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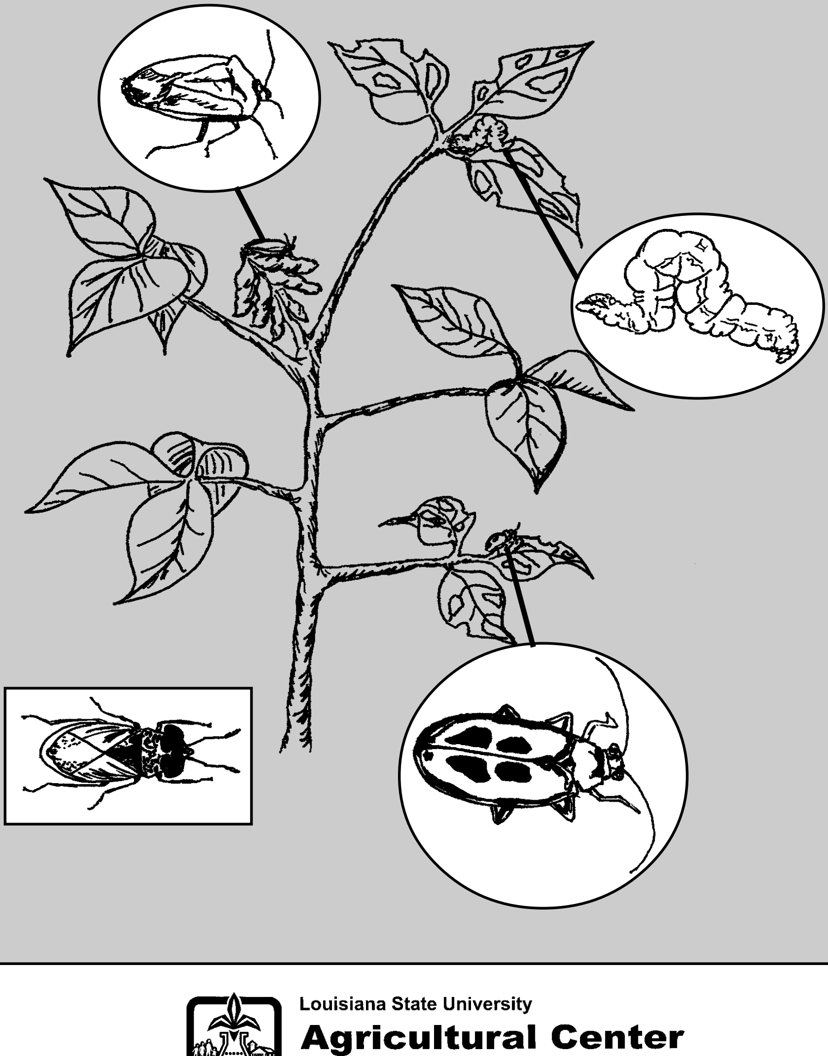

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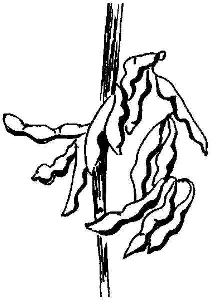

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Seasonal Abundance of Arthropod Populations on Selected Soybean Varieties Grown in Early Season Production Systems in Louisiana

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Introduction

In 1992, an estimated 19.5 million tons of soybean, *Glycine max* (L.) Merrill, valued a $4.1 billion dollars were exported by the United States (Smith 1994). Louisiana alone produced 23.6 million bushels of soybean on 1.1 million acres with an export value of $153 million in 1995 (Walter Morrison ,LSU Agricultural Center, Louisiana Cooperative Extension Service, 252 Knapp Hall, Baton Rouge, LA 70803, personal communication). Approximately 99% of Louisiana's soybean production is exported; therefore, soybean production is an important component of the state's economy.

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By utilizing Group IV or early maturing Group V soybean varieties, Louisiana farmers can initiate planting in mid-April. This planting period decreases production time from emergence to flowering (Teare and Hodges 1994), and a shorter production period is advantageous for several reasons. Early planting in the southeastern United States helps to avoid late summer drought. This drought period can be detrimental to the soybean crop because research has shown water stress is the most important environmental agent (biological or physical) affecting crop injury and subsequent yield loss (Higley et al. 1993). Utilizing early maturing soybean groups helps to avoid poor harvest weather (i.e. hurricanes, excessive rainfall, etc.) that can frequent Louisiana. Early maturity also may lessen disease exposure that can occur late in the growing season.

The soybean ecosystem in the United States harbors over 700 species of phytophagous insects (Way 1994); however, only four species are considered frequent pests in the southeastern United States (Kogan and Turnipseed 1987). The corn earworm, *Helicoverpa zea* (Boddie), and the southern green stink bug, *Nezara viridula* (L.), are important pod feeders, whereas the soybean looper, *Pseudoplusia includens* (Walker), and the velvetbean caterpillar, *Anticarsia gemmatalis* Hübner, are important defoliating pests that accounted for >$37 million in damage and control costs in 1984 in the southeastern United States (Way 1994). Therefore, early maturing varieties may help to lessen insect damage from large, late season infestations of soybean loopers and velvetbean caterpillars that migrate into Louisiana during early August through September (Baldwin et al. 1996).

A joint, interdisciplinary project was established to evaluate Group IV soybean varieties for commercial production in Louisiana. Field trials were conducted at three locations in Louisiana from 1991 to 1993. As a part of this project, species composition and seasonal incidence of arthropods in a representative Group IV and V soybean variety were determined. The data presented in this report were collected by entomologists to provide Louisiana soybean producers with information on insect management practices that may be required as they select the soybean maturity group that best fits their production systems.

Materials and Methods

In 1991, soybean plots were sampled from 8 May through 9 September at the Macon Ridge Branch of the Northeast Research Station located near Winnsboro (Franklin Parish). During the 1992 growing season, soybean plots were sampled from 7 May through 28 September at Winnsboro and from 10 June through 10 October in southern Louisiana at the Rice Research Station near Crowley (Acadia Parish). In 1993, soybean plots again were sampled at Crowley (2 June to 15 September), Winnsboro (18 May to 12 August), and at the Iberia Research Station (9 June through 22 September) near Jeanerette (Iberia Parish).

Soybean plots measured 100 ft. by 100 ft. with 7- or 20-in. row spacing and were arranged in a randomized complete block design with four replicates each of Group IV ('Pioneer 9442') and V ('Coker 485') varieties. Weed control was accomplished using recommended production practices for Louisiana. At Crowley, group IV and V soybean varieties were drill planted on 7-in. row spacing at 50 lbs./ac. on 21 April and 20 May, respectively, in 1992 and on 27 April and 14 May, respectively, in 1993. At Jeanerette in 1993, both soybean varieties were drill planted on 7-in. row spacing at 50 lbs./ac. on 30 April and 17 May for Group IV and V plots, respectively. At Winnsboro, both soybean varieties were planted on 20-in. row spacing at 50 lbs./ac. Group IV soybean were planted on 24, 13, and 22 April in 1991, 1992, and 1993, respectively. Group V soybean were planted on 25, 17, and 17 May in 1991, 1992, and 1993, respectively.

Plots were sampled once a week with a sweep-net (15 in. diameter), and each plot sample consisted of two to four sets of 25 sweeps each. Due to Hurricane Andrew in 1992, plots were not sampled the week of 24 August at Crowley. Each sample was examined in the field, and the number of insects was recorded. Arthropod species included: banded cucumber beetle, *Diabrotica balteata* (LeConte); bean leaf beetle, *Cerotoma trifurcata* (Forster); big-eyed bugs, *Geocoris* spp.; brown stink bugs, *Euschistus* spp.; *Colaspis* spp. beetle; corn earworm, *Helicoverpa zea* (Boddie); damsel bugs, *Nabis* spp.; green cloverworm, *Plathypena scabra* (F.); southern green stink bug, *Nezara viridula* (L.); soybean looper, *Pseudoplusia includens* (Walker); spined soldier bug, *Podisus maculiventris* (Say); threecornered alfalfa hopper, *Spissistilus festinus* (Say); velvetbean caterpillar, *Anticarsia gemmatalis* Hübner; and spiders. Also, the growth stage (Table 1; Fehr et al. 1971) of each variety was recorded weekly. When stink bugs exceeded their economic threshold level (9/25 sweeps), plots at Crowley and Jeanerette were treated with acephate (Orthene®, Valent USA Corporation, Walnut Creek, CA 94596) at 0.75 lbs. AI/ac. Treatments at Crowley were applied with a tractor and compressed air sprayer calibrated to deliver 10 gal./ac. of formulated material at 30 lbs./in^2, and at Jeanerette, Orthene® was applied with a Melroe spray coupe calibrated to deliver 30 gal./ac. of formulated material at 40 lbs./in^2.

Table 1. Description of Soybean Growth Stages[A]

Stage #	Stage Title	Stage Description
VE	Emergence	Cotyledons emerge above soil surface.
VC	Cotyledon	Cotyledons fully unrolled.
V(n)	nth-node	N number of nodes on main stem with fully developed leaves beginning with the cotyledon leaves.
R1	Beginning bloom	Flowers open at any node on the main stem.
R2	Full bloom	Flowers open at upper two nodes on the main stem with a fully developed leaf.
R3	Beginning pod	Pod (3/16 inch) long at one of four uppermost nodes with a fully developed leaf.
R4	Full pod	Pod (3/4 inch) long at one of four uppermost nodes with a fully developed leaf.
R5	Beginning seed	Seed (1/8 inch) long in a pod at one of four uppermost nodes with a fully developed leaf.
R6	Full seed	Pod containing a green seed that fills the pod cavity at one of the four uppermost nodes with a fully developed leaf.
R7	Beginning maturity	One normal pod on the main stem has reached its mature pod color.
R8	Full maturity	Over 95% of the pods have reached their mature pod color.

[A] From Fehr et al. (1971)

Results and Discussion

1991 Field Season

Arthropod populations were sampled in field plots near Winnsboro in 1991. Threecornered alfalfa hoppers were present throughout the season in both soybean maturity groups, and populations continued to increase until plant senescence on 9 September (Figure 1). Wuensche (1976) observed that threecornered alfalfa hopper populations increased throughout the growing season at three locations in Louisiana. Threecornered alfalfa hoppers are phloem feeders that girdle plant stems and petioles, and this damage may eventually lead to plant mortality (Mueller and Sparks 1994); however, Sparks and Newsom (1984) reported that early season damage did not affect yield in previous studies. Sparks and Newsom (1984) determined that early season damage by the threecornered alfalfa hopper will not adversely affect yield unless damage is severe enough to reduce stand density to a level below the minimal requirements for maximal yield. In our study, we did not observe early season damage for the two varieties that were tested at Winnsboro where threecornered alfalfa hopper populations peaked at 7.3/25 sweeps in Group IV plots on 1 August (R7 = reproductive stage 7; see Table 1) and at 15.3/25 sweeps on 9 September (R8) in Group V plots.

Populations of both banded cucumber beetles and *Colaspis* spp. beetles remained below 2.0/25 sweeps throughout the growing season in both soybean maturity groups. Bean leaf beetle populations generally were greater in Group IV than Group V plots. Previously, Wuensche (1976) documented significantly greater infestations of bean leaf beetles in early planted soybean than in intermediate or late planted soybean. In our study, bean leaf beetle populations peaked on 7 June (V5 = vegetative stage 5; see Table 1) in Group IV plots at 21.0/25 sweeps. Early season injury by bean leaf beetles is primarily defoliation damage, and soybean can compensate for this damage without appreciable yield loss (Pedigo 1994). In Group V plots, populations peaked on 30 June (V7) at 6.9/25 sweeps.

Four lepidopteran species (corn earworms, green cloverworms, soybean loopers, and velvetbean caterpillars) were present in 1991; however, only green cloverworm and soybean looper populations exceeded 1.0/25 sweeps on any sampling date. Green cloverworm populations peaked at 2.3/25 sweeps on 15 June in Group IV plots (R1) and at 3.7/25 sweeps on 26 August in Group V plots (R6). Soybean looper populations remained below 1.0/25 sweeps in Group IV plots throughout the growing season (Figure 2). In Group V plots, soybean loopers initially infested soybean on 15 June, and populations remained below 10.0/25 sweeps until the last sampling date.

The southern green stink bug was the predominant stink bug species. In Group IV soybean plots, southern green stink bug populations remained below 1.5/25 sweeps (Figure 3). Southern green stink bug populations in Group V plots reached 2.8/25 sweeps on the last sampling date.

The predominant beneficial insect species were big-eyed bugs and damsel bugs. In general, these two genera and minute pirate bugs, *Orius* spp., are the most abundant hemipteran predators in soybean fields (Irwin and Shepard 1980). All predaceous arthropod populations fluctuated in both soybean maturity groups. Big-eyed bugs' greatest population in Group IV plots occurred on 7 June at 2.7/25 sweeps (Figure 4). Big-eyed bugs feed on many noctuid species (Tamaki and Weeks 1972), and the big-eyed bug peak population at Winnsboro may have coincided with green cloverworm infestations. In Group V soybean plots, big-eyed bug populations peaked on 21 June at 1.5/25 sweeps and then declined. Population peaks for big-eyed bugs on both maturity groups occurred earlier than those reported in South Carolina (Shepard et al. 1974) or North Carolina (Dietz et al. 1976); however, Wuensche (1976) in Louisiana and Pitre et al. (1978) in Mississippi found big-eyed bug populations peaked at times similar to those in our study. Damsel bug populations in either maturity group were below 1.5/25 sweeps. Spiders were the predominant beneficial arthropod taxa collected in 1991. Spider populations peaked on 6 July at 4.9/25 sweeps in Group IV plots and on 20 August at 3.9/25 sweeps in Group V plots.

1992 Field Season

Arthropod populations were sampled in field plots near Crowley and Winnsboro in 1992. For the second consecutive year, threecornered alfalfa hopper populations were greater in Group V than in Group IV plots at both Crowley and Winnsboro (Figure 1). At Crowley, threecornered alfalfa hopper populations never rose above 4.2/25 sweeps once plots were treated for stink bug infestations in Group IV plots, and at Winnsboro, threecornered alfalfa hopper populations peaked at 6.0/25 sweeps on 12 June when soybean were in the R4 growth stage. In Group V soybean plots at Crowley, threecornered alfalfa hopper populations generally increased despite insecticide treatments for stink bug infestations before reaching peak infestation levels on 10 September (R6) at 16.9/25 sweeps. At Winnsboro, threecornered alfalfa hopper populations gradually increased in Group V plots until they reached their economic threshold level (25/25 sweeps) on 11 September and peaked the next week at 34.6/25 sweeps during the R7 growth stage. Sparks and Boethel (1987) documented that threecornered alfalfa hoppers can cause yield reductions in late season soybean as plants flower (R2) to seed fill (R5). Soybean pods at this later growth stage are 2 cm in length, and feeding damage by threecornered alfalfa hoppers may lead to shedding of pods or decreased seed weight at harvest (Sparks and Newsom 1984, Sparks and Boethel 1987, Mueller and Sparks 1994). Late season threecornered alfalfa hopper infestations should be closely monitored, and insecticide treatments may be necessary to avoid yield reductions during these reproductive growth stages.

Banded cucumber beetles, bean leaf beetles, and *Colaspis* spp. beetles were present throughout the growing season. Banded cucumber beetle populations at either location remained below 3.5/25 sweeps throughout the growing season in both maturity groups, whereas *Colaspis* spp. beetle populations were below 6.5/25 sweeps at both locations. Bean leaf beetle populations fluctuated in both soybean maturity groups; however, no discernible differences were observed to detect which soybean maturity group was more susceptible to bean leaf beetle infestations at Crowley or Winnsboro. At Crowley, bean leaf beetle populations never rose above 3.5/25 sweeps in either maturity group. The largest populations at Winnsboro were 5.0/25 sweeps on 10 July (R5) in Group IV plots and 7.1/25 sweeps on 31 July (R3) in Group V plots.

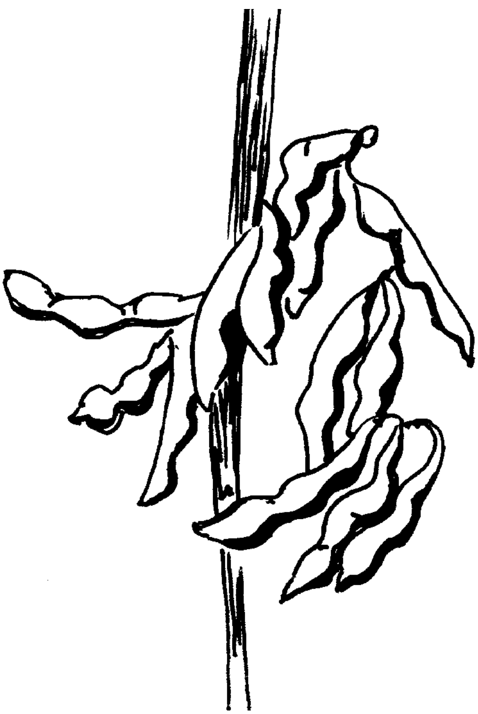
Both green cloverworms and soybean loopers infested plots at Crowley and Winnsboro, whereas velvetbean caterpillars were absent from soybean plots in 1992. At Crowley, green cloverworm populations in both maturity groups remained below 3.2/25 sweeps during most of the growing season, except for a late season peak of 13.0/25 sweeps on 10 September (R6) in Group V plots. Buschman et al. (1981) observed a similar trend in Mississippi where green cloverworms developed greater populations in late planted, late maturing varieties. Previous studies in Louisiana have shown heavy green cloverworm infestations on legumes in the spring (Newsom 1953, Oliver 1957). At Winnsboro, green cloverworm populations peaked at 9.1/25 sweeps on 19 June in Group IV plots (R4), but they never exceeded 2.2/25 sweeps in Group V plots. Sprenkel et al. (1979) also observed green cloverworm populations were significantly larger in early planted soybean. At Crowley, there was a possible influx of green cloverworms from surrounding untreated variety plots, which may be the explanation for this difference between locations. Wuensche (1976) did not report economically damaging infestations on soybean in Louisiana. If these early season green cloverworm populations remain at subeconomic levels (<75/25 sweeps), they may help to enhance and stabilize natural enemy populations in soybean fields (Dietz et al. 1976). Daigle et al. (1988) suggested that the presence of green cloverworms early in the growing season may aid in the maintenance and increase of natural enemy populations prior to the influx of migratory lepidopteran pests (i.e. soybean loopers and velvetbean caterpillars).

At Crowley, soybean looper populations increased throughout the growing season until the second insecticide application for stink bug control in both maturity groups. Soybean looper population peaks in both maturity groups were 5.0/25 sweeps (Figure 2). Soybean loopers were absent from Group IV plots at Winnsboro in 1992 (Figure 2). In Group V plots, soybean loopers first appeared on 31 July, and the population peaked on 28 August (R5) at 7.9/25 sweeps, well below the economic threshold level (37.5/25 sweeps).

Both brown stink bugs and southern green stink bugs were collected in each maturity group; however, southern green stink bugs were the predominant stink bug species collected. Wuensche (1976) previously reported similar species composition in soybean fields in Louisiana. Brown stink bug populations did not reach 3.5/25 sweeps in either maturity group. In Group IV plots, southern green stink bugs reached their economic threshold (9/25 sweeps) at Crowley on 16 July (R5) and 6 August (R6) (Figure 3) but never exceeded the economic threshold level at Winnsboro. A third insecticide treatment was applied in Group IV plots at Crowley on 13 August when combined stink bug populations (brown, green, and southern green stink bugs) neared the economic threshold level for stink bugs. In Group V plots at Crowley, southern green stink bugs exceeded their economic threshold on 20 August and 10 and 24 September when the plants were in the R5, R6, and R7 growth stages, respectively. The peak population of southern green stink bugs in Group V plots was 33.4/25 sweeps on 24 September. Lingren (1995) documented that soybean in the R5 growth stage is most susceptible to southern green stink bug injury. At this growth stage and R4, percent pod fill was significantly decreased as compared with the remaining reproductive stages when southern green stink bug populations exceeded the economic threshold level. Plant maturity also was documented to be significantly delayed by stink bug population levels greater than one per row foot at the R5 growth stage. At Winnsboro, southern green stink bug populations did not reach the economic threshold level in Group V plots until 11 September (9.1/25 sweeps) during the R7 growth stage. Because plants were nearly mature (R8) and stink bugs prefer developing seeds, chemical treatment was unnecessary (McPherson et al. 1979, 1994).

Wuensche (1976) found southern green stink bugs were highly attractive to early planted soybean, and Newsom and Herzog (1977) advocated utilizing these early maturing varieties as a trap crop. Field observations suggest both soybean groups are susceptible to stink bug infestations; however, stink bug infestations in Group V plots at Crowley may have occurred due to reinfestations from surrounding, untreated soybean variety plots and stink bugs escaping insecticide applications in adjacent variety evaluation experiments.

Big-eyed bugs and damsel bugs were the predominant predaceous insect taxa present in 1992. Big-eyed bug populations were <2.0/25 sweeps all season in both soybean groups at Crowley (Figure 4). At Winnsboro, big-eyed bugs' greatest population peaks were 3.8 and 3.3/25 sweeps on 29 May in Group IV and 26 June in Group V plots, respectively. The late season increase in Group V populations occurred two weeks after the soybean looper population reached its greatest level. Similar trends in big-eyed populations were observed by Wuensche (1976) in Louisiana on early season soybean and in Mississippi cotton fields where big-eyed bugs were more abundant in early season cotton (Dinikins et al. 1970). Damsel bug populations never exceeded 1.7/25 sweeps at either location. Spiders were not sampled in 1992 at Crowley; however, at Winnsboro, spider populations peaked on 10 July at 4.8 and 3.3/25 sweeps in Group IV and V plots, respectively. Among the beneficial species, spiders were second in abundance to big-eyed bugs at Winnsboro, and Shepard et al. (1974) observed a similar species composition in South Carolina.



1993 Field Season

Unlike 1992, no discernible differences were observed for threecornered alfalfa hopper populations between the two soybean maturity groups. Threecornered alfalfa hopper populations were low (<10/25 sweeps) at all three locations sampled (Figure 1), and populations in both maturity groups peaked well below the economic threshold level (25/25 sweeps). The highest population peaks in either maturity group were 9.1/25 sweeps in Group V plots at Crowley, <4.0/25 sweeps in both maturity groups at Jeanerette, and 4.4/25 sweeps in Group V plots at Winnsboro.

Banded cucumber beetles and *Colaspis* spp. beetles were more common than bean leaf beetles in both soybean maturity groups at Crowley and Jeanerette but less common at Winnsboro. At Crowley and Jeanerette, banded cucumber beetle populations peaked between 7.0 and 15.0/25 sweeps in both maturity groups, and at Winnsboro, populations peaked at <1.5/25 sweeps. These populations are far below the economic threshold level (100/25 sweeps) in Louisiana (Baldwin et al. 1996), and yield loss has not been attributed to this insect (Pitre 1994). *Colaspis* spp. beetle populations peaked between 4.0 and 18.5/25 sweeps in Group IV and V soybean plots. At Crowley, bean leaf beetles were collected at <1.0/25 sweeps regardless of the maturity group, and populations did not exceed 5.0/25 sweeps at Jeanerette. At Winnsboro, populations peaked at <6.0/25 sweeps in late July.

Green cloverworms, soybean loopers, and velvetbean caterpillars were all collected in 1993. Green cloverworm was the least common species, and populations peaked between 1.0 and 7.0/25 sweeps at the three locations. Soybean looper populations were <3.0/25 sweeps in both maturity group at Crowley and Winnsboro (Figure 2). At Jeanerette, soybean looper populations gradually increased after the initial sampling date. Soybean looper populations peaked on 4 August at 19.0 and 11.3/25 sweeps in Group IV (R5) and V (R4) plots, respectively (Figure 2).

Velvetbean caterpillars were absent in Group IV plots at Crowley and in both maturity groups at Winnsboro. In Group V plots at Crowley, velvetbean caterpillar populations peaked at 5.4/25 sweeps on 15 September (R7). At Jeanerette, a distinct infestation pattern was observed between the two soybean maturity groups. Velvetbean caterpillar infestations were greater in Group V than in Group IV plots. In Group IV plots, velvetbean caterpillars peaked at 6.0/25 sweeps on 4 August (R5). Velvetbean caterpillars first infested Group V plots on 11 August, and populations increased until 8 September when plots were treated for stink bug infestations. On 8 September, velvetbean caterpillars averaged 44.3/25 sweeps during the R6 growth stage, and plots sustained substantial defoliation; however, this infestation level was below the species' economic threshold level (75/25 sweeps). Hinds and Osterberger (1931) noted that velvetbean caterpillars completely defoliated soybean fields in Iberia Parish as early as 1921. Velvetbean caterpillars are a key, though sporadic, soybean pest that can completely defoliate a field (Turnipseed and Kogan 1976, Herzog and Todd 1980, Funderburk 1994). In Louisiana, Wuensche (1976) found no preferences for a particular age of soybean; however, he noted that heavy velvetbean caterpillar infestations had less time to develop on early maturing soybean. Previous researchers in Louisiana have reported velvetbean caterpillars were most destructive from early August to mid-September (Hinds and Osterberger 1931, Ellison 1942, Dugas and Gray 1944, Boethel 1984). In South Carolina, Carner et al. (1974) found later planted soybean had higher velvetbean caterpillar infestations than early planted soybean. Data gathered during this study would indicate maturity Group V soybean may be more susceptible to late-season velvetbean caterpillar infestations than Group IV soybean due this insect's temporal migration patterns (Herzog and Todd 1980).

Southern green stink bugs were the most common stink bug species collected in 1993. Populations of brown and green stink bugs were <4.5/25 sweeps. In Group IV plots at Crowley, southern green stink bug populations gradually increased until reaching populations above the economic threshold on 21 July (R5) at 9.7/25 sweeps (Figure 3). After an application of Orthene®, southern green stink bug populations remained below the economic threshold the remainder of the field season. In Group V plots, the population peak occurred on 8 September (R7) at 2.9/25 sweeps. The highest population peaks for southern green stink bugs at Jeanerette occurred on 11 August and 8 September at 9.3 and 9.9/25 sweeps in group IV (R6) and V

(R6) plots, respectively (Figure 3). The stink bug complex exceeded the economic threshold three times when all stink bug populations were pooled, and insecticide treatments were required twice in Group IV and once in Group V plots. Group IV plots were treated on 21 July and 11 August when soybeans were in the R5 and R6 growth stages, respectively, and in Group V plots were treated on 8 September during the R6 growth stage. At Winnsboro, southern green stink bugs exceeded the economic threshold in Group IV plots on 17 July (R5), and they remained above the economic threshold until sampling ceased at crop maturity (Figure 3). Plots were not sprayed to determine the value of using earlier maturing soybean as a trap crop for stink bugs. Southern green stink bug populations peaked on 23 July at more than twice the economic threshold at 22.9/25 sweeps. Southern green stink bugs never reached economically damaging levels in Group V plots, and populations remained below 2.0/25 sweeps throughout the growing season. Data gathered at both Crowley and Jeanerette in 1993 suggest Group IV soybean are more susceptible to early season stink bug infestations and that multiple insecticide applications may be needed to control stink bug damage in southern Louisiana. Also, the degree of attractiveness of Group IV soybean at Winnsboro provides a basis for utilizing these soybean varieties as trap crops for this insect (Newsom and Herzog 1977).

Big-eyed bugs were the predominant beneficial insect species collected in 1993. At Crowley, big-eyed bug populations peaked on 16 June at 14.0 and 17.4/25 sweeps in Group IV and V plots, respectively (Figure 4). Greater early season populations may have been partially attributed to big-eyed bugs feeding on abundant thrips populations present in weedy plots (Tamaki and Weeks 1972, Crocker and Whitcomb 1980). At Jeanerette, big-eyed bugs were <2.5/25 sweeps in both maturity groups (Figure 4). Big-eyed bug populations at Winnsboro peaked on 15 June at 5.2 and 2.3/25 sweeps in Group IV and V plots, respectively (Figure 4). Damsel bug populations remained below 2.5/25 sweeps, and spiders were found at <3.0/25 sweeps regardless of the maturity group at all three locations in 1993.

Summary and Conclusions

Threecornered alfalfa hoppers were more abundant in northern than southern Louisiana parishes, and Group V soybean generally were more heavily infested than Group IV soybean in 1991 and 1992. Late season infestations of threecornered alfalfa hoppers exceeded their economic threshold level (25/25 sweeps) after the R4 growth stage at Winnsboro in 1992, and damage during this growth stage has been shown to decrease soybean yields (Sparks and Boethel 1987). Threecornered alfalfa hoppers should be closely monitored after pod set to avoid late season yield reductions.

Bean leaf beetles generally had the largest populations among beetle species. The greatest bean leaf beetle population (21.0/25 sweeps) infested Group IV soybean at Winnsboro in 1991. Because this population was <50% the economic threshold level (50/25 sweeps), no insecticide treatments were necessary. Insecticide usage can be minimized by planting small blocks (<5% of the total acreage) of early maturing soybean varieties, such as Group IV varieties, to attract overwintering adults, concentrate bean leaf beetles into a small area, and eliminate these populations with insecticides. However, these soybean varieties must be planted 10 to 14 days earlier than the remainder of the crop to effectively function as a trap crop (Baldwin et al. 1996).

Green cloverworms, soybean loopers, and velvetbean caterpillars infested soybean throughout these studies. Green cloverworms were more prevalent in Group IV soybean than Group V soybean at Winnsboro in 1992. During all three field seasons, green cloverworm populations were sub-threshold (<75/25 sweeps). These sub-threshold infestations, if left untreated, may provide beneficial arthropods with an early season prey resource and contribute to the population growth of several natural enemies. These resident natural enemy populations then may slow the population growth of pest species (i.e. soybean loopers, velvetbean caterpillars, etc.) that migrate into Louisiana in late season.

Soybean loopers infested Group V soybean more heavily than Group IV soybean at Winnsboro in 1991 and 1992, whereas Group IV plots were more heavily infested at Jeanerette in 1993. This pest species is primarily controlled with insecticides; however, it has become resistant to most major classes of insecticides (Boethel et al. 1992). Currently, formulations of *Bacillus thuringiensis* and thiodicarb (Larvin®) are the only compounds recommended in Louisiana for controlling this pest species in soybean (Baldwin et al. 1996). Economically damaging soybean looper populations typically do not occur until early August in Louisiana; therefore, data gathered from our study would suggest Group IV soybean varieties (i.e. planted in April) should mature early enough to escape soybean looper defoliation damage. This would enable soybean producers to harvest their crop early to avoid insecticide treatments for soybean looper or velvetbean caterpillar infestations.

Velvetbean caterpillar populations have widely fluctuated during the 1990s, as our study demonstrated, with virtually no infestations in 1991 and 1992 but heavy infestations at one location in 1993. Velvetbean caterpillars were more abundant in Group V than IV soybean at Jeanerette in 1993. Previous research has shown velvetbean caterpillar infestations are most destructive in August and September. In our study, Group IV soybean generally matured by mid-August; therefore, Group IV soybean should escape late season damage by this pest species. Group V soybean plots required another four to five weeks before maturity, and these soybean plants sustained substantial defoliation from late-season velvetbean caterpillar infestations. Because soybean may not compensate for this late-season feeding damage, soybean yields from later soybean maturity groups may be reduced. However, this pest species, unlike the soybean looper, has not developed resistance to insecticides (Boethel et al. 1992), and velvetbean caterpillars are effectively managed with several recommended insecticides in Louisiana (Baldwin et al. 1996).

Southern green stink bugs were the most commonly collected stink bug species, and populations exceeded the economic threshold at all three locations. Group IV soybean were more heavily infested than Group V soybean, and in southern Louisiana, Group IV soybean required more insecticide applications than Group V soybean to manage stink bug infestations. Soybean producers should monitor their fields weekly, particularly during full pod development (R4) and initial seed development (R5) because stink bug populations at economic threshold levels are documented to significantly decrease pod fill and delay plant maturity (Lingren 1995). Previously, Newsom and Herzog (1977) advocated the use of early maturing soybean varieties as trap crops due to their attractiveness to stink bugs. They said "stink bugs are strongly attracted to soybeans on which pods have formed and seeds have begun to develop in preference to plants in earlier stages of development." Baldwin et al. (1996) suggest <15% of the total acreage be utilized as a trap crop, and insecticide treatments should be applied when stink bug populations reach approximately two per 25 sweeps. This threshold level is lower than the normal threshold (9/25 sweeps) to prevent stink bugs from escaping into the main crop. However, if plantings of Group IV varieties comprise a greater proportion of the soybean acreage planted on a farm each year, the insecticide savings associated with the trap crop approach will be nullified. Possibly, stink bug management will become more intense because of the attractiveness of Group IV soybean and the potential for early season build-up of stink bug populations. If these early season populations are not properly managed, then Group IV soybean varieties may act as a nursery crop. Previous research has shown that as early planted soybean varieties mature and become unattractive for feeding and oviposition, adult stink bugs will migrate to more reproductively and nutritionally acceptable host plants (Todd and Herzog 1980).

Big-eyed bugs along with spiders were the most abundant predaceous arthropods in field plots, and this species composition trend is similar to that observed by Shepard et al. (1974) in South Carolina. In general, there were no differences in predator populations by a comparison of different maturity groups or by location. Because these are generalist predators, it was difficult to directly correlate their populations with prey populations; however, previous research has shown predator populations coincide seasonally with those of their prey species (Yeargan 1994).

In conclusion, our research can serve as a point of reference for potential pest problems in early maturity group soybean varieties. The use of Group IV soybean varieties should enable soybean producers to avoid late summer drought conditions as well as economically damaging populations of the soybean looper and the velvetbean caterpillar. Group IV soybean varieties may also be utilized as a trap crop for attracting bean leaf beetles and stink bugs; however, should Group IV soybean varieties become widely adopted, our data indicate more insecticide treatments will be required to control stink bug infestations as compared with Group V soybean varieties in southern Louisiana parishes. Soybean producers must determine which soybean maturity group is best suited to their particular farm operation, and our data should serve as a baseline for managing insect pest populations that may develop on these varieties.

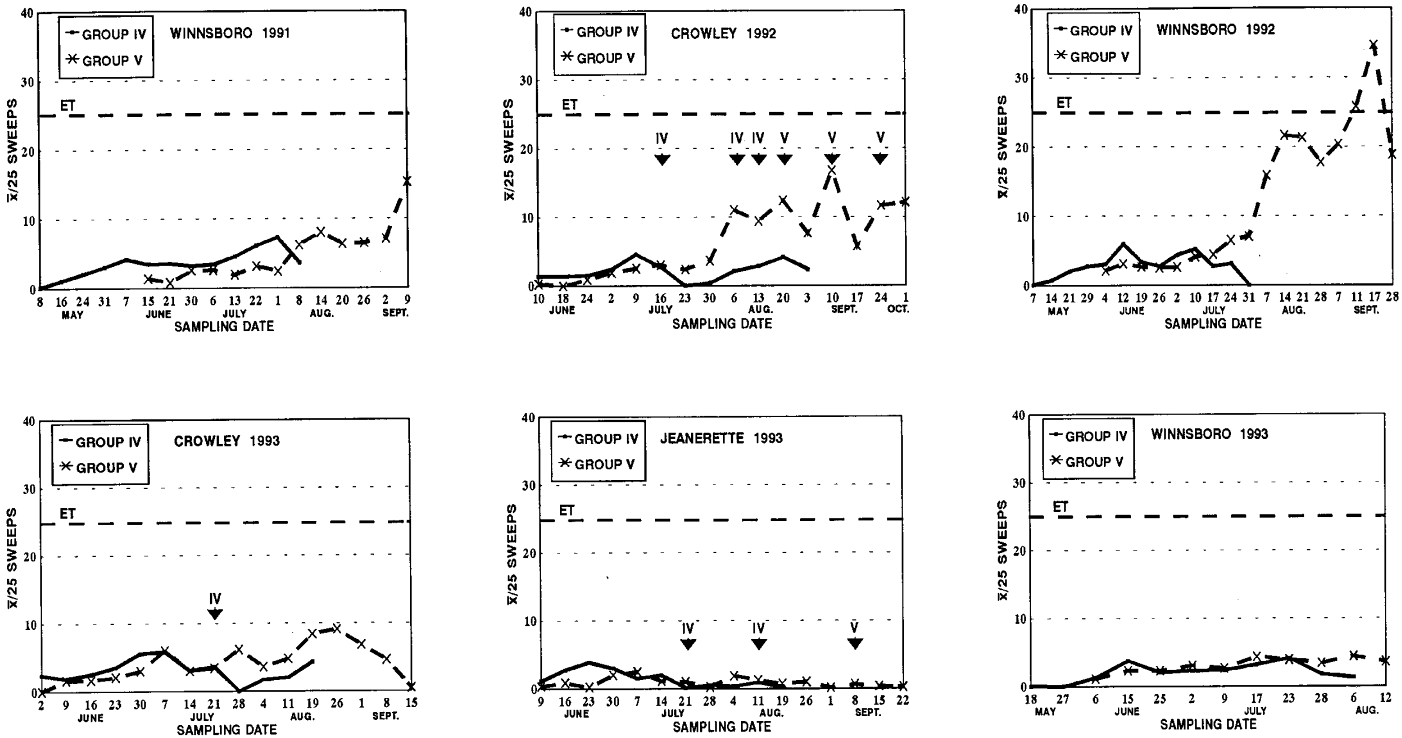


Figure 1. Weekly population means of the threecornered alfalfa hopper, *Spissistilus festinus* (Say), collected from Group IV and V soybeans in Louisiana. The economic threshold (ET) for threecornered alfalfa hoppers is 25 adults per 25 sweeps starting at pod set. The ‘s indicate that soybeans were treated for stink bug infestations.

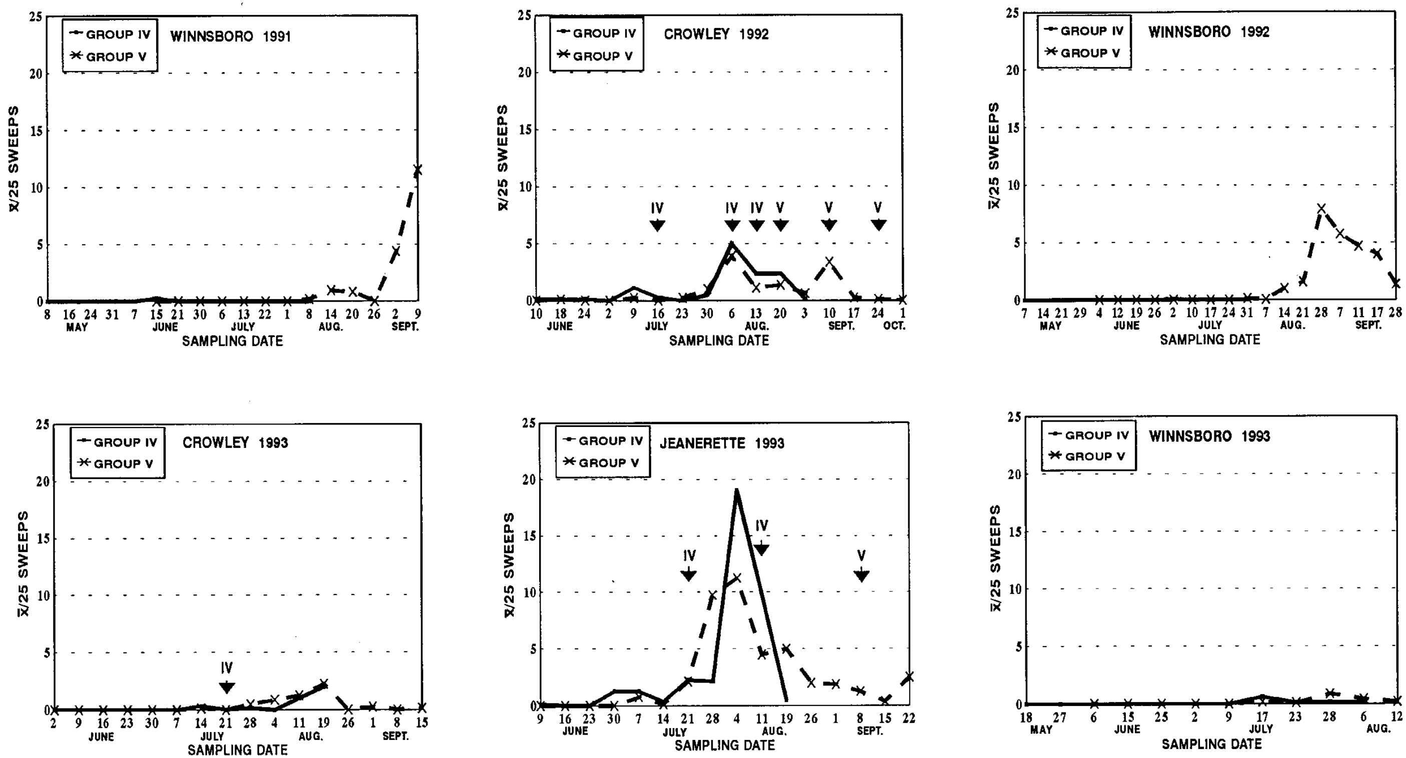


Figure 2. Weekly population means of the soybean looper, *Pseudoplusia includens* (Walker) collected from Group IV and V soybeans in Louisiana. The economic threshold (ET) for soybean loopers is 37.5 per 25 sweeps. The ‘s indicate that soybeans were treated for stink bug infestations.

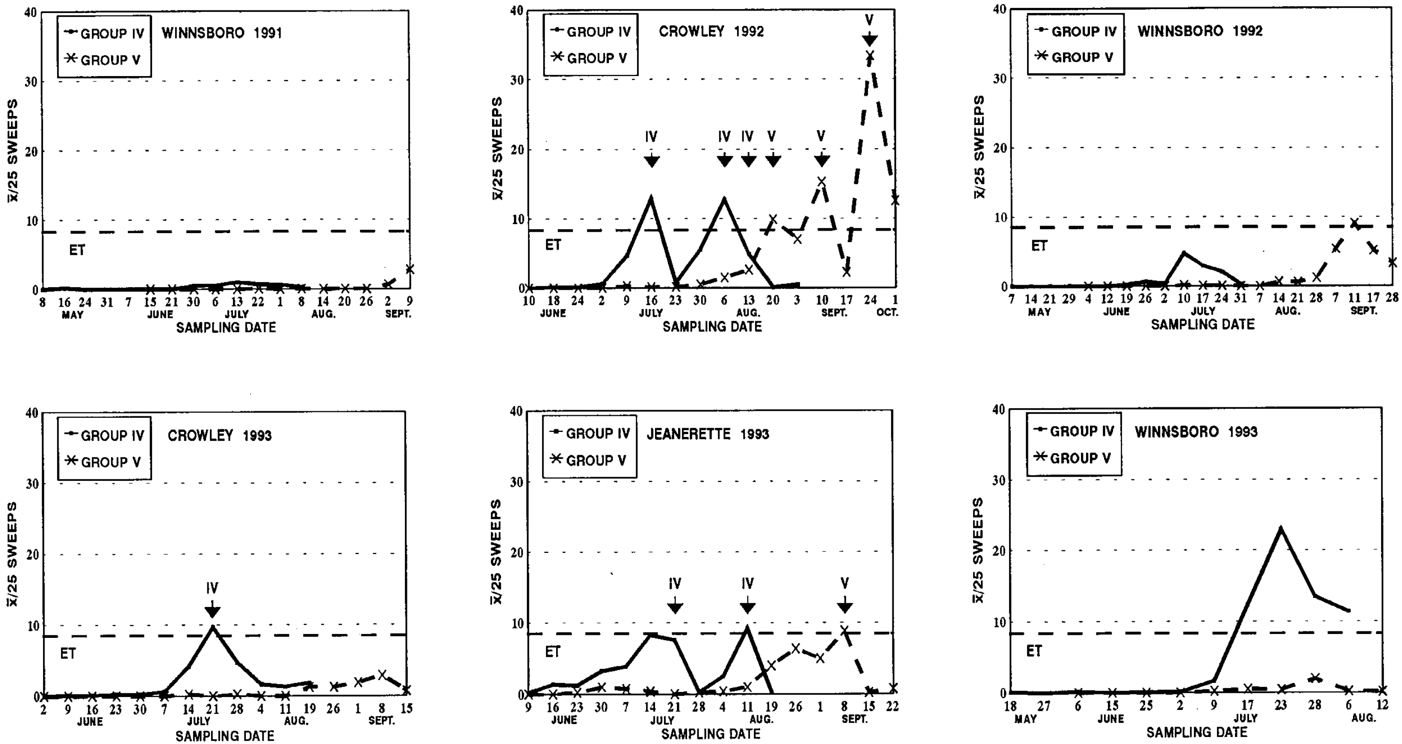


Figure 3. Weekly population means of the southern green stink bug, *Nezara viridula* (L.), collected from Group IV and V soybeans in Louisiana. The economic threshold (ET) for stink bugs is 9 per 25 sweeps after pod set. The ‘s indicate that soybeans were treated for stink bug infestations.

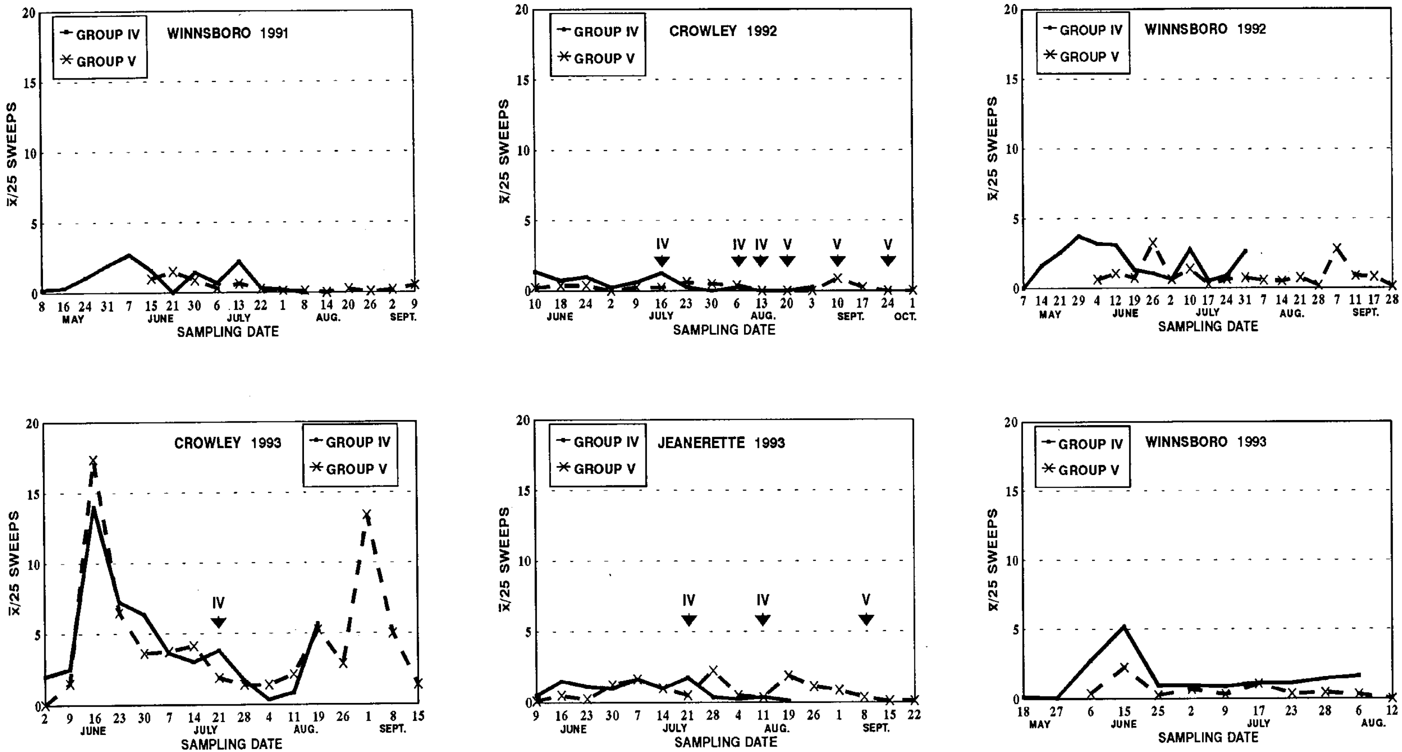


Figure 4. Weekly population means of big-eyed bugs, *Geocoris* spp., collected from Group IV and V soybeans in Louisiana. The ‘s indicate soybeans were treated on that date for stink bug infestations.

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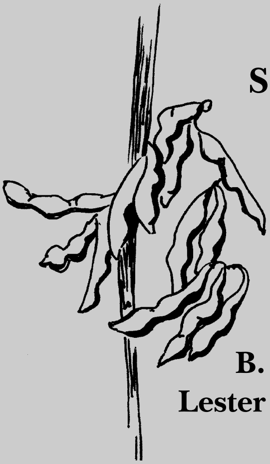

Seasonal Abundance of Arthropod Populations on Selected Soybean Varieties Grown in Early Season Production Systems in Louisiana

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