

**EVALUATION OF BOLL WEEVIL
OVERWINTERING ON THE TEXAS HIGH
PLAINS THROUGH HABITAT SAMPLING**

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Abstract

Since 1992 the boll weevil has become a newly established economic pest to cotton production on the Texas High Plains. The present boll weevil problem in Texas High Plains counties is believed to result from two major factors: an unprecedented five successive mild winters and the establishment and maturation of CRP (Conservation Reserve Program) grass acreage. The objectives of these studies were to sample and compare various habitats for overwintering boll weevils and determine the range of weevil overwintering. Habitats sampled consisted of the ground-trash (leaves, stems, debris, etc.) along with approximately a quarter inch of loose soil. Samples were processed and examined visually for adult boll weevils. Boll weevils are able to overwinter successfully on the High Plains of Texas in a number of habitats. Tree litter appears to be a primary habitat for boll weevils to overwinter but CRP acres may be the most important habitat on the High Plains of Texas.

Introduction

The scarcity of favorable overwintering habitat has long been considered a major obstacle to the establishment of boll weevils, *Anthonomus grandis* Boheman, on the Texas High Plains. However, since 1992 the boll weevil has become a newly established economic pest to cotton production on the Texas High Plains (Table 1). The boll weevil is known to overwinter in a variety of habitats outside cotton fields. The best habitats are those areas where large amounts of deciduous leaf litter accumulates. However, there are many other types of less favorable habitat, and these can be significant to survival during mild winters. These less favorable habitats include mesquite pasture, fence rows, abandoned farmsteads which have become overgrown with vegetation and other such habitats. Small areas, of these habitats can harbor relatively large numbers of boll weevils. The present boll weevil problem in Texas High Plains counties is believed to result from two major factors: an unprecedented five successive mild winters and the establishment and maturation of CRP (Conservation Reserve Program) grass acreage. Grasses established in the CRP comprise the majority of the overwintering habitat. The Southern High Plains of Texas has approximately 2.5 million acres of CRP grasses. The objectives of these studies were to sample and compare various habitats for overwintering boll weevils and determine the range of weevil overwintering.

Materials and Methods

Habitat refers to the dominant plant type in the area in which the samples were taken. Pasture habitat is characterized by mesquite and sage. Habitats sampled ranged from being adjacent to cotton to 2.5 miles from cotton. Samples, one square meter in size, consisted of the ground-trash (leaves, stems, debris, etc.) along with approximately a quarter inch of loose soil. This material was collected by hand and placed into canvas mail bags. CRP grass was trimmed down to within six inches of the crown and the trimmed material was discarded. The grass crowns were dislodged using a shovel and placed into the bags along with the loose soil. Samples were collected between late-February through early-March. Typically, three samples were taken from each location.

Samples were processed through a trash separator machine which consists of two rotating drums; one inside the other. The outer drum is made of 0.25 inch mesh wire and is shorter than the inside drum which consists of 0.5 inch mesh wire. The sample is placed inside the inner drum. Larger material rotates out of the end of the inside drum while the small material falls through both drums and the material the size of adult weevils fall out of the end of the outside drum and is collected in a pan. Material from the pan is placed into a paper bags. The following day these samples were spread onto a heat table where they were examined visually for adult boll weevils.

There were no statistical analysis performed, however to obtain a value for comparisons between habitats, boll weevils per acre was calculated. This value assumes equal distribution across the acre.

Results and Discussion

1995

Forty six samples from six habitats and 16 locations in Dawson County, Texas were sampled in 1995. Saltcedar, *Tamarix ramosissima* Ledeb, appeared to be the most favorable habitat for boll weevil overwintering, based on the number of boll weevils recovered (Table 2). Nine live and six dead boll weevils were recovered with seven of the live boll weevils coming from saltcedar, however all seven came from one of the two locations sampled. One each of the remaining two boll weevils came from Arizona cypress, *Cupressus arizonica*, and CRP grass habitats; one each. The boll weevil recovered from the CRP grass is believed to be the first reported wild boll weevil recovered from CRP grass. The six dead boll weevils came from three habitats, three from CRP grass, two from elm leaf litter and one from Arizona cypress. Two boll weevils from both the CRP grass and elm leaf litter samples were classified as dead, however they were pliable and assumed to have been alive during sampling; dead boll weevils are typically very brittle.

1996

Samples for 1996 came from five Texas counties, Dawson, Gaines, Lubbock, Terry and Yoakum. On hundred and fifty-three samples were taken from 51 locations representing seven habitats. All boll weevils recovered were dead. Live specimens of other arthropods, ground, darkling and lady beetles, spiders and others were recovered indicating that the sampling process was not so harsh to cause the mortality of the boll weevils. The mortality of the boll weevils is attributed to the combination of a successful Diapause Control Program conducted by Plains Cotton Growers, Inc. and moderately hard winter conditions.

Saltcedar was the only habitat that did not produce a single boll weevil. Twenty dead boll weevils were recovered from tree litter while both the CRP grass and shinnery oak habitats had eight recovered (Table 3). The tree habitat was represented by five different tree species with elm leaf litter harboring 17 and the remaining 3 dead boll weevils came from pecan leaf litter (Table 4). When calculated to boll weevils per acre both tree habitats harbored over 4,000 dead boll weevils. The CRP grass habitats were represented by three different management practices; shredded, burned and left unmanaged (Table 5). The burned CRP grass locations had one years worth of regrowth and one dead boll weevil was recovered while the natural and the shredded CRP grass had 3 and 4 dead boll weevils recovered respectively. There were over 5,000 dead boll weevils per acre in CRP grass being managed through shredding when calculated to a per acre bases.

Shinnery oak and railroad beds, characterized by grass thatch, high weeds and lava rock mulch showed to be habitats utilized by overwintering boll weevils. Each habitat calculated to have over 1,000 dead weevils per acre. Of the 42 dead weevils recovered, 20 were from Dawson County samples, 20 from Lubbock County samples, two from the Terry-Yoakum Counties samples and zero from the Gaines County samples.

1997

The sampling program in 1997 expanded to cover 16 Texas High Plains Counties, Bailey, Castro, Cochran, Crosby, Dawson, Floyd, Gaines, Hale, Hockley, Lamb, Lubbock, Lynn, Parmer, Swisher, Terry and Yoakum (Table 6). There were 89 live and 43 dead boll weevils recovered. Four counties recorded zero total boll weevils recovered, while four counties, Dawson (13 live and 9 dead), Lubbock (13 and 5), Lynn (40 and 17) and Terry (4 and 7), accounted for 81.3% of the total boll weevils recovered.

When evaluating these data, one needs to keep in mind that only the elm leaf habitat was sampled across the whole area and the other habitats happened to be sampled only in the areas of higher boll weevil pressure. From the 16 counties there were 191 samples from 64 locations and six habitats (Table 7). There was at least one live boll weevil recovered from all six habitats. Tree litter habitats represent 60.6% of the total, 59.5% of the live and 62.8% of the dead boll weevils recovered. The tree litter is comprised of six different tree species (Table 8). Elm litter represents 83% of the live, 96.3% of the dead and 87.5% of the total boll weevils recovered and 85% of the samples taken from tree litter habitats. The other five tree litter habitats had only one location each sampled with willow tree litter producing 6 (11.3%) live boll weevils. When the number of boll weevils per acre are calculated willow habitat produced 8,094 boll weevils while elm and cottonwood produced 3,256 and 2,698 boll weevils respectively.

The CRP grass habitat was sampled in three locations all from Dawson and Lynn Counties. All boll weevils recovered were live. Again, CRP grasses were sampled with one location coming from a different management practice, shredded, burned and unmanaged. Of the 11 total boll weevils recovered from CRP grasses, 10 came from an unmanaged CRP field in Lynn County and the remaining one came from a shredded CRP field (Table 9).

Arizona cypress harbored 24 (18%) of the total, 16 (18%) of the live and 8 (18%) of the dead boll weevils recovered. These numbers represent the second highest for each category behind the tree litter habitats. All of the boll weevils recovered from the Arizona cypress habitat came from three locations, two in Dawson County and one in Lynn County. The location in Lynn County produced 12 live and 6 dead boll weevils. The remaining three habitats apparently provides boll weevils additional habitat to overwinter at various levels.

Conclusions

Boll weevils are able to overwinter successfully on the High Plains of Texas in a number of habitats. Tree litter, particularly broadleaf litter appears to be a primary habitat for boll weevils to overwinter across the High Plains of Texas, which is consistent with other studies addressing the quality of overwintering habitats. However, with the boll weevils ability to overwinter successfully in CRP grasses, CRP may be the most important habitat on the High Plains due to the large number of acres it represents and the checkered-board distribution across the area. It appears that the management of CRP grasses effects the quality of habitat it provides. The practice of burning CRP grass appears to limit the ability of the boll weevils to overwinter while the practice of shredding CRP grasses appears to provide the boll weevil with a more suitable habitat to overwinter.

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Table 1. Importance of the boll weevil on the Texas High Plains.

YEAR	ACRES INFESTED*	BALES LOST*
1991	100,000	25
1992	70,000	33
1993	180,000	84
1994	1.1 million	313
1995	2.3 million	119,983
1996	1.9 million	91,863
1997	2.8 million	??

* From the NCC Beltwide Cotton Conferences Proceedings.

Table 2. Summary of Habitat Sampling for Overwintering Boll Weevils on the Texas High Plains in Dawson County, 1995.

Habitat ^{1/}	No. Sites ^{2/}	No. Samples ^{3/}	Number of Boll Weevils			
			Live	Dead	Per Acre	
					Live	Dead
CRP	5	15	1	3	311	934
Elm	3	9	0	2	0	899
SO	1	2	0	0	0	0
SC	2	8	7	0	3,541	0
Az Cy ^{4/}	2	5	1	1	809	809
Pasture ^{5/}	3	9	0	0	0	0

1/ Habitat refers to the dominant plant type in the area in which samples were taken. (SO=shinnery oak, SC=saltcedar, Az. Cy=Arizona Cypress)

2/ All locations were bordering cotton fields.

3/ All samples were one square meter in size.

4/ Used as windbreaks.

5/ Characterized by mesquite, sage and shinnery.

Table 3. Summary of Habitat Sampling for Overwintering Boll Weevils on the Texas High Plains in Dawson, Gaines, Lubbock, Terry and Yoakum Counties, 1996.

Habitat ^{1/}	No. Sites ^{2/}	No. Samples ^{3/}	Number of Boll Weevils			
			Live	Dead	Per Acre	
					Live	Dead
CRP	18	54	0	8	0	599
Tree	9	27	0	20	0	2,998
SO	9	27	0	8	0	1,199
SC	5	15	0	0	0	0
Az Cy ^{4/}	3	9	0	2	0	899
Pasture ^{5/}	5	15	0	2	0	539
RxR ^{6/}	2	6	0	2	0	1,349

1/ Habitat refers to the dominant plant type in the area in which samples were taken. (Tree=tree leaf litter, SO=shinnery oak, SC=saltcedar, Az. Cy=Arizona Cypress, RxR=Railroad beds)

2/ All locations were bordering cotton fields.

3/ All samples were one square meter in size.

4/ Used as windbreaks.

5/ Characterized by mesquite, sage and shinnery.

6/ Characterized by grass thatch, high weeds and lava rock mulch.

Table 4. Summary of Tree Litter Habitat Sampling for Overwintering Boll Weevils on the Texas High Plains in Dawson, Gaines, Lubbock, Terry and Yoakum Counties, 1996.

Habitat ^{1/}	No. Sites ^{2/}	No. Samples ^{3/}	Number of Boll Weevils			
			Live	Dead	Per Acre	
					Live	Dead
Elm	5	15	0	17	0	4,586
Willow	1	3	0	0	0	0
Pecan	1	3	0	3	0	4,047
Cedar	1	3	0	0	0	0
Misc. ^{4/}	1	3	0	0	0	0

1/ Habitat refers to the dominant plant type in the area in which samples were taken.

2/ All locations ranged from bordering to 2 miles from closest cotton fields.

3/ All samples were one square meter in size.

4/ Species of tree not recorded.

Table 5. Summary of CRP Grass Habitat Sampling for Overwintering Boll Weevils on the Texas High Plains in Dawson, Gaines, Lubbock, Terry and Yoakum Counties, 1996.

Management Practice	No. Sites ^{2/}	No. Samples ^{3/}	Number of Boll Weevils			
			Live	Dead	Per Acre	
					Live	Dead
Unmanaged	11	33	0	3	0	368
Burned	6	18	0	1	0	225
Shredded	1	3	0	4	0	5,396

1/ All locations ranged from bordering to 2 miles from closest cotton fields.

2/ All samples were one square meter in size.

Table 6. Summary of Habitat Sampling for Overwintering Boll Weevils on the Texas High Plains 1997.

County	No. of Sites ^{1/}	No. of Samples ^{2/}	Number of Boll Weevils		
			Alive	Dead	Total
Bailey	4	12	1	0	1
Castro	2	6	0	0	0
Cochran	4	12	0	1	1
Crosby	4	12	5	0	5
Dawson	9	26	13	9	22
Floyd	4	12	7	1	8
Gaines	4	12	2	0	2
Hale	4	12	1	1	2
Hockley	4	12	3	1	4
Lamb	4	12	0	0	0
Lubbock	4	12	13	5	18
Lynn	5	15	40	17	57
Parmer	2	6	0	0	0
Swisher	2	6	0	1	1
Terry	4	12	4	7	11
Yoakum	4	12	0	0	0
Total	64	191	89	43	132

1/ All locations ranged from bordering to 2 miles from closest cotton fields.
 2/ All samples were one square meter in size.

Table 7. Summary of Habitat Sampling for Overwintering Boll Weevils on the Texas High Plains, 1997.

Habitat ^{1/}	No. Sites ^{2/}	No. Samples ^{3/}	Number of Boll Weevils			
			Live	Dead	Per Acre	
					Live	Dead
CRP	3	8	11	0	5,564	0
Tree	34	102	53	27	2,102	1,071
SO	14	42	7	7	674	674
SC	3	9	1	0	449	0
Az Cy ^{4/}	9	27	16	8	2,396	1,199
Pasture ^{5/}	1	3	1	1	1,349	1,349

1/ Habitat refers to the dominant plant type in the area in which samples were taken.
 2/ All locations ranged from bordering to 2 miles from closest cotton fields.
 3/ All samples were one square meter in size.
 4/ Used as windbreaks.
 5/ Characterized by mesquite, sage and shinnery.

Table 8. Summary of Tree Litter Habitat Sampling for Overwintering Boll Weevils on the Texas High Plains, 1997.

Habitat ^{1/}	No. Sites ^{2/}	No. Samples ^{3/}	Number of Boll Weevils			
			Live	Dead	Per Acre	
					Live	Dead
Elm	29	87	44	26	2,047	1,209
Willow	1	3	6	0	8,094	0
CW	1	3	2	0	2,698	0
Cedar	1	3	1	0	1,349	0
CB	1	3	0	0	0	0
Misc. ^{4/}	1	3	0	1	0	1,349

1/ Habitat refers to the dominant plant type in the area in which samples were taken. (CW=Cottonwood, CB=Chinaberry)
 2/ All locations ranged from bordering to 2 miles from closest cotton fields.
 3/ All samples were one square meter in size.
 4/ Species of tree not recorded.

Table 9. Summary of CRP Grass Habitat Sampling for Overwintering Boll Weevils on the Texas High Plains, 1997.

Management Practice	No. Sites ^{2/}	No. Samples ^{3/}	Number of Boll Weevils			
			Live	Dead	Per Acre	
					Live	Dead
Unmanaged	1	3	10	0	13,489	0
Burned	1	3	0	0	0	0
Shredded	1	3	1	0	2,023	0

1/ All locations bordered cotton fields.
 2/ All samples were one square meter in size.