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Suggested Guidelines for Controlling Panicle-Feeding Bugs in Texas Sorghum

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Several species of true bugs, primarily stink bugs, may move from alternate host plants to infest sorghum panicles during grain development. Initial infestations of panicle-feeding bugs are made by adult bugs, and nymphs may develop later. Large panicle infestations are reported occasionally and may cause economic damage to sorghum seed, depending on the number of bugs per panicle, the time during grain development at which bugs move into sorghum and the duration of the infestation.

Sorghum Damage

Panicle-feeding bugs feed primarily on seeds but to a lesser extent on the stem and rachis branches. Stink bugs have piercing-sucking mouthparts which they insert into plant tissues for feeding; enzymes are released at feeding sites and the partially digested material is ingested. Feeding on seeds reduces grain weight, size, quality and germination. Non-seed feeding may reduce seed yield indirectly. The number of feeding punctures per seed and percentage of seeds punctured on infested panicles depend on the infestation period and number of bugs present. Bugs may puncture every seed on a panicle, and some seeds may have more than 10 feeding wounds each. Bugs deposit a volcano-shaped stylet sheath at feeding sites which protects the mouthparts and which is often used as an indicator of feeding activity. Stylet sheaths are translucent and small, but researchers have developed staining techniques which facilitate sheath detection and counting.

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During years of abundant rainfall, grain molds may develop on infested panicles. Some molds give punctured seeds a black appearance and may further deteriorate seed quality. Extensive insect feeding usually results in underdeveloped seeds that are smaller, softer and lighter weight than undamaged seeds. Such seed reduces bushel weight and may be lost during harvest.

The seed development stage strongly influences the extent of damage caused by panicle-feeding bugs. Sorghum grain development begins shortly after a panicle exerts from the boot, approximately 60 days after seedling emergence. The entire grain developmental process takes about 36 days and progresses through an anthesis or flowering stage (about 8 days), a milk stage (about 8 days), a soft dough stage (about 10 days) and a hard dough stage (about 10 days) before reaching maturity. During the anthesis stage, flowering begins at the top of panicles and progresses toward the base; the point during flowering when the top half of a panicle has flowered is called 50 percent flower. Panicles enter the milk stage, soft dough stage and hard dough stage of grain development about 7, 15 and 25 days, respectively, after 50 percent flower. Panicle-feeding bugs cause more damage to seeds early during grain development, and less damage as grain develops to the hard dough stage. Bugs cause the most damage when infestations begin early during grain development and persist to grain maturity. Infestations of bugs during the anthesis stage of grain development cause reductions in the number of seeds per panicle, while later infestations cause reductions in the weight and size of seed.

In the sorghum field, panicles damaged by bugs usually can be distinguished from undamaged panicles by having a number of smaller,

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sometimes shriveled seeds. Visible insect damage increases as infestation densities increase, and is more pronounced when infestations begin during the anthesis or milk stages.

Description

Common species of panicle-feeding bugs in Texas include the rice stink bug (figure 1), the southern green stink bug (figure 2), the conchuela stink bug (figure 3), the brown stink bug (figure 4), the redshouldered stink bug (figure 5), the leaffooted bug (figure 6) and the false chinch bug (figure 7). Geographical variations across Texas affect the occurrence of these panicle-feeding bugs in sorghum; species are abundant in some areas but not in others. Not all bugs are sorghum pests. Some species are predators and are thus beneficial in nature. The bugs listed above are the more common potential panicle bug pests in Texas. For information about other bug species which may be pests, consult your county Extension agent.

Economic Injury Levels

Sorghum entomologists at Texas A&M University have assessed damage to sorghum seed caused by several species of panicle-feeding bugs, including the rice stink bug, the southern green stink bug, the conchuela stink bug and the leaffooted bug. Of particular interest is the economic injury level (lowest population density of bugs justifying the cost of control) for each of the four species. Data were collected on the yield of panicles artificially infested at different infestation levels of adult bugs during different infestation periods. Infestation levels studied ranged from 0 to 16 bugs per panicle; periods studied were the anthesis stage, the milk stage to maturity (28 days), the soft dough to maturity (20 days) and the hard dough to maturity (10 days).

Regression analyses indicated that yield reductions increased quadratically as the number of bugs per panicle increased, especially when grain was infested during anthesis and from milk to maturity. At the infestation densities studied, significant yield reductions occurred when panicles were infested during anthesis, from milk to maturity and from soft dough to maturity but not when infested from hard dough to maturity. Equations were determined which estimated yield losses at different infestation levels, and economic injury levels were calculated for different control costs and crop market values. Whether or not a producer should control an insect infestation depends on the stage of grain development at the time bugs move into sorghum, the number of bugs per panicle, the cost of controlling bugs and the market value of the grain.

Using the Tables

To determine the profitability of controlling an infestation of rice, southern green or conchuela stink bugs or leaffooted bugs, calculate the per acre control cost (insecticide and application) and the expected per acre market value of the grain (yield x price). Next, determine the approximate grain development stage when the infestation occurred. If the estimated stage of development is hard dough and the infestation level per panicle is 16 bugs or less, do not control bugs. For bug infestations beginning at the milk or soft dough stages, consult the economic injury level tables. Economic injury levels for infestations of rice stink bugs per panicle at which control is justified is indicated for a given control cost and market value. The economic threshold level for an infestation of false chinch bug is 140 bugs per panicle when infestations begin at the milk stage of grain development. Economic thresholds for the rice stink bug, southern green stink bug, conchuela stink bug and leaffooted plant bug are given in Tables 1, 2 and 3, 4 and 5, 6 and 7, and 8 and 9, respectively.

A method that can be used to establish the average number of bugs per head is the "beat-bucket" technique. Use the bottom 10 inches of a 5-gallon plastic bucket and shake the heads into the bucket with a sharp strike. The bugs from each head can then be counted.

Chemical Control

Insecticides suggested for controlling these pests are given in publication B-1220 *Insect and Mite Pests of Grain Sorghum — Management Approaches.* Application rates and suggestions for treatment are also provided.

Figure 1. Rice Stink Bug. The adult bug has a tannish-brown, shield-shaped body with sharp forward pointing spines on the shoulders. The body is about 3/8- to 1/2-inch long and half as wide as long.

Figure 2. Southern Green Stink Bug. The adult bug has a shield-shaped body about 5/8-inch long and is uniformly green. The shoulders are rounded.

Figure 3. Conchuela Stink Bug. The adult bug is 5/8-inch long and shield-shaped; it has a blackish body outlined in red with a red spot on the middle of the back.

Figure 4. Brown Stink Bug. The adult bug has a brownish, shield-shaped body about 5/8-inch long. The shoulders are usually bluntly pointed but they may be more pointed in some individuals. The underside of the body is yello to light green.

Figure 5. Redshouldered Stink Bug. The adult bug has a shield-shaped body about 1/2-inch long and is usually green. Late summer individuals are frequently greenish brown or may even be tannish red. The green form may be distinguished from the southern green stink bug by its smaller size and the variable reddish markings on the edges of the shoulders.

Figure 6. Leaffooted Bug. The adult bug has a dark brown, elongate-oval body about 3/4-inch long. The hind legs have flattened, leaf-like expansions which are very noticeable. There is a white or yellowish stripe across the central part of the back.

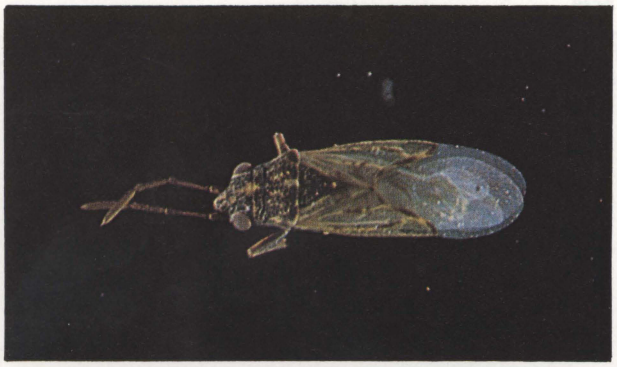

Figure 7. False Chinch Bug. The false chinch bug is 1/8-inch long. The body is narrow, straight on the sides and dull, yellowish-gray. The wings are uniform in color with small dark veins and a transparent membranous tip.

Table 1. Per panicle economic injury levels for an infestation of rice stink bug during the anthesis stage of grain development.

Control Cost ($) per acre	Market Value ($) per acre												
	100	110	120	130	140	150	160	170	180	190	200	210	220
2	3	3	3	3	3	3	3	2	2	2	2	2	2
3	4	4	4	4	3	3	3	3	3	3	3	3	3
4	5	4	4	4	4	4	4	3	3	3	3	3	3
5	5	5	5	4	4	4	4	4	4	4	4	4	3
6	6	5	5	5	5	5	4	4	4	4	4	4	4
7	6	6	5	5	5	5	5	5	4	4	4	4	5
8	6	6	6	6	5	5	5	5	5	5	5	4	4
9	7	6	6	6	6	6	5	5	5	5	5	5	5
10	7	7	7	6	6	6	6	5	5	5	5	5	5

Table 2. Per panicle economic injury levels for an infestation of rice stink bug beginning at the milk stage of grain development.

Control Cost ($) per acre	Market Value ($) per acre												
	100	110	120	130	140	150	160	170	180	190	200	210	220
2	4	4	4	4	3	3	3	3	3	3	3	3	3
3	5	5	4	4	4	4	4	4	4	4	4	3	3
4	5	5	5	5	5	5	4	4	4	4	4	4	4
5	6	6	6	5	5	5	5	5	5	5	4	4	4
6	7	6	6	6	6	6	5	5	5	5	5	5	5
7	7	7	7	6	6	6	6	6	5	5	5	5	5
8	8	7	7	7	6	6	6	6	6	6	6	5	5
9	8	8	7	7	7	7	6	6	6	6	6	5	5
10	8	8	8	7	7	7	7	7	6	6	6	6	6

Table 3. Per panicle economic injury levels for an infestation of rice stink bug beginning at the soft dough stage of grain development.

Control Cost ($) per acre	Market Value ($) per acre												
	100	110	120	130	140	150	160	170	180	190	200	210	220
2	5	5	5	5	5	5	4	4	4	4	4	4	4
3	7	6	6	6	6	5	5	5	5	5	5	5	5
4	8	7	7	7	6	6	6	6	6	6	6	5	5
5	8	8	8	7	7	7	7	7	6	6	6	6	6
6	9	9	8	8	8	8	7	7	7	7	7	6	6
7	10	9	9	9	8	8	8	8	7	7	7	7	7
8	10	10	9	9	9	9	8	8	8	8	8	7	7
9	11	11	10	9	9	9	9	9	8	8	8	8	8
10	12	11	10	10	10	10	9	9	9	9	8	8	8

Table 4. Per panicle economic injury levels for an infestation of adult southern green stink bugs beginning at the milk stage of grain development.

Control Cost ($) per acre	Market Value ($) per acre												
	100	110	120	130	140	150	160	170	180	190	200	210	220
2	3	3	3	3	3	3	2	2	2	2	2	2	2
3	4	3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	3	3	3	3	3	3	3	3	3
5	4	4	4	4	4	4	4	4	3	3	3	3	3
6	5	5	4	4	4	4	4	4	4	4	4	3	3
7	5	5	5	5	5	4	4	4	4	4	4	4	4
8	5	5	5	5	5	5	4	4	4	4	4	4	4
9	6	6	5	5	5	5	5	5	4	4	4	4	4
10	6	6	6	5	5	5	5	5	5	5	4	4	4

Table 5. Per panicle economic injury levels for an infestation of adult southern green stink bugs beginning at soft dough stage of grain development.

Control Cost ($) per acre	Market Value ($) per acre												
	100	110	120	130	140	150	160	170	180	190	200	210	220
2	4	4	4	4	4	4	4	4	3	3	3	3	3
3	5	5	5	5	5	4	4	4	4	4	4	4	4
4	6	6	6	5	5	5	5	5	5	5	4	4	4
5	7	6	6	6	6	6	5	5	5	5	5	5	5
6	7	7	7	6	6	6	6	6	6	5	5	5	5
7	8	7	7	7	7	6	6	6	6	6	6	6	5
8	8	8	8	7	7	7	7	7	6	6	6	6	6
9	9	8	8	8	8	7	7	7	7	7	6	6	6
10	9	9	8	8	8	8	7	7	7	7	7	7	6

Table 6. Per panicle economic injury levels for an infestation of adult conchuela stink bugs beginning at the milk stage of grain development.

Control Cost ($) per acre	Market Value ($) per acre												
	100	110	120	130	140	150	160	170	180	190	200	210	220
2	3	3	3	3	3	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	2	3	3	2
4	4	4	4	3	3	3	3	3	3	3	3	3	3
5	4	4	4	4	4	4	3	3	3	3	3	3	3
6	5	4	4	4	4	4	4	4	4	4	3	3	3
7	5	5	5	4	4	4	4	4	4	4	4	4	4
8	5	5	5	5	5	4	4	4	4	4	4	4	4
9	6	5	5	5	5	5	5	4	4	4	4	4	4
10	6	6	5	5	5	5	5	5	4	4	4	4	4

Table 7. Per panicle economic injury levels for an infestation of adult conchuela stink bug beginning at the soft dough stage of grain development.

Control Cost ($) per acre	Market Value ($) per acre												
	100	110	120	130	140	150	160	170	180	190	200	210	220
2	5	5	4	4	4	4	4	4	4	4	4	3	3
3	6	5	5	5	5	5	5	5	4	4	4	4	4
4	7	6	6	6	6	5	5	5	5	5	5	5	5
5	7	7	7	6	6	6	6	6	6	5	5	5	5
6	8	8	7	7	7	7	6	6	6	6	6	6	5
7	8	8	8	7	7	7	7	7	6	6	6	6	6
8	9	9	8	8	8	7	7	7	7	7	7	6	6
9	10	9	9	8	8	8	8	7	7	7	7	7	7
10	10	10	9	9	9	8	8	8	8	7	7	7	7

Table 8. Per panicle economic injury levels for an infestation of adult leaffooted bug beginning at the milk stage of grain development.

Control Cost ($) per acre	Market Value ($) per acre												
	100	110	120	130	140	150	160	170	180	190	200	210	220
2	3	3	3	3	3	3	3	2	2	2	2	2	2
3	4	4	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	3	3	3	3	3	3	3	3
5	5	4	4	4	4	4	4	4	4	3	3	3	3
6	5	5	5	4	4	4	4	4	4	4	3	4	4
7	5	5	5	5	5	4	4	4	4	4	4	4	4
8	6	5	5	5	5	5	5	4	4	4	4	4	4
9	6	6	5	5	5	5	5	5	5	4	4	4	4
10	6	6	6	6	5	5	5	5	5	5	5	4	4

Table 9. Per panicle economic injury levels for an infestation of leaffooted bug beginning at the soft dough stage of grain development.

Control Cost ($) per acre	Market Value ($) per acre												
	100	110	120	130	140	150	160	170	180	190	200	210	220
2	5	5	4	4	4	4	4	4	4	4	4	3	3
3	6	5	5	5	5	5	5	5	4	4	4	4	4
4	7	6	6	6	6	5	5	5	5	5	5	5	5
5	7	7	7	6	6	6	6	6	6	5	5	5	5
6	8	8	7	7	7	7	6	6	6	6	6	6	5
7	8	8	8	7	7	7	7	7	6	6	6	6	6
8	9	9	8	8	8	7	7	7	7	7	7	6	6
9	10	9	9	8	8	8	8	7	7	7	7	7	7
10	10	10	9	9	9	8	8	8	8	7	7	7	7

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