The 1964 program treated 295,000 acres in an eight county area at a cost of $1,728,777 (Table 1). As many as 5 applications were made in the early years and the boll weevil was almost eliminated from the area. By 1967, program acreage was down to 90,000 acres and the number of applications had been reduced to 3-4 per treated acre.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1201-1205 (1997)
National Cotton Council, Memphis TN

Second Invasion

From 1967 to 1969, the boll weevil greatly expanded its geographical range westward. Even though most infestations in the newly infested area were generally light, this second invasion of the High Plains demonstrated that boll weevils could survive in the semiarid cotton production region (Bottrell et al. 1972). During the period of 1968 through 1970, the boll weevil expanded its range westward and northward into the substantial cotton acreage of Garza, Borden, Dawson, Lynn, Andrews and Gaines counties. These counties were included in the control zone. Program finances were limited and not adequate to deal with this latest threat to the High Plains cotton industry. It was necessary to treat fields on a selective basis by concentrating applications in the infested areas to the west and north.

In 1970, program acreage expanded to 360,325 acres at a cost of $1,234,855; a doubling of the cost of the previous 3 program years. In so doing, acreage in the original control zone along the margin of the Texas High Plains and Rolling Plains was not treated adequately and overwintering boll weevil numbers within the control zone were not that different from those outside the control zone when evaluated in January, 1970 and January, 1971 (D. R. Rummel, unpublished data). However, by February, 1972, the return of harsh winters and a successful suppression program finally reduced the infested area and the boundaries of the control zone were stabilized.

During the period from 1971 to 1976, an average of 178,366 acres were treated each year. From 1977 to 1987 the size of the control zone remained relatively stable with treated acreage fluctuating between a low of 15,040 in 1980 and a high of 437,118 acres in 1977. The fluctuations in the size of the boll weevil population and subsequent program acreage was attributed to the overall program effectiveness and the degree of boll weevil mortality occurring during the winter months and summer period preceding a given program year. Evaluations of the effectiveness of the control program have been conducted by the Texas A&M University System since its inception in 1964. Program suppression has ranged from 65 to 98 percent, averaging 82% during the thirty-three years the control zone has been in place.

Third Invasion

A 3rd invasion started in 1992, as boll weevils spread dramatically into the southern and western counties of the High Plains. By 1993, some producers in Dawson, Gaines and Terry counties were applying in-season and late season insecticide treatments for the first time in the history of High Plains cotton production. By 1994, treatment for emerging overwintered boll weevils was necessary in many fields. In newly infested areas, late season boll weevil infestations were generally widespread and heavy. Infested acreage ballooned from 180,000 acres in 1993 to 1.1 million acres by the end of 1994 (M. R. Williams 1994, 1995). The recent boll weevil incursion is believed to be a product of several factors including: 1) the introduction of a large acreage of overwintering sites in the form of Conservation Reserve Program (CRP) grasses, 2) five consecutive mild winters, 3) higher summer survival in the more abundant irrigated acreage of the High Plains and 4) insufficient financial resources to treat the expanding weevil infested acreage during the 1992-1994 period.

By 1993, the cost of the fall suppression program had increased to $3.7 million. With an assessed cotton acreage less than 3.5 million acres and a maximum assessment of $0.50 per bale, annual program funds were limited to approximately $1.75 million dollars in a good production year.

Because of the growing threat of the boll weevil to the High Plains, increased funding for the existing fall suppression program was sought and obtained through a referendum conducted under the Texas Boll Weevil Eradication Foundation. There was a real sense of urgency on the part of Plains Cotton Growers, Inc. to halt the further spread of the boll weevil. The continued infestation expansion meant increased economic impact to growers and the real concern that an eradication program would end up costing too much by the time it could be implemented in 1998. The referendum passed in the spring of 1995, following a series of educational meetings conducted by the Texas Agricultural Extension Service. The two referenda established an eradication zone and set a maximum assessment. The zone encompassed 31 counties bordered on the north by Deaf Smith and Armstrong counties, and to the south by Ector and Glasscock counties. Assessments were to vary according to the level of risk associated with the acreage. Three assessment zones were established from north to south. Cotton producers in all zones were to be assessed $1.25 per cotton acre. The middle zone producers were also to be assessed 0.75¢ per pound of lint based on their 1985 yields. Southern zone producers were to pay 1.25¢ per pound. The increased funding was to be used to enhance the existing diapause program for the 3 years preceding the start of full scale eradication. It was hoped that the eventual eradication program size could be reduced to 500,000 acres or less by 1998.

The boll weevil infested area had expanded to 2.3 million acres by the late summer of 1995, and over 5 million aggregate acres of cotton were treated in the enhanced fall diapause program at a cost of $12.2 million. During the 1995 growing season, approximately 650,000 acres of boll weevil infested cotton required treatment by growers at a cost of $20.8 million (Table 2). Yield losses of almost 121,000 bales were still incurred.

In spite of the expanded control program and the first fairly harsh winter in six years (Table 3), light to moderate

overwintered boll weevil infestations were present during the spring-early summer period of 1996. Trap catches of emerging overwintered boll weevils in 1996 were reduced by 67.2% over those measured in 1995 (Table 4). However, overwintered boll weevils were able to increase rapidly in irrigated cotton and infestations ranging from very light to heavy were present during the fall of 1996. The 1996 control program treated approximately 3 million aggregate acres. However, program funds again limited treatments to 2 full applications and a partial third at a cost of $8.5 million. The pending Hale County lawsuit in the Texas Supreme Court and the ongoing referendum recall effort appeared to influence many growers to withhold their assessment payment. Only because of some federal funds and through the use of limited boll weevil control program reserve funds accumulated from pre-referendum programs, was Plains Cotton Growers, Inc. able to put together any kind of control effort for 1996. Even so, the 1996 program fell short of the kind of program needed to attain stated objectives.

By the end of 1996, the number of boll weevils captured in traps had increased 39.2% over those captured in traps by the end of the 1995 growing season (Table 5). Acreage infested amounted to 1.9 million acres, down from last year, but only because overall cotton acreage was down too. Producers treated approximately 553,000 acres at a cost of $12.8 million. Control costs were down from 1995 due mainly to the late appearance of damaging weevils in most cotton fields. A harsher winter and successful diapause program were undoubtedly the reasons for this reduction. Yield losses were still almost as high as those incurred in 1995, totaling 110,000 bales.

The boll weevil now appears to be firmly established in much of the High Plains cotton acreage. Infestations are heaviest in the eastern and southern counties and decrease in intensity to the northwest (Table 6). The future expansion and severity of the boll weevil infestation in the Texas High Plains cannot be predicted with any kind of certainty. To do so would require a better knowledge of overwintering habitat in the High Plains, a better understanding of the role of CRP grasses as an overwintering site, and to be able to predict long range weather patterns. However, a historical review of boll weevil movement into the area and a review of available data should provide some insight into what can be expected.

Sterling and Adkisson (1966) reported that boll weevils along the boundary of the Texas High Plains entered diapause considerably earlier in the fall and in greater percentages than those in central Texas. These studies indicated that the boll weevil was adapting to the High Plains area and a more cold hardy strain was developing. Recent documentation of overwintering boll weevil survival in some of the most northern cotton producing counties supports these earlier conclusions.

Carroll et al. (1993) documented winter survival of boll weevils in CRP grasses in the Texas High Plains and concluded that economically damaging infestations might develop following mild winters. A series of five consecutive mild winters beginning in 1990 marked a dramatic spread of boll weevils into the area. The presence of a large acreage of CRP grasses is believed to have greatly enhanced the establishment of boll weevils in previously uninfested areas of the High Plains. Trapping studies conducted in the fall of 1995 clearly demonstrated the role of CRP grasses as a boll weevil overwintering site (Table 7). The removal of the insulating layer of thatch from CRP fields through burning and the resulting reduction in boll weevil trap catches further demonstrated the importance of CRP grasses as an overwintering site (Table 8).

It is evident that the boll weevil also utilizes other types of vegetation for winter survival in the High Plains area. Shinnery oak, mesquite-grass pastures, fence rows, abandoned farmsteads, railroad right-of-ways and even ornamental vegetation in towns are utilized by diapausing weevils for winter protection. Natural waterways which drain the High Plains area, such as Yellow House Canyon and Running Water Draw, support natural vegetation which serves as overwintering sites for the boll weevil. These same draws, which run from northwest to southeast, appear to act as flyways for weevil movement during the growing season. Trap activity adjacent to these draws, even where vegetation is scarce, is generally higher both early season and late in the season (unpublished data).

During 1996, overwintered boll weevils were detected in most of the High Plains area, although infestations were more concentrated and at lower levels than observed in 1995. Most of these early infestations were associated with the better overwintering sites and areas that were not sprayed in the fall diapause program of 1995. By late summer, economic infestations had extended northward into some areas of Hale, Lamb and Bailey counties. Because of the large acreage of irrigated cotton in the area, small overwintered boll weevil populations were able to increase dramatically during the growing season.

Boll weevils began moving into eastern New Mexico in large numbers during the fall of 1995. By 1996, the boll weevil had become established in several areas and was beginning to cause economic damage in some fields. This movement into New Mexico has been greatest in the Lea County area and has prompted growers in that region to begin to put together a boll weevil control program.

A series of harsh winters would no doubt significantly suppress weevil numbers and slow the spread of the boll weevil in the Texas High Plains. However, it is unlikely that harsh winter weather alone would eliminate the weevil population. The history of boll weevil movement into new areas of the cotton belt would indicate that infestations will continue to be a problem in the Texas High Plains area and

could continue to spread and increase in severity. Weather conditions during the winter and summer will ultimately mediate weevil population levels. But the history of the boll weevil in this country indicates that once an area is infested, only through man's intervention is it eliminated.

What's in the Future ?

The resolution of the Hale County lawsuit by the Texas Supreme Court could go a long way in paving a smoother road to the eventual elimination of the boll weevil as an economic pest of the High Plains cotton production region. A referendum recall effort also casts a cloud over the future of the eradication effort in the High Plains. Until the issues that have caused dissension amongst growers of the region are settled, there will continue to be problems associated with the eradication effort. Hopefully, the late winter release of a report on the economic impact of the boll weevil on the cotton production of the High Plains of Texas will provide the information needed to make sound decisions on the boll weevil problem.

There is a real need for a harsh winter similar to that of 1983/84, when overwintering boll weevil survival fell below 1 percent. This could go a long way toward eliminating the weevil from the High Plains. Studies continue to evaluate different overwintering habitats and to map out survival and emergence of overwintered weevils in 1997. Dig-up cage studies conducted by Don Rummel with the Texas Agricultural Experiment Station at Lubbock will provide the means of updating growers on the current level of boll weevil survival without having to wait until the end of the emergence period. As of December 19th, dig-up cages indicate that overwintering boll weevil numbers have been reduced by 90% in a mesquite-grass pasture site at Lubbock. Better overwintering sites or different temperatures either north or south of Lubbock could produce different results than these.

There is still a need to develop and promote individual grower management tactics, especially if the eradication program stalls. While some CRP acreage will voluntarily come out of the program, there is still a need to burn existing CRP grass fields as a means of both killing overwintering boll weevils outright and in eliminating these fields as overwintering sites for the following couple of years. Further studies are needed to more clearly define the role of CRP grasses as overwintering sites and the value of burning as a management tactic.

Regardless of the legal outcome in the Texas Supreme Court or the success of the recall effort, and regardless of the severity of this winter's weather, the boll weevil has already had a significant impact on the economy of the High Plains region and has drastically altered the way many producers manage their cotton crop. And the boll weevil, more than any other issue, has deeply polarized the agricultural community. On one point there can be no doubt. The boll weevil is no longer just looking for a home in the High Plains area, it has found a home!

Acknowledgments

The authors would like to thank the Boll Weevil Steering Committee of Plains Cotton Growers, Inc. for their financial support of the diapause boll weevil control program evaluation, overwintering studies of CRP grasses and the Grid Trapping Program. Special thanks is extended to all of those in the AgriPartners program that assisted in collecting data. We greatly appreciate Don R. Rummel for his insightful views of the boll weevil situation in the Texas High Plains and his assistance in preparing this report.

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Table 1. Texas High Plains Boll Weevil Diapause Control Program statistics

Year	Base acreage treated	Aggregate acreage treated	Total program cost
1964	295,000	1,136,665	$1,728,777
1965	250,000	1,512,548	$1,746,779
1966	190,000	1,020,225	$1,034,461
1967	90,000	501,024	$590,839
1968	168,000	616,929	$689,367
1969	241,094	768,792	$788,373
1970	360,325	1,170,002	$1,234,855
1971	133,232	379,544	$518,569
1972	185,921	514,131	$650,401
1973	222,505	652,279	$826,256
1974	177,300	591,107	$817,536
1975	219,000	739,521	$1,143,120
1976	351,022	1,161,556	$1,685,073
1977	437,118	1,257,620	$1,872,607
1978	281,500	664,789	$1,153,891
1979	32,479	37,550	$381,495
1980	15,040	17,445	$410,058
1981	43,040	78,926	$530,362
1982	164,710	457,242	$1,381,084
1983	198,610	548,385	$1,665,710
1984	32,500	49,647	$444,977
1985	97,380	233,737	$941,259
1986	109,259	325,638	$1,125,125
1987	224,908	615,008	$1,839,766
1988	270,144	663,311	$1,952,393
1989	132,509	240,416	$1,153,102
1990	57,168	114,265	$823,410
1991	111,986	224,264	$1,023,872
1992	227,569	453,040	$1,728,741
1993	450,000	1,357,521	$3,700,313
1994	425,000	1,017,666	$2,900,000
1995	2,099,298	5,078,878	$12,238,394
1996	1,578,200	3,013,662	$8,468,391

Table 2. Economic impact of the recent boll weevil infestation expansion. Farm level.

Year	Acres infested	Acres treated	Control costs	Yield loss (bales)
	1/			
1995	2.3 mill (73)	650,000	$20.8 mill	120,750
1996	1.9 mill (78)	552,520	$12.8 mill	110,112

1/ Percent of harvested acres.

Table 3. Historical overwintering boll weevil survival in West Texas. 1/

Year	Total % survival
1995/96	10
1994/95	59
1993/94	31
1992/93	22
1991/92	17
1990/91	20
6 year average	26.5
1989/90	2
1988/89	3
1987/88	2
1986/87	16
1985/86	4
1984/85	7
6 year average	5.7

1/ D.R. Rummel, unpublished data.

Table 4. Accumulative number of emerging overwintered boll weevils trapped in the Texas High Plains. 1/

County	1995	1996
Bailey	4	0
Borden	336	152
Briscoe	*	120
Castro	1	0
Cochran	5	0
Crosby	74	71
Dawson	2,382	454
Deaf Smith	*	0
Floyd	884	195
Gaines	432	255
Garza	100	49
Hale	10	5
Hockley	4	66
Lamb	6	5
Lubbock	71	42
Lynn	214	84
Parmer	4	1
Randall	*	0
Swisher	5	2
Terry	321	48
Yoakum	51	57
TOTAL 2/	4,904	1,606

1/ Total trap period 4/10 - 7/10. Based on 24 traps per county.
2/ Does not include asterisks.
* Not trapped in 1995

Table 5. Accumulative number of boll weevils trapped late season in the Texas High Plains. 1/

County	1995	1996
Bailey	51	148
Borden	*	945
Briscoe	*	2,430
Castro	30	236
Cochran	345	2,026
Crosby	781	1,989
Dawson	**	1,609
Deaf Smith	*	30
Floyd	1,665	1,312
Gaines	3,113	6,766
Garza	*	864
Hale	849	1,574
Hockley	118	1,053
Lamb	405	648
Lubbock	2,030	847
Lynn	**	625
Parmer	109	70
Randall	*	1,909
Swisher	357	492
Terry	1,248	3,135
Yoakum	6,418	3,228
TOTAL 2/	17,523	24,388

1/ Total trap period 9/25 - 11/6. Based on 24 traps per county.
2/ Does not include asterisks.
* Not trapped in 1995
** Incomplete data not included.

Table 6. Accumulative boll weevil trap catches by assessment zone in the Grid Trapping Program in the Texas High Plains. 1/

Zone	Total early season emergence period		Total fall period 2/	
	1995	1996	1995	1996
Northern	17	4	900	2,895
Central	869	316	4,536	7,497
Southern	3,283	948	14,971	8,950

1/ Based on average of 100 traps.
2/ September 25 - November 6

Table 7. Average number of fall boll weevils caught in traps around cotton fields in Terry and Yoakum Counties surrounded by either row crop land or CRP acreage. Texas. 1995

Adjacent habitat	Weevils/trap-week
Crops	3.4
CRP grasses	24.0

Table 8. Impact of burning CRP grass acreage on overwintering boll weevil emergence. Terry County, Texas. 1996

Adjacent habitat	Weevils/trap-week
Unburned CRP	9.2
Burned CRP	0.8