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Pest and beneficial arthropods in a ‘Tifton 85’ bermudagrass field in north central Florida

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The bermudagrass cultivar ‘Tifton 85’ (*Cynodon dactylon* [L.] Pers. × *Cynodon transvaalensis* Burtt Davy; Poaceae) is being planted frequently in north central Florida for hay production and in pastures for grazing primarily because of its high dry matter yield and forage digestibility relative to other cultivars (Hill et al. 2001). General recommendations are to cut the grass every 4 to 5 wk for maximum dry matter yield of hay (Burton et al. 1992). However, producers need to know the best cutting height and harvest interval for their specific region. Consequently, for north Florida, a forage study was conducted in Levy County, Florida, using plots of ‘Tifton 85’ bermudagrass cut to stubble heights of 8 or 15 cm and harvested at intervals of 21 to 35 d (Clavijo Michelangeli et al. 2010). The resulting recommendation was to maximize the production of grass by cutting it to a height of 15 cm and maintaining it for a 35 d period. However, this relatively long period of growth could expose the grass to yield-reducing insects, such as grass loopers (*Mocis* species; Lepidoptera: Erebidae) (Meagher 2001), and fall armyworms (*Spodoptera frugiperda* [J. E. Smith]; Lepidoptera: Noctuidae), grasshoppers (Orthoptera: Caelifera), leafhoppers and spittle bugs (Hemiptera: Auchenorrhyncha), and plant bugs (Hemiptera: Miridae) (Newman et al. 2014) . These pest insects can be especially damaging in the summer and fall, completely stripping a field of bermudagrass (Newman et al. 2014), but certain cultivars are more susceptible than others (Meagher et al. 2007). To determine if the recommendation for cutting and harvesting the grass was affected by the population levels of pest insects, pest and beneficial arthropods were sampled simultaneously throughout the Levy County forage study (Clavijo Michelangeli et al. 2010).

The research was conducted in an approximately 9 ha pasture in north central Florida near the city of Chiefland (29.51038°N, 82.81362°W). A study area was demarcated in a 35 × 29 m central area of the pasture in which ‘Tifton 85’ bermudagrass had been grown for at least 3 yr. The study was conducted as a completely randomized design with a split-plot arrangement. Two plots were established for the main effect stubble height. One plot was mowed to a stubble height of 8 cm (short) and the other to 15 cm (tall). Each plot was divided into twelve 4 × 9 m sub-plots. The sub-plots were arranged in 4-m-wide strips, 4 sub-plots per strip and 3 strips per plot. The 12 sub-plots were mowed based on randomized cutting intervals of 21, 24, 27, or 35 d, with 3 replicates per interval. A 6-m-wide buffer of ‘Tifton 85’ bermudagrass surrounding each sub-plot was mowed every 21 d, and the study area was surrounded by a 9-m-wide border of the grass that was uncut.

The plots were sampled for insects approximately weekly (every 5–9 d) using a sweep net (BioQuip® 38-cm-diameter bag, heavy duty; BioQuip Products Inc., Rancho Dominguez, California) to make 9 sweeps in each sub-plot (Hawkins et al. 1979). The sweeps were made back and forth across a sub-plot beginning on a long side about 2 m in from an end. On a sampling day, all of the arthropods collected from each sub-plot were placed in a separate plastic bag that was sealed and labeled, transported to the laboratory, and placed in a freezer (−20 °C) until the specimens were identified and counted. After mowing the grass to the 8 or 15 cm stubble height, field sampling began on 5 Aug 2008 and ended on 29 Oct 2008. The sampling days were 5, 13, 18, and 27 Aug; 3, 9, 16, 23, and 30 Sep; and 7, 14, 22, and 29 Oct.

The arthropod collection data were analyzed to identify correlations between cutting height (8 or 15 cm) and harvest interval (21, 24, 27, or 35 d) (PC-ORD 6.22, MjM Software Design, Gleneden Beach, Oregon). The multivariate analysis revealed no correlation between grass cutting height and arthropod community or between harvest interval and arthropod community. Consequently, because the recommended harvest interval to maximize dry matter yield for north central Florida was 35 d (Burton et al. 1992; Clavijo Michelangeli et al. 2010), only data for this interval and the 2 stubble heights were analyzed further. The grass was cut to the 8 or 15 cm stubble height for the 35 d intervals on 4 Sep and 9 Oct. For each stubble height, the number of each arthropod type was totaled for the 13 sampling days. Totals from the 3 replicated sub-plots were used to calculate a mean and standard error for each stubble height and arthropod type. The means were compared using paired *t*-tests to determine the effect of stubble height on the abundance of each type of arthropod (JMP® Pro 11, SAS Institute Inc., Cary, North Carolina).

In combined short and tall grass, the major pest insect taxa collected in the sweep net samples were the following: Auchenorrhyncha (61.1%), grasshoppers (20.3%), grass loopers (14.6%), plant bugs (2.6%), fall armyworms (1.2%), and stinkbugs (0.25%) (Table 1). Less abundant insects in the collections included click beetles (Coleoptera: Elateridae); weevils (Coleoptera: Curculionidae); red imported fire ants, *Solenopsis invicta* Buren (Hymenoptera: Formicidae); katydids (Orthoptera: Tettigoniidae); crickets (Orthoptera:

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Table 1. Mean (± SE) number of pest and beneficial arthropods collected on a north central Florida farm in 'Tifton 85' bermudagrass grown for 35 d after being cut to a short or tall stubble height[a].

	Stubble height[b]	
Arthropod type and taxon	Short (8 cm)	Tall (15 cm)
Pest arthropods:		
Auchenorrhyncha[c]	836.7 ± 47.0a	393.7 ± 11.7b
Grasshopper (Caelifera)	190.3 ± 28.9a	218.3 ± 30.1a
Grass looper (Erebidae)	77.3 ± 4.4a	216.0 ± 14.2b
Plant bug (Miridae)	21.3 ± 8.1a	31.0 ± 3.8a
Fall armyworm (Noctuidae)	12.3 ± 2.4a	13.0 ± 3.2a
Stink bug (Pentatomidae)	1.0 ± 0.6a	3.7 ± 0.7b
Beneficial arthropods:		
Spider (Araneae)	4.7 ± 0.9a	10.3 ± 3.4a
Damsel bug (Nabidae)	4.0 ± 1.5a	7.3 ± 3.0a
Big-eyed bug (*Geocoris* spp.)	1.7 ± 0.3a	2.7 ± 1.8a
Small wasp (Hymenoptera)	0.3 ± 0.3a	1.3 ± 0.9a

[a]Total number of specimens per arthropod taxon collected in 9 sweep net samples in each of 3 sub-plots on all 13 sampling days. The sampling days were 5, 13, 18, and 27 Aug; 3, 9, 16, 23, and 30 Sep; and 7, 14, 22, and 29 Oct 2008.

[b]Means within a row followed by the same letter are not significantly different ($P > 0.05$, paired t-test)

[c]Leafhoppers (Cicadellidae) and spittle bugs (Cercopidae).

Gryllidae); dragonflies (Odonata: Anisoptera); earwigs (Dermaptera); and tiger beetles (Coleoptera: Carabidae). The Auchenorrhyncha were collected significantly more often on grass grown from short than from tall stubble, whereas equal numbers of grasshoppers, plant bugs, and fall armyworms were encountered regardless of cutting height. Grass looper and stink bug populations reached higher levels in the tall grass than in the short grass.

The most abundant beneficial arthropods were spiders (Araneae) (46.4%); damsel bugs (Hemiptera: Nabidae) (35.0%); big-eyed bugs, *Geocoris* spp. (Hemiptera: Geocoridae) (13.6%); and small possibly parasitoid wasps (5.0%). The predators and small wasps were less abundant than the pest insects, except for stink bugs. Spiders, damsel bugs, and small wasps tended to have larger populations in the tall grass than in the short grass. Big-eyed bugs and small wasps were much less common than the other 2 arthropod types in both the short and tall grasses.

The pest insects of major concern for forage production using 'Tifton 85' bermudagrass were leafhoppers and spittle bugs (Auchenorrhyncha), grasshoppers, grass loopers, and fall armyworms (Fig. 1). These insects were sampled for 13 wk, and the grass was cut at the beginning of the study and between sample days 5 and 6 and sample days 10 and 11. The Auchenorrhyncha adult populations increased after each harvest, particularly in the grass grown from short stubble. The pattern of fluctuation in the sample sizes over time was similar for the 2 stubble heights but many more of these insects were collected after the grass had been cut short. Grasshopper populations reached about the same level with both short and tall stubble, and the sample patterns over time were similar. The grasshopper populations did not rebound after the first grass cutting date. More grass looper moths and larvae were captured in the grass grown from tall than from short stubble. The populations in grass from both stubble heights peaked on sample days 4 or 5, and 7 after the grass had been cut initially. Grass loopers in the tall stubble grass also had a major peak on day 3. Fall armyworm populations in grass grown from both short and tall stubble peaked on day 4 after the grass had been cut at the beginning of the study, although the peak was higher following the short cutting height. Fall armyworm populations did not rebound after the grass had been cut between sample days 5 and 6. Similar to the grass loopers, fall armyworms had earlier population increases in grass from tall than in grass from short stubble.

In the companion forage study, bermudagrass yields increased with longer harvest intervals (Clavijo Michelangeli et al. 2010). This result is consistent with those from previous studies on coastal bermudagrass production (Prine & Burton 1956), but growth of the grass levels off at about 6 wk (Burton et al. 1963). Pest populations also tend to increase as the harvest interval is extended and can cause significant yield loss, especially due to leafhoppers and plant hoppers early in the summer growing season (Hawkins et al. 1979). Although Auchenorrhyncha typically are the most abundant pest insects (Lynch et al. 1980), controlling the complete pest complex with insecticides over an entire growing season increased the mean kg per ha dry weight yield by 42% (Buyers 1967). Frequent harvesting also can be an effective means of managing these pests by physical removal (Hawkins et al. 1979). The maximum harvest interval was 35 d in the current study, so populations of grass-feeding insects had a limited period to increase and reduce the quantity of forage.

Beneficial arthropods might have reduced the abundance and impact of insect pests in the 'Tifton 85' bermudagrass, although their potential impact was not measured. Predators were more abundant than small possibly parasitic wasps, including a diversity of spiders, damsel bugs, and big-eyed bugs. In a different area of the same pasture, 864 sentinel fall armyworm larvae were deployed to collect parasitoids (Hay-Roe et al. 2016) and, of the 165 recovered, about 22% were parasitized. Collected parasitoids were the braconids *Aleiodes laphygmae* (Viereck) and an *Aleiodes* sp. (Hymenoptera: Braconidae) and the ichneumonids *Ophion flavidus* Brullé and an *Ophion* sp. (Hymenoptera: Ichneumonidae); additional parasitoids were the tachinids *Lespesia archippivora* (Riley), *Lespesia aletiae* (Riley), and *Eucelatoria rubentis* (Coquillett) (Diptera: Tachinidae) (Hay-Roe et al. 2016). Beneficial arthropod populations tended to increase as the grass grew and the pests became more abundant (Hay-Roe et al. 2016).

The results of this research indicated that herbivorous arthropods may have had a negligible impact on the forage study (Clavijo Michelangeli et al. 2010). Within 35 d after the grass had been cut, none of the arthropod pest populations reached unequivocally damaging levels. This may have been due to the pest generation times and potential impacts of the variety of parasitoids and predators present in the pasture.

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Summary

Pest and beneficial arthropods were collected in a 'Tifton 85' bermudagrass pasture in north central Florida to assess their impact on forage production. The primary pests were Auchenorrhyncha (leafhoppers and spittlebugs), grasshoppers, grass loopers, plant bugs, fall armyworms, and stinkbugs. Major beneficial arthropods included spiders, damsel bugs, big-eyed bugs, and small possibly parasitoid wasps. The pest populations did not increase to obvious damaging levels during 35 d growing periods after the grass had been mowed to heights of 8 or 15 cm. Thus, pest arthropods probably can be managed by grazing or periodically mowing 'Tifton 85' bermudagrass.

Key Words: harvest management; pasture pest; beneficial arthropod

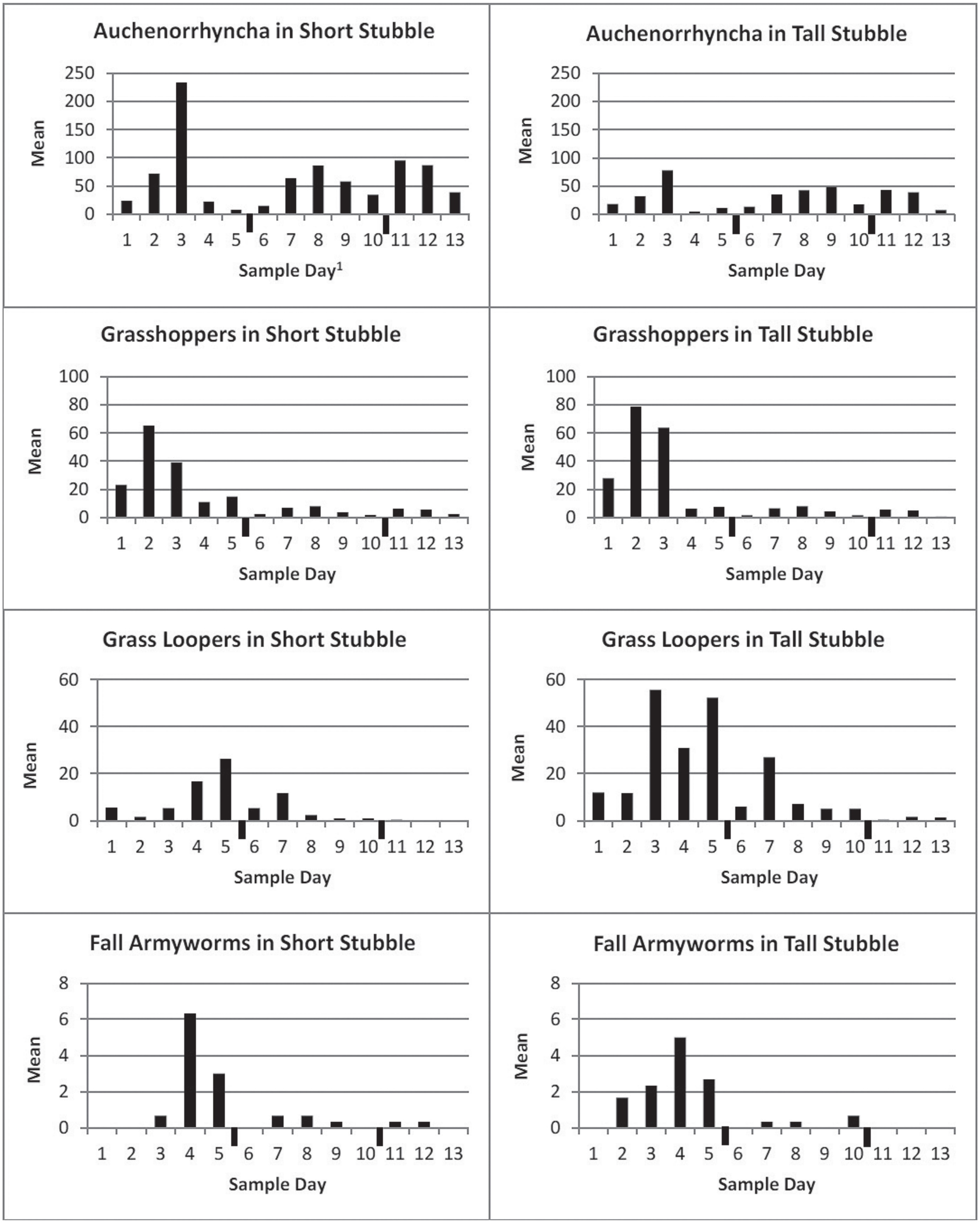

Fig. 1. Mean number of major pest arthropods collected each sampling day (9 sweep net samples per sub-plot, 3 replicates) on a north central Florida farm in 'Tifton 85' bermudagrass grown for 35 d after being cut to a stubble height of 8 or 15 cm. The sampling days were 5, 13, 18, and 27 Aug; 3, 9, 16, 23, and 30 Sep; and 7, 14, 22, and 29 Oct 2008. The grass was cut on 4 Sep and 9 Oct, between sample days 5 and 6 and sample days 10 and 11, respectively (bars below the x-axes).

Sumario

Se recolectaron las plagas y los artrópodos benéficos en una pradera de pasto Bermuda ‘Tifton 85’ en la región norte central de la Florida para evaluar su impacto en la producción de forraje. Las plagas principales fueron Auchenorrhyncha (saltahojas y salivazos), saltamontes, medidores de pastos, chinches de plantas, cogollero y chinches hediondas. Los artrópodos benéficos principales incluyeron arañas, caballitos de diablo, chinches de ojos grandes (Geocoridae) y pequeñas avispas parasitoides. Las poblaciones de plagas no aumentaron a niveles evidentes de daño durante los períodos de crecimiento de 35 días después de que el césped fuera cortado a alturas de 8 ó 15 cm. Por lo tanto, los artrópodos de plagas probablemente pueden ser manejados por pastoreo o cortando periódicamente el pasto Bermuda ‘Tifton 85’.

Palabras Clave: manejo de la cosecha; plaga de pasto; artrópodo benéfico

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