BOLL WEEVIL INFESTATIONS IN THE NORTHWEST TEXAS HIGH PLAINS: WHAT'S THE PROBLEM?

Johnna Patterson
Texas Agricultural Extension Service
Dimmitt, TX
J. F. Leser
Texas Agricultural Extension Service
Lubbock, TX
Cherinell Riley
Texas Agricultural Extension Service
Farwell, TX
R. K. Haldenby
Plains Cotton Growers, Inc.
Lubbock, TX

Abstract

Following the invasion of the United States by the boll weevil in 1892, it took another 100 years before this key cotton pest was able to overcome the harsh climatic conditions of the High Plains and make an end run around a very successful 28 year containment program that utilized late season insecticide applications against potential diapausing weevils. While most of the earlier High Plains boll weevil infestations were located in the southern acreage and fields near the eastern Caprock Escarpment, continued mild winters and warm open Falls have fostered continued spread generally toward the northwest. Initially thought to be relatively safe from the development of widespread economically damaging boll weevil infestations, recent trap and overwintering site survey data indicates the northwest area of the High Plains is not immune to this pest. Cotton farmers in this area, not wanting to wait on the appearance of widespread damaging infestations elected to initiate eradication in the fall of 1999 along with two of the other four remaining High Plains zones. While the first year eradication program probably will not meet its stated goal of 90% reduction of the emerging 2000 population, it has gone a long way in significantly reducing the number of boll weevils that made it to overwintering sites in 1999. This should provide a good start toward the northwest cotton producer's goal of avoiding the inevitable battle with the boll weevil that has already become routine for many farmers to the south, even though weevils have only been in the High Plains for seven years.

Introduction

The boll weevil, *Anthonomus grandis* Boh., entered Texas in 1892 (Hunter and Pierce 1912) but did not reach the eastern edge of the High Plains until 1959 (R. S. Conner, personal communication). By this time the boll weevil had become a serious economic pest throughout the cotton belt, excluding New Mexico, and California. Texas High Plain's cotton farmers enjoyed minimal inputs for insect control, a necessity since harsh weather often limited yields as well as producing acres.

Even though cold winters, an apparent lack of overwintering sites and arid summer conditions seemed to limit the spread of boll weevil infestations into the High Plains area, by 1963, fall surveys indicated heavy infestations in counties 50 miles to the west of the Caprock Escarpment. The initiation of the cooperative diapause boll weevil control program in 1964 eliminated the threat of economic infestations in High Plains cotton for another 28 years (Leser et al. 1997). A series of warm winters, open falls and an increase in overwintering sites through the planting of a vast acreage of Conservation Reserve Program grasses finally led to the establishment of resident populations of boll weevils in 1992. In 1996, the diapause control program finished it's final sprays, unable to stem the tide because of inadequate funding.

Boll weevils have spread rapidly across the High Plains of Texas and New Mexico, taking advantage of increased summer survival in the over 1.5 million acres of irrigated cotton (Leser and Haldenby 1999). All cotton acreage is now infested to varying degrees with the most damaging infestations generally developing from Lubbock south. Thus far boll weevil infestations have been slow to spread into the northwest area of the High Plains. GRID trap catches and overwintering site surveys have indicated very low numbers of boll weevils have so far successfully overwintered in this area.

In 1997, the Boll Weevil Economic Impact Task Force designated the northwest production region as having low to moderate risk of developing economically damaging infestations of boll weevils, with the highest risk in the southern most counties of Bailey and Lamb. This was based on the assumption that climatic factors were more severe in this area than production areas to the south and east.

By 1998, the High Plains had been divided into five potential eradication zones: Western, Permian Basin, Southern High Plains/Caprock, Northern and Northwest (Figure 1). The Western Zone passed a referendum in December, 1998, the Permian Basin in April of 1999 and the Northwest in March, 1999. These zones initiated eradication with a fall diapause control program in 1999. The Northern Zone is just now organizing while the Southern High Plains/Caprock Zone is considering another referendum after the first failed in 1999.

Why did Northwest Zone producers elect to start eradication in 1999 even though the boll weevil had yet to become much of a production threat by the time of the referendum vote?

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1176-1180 (2000)
National Cotton Council, Memphis TN

Most experts felt that by far the greatest threat to this area was from late season weevils migrating from zones to the south and east. Indeed, there is considerable concern for reinfestation from these adjacent zones as eradication progresses in the Northwest Zone. The following narrative details the real threat of the boll weevil to the Northwest Zone and provides the results of the first year of eradication.

Material and Methods

The Northwest Eradication Zone consists of five counties: Deaf Smith, Parmer, Castro, Bailey, and Lamb (Figure 2).

Winter Habitat Sampling

The objectives of this survey were to determine which were the better habitats for successful boll weevil overwintering and to establish the distribution and survival of boll weevils in overwintering sites.

Boll weevil overwintering sites were sampled in 16 counties in early spring of both 1998 and 1999. While several different habitats were sampled, litter under clumps of elm trees and Conservation Reserve Program (CRP) grasses were the most commonly sampled habitats. Elm tree leaf litter was considered to represent the best overwintering sites while CRP grasses were considered the most abundant. One hundred and seventeen sites were examined in 1998. Habitats sampled included: elm, brush shinnery oak, Osage orange, pecan, cottonwood, salt cedar, Arizona cypress, mesquite/grass pastures and CRP grasses. One hundred and ten sites were sampled in 1999. Only broadleaf litter was sampled this year. There were 25 sites sampled in the Northwest Zone in 1998 and 30 in 1999. Numbers of sites per county ranged from zero in Deaf Smith to eleven in both Lamb and Bailey.

Three 1 M^2 samples were taken from each site. Litter samples were collected by placing a 1 M^2 wooded frame on the surface within the prescribed habitat and collecting all plant debris within the frame. Collection sites were within 2.5 miles or less of cotton fields. Samples included the upper one inch of soil. This material was placed in a large plastic bag for transportation to the Texas A&M Research and Extension Center in Lubbock. All samples were processed and examined within 24 hours. All samples were processed through a separating machine used to sort out materials approximately the size of a boll weevil from soil and larger debris. The materials remaining after separation were spread out and examined on a heated table which facilitated the location of live boll weevils. Both dead and live boll weevils were counted.

Trapping Studies

A number of boll weevil pheromone traps has been placed in a grid pattern across the High Plains production region beginning in 1995. The purpose of this trapping program was to track the spread of the boll weevil across the area, monitor emerging overwintered boll weevils to evaluate winter mortality and the level of suicidal emergence, and to gauge the population level late in the season as a means of assessing the potential overwintering population.

Foundation boll weevil pheromone traps were placed in counties at the average rate of 24 traps per county. The actual number varied from 3 to 42, depending upon the geographical size of the county and the amount of cotton acreage. The GRID trapping program was expanded from 16 counties to the 28 counties comprising all the potential High Plains boll weevil eradication zones. One hundred and six traps were monitored in the Northwest Zone. Traps were only placed in areas where cotton was grown. Traps were established along public right-of-ways and not actually in cotton fields or overwintering sites. A total of 534 traps were in the GRID in 1998 and 1999. Trapping was initiated the early part of April. Traps were checked on a weekly basis until the second week of November, when a plant-killing freeze usually had occurred. Pheromone was changed biweekly and kill strips monthly. Distribution maps of trap catches were developed using MapInfo software.

Results and Discussion

Boll weevils have historically overwintered in very low numbers in the Northwest Zone (Figure 3) in spite of the relatively high numbers caught in traps late in the season (Table 1). When compared to other High Plains zones it is clear that the numbers of weevils caught in traps both early and late in the season are quite low. Numbers of weevils that are observed in traps early in the season are a reflection of the number entering overwintering sites in the fall and winter survival. Weather conditions appear to be more severe in this area than in other zones and late season food supply can be limited. Without an adequate food supply late in the year, potential diapausing weevils will build up insufficient fat reserves to bridge the host-free gap until squares appear the following summer. Even though the percent of overwintering sites surveyed with overwintering weevils has increased steadily in other zones and has reached levels of 75-100%, the Northwest Zone has remained static the last two years and with only 1/3rd of the sites examined with boll weevils (Table 2). The general lack of fields requiring sprays for overwintering boll weevils and the general absence of economically damaging infestations until quite late in the season indicates that the Northwest Zone is less favorable for boll weevil survival and development as an economic pest than other areas.

But as gradual as it is, the boll weevil is steadily invading the Northwest Zone and increasing in numbers each year. In spite of the infestation-suppressing drought of 1998, late season

boll weevil numbers were up considerably in 1998 compared to 1997, with more traps catching more weevils (Figure 4). There was also a significant increase in numbers and distribution of emerging overwintered weevils from 1997 to 1999, even though there was a decline in 1998 (Figure 5). The decrease in 1998 may have been due to lower survival rates as a result of desiccation from the very dry conditions observed during the survey of overwintering sites. Most emerging boll weevils were still caught in traps in the southern two counties of the zone. While early trap catches were up appreciably in 1997 and 1998 when compared to 1995 and 1996, the greatest increase took place in 1999 (Table 3).

The number of boll weevils found in overwintering sites examined has remained low since first sampled in 1997 but has steadily increased in Southern Zone counties of Bailey and Lamb (Table 4). With the exception of one site each in Castro and Parmer counties, all overwintering sites sampled with weevils in 1998 and 1999 were in Bailey and Lamb counties (Figure 6). Weevils have yet to be detected in sites near the New Mexico state line with the exception of one site a few miles east of the state line in southern Bailey County.

In spite of a slower increase and spread of boll weevils in the Northwest Zone compared to the other zones to the east and south, the boll weevil is becoming a more significant factor to producers in this area. Many more fields received applications for emerging overwintered boll weevils in 1999 than in previous years and in-season economic infestations developed in fields as far north as Castro County. And weevils have been trapped as far north as Bushland, on Interstate 40 west of Amarillo. Clearly, boll weevil numbers are increasing and infestations are pushing further north each year (Table 5). Record numbers were caught in all Northwest Zone counties with the exception of Deaf Smith County. Zone wide, trap catches were up 3X over 1998 and up 34X over 1995 when trapping was initiated.

Apparently it was an insightful decision on the part of producers to approve the start of eradication in the Northwest Zone this year. The state provided $50 million dollars in a cost share with existing programs for 1999. The eradication program began treating a limited acreage the first week of September and was in full swing by the 2nd week (Figure 7). Applications continued on a weekly basis on all fields that still held hostable squares or bolls. A little over 400,000 acres survived earlier weather events, to be sprayed in the program. Over 2.9 million acre-treatments were made in this strictly diapause program which stretched out for over 12 weeks due to a late plant killing freeze, delayed by three weeks. Because of this, the program has run over budget.

In hindsight, the program probably should have started at least a week earlier to catch the tail end of the last reproductive generation. This would have further limited the number of potential diapausing weevils to target with later applications. A further benefit could have been derived by increasing the spray interval from the standard weekly application to 10 days once only diapausing weevils were present in the population. In all fairness to the program, it did have to contend with a very late crop and a record number of boll weevils. The program also had to avoid creating a late season buildup of aphids and a resulting sticky cotton problem. We would not expect the program to have met its objective of reducing next year's emerging boll weevil numbers by 90%. In spite of this, lower GRID trap catches during the 3rd week of October in active zone areas versus non active zones clearly demonstrate the program's effectiveness in significantly reducing late season boll weevil numbers (Figure 8). The mapped trap catches also clearly demonstrate the potential threat of re-infestation pressure from eastern and southern counties adjacent to the Northwest Zone. Regardless, producers have wisely invested in their future of cotton production by taking the first step toward eradication of this potentially devastating pest before it had become an area wide major yield detractor.

Acknowledgments

The authors would like to thank the Boll Weevil Steering Committee of Plains Cotton Growers, Inc. for their financial support of the overwintering boll weevil site survey and the AgriPartners GRID trapping program. Special thanks is extended to all those Extension Agents that assisted in data collection. We greatly appreciate the contributions of Don R. Rummel and Stan Carroll of the Texas Agricultural Experiment Station pertaining to the ecology of the boll weevil as it applies to the High Plains area. Thanks is also given to the Texas Boll Weevil Eradication Foundation for providing information on their eradication efforts.

References

Boll Weevil Economic Impact Task Force. 1997. Assessment of the economic impact of the boll weevil in the Texas High Plains. Special Report 97-1. Texas A&M Univ. 31 pp.

Hunter, W. D. and W. E. Pierce. 1912. The Mexican cotton boll weevil: A summary of the investigation of this insect up to December 31, 1911. U. S. Senate Doc. No. 305. 188 pp.

Leser, J. F. and R. K. Haldenby. 1999. The boll weevil problem on the High Plains of Texas and eastern New Mexico. Proc. Beltwide Cotton Conf. pp. 828-832.

Leser, J. F., E.A. Bodden, and R. K. Haldenby. 1997. Boll weevil status in the Texas High Plains. Proc. Beltwide Cotton Conf. pp. 1201-1205.

Table 1. Total number of boll weevils caught per trap in the Texas High Plains GRID trapping program.

Eradication Zone	1998 Late 1/	1999 Early 2/
Northwest	73.2	19.3
Northern	341.3	109.4
Southern	329.6	88.2
Western	251.7	247.2
Permian Basin	491.5	157.3

1/ August 1 - November 12
2/ April 1 - July 31

Table 2. Percent of overwintering sites sampled in the Texas High Plains with boll weevils.

Eradication Zone	1997	1998	1999
Northwest	16.7	37.5	33.3
Northern	62.5	56.2	75.0
Southern	57.0	77.4	90.0
Western	46.2	84.2	87.2
Permian Basin	67.0	100.0	100.0

Table 3. Total number of emerging overwintered boll weevils caught per trap in the Texas High Plains GRID trapping program. 1/

County	1995	1996	1997	1998	1999
Deaf Smith	-----	0	0.57	0	1.3
Parmer	0.17	0.04	0.07	0.11	1.1
Castro	0.03	0	0.08	0.46	3.8
Bailey	0.17	0	1.25	2.70	48.0
Lamb	0.25	0.12	6.83	4.08	42.5
Northwest Eradication Zone	0.15	0.03	1.76	1.47	19.3

1/ April 1 - July 31

Table 4. Number of boll weevils per M^2 of overwintering habitat sampled in the Texas High Plains.

County	1997	1998	1999
Parmer	0	0	0.07 (0) 1/
Castro	0	0.08 (100)	0
Bailey	0.08 (100)	0.17 (25)	0.30 (43)
Lamb	0	0.08 (100)	0.30 (57)
Northwest Zone	0.03 (100)	0.10 (75)	0.13 (53)

1/ ( ) ' percent live

Table 5. Total number of late season boll weevils caught per trap in the Texas High Plains GRID trapping program.

County	1995	1996	1997	1998	1999
Deaf Smith	-----	4.4	20.5	27.7	17.0
Parmer	4.5	2.5	3.1	10.0	45.8
Castro	0.8	10.1	10.6	40.1	83.9
Bailey	2.1	34.4	53.4	109.1	459.3
Lamb	16.9	25.8	109.7	113.9	432.9
Northwest Zone	6.1	15.4	41.5	73.2	207.8

1/ August 1 through November 12

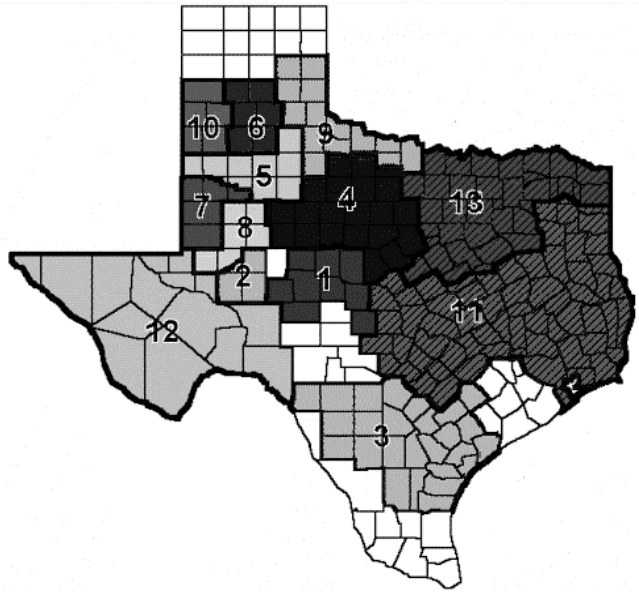


Figure 1. Texas boll weevil eradication zones, 1999. Zone 10 is the Northwest Plains zone.

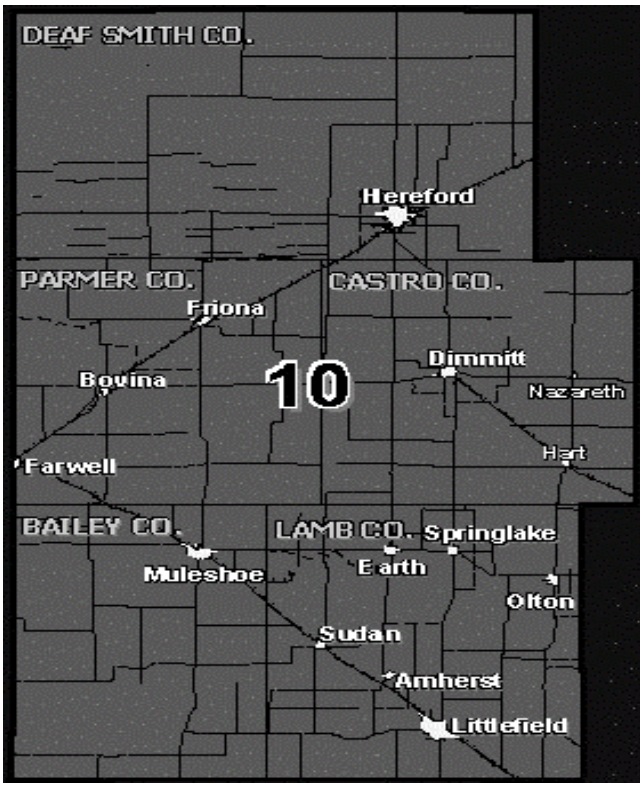


Figure 2. Texas Northwest Plains boll weevil eradication zone.

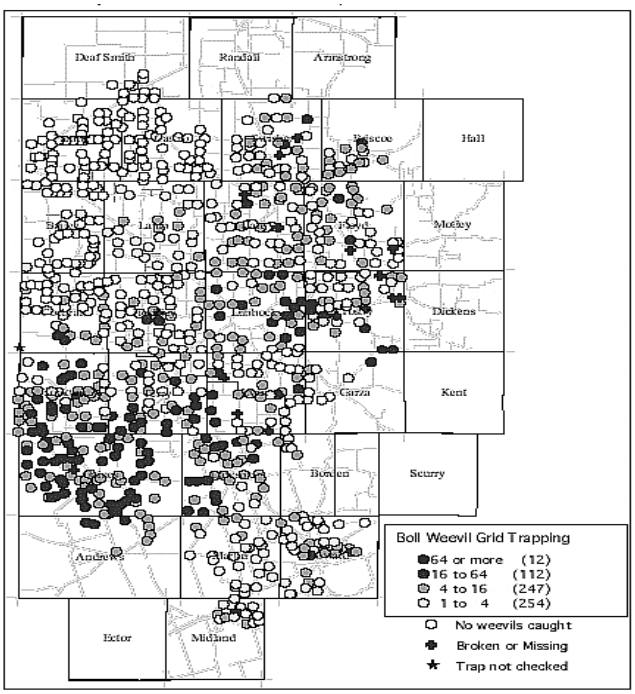
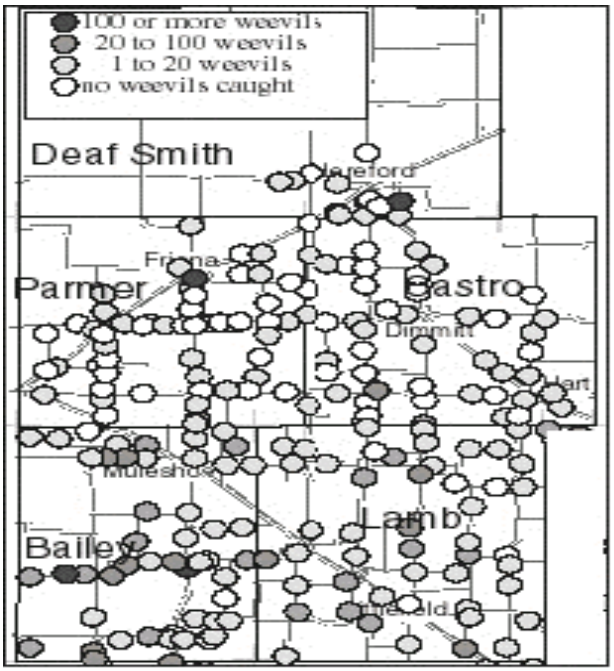
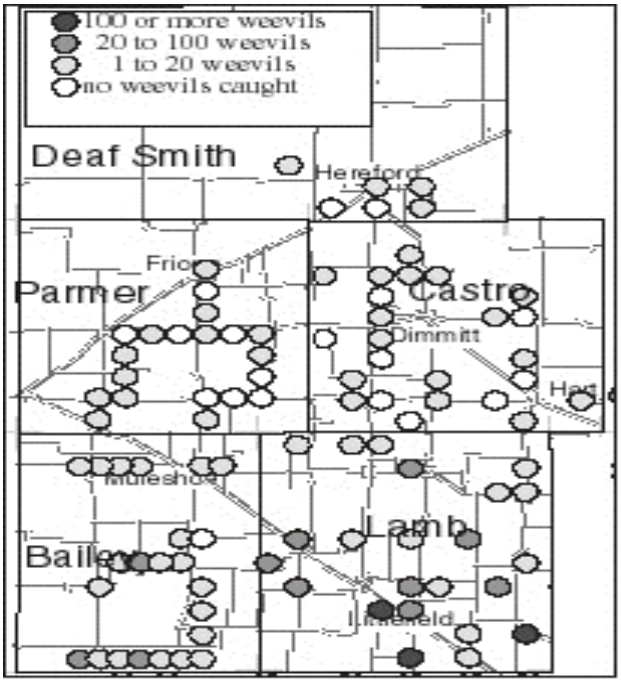


Figure 3. Boll weevil catches in the Texas High Plains GRID trapping program for the week of May 15-21, 1999.

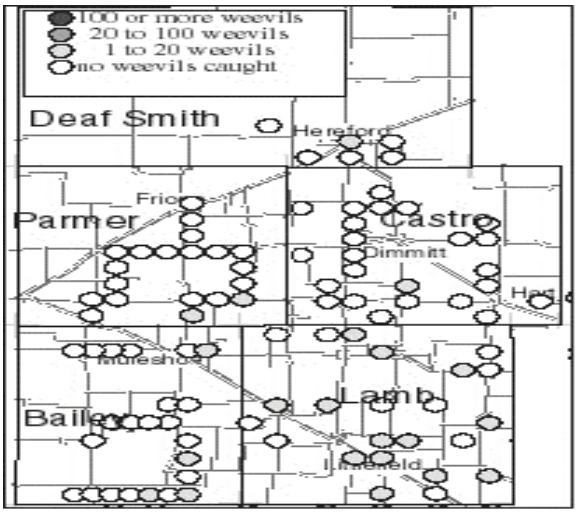


1998

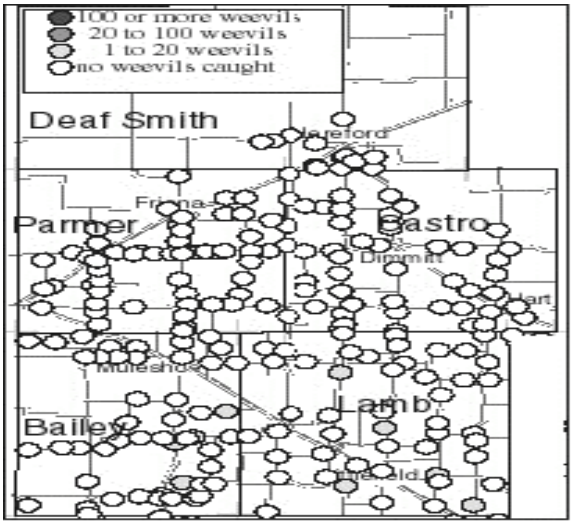
Figure 4. Total number of late season boll weevils caught in each trap in the Texas Northwest Eradication Zone GRID trapping program. August 1 – November 12.



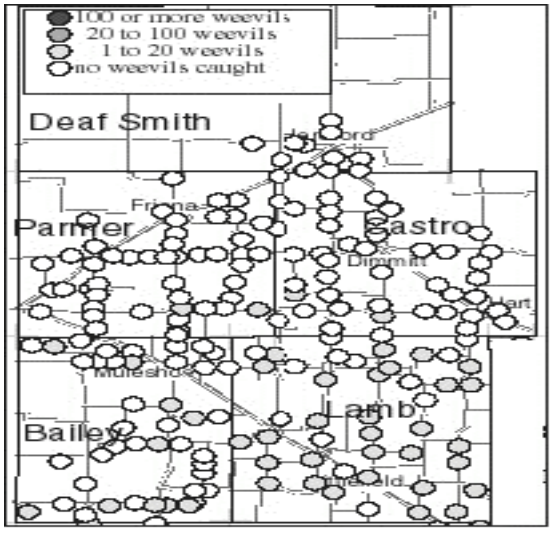
1997



1997



1998



1999

Figure 5. Total number of emerging boll weevils caught in each trap in the Texas Northwest Eradication Zone GRID trapping program. April 1 - July 31.

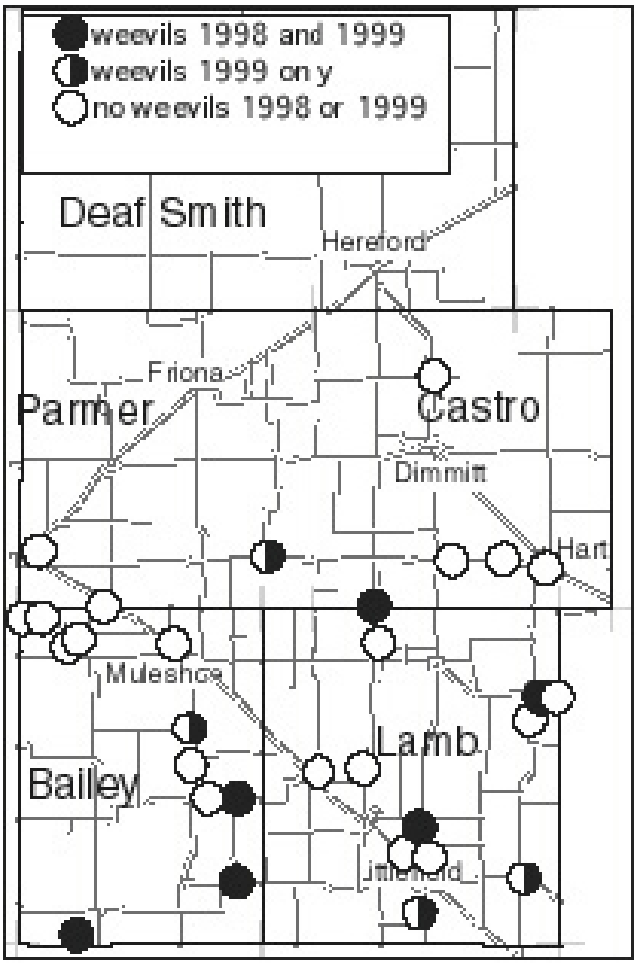


Figure 6. Texas Northwest Eradication Zone boll weevil overwintering site survey, 1998 and 1999.

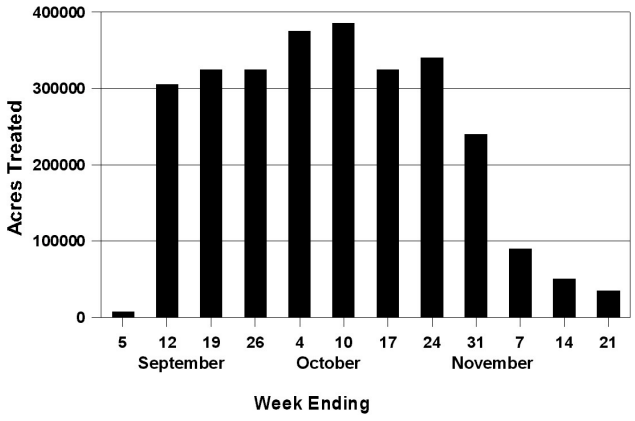


Figure 7. Weekly boll weevil insecticide acre applications in the Texas Northwest Plains Eradication Zone, 1999.

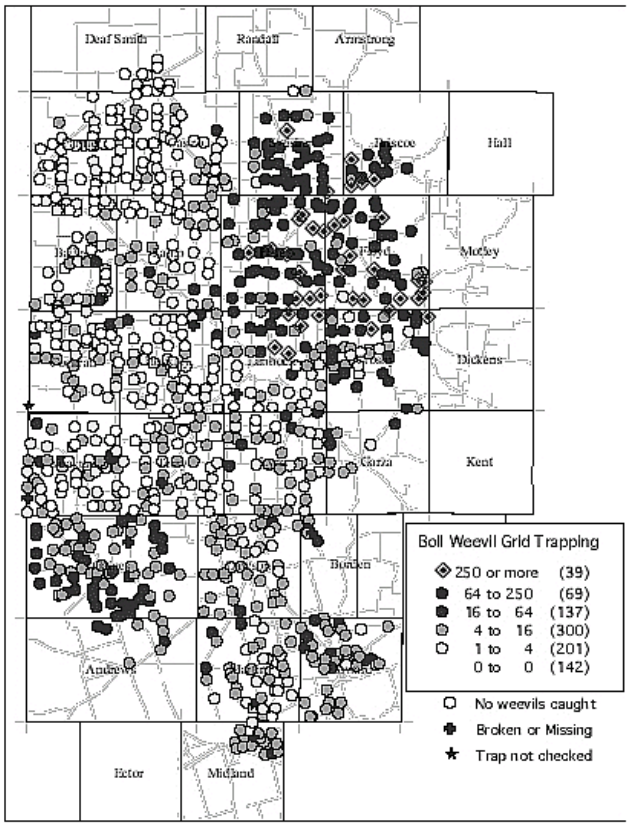


Figure 8. Boll weevil trap catches in the Texas High Plains GRID trapping program for the week of October 16-22, 1999.