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FINAL STUDY REPORT
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Evaluation of Warm-Season Grasses for Use as Cover Crops in Florida

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ABSTRACT

From 2015-2018, the USDA-Natural Resources Conservation Service Brooksville Plant Materials Center (PMC) gathered data on plant characteristics and yield for ten species and cultivars of warm-season grasses that have potential for use as summer cover crops in Florida. Most of the millet species and cultivars we evaluated provided good to excellent canopy coverage. An exception was common or white proso millet (*Panicum miliaceum* L.); these proso millet plants flowered and started to set seed less than 30 days after planting (DAP) and supplied little canopy coverage or plant biomass. Common sterile sorghum [*Sorghum bicolor* (L. Moench)], ‘Honey Graze BMR’ sorghum-sudan [*Sorghum bicolor* (L. Moench) var. *bicolor* × *S. bicolor* ssp. *drummondii* (Nees ex Steud.) de Wet & Harlan], and two lines of teosinte [*Zea mexicana* (Schrad.) Kuntze], common and ‘Chapingo’, provided slightly less early (28-30 DAP) canopy coverage than the millets, but coverage improved later in the study period. The data on flowering dates for these grasses showed that they fell into three general groupings. Browntop millet [*Urochloa ramosa* (L.) Nguyen], Japanese millet [*Echinochloa esculenta* (A. Braun) H. Scholz.] and ‘Dove’ proso millet were early flowering (32-36 DAP); ‘Chiwapa’ billion-dollar grass (*E. frumentacea* Link), common sterile sorghum and ‘Leafy 22’ pearl millet [*Pennisetum glaucum* (L.) R. Br.] were intermediate flowering (49-53 DAP); and Honey Graze BMR sorghum-sudan, common and Chapingo teosinte were late flowering (60-80 DAP). The sorghum and sorghum-sudan lines were high yielding warm-season grasses that produced from 6,206 to 30,544 lb/ac of dry matter. Both teosintes were also highly productive, yielding 8,063 to 14,023 lb/ac of dry matter. Ratios of the amount of carbon to nitrogen (C:N ratio) were less than 30:1 in the millets, except for Chiwapa billion-dollar grass. The C:N ratios of Chiwapa, both sorghum types, and both teosinte lines were above 30:1, which will likely decrease nitrogen availability for the following cash crop.

INTRODUCTION

Incorporating cover crops into cropping systems can improve soil quality and resiliency of agricultural lands by increasing soil organic matter, improving water holding capacity, serving as a nitrogen trap to improve water quality, reducing soil erosion, and for suppression of weeds and other pests. Cover crops are useful in both conventional row crops and organically grown crops (SARE, 2007; Wright et al., 2017). Selecting the most useful warm-season grass species or cultivars to fit into specific cropping systems has been constrained by a lack of data on growth potential, biomass production, adaptability, winter hardiness, and bloom time of these species or cultivars. In the southeastern US, data on potential cover crops are arguably even more lacking than in other parts of the US and as a result many producers, except for those growing organic

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crops, have not begun to embrace the idea of incorporating cover crops into their production systems.

Currently, most of the available information on potential warm-season grass cover crops in this region has been culled from research on using these species for either forage or grain/seed production, both of which have different management requirements than when using them as cover crops. The Florida Department of Agriculture and Consumer Services reports that almost a fifth of the receipts from Florida agricultural production in 2017 was derived from production of vegetable crops and almost the same amount was derived from production of citrus and other fruits and nuts (FDACS, no date). These crops often require a broader spectrum of cover crop options than those traditionally used in agronomic row crop systems. For example, in Florida there may be a greater need for summer cover crops, because a large portion of vegetable production occurs during the winter months. Also, because of our mild weather, tropical species that may not be suitable for use in cooler climates may be well adapted for use as cover crops here. Even row crop producers may have needs for cover crops at different times of the year than producers in more temperate areas if they wish to keep a year-round cover on the soil.

Objective of this study was to assemble a wide range of commercially available sources of warm-season grasses with potential for use as cover crops in Florida and to collect information on survival, phenology, and productivity from evaluations at the USDA-Natural Resources Conservation Service (NRCS) Brooksville Plant Materials Center (PMC). This research report summarizes results from four years (2015-2018) of planting these grasses at the Brooksville PMC.

MATERIALS AND METHOD

Seed lots of warm-season grass cultivars shown in Table 1 were purchased from commercial producers in the spring of 2015, except for ‘Chapingo’ teosinte, which came from our PMC production seed lot. These same seed lots were used for planting the plots in 2015, 2016, and 2017. There were concerns that the quality of the seed was deteriorating in storage, so new seed of the commercial-sourced seed types was purchased in the spring of 2018. The same cultivars were purchased, but it was not always possible to purchase each cultivar from the same vendor. Leafy 22 pearl millet was dropped from the study in 2018.

Table 1. Species, cultivars, and seeding rates of warm-season grasses used in evaluation plots at the Brooksville Plant Materials Center.

Common Name	Scientific Name	Cultivar	Seeding Rate ¹ ----lb/ac----
Billion-dollar Grass	<i>Echinochloa frumentacea</i>	Chiwapa	12
Browntop Millet	<i>Urochloa ramosa</i>	Common ²	15
Japanese Millet	<i>E. esculenta</i>	Common	12
Pearl Millet ³	<i>Pennisetum glaucum</i>	Leafy 22	25
Proso Millet	<i>Panicum miliaceum.</i>	Common (white)	25
Proso Millet		Dove	25
Sorghum-Sudan	<i>Sorghum bicolor</i> var. <i>bicolor</i> × <i>S. bicolor</i> ssp. <i>drummondii</i>	Honey Graze BMR	12
Sterile Sorghum	<i>S. bicolor</i>	Common	12
Teosinte	<i>Zea mexicana</i>	Chapingo	12
Teosinte		Common	12

¹ Seeding rate is in bulk pounds per acre.

² Common seed lots sold without a cultivar name; can also be referred to as variety not stated (VNS) seed.

³ Pearl Millet was excluded from the 2018 planting.

The planting area was clean tilled and cultipacked prior to planting. All plots were planted on a single planting date. Planting dates were 11 June 2015, 23 June 2016, 21 June 2017, and 26 June 2018. Seeding rates (Table 1) were based on university extension recommendations for the southeastern US, such as those presented in Wright et al., 2017 for Florida cover crops. If seeding rates for a species were not available from extension publications, then rates were based on references from other reputable sources. In 2015 and 2016, the 4 ft x 20 ft plots were planted by broadcasting the seed uniformly over the entire plot and the soil was lightly raked to incorporate the seed. The soil was then cultipacked after planting. In 2017 and 2018, the plots were planted using a precision plot seeder (Wintersteiger Plotseed XL, Wintersteiger, Inc, Salt Lake City, UT), which seeded 8 rows spaced 6 in apart. This equated to a 3.5 ft wide planting area and the plot length remained 20 ft. The quantity of seed was adjusted in these years to plant at the same seeding rate used in 2015 and 2016. The study was arranged as a randomized complete block. From 2015 through 2017, plots of each cultivar were replicated three times and a fourth replication was added in 2018. Plots were moved to different fields at the PMC each year to prevent issues with carry-over of dormant seeds. Soil types in 2015 and 2016 were a Kendrick fine sand - 0-5% slopes; in 2017 the plots were primarily planted on a Kendrick soil, however, the third replication graded into a Flemington fine sandy loam - 0-5% slopes. In 2018, the plots were planted on an Electra variant fine sand - 0-5% slopes, but the fourth replication graded into a Floridana variant loamy fine sand.

Soil samples taken from the planting areas in each year were submitted to the University of Florida Extension Soils Laboratory to determine fertilizer needs. Prior to planting, P₂O₅ and K₂O fertilizer was applied to the entire planting area as needed based on the reports received from the laboratory. Nitrogen fertilizer was applied at a rate of 80 lb/acre to each plot according to recommendations for growing warm-season annual grasses in Florida (Mylavarapu et al., 2015). Plots were irrigated as needed to maintain adequate plant growth in 2015-2017 but not in 2018. Plant growth in each plot was terminated by mowing following harvest (see data collection below).

Data Collection:

- a. Emergence – Emergence was rated at 7, 14, and 21 days after planting (DAP) in 2015 and 2017 and 7 and 14 DAP in 2016 and 2018 on a rating scale of 0-3 where 0 = Poor (<25%); 1 = Moderate (30-60%); 2 = Good (65-85%); 3 = Excellent (90-100%).
- b. Vigor – Vigor of the plants was rated visually in 2015 and 2016. The vigor rating scale ranged from 1-5 where 1 = Poor; 2 = Fair; 3 = Good, 4 = Very Good, and 5 = Excellent.
- c. Canopy – A visual estimate of the amount of canopy cover was rated at various intervals during the evaluation period. From 2015-2017, the rating scale used was 0-10 where 0 = less than 10%; 1 = 10%; 2 = 20% 3 = 30%; 4 = 40%, 5 = 50%; 6 = 60%; 7 = 70%; 8 = 80%; 9 = 90%; and 10 = 100% cover. In 2018, the scale used was 1-5 where 1 = 0-15%; 2 = 20-35%; 3 = 40-60%; 4 = 65-80%; 5 = 85-100%.
- d. Plant height – Plants were measured from the ground to the uppermost leaf (not to the top of the inflorescence) at various intervals during the evaluation period and at harvest from three random plants in each plot.
- e. Insect and disease ratings – Damage from insects and diseases was either noted or visually rated during the evaluation period. The rating scale used was 0-5 where 0 = No Damage and 5 = Severe Damage.
- f. Flowering – Flowering stage was recorded at regular intervals during the 2015-2016 evaluation periods (Table 2). In 2017, flowering was rated as a percentage of the plants in the plot that were in flower at 10-day intervals starting at 40 DAP. In 2018, plots were checked every three days for flower development and the date when plants reached the boot or head emergence stage (Table 2) was noted for each plot.
- g. Dry matter yield – Aboveground biomass was harvested after the plants reached the boot to ripening stage (Table 2). Plant matter from a 5.4 ft² (0.5 m²) area in the center of each plot was cut at ground level and weighed. A uniform grab sample was pulled from the harvested material, cut into smaller sections, and dried to determine moisture content in the plant tissue. The moisture content was used to calculate dry matter (DM) yield for each plot.
- h. C:N ratio – The grab samples of the dried plant material were fed through a hammermill to roughly grind the tissue. A 2-4 oz sub-sample was collected for tissue testing. The samples were sent to the Agricultural and Environmental Services Laboratories at the University of Georgia for analysis of total carbon (C) and total nitrogen (N). These values were used to calculate the C:N ratio of the plant tissue.

DM yields were subjected to an analysis of variance procedure and significant means were separated at using $P < 0.05$ using the least significant difference all pairwise comparisons test in Statistix 10 (Analytical Software, Tallahassee, FL). Species and cultivars with similar growth habit (bushy or upright) and phenology period were grouped for comparison. This led to three groupings: millets (including Chiwapa billion-dollar grass) (bushy, early flowering), sorghum and sorghum hybrid (upright), and teosintes (bushy, late flowering). Data sets that were not normally distributed were transformed prior to analysis. The raw data sets for the entire study period (Tables 8-30) are included in Appendix A.

Table 2. Growth stage descriptions for grasses in study (Purdue University, 2009).

Stage	Description
1	3-Leaf Stage: The first two leaves are completely developed, and the middle, or third, leaf is partially developed.
2	The tillers (sometimes called side shoots) are beginning to form.
3	Tillers have formed and are in their primary growth stage.
4	Tillers have ended their growth and the leaf sheaths (the lower part of the leaf which surrounds the stem) begin to form.
5	Leaf sheaths are strongly erected and the stems formed start to grow in length.
6	One-Joint Stage: The first joint develops near the soil surface and can be felt inside the stem. The joints, or nodes, produce a swelled appearance in the lower portion of the stem.
7	Two-Joint Stage: The second joint has formed, marking the beginning of the reproductive phase.
8	Appearance of the last leaf.
9	Ligule Stage: The ligule (a membrane at the junction of the leaf sheath and leaf base) of the last leaf is fully developed, and the leaf sheath is swollen at the level of the capsuled head of grain.
10	"Boot" Stage: At this stage, the immature head of grain presses the rolled leaf sheath apart and becomes visible.
10.1	Head Emergence Stage.
10.5	Flowering Stage
11	Ripening State (includes "dough" stage)

RESULTS AND DISCUSSION

Chiwapa billion-dollar grass was the highest yielding millet cultivar in 2015 and 2018 and common browntop millet was the highest yielding in 2016 and 2017 (Table 3). However, the yield of these two millet cultivars was not significantly different than that of common Japanese millet and Leafy 22 pearl millet, except in 2018 when yield of common browntop millet was lower than that of Chiwapa and Japanese millet. All four of these millets produced 60% or more ground coverage within one month after planting (Table 4). This quick canopy closure and high biomass production indicates these millet cultivars can be very effective in suppressing weeds.

The proso millet lines, especially the common (white) type, were consistently the lowest yielding. This agrees with Myers (2018), who notes that proso millet produces less biomass than other millet species. Common proso millet was the earliest flowering of all grasses included in the study; plants were in full flower in less than 30 DAP (Table 28). Because the common proso millet plants flowered so quickly, they produced little biomass before they started to form seeds and the plots were harvested. These plants also provided a negligible amount of canopy coverage within the plot (Table 4). Therefore, we do not recommend common proso millet as a cover crop for central Florida. Proso millet is much better adapted to the High Plains and other parts of the western US, which have cooler and drier summers than we have in Florida (Myers 2018). 'Dove' proso millet also produced less biomass than the other millet species (Table 3) but provided a greater amount of canopy coverage (50-70%) than the common type (Table 4). Dove was released by the Jimmy Carter PMC in Americus, Georgia (Jimmy Carter PMC, 2012). Because

Dove was evaluated and released for use in the Southeast, this explains why it was better adapted to central Florida growing conditions than common proso millet.

Table 3. Dry matter yields of bushy, early-flowering millets planted during four years at the Brooksville Plant Materials Center.

Species	Cultivar	2015	2016	2017	2018
lb/acre					
Billion-dollar Grass	Chiwapa	9,173 a ¹	3,767 a	6,572 ab	10,073 a
Browntop Millet	Common	6,407 a	4,233 a	9,918 a	6,127 b
Japanese Millet	Common	7,247 a	3,516 a	6,253 ab	9,700 a
Pearl Millet	Leafy 22	7,311 a	2,879 a	9,172 a	----- ²
Proso Millet	Common (white)	3,005 b	671 b	151 c	2,690 b
Proso Millet	Dove	3,178 b	2,712 ab	3,615 bc	3,593 b
Grand Mean		6,054	2,963	5,947	6,437

¹ Means in columns within a year followed by the same letters are not significantly different at $P < 0.05$.

² Leafy 22 Pearl Millet was excluded from the 2018 planting.

Yield of all millet lines decreased in 2016 (Table 3). The field where the plots were located had a long-term cover crop study that ended a few months before this study was planted. Although we had standard soil tests done to determine macronutrient needs and applied these as recommended, we suspect that there may have been micronutrient deficiencies that were not captured with this testing. Or there may have been other carryover effects from the long-term study that affected plant growth in this field.

Cover crops that reach the reproductive stage quickly, as many of these millets did, will require careful management. They are best suited for use as cover crops in cropping systems with a short interval between cash crops. If allowed to set seed prior to termination, the cover crops could become another weed in a producer's field. Chiwapa billion-dollar grass and Leafy 22 pearl millet were the latest flowering of the millets. We harvested the Leafy 22 plants at a little over 1.5 months and the Chiwapa plants at about 2 months after they were planted (Table 22).

Table 4. Average of canopy cover ratings for all warm-season grass plots planted at the Brooksville Plant Materials Center.

Species	Cultivar	2015 ¹ 28 DAP	2016 ¹ 28 DAP	2017 ¹ 30 DAP	2018 ² 30 DAP
Billion-dollar Grass	Chiwapa	6	7	6	5
Browntop Millet	Common	8	9	8	4
Japanese Millet	Common	6	8	7	5
Pearl Millet ³	Leafy 22	7	9	8	-----
Proso Millet	Common (white)	2	0	0	2
Proso Millet	Dove	5	7	7	3
Sorghum-Sudan	Honey Graze BMR	3	5	7	5
Sterile Sorghum	Common	4	3	7	4
Teosinte	Chapingo	3	3	5	3
Teosinte	Common	3	4	6	3

¹ Canopy rating scale 0-10 where 0 = less than 10%; 1 = 10%; 2 = 20% 3 = 30%; 4 = 40%, 5 = 50%; 6 = 60%; 7 = 70%; 8 = 80%; 9 = 90%; and 10 = 100% canopy cover.

² Canopy rating scale 1-5 where 1 = 0-15%; 2 = 20-35%; 3 = 40-60%; 4 = 65-80%; 5 = 85-100% canopy cover.

³ Pearl Millet was excluded from the 2018 planting.

Honey Graze BMR sorghum-sudan and common sterile sorghum, with their more upright, corn-like growth, were generally higher yielding than the millets (Table 5). There were no significant differences in DM yield between these two lines in any of the study years. Yields were variable throughout the study but based on the high yields we recorded in 2017, these two cultivars have the capability to produce a greater amount of biomass than any of the millet lines tested (Table 4). Yield of these two cultivars also declined in 2016 due to the issues with the planting site discussed previously, although they still produced 3 to 4.5 tons of biomass (Table 5). Sorghum-sudan hybrids are a highly recommended cover crop for depleted soils due to their high biomass production potential (SARE, 2007). Common sterile sorghum started flowering a couple of weeks earlier than Honey Graze BMR sorghum-sudan (45-48 DAP vs. 59-63 DAP). The flowering period of sterile sorghum was similar to that of Chiwapa billion-dollar grass (Table 28), but Honey Graze BMR sorghum-sudan can provide a longer period of growth before plants would require termination.

Table 5. Dry matter yields of upright sorghum and sorghum hybrid planted during four years at the Brooksville Plant Materials Center.

Species	Cultivar	2015	2016	2017	2018
-----lb/acre-----					
Sorghum-Sudan	Honey Graze BMR	7,976 ¹	6,206	30,544	10,444
Sterile Sorghum	Common	13,884	9,164	23,902	11,488
Grand Mean		10,930	7,685	27,223	10,966

¹ Means in columns within a year without letters indicate no significant differences at $P < 0.05$.

Canopy coverage of Honey Graze sorghum-sudan and common sterile sorghum at one month after planting tended to be slightly less than the more vigorous millets (browntop, Japanese, and pearl) (Table 4). This can probably be attributed to the differences in growth habit noted previously (bushy vs. upright). All sorghum and sudangrass species and hybrids excrete allelopathic chemicals (SARE, 2007), so their ability to control weeds does not entirely depend on smothering them. In 2018 an entire plot of sterile sorghum was lost due to dense weed growth that emerged quickly after planting and did not allow the seedlings to establish. However, if seedlings of these two cultivars get a head start on the weeds, they should compete well with them due to the chemicals as well as the large amount of biomass that they produce. If cover crops will be used for grazing, prussic acid poisoning of livestock could be a concern if either of these lines are planted (Creamer and Baldwin, 2000; SARE, 2007).

Teosinte was a novel addition to this study. It is a wild relative of corn (*Zea mays* L.) native to Mexico that is promoted primarily for use as a wildlife food source. Unlike sorghum and its hybrids, teosinte plants produce numerous tillers, forming a clumping plant (Brooksville PMC, 2018). Biomass production of the two teosinte cultivars in most years (Table 6) was comparable to that of the sorghum and sorghum-sudan cultivars (Table 5). There were no significant yield differences between Chapingo and the common type in any of the study years. There was less yield depression in 2016 due to the suboptimal field conditions for these teosinte cultivars compared to the other species in the study (Table 6). Teosinte is a wild type of grass that has not undergone genetic improvement. Although marketed as a named cultivar, Chapingo was released as a native selection and was not the product of a breeding program (Brooksville PMC, 2018). Since teosinte is not a domesticated species, it likely was better able to adapt to the poor soil conditions in 2016.

Table 6. Dry matter yields of bushy, late flowering teosinte lines planted during four years at the Brooksville Plant Materials Center.

Species	Cultivar	2015	2016	2017	2018
		lb/acre			
Teosinte	Chapingo	14,023 ¹	10,592	12,389	11,421
Teosinte	Common	8,633	8,063	13,904	11,876
Grand Mean		11,328	9,328	13,146	11,649

¹ Means in columns within a year without letters indicate no significant differences at $P < 0.05$.

These teosinte lines only provided moderate canopy coverage at one month after planting (Table 4), which would allow a greater opportunity for weeds to become established before canopy closure. However, once the plant's tillers began to expand, canopy coverage improved quickly (Table 21). These teosinte cultivars were the latest flowering of any of the warm-season grasses in the study. In 2018, they did not begin to flower until mid-September which was 77-80 DAP (Table 28). Chapingo teosinte requires 112 days to produce a seed crop (Brooksville PMC, 2018). Few cropping systems would require a cover crop for a longer period than teosinte can provide.

One potential concern about using teosinte as a cover crop is its hard seededness. Due to the very long seed production period required for this species, it is highly unlikely that a teosinte cover crop will go to seed in the field (Brooksville PMC, 2018); however, hard seed from the initial planting that did not germinate could carryover and germinate in future years.

Samples of the plant material from the biomass harvest were analyzed for total carbon and total nitrogen because the amount of these two elements in the tissue affects the rate of residue breakdown and can affect nutrient management of the subsequent cash crop. Microorganisms use nutrients, especially carbon and nitrogen, as a food source to break down cover crop residues. When there is a large amount of carbon in the residue and a small amount of nitrogen, the microorganisms utilize nitrogen from the surrounding soil to break down the tissue. The immobilized nitrogen becomes tied up in the microorganisms and is not available for plant growth until the microorganisms die, then the nitrogen released for plant growth. Whenever the ratio of the amounts of carbon and nitrogen (C:N ratio) in a cover crop residue exceeds 30:1, nitrogen immobilization will likely occur, and nitrogen fertilization of the cash crop will need to be adjusted. However, plant residues with a high C:N ratio, because they break down more slowly, can provide a greater level of weed control than those with a low C:N ratio (SARE, 2007).

The C:N ratio of the millet cultivars, except Chiwapa billion-dollar grass, were generally below 30:1 (Table 7). This relates to the quickness of flowering and harvest discussed previously. Creamer and Baldwin (2000) reported higher C:N ratios for pearl millet and Japanese millet than we found. They did not harvest the plants until 62-64 DAP, when the plants would have been at a later growth stage than those that we harvested in our study. The C:N ratio increases when plants are in the flowering or later growth stages (SARE, 2007). If browntop, Japanese and proso millet cover crops are terminated at the boot to early flower emergence stage, nitrogen immobilization may not be an issue. However, tissue samples of Chiwapa billion-dollar grass had C:N ratios that were consistently above 30:1, even when harvested at approximately the same growth stage as the other millets. The culms (stems) of Chiwapa were tougher than the other millets (J. Grabowski, personal observation) and there is likely more carbon in the internal structural support tissues in Chiwapa than in the other millet cultivars.

Table 7. Average C:N ratio of plant in plant tissue harvested from all warm-season grass study plots at the Brooksville Plant Materials Center.

Species	Cultivar	2015	2016	2017	2018
Billion-dollar Grass	Chiwapa	31:1 ¹	33:1	30:1	48:1
Browntop Millet	Common	26:1	25:1	28:1	37:1
Japanese Millet	Common	25:1	30:1	27:1	25:1
Pearl Millet ²	Leafy 22	23:1	16:1	19:1	-----
Proso Millet	Common (white)	18:1	16:1	23:1	23:1
Proso Millet	Dove	22:1	27:1	30:1	29:1
Sorghum-Sudan	Honey Graze BMR	33:1	43:1	40:1	74:1
Sterile Sorghum	Common	39:1	35:1	43:1	80:1
Teosinte	Chapingo	43:1	45:1	36:1	55:1
Teosinte	Common	43:1	34:1	39:1	61:1

¹ C:N ratio calculated using total C and total N in plant samples measured by the University of Georgia Agricultural and Environmental Services Laboratories.

² Pearl Millet was excluded from the 2018 planting.

Creamer and Baldwin (2000) reported a high C:N ratio for sorghum-sudan (53:1) in their study. The C:N ratios we found for Honey Graze BMR sorghum-sudan, sterile sorghum, and both teosinte cultivars were above 30:1 at all sampling dates (Table 7). Again, the higher C:N ratios in our study cannot be attributed to plant growth stage, because all species were harvested at comparable growth stages. All three of these species are corn relatives with thick, sturdy culms. Nitrogen fertilization of cash crops that follow these species should be increased or legume cover crops should be incorporated in the cropping system to overcome effects on growth and yield that could result from nitrogen immobilization. However, from a weed control standpoint, these cover crops will have longer lasting residues that can help prevent weeds from germinating.

CONCLUSION

The warm-season grass species and cultivars included in the study, except for common (white) proso millet and to a lesser extent Dove proso millet, provided ample biomass and canopy coverage to scavenge nutrients from the soil and compete with weeds. Common proso millet should not be used as a summer cover crop in central Florida. The available period between harvest of the cash crop in the spring and planting of the subsequent cash crop will have a large impact on selection of warm-season grasses to use as cover crops. Of the cultivars studied, browntop, Japanese, and Dove proso millet would be suited for a short turnaround time of 4 to 5 weeks between crop harvest and planting. If plants of these millets are allowed to stay in the field much longer than this, they may begin to start producing ripe seed. Honey Graze BMR sorghum-sudan and both teosinte cultivars have potential as long-term cover crops that can be grown for periods of 2.5 to 3 months before the plants would require termination. Chiwapa billion-dollar grass, Leafy 22 pearl millet, and sterile sorghum fell between these two groups, with plants capable of growing for a period of up to 1.5 to 2 months before the plants would reach a growth stage where they should be terminated.

This study is the starting point in the evaluation of warm-season grasses for use as cover crops in central Florida. There are other grass species and additional cultivars of some of these grass species that should be tested. A June planting date was chosen because it fit into the production calendar for vegetable crops, such as bell pepper (*Capsicum annuum* L.). Due to the diversity of crops that may be grown in the state and the length of the growing season, additional planting dates should be examined. Further research on termination dates and methods for these and other

potential summer grass cover crops is also warranted. The seeding rates that we selected were based on recommendations from reputable sources; however, these rates may have been developed for growing these grasses for grain or forage production rather than as cover crops. The slow canopy coverage of some of these species, such as the teosinte lines, may be improved by increasing the seeding rate. Studies to address many of these research issues could be coupled with an analysis of the economics of using these warm-season grass cover crops.

Further research on using these warm-season grasses in cover crops mixes is highly recommended. The author has observed that the growth of sorghum-sudan plants that were growing with legumes, such as cowpea [*Vigna unguiculata* (L.) Walp.] and sunn hemp (*Crotalaria juncea* L.) in demonstration plantings at the PMC were more vigorous than the plants in the single species plots in this study. No nitrogen fertilizer was applied to these demonstration plantings, which indicates that the legumes in the mix were supplying the sorghum-sudan plants with the nitrogen they needed for growth. A possible long-term research initiative would be to select or breed warm-season grasses specifically for traits that improve their utility as cover crops.

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APPENDIX A

2015 Data

Table 8. Emergence ratings at 7, 14, and 21 days after planting (DAP) for warm-season grass cover crop plots planted 11 June 2015 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	7 DAP	14 DAP	21 DAP
Billion-dollar Grass	Chiwapa	1	104	1	1	1
Billion-dollar Grass	Chiwapa	2	208	1	2	2
Billion-dollar Grass	Chiwapa	3	310	0	1	1
Browntop Millet	Common	1	103	1	1	2
Browntop Millet	Common	2	209	1	2	2
Browntop Millet	Common	3	303	1	2	2
Japanese Millet	Common	1	108	1	1	1
Japanese Millet	Common	2	210	1	1	2
Japanese Millet	Common	3	301	1	1	1
Pearl Millet	Leafy 22	1	102	1	2	2
Pearl Millet	Leafy 22	2	201	1	2	2
Pearl Millet	Leafy 22	3	308	1	2	2
Proso Millet	Common (white)	1	107	0	0	0
Proso Millet	Common (white)	2	202	0	0	0
Proso Millet	Common (white)	3	302	0	0	0
Proso Millet	Dove	1	106	1	1	1
Proso Millet	Dove	2	204	1	1	2
Proso Millet	Dove	3	305	1	2	2
Sorghum-Sudan	Honey Graze BMR	1	109	0	0	0
Sorghum-Sudan	Honey Graze BMR	2	205	0	0	0
Sorghum-Sudan	Honey Graze BMR	3	304	0	0	1
Sterile Sorghum	Common	1	110	0	0	1
Sterile Sorghum	Common	2	207	0	0	0
Sterile Sorghum	Common	3	307	0	0	0
Teosinte	Chapingo	1	105	1	2	2
Teosinte	Chapingo	2	203	0	1	1
Teosinte	Chapingo	3	306	0	1	1
Teosinte	Common	1	101	0	1	1

Species	Cultivar	Rep	Plot	7 DAP	14 DAP	21 DAP
Teosinte	Common	2	206	0	1	2
Teosinte	Common	3	309	0	1	2

¹ Rating Scale 0-3 where 0 = Poor (<25%); 1 = Moderate (30-60%); 2 = Good (65-85%); 3 = Excellent (90-100%).

² Accurately rating emergence at 21 days was difficult because plants were tillering.

Table 9. Vigor and canopy ratings at 28 and 42 days after planting (DAP) for warm-season grass cover crop plots planted 11 June 2015 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	28 DAP		42 DAP	
				Vigor ¹	Canopy ²	Vigor	Canopy
Billion-dollar Grass	Chiwapa	1	104	4	6	4	6
Billion-dollar Grass	Chiwapa	2	208	5	6	5	8
Billion-dollar Grass	Chiwapa	3	310	4	6	5	7
Browntop Millet	Common	1	103	5	7	5	9
Browntop Millet	Common	2	209	5	8	5	9
Browntop Millet	Common	3	303	5	8	5	9
Japanese Millet	Common	1	108	3	5	4	6
Japanese Millet	Common	2	210	5	7	5	8
Japanese Millet	Common	3	301	5	6	5	8
Pearl Millet	Leafy 22	1	102	5	7	5	7
Pearl Millet	Leafy 22	2	201	5	8	5	8
Pearl Millet	Leafy 22	3	308	5	7	5	8
Proso Millet	Common (white)	1	107	2	2	2	2
Proso Millet	Common (white)	2	202	1	1	2	2
Proso Millet	Common (white)	3	302	-----	-----	-----	-----
Proso Millet	Dove	1	106	4	5	4	5
Proso Millet	Dove	2	204	3	5	4	6
Proso Millet	Dove	3	305	4	6	4	7
Sorghum-Sudan	Honey Graze BMR	1	109	5	3	5	5
Sorghum-Sudan	Honey Graze BMR	2	205	5	4	5	4
Sorghum-Sudan	Honey Graze BMR	3	304	5	3	5	5.5
Sterile Sorghum	Common	1	110	4	5	5	6
Sterile Sorghum	Common	2	207	5	4	5	6
Sterile Sorghum	Common	3	307	5	4	5	4

Species	Cultivar	Rep	Plot	28 DAP		42 DAP	
				Vigor ¹	Canopy ²	Vigor	Canopy
Teosinte	Chapingo	1	105	4	3	4	4
Teosinte	Chapingo	2	203	4	3	4	3
Teosinte	Chapingo	3	306	3	2	3	3
Teosinte	Common	1	101	4	3	4	3
Teosinte	Common	2	206	4	3	4	4
Teosinte	Common	3	309	5	3	5	4

¹ Vigor rating scale 1-5 where 1 = Poor; 2 = Fair; 3 = Good, 4 = Very Good, and 5 = Excellent.

² Canopy rating scale 0-10 where 0 = less than 10%; 1 = 10%; 2 = 20% 3 = 30%; 4 = 40%, 5 = 50%; 6 = 60%; 7 = 70%; 8 = 80%; 9 = 90%; and 10 = 100% cover.

Table 10. Flowering observations at 35 and 42 days after planting (DAP) for warm-season grass cover crop plots planted 11 June 2015 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	35 DAP	42 DAP
Billion-dollar Grass	Chiwapa	1	104		
Billion-dollar Grass	Chiwapa	2	208		
Billion-dollar Grass	Chiwapa	3	310		
Browntop Millet	Common	1	103		Bloom
Browntop Millet	Common	2	209	Boot	Seed
Browntop Millet	Common	3	303	Boot	Seed
Japanese Millet	Common	1	108	Boot	Seed
Japanese Millet	Common	2	210	Boot	Seed
Japanese Millet	Common	3	301	Boot	Seed
Pearl Millet	Leafy 22	1	102	Rust	Bud/rust
Pearl Millet	Leafy 22	2	201		Rust
Pearl Millet	Leafy 22	3	308		
Proso Millet	Common (white)	1	107	Boot	Seed
Proso Millet	Common (white)	2	202	Boot	Seed
Proso Millet	Common (white)	3	302	-----	-----
Proso Millet	Dove	1	106	Boot	Seed
Proso Millet	Dove	2	204	Boot	Seed
Proso Millet	Dove	3	305	Boot	Seed
Sorghum-Sudan	Honey Graze BMR	1	109		

Species	Cultivar	Rep	Plot	35 DAP	42 DAP
Sorghum-Sudan	Honey Graze BMR	2	205		
Sorghum-Sudan	Honey Graze BMR	3	304		
Sterile Sorghum	Common	1	110		
Sterile Sorghum	Common	2	207		
Sterile Sorghum	Common	3	307		
Teosinte	Chapingo	1	105		
Teosinte	Chapingo	2	203		
Teosinte	Chapingo	3	306		
Teosinte	Common	1	101		Bloom
Teosinte	Common	2	206		
Teosinte	Common	3	309		

¹ Boot stage – inflorescence still enclosed within the sheath of the flag leaf.

Table 11. Growth stage and plant height measured at harvest and dry matter (DM) yield of biomass harvested from warm-season grass cover crop plots planted 11 June 2015 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	Date	Growth Stage ¹	Height 1	Height 2	Height 3	DM Yield ² --(lb/ac)--
						-----in-----			
Billion-dollar Grass	Chiwapa	1	104	8/6/2015	10.1	62	57	63	8087
Billion-dollar Grass	Chiwapa	2	208	7/8/2015	10.1	54	62	61	13238
Billion-dollar Grass	Chiwapa	3	310	8/6/2015	10.5	54	66	60	6194
Browntop Millet	Common	1	103	7/23/2015	10.5	11	11	11	7511
Browntop Millet	Common	2	209	7/23/2015	11	31	33	31	5398
Browntop Millet	Common	3	303	7/23/2015	10.5	33	34	35	6313
Japanese Millet	Common	1	108	7/23/2015	11	35	36	37	5472
Japanese Millet	Common	2	210	7/23/2015	11	37	43	38	9500
Japanese Millet	Common	3	301	7/23/2015	10.5	38	37	39	6769
Pearl Millet	Leafy 22	1	102	7/23/2015	10.1	38	47	41	7274
Pearl Millet	Leafy 22	2	201	8/6/2015	10.1	58	66	59	7299
Pearl Millet	Leafy 22	3	308	8/6/2015	10.1	56	54	62	7361
Proso Millet	Common (white)	1	107	7/23/2015	11	10	13	9	3189
Proso Millet	Common (white)	2	202	7/23/2015	11	14	15	12	3075
Proso Millet	Common (white)	3	302	7/23/2015	11	15	13	12	2751

Species	Cultivar	Rep	Plot	Date	Growth Stage ¹	Height 1	Height 2	Height 3	DM Yield ²
						-----in-----			---(lb/ac)---
Proso Millet	Dove	1	106	7/23/2015	10.5	29	27	29	2299
Proso Millet	Dove	2	204	7/23/2015	11	30	33	34	4188
Proso Millet	Dove	3	305	7/23/2015	10.5	30	29	30	3047
Sorghum-Sudan	Honey Graze BMR	1	109	8/6/2015	10.1	66	73	69	6633
Sorghum-Sudan	Honey Graze BMR	2	205	8/6/2015	10.5	54	61	57	10904
Sorghum-Sudan	Honey Graze BMR	3	304	8/6/2015	10.5	62	54	52	6391
Sterile Sorghum	Common	1	110	8/6/2015	10.5	62	64	62	8723
Sterile Sorghum	Common	2	207	8/6/2015	10.1	74	74	70	20868
Sterile Sorghum	Common	3	307	8/6/2015	10.1	69	62	64	12060
Teosinte	Chapingo	1	105	9/11/2015	10	67	71	79	12503
Teosinte	Chapingo	2	203	9/11/2015	10	67	75	71	12767
Teosinte	Chapingo	3	306	9/11/2015	10	79	63	75	16800
Teosinte	Common	1	101	9/11/2015	10.5	67	71	59	8884
Teosinte	Common	2	206	9/11/2015	11	71	79	59	11189
Teosinte	Common	3	309	9/11/2015	11	71	67	75	5827

¹ See Table 2 for growth stage descriptions.

² A 5.4 ft² (0.5 m²) area in the center of each 4' x 20' plot was harvested to determine yield.

Table 12. Carbon and nitrogen content determined by tissue analysis of plant material harvested from warm-season grass cover crop plots planted 11 June 2015 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	Total C	Total N
				-----%-----	
Billion-dollar Grass	Chiwapa	1	104	43.29	1.32
Billion-dollar Grass	Chiwapa	2	208	42.18	1.42
Billion-dollar Grass	Chiwapa	3	310	42.46	1.41
Browntop Millet	Common	1	103	43.19	1.59
Browntop Millet	Common	2	209	42.62	1.67
Browntop Millet	Common	3	303	42.78	1.78
Japanese Millet	Common	1	108	42.90	1.37
Japanese Millet	Common	2	210	43.52	1.86
Japanese Millet	Common	3	301	43.30	2.21
Pearl Millet	Leafy 22	1	102	42.34	2.82

Species	Cultivar	Rep	Plot	Total C	Total N
				-----%-----	
Pearl Millet	Leafy 22	2	201	43.74	1.44
Pearl Millet	Leafy 22	3	308	43.82	1.90
Proso Millet	Common (white)	1	107	43.42	2.49
Proso Millet	Common (white)	2	202	43.55	2.35
Proso Millet	Common (white)	3	302	42.81	2.25
Proso Millet	Dove	1	106	44.12	1.68
Proso Millet	Dove	2	204	43.86	2.04
Proso Millet	Dove	3	305	43.63	2.47
Sorghum-Sudan	Honey Graze BMR	1	109	42.88	1.53
Sorghum-Sudan	Honey Graze BMR	2	205	43.04	1.24
Sorghum-Sudan	Honey Graze BMR	3	304	42.41	1.22
Sterile Sorghum	Common	1	110	42.63	0.99
Sterile Sorghum	Common	2	207	43.82	1.00
Sterile Sorghum	Common	3	307	42.04	1.48
Teosinte	Chapingo	1	105	44.42	0.86
Teosinte	Chapingo	2	203	44.42	0.98
Teosinte	Chapingo	3	306	44.57	1.35
Teosinte	Common	1	101	44.86	0.95
Teosinte	Common	2	206	43.86	1.02
Teosinte	Common	3	309	44.33	1.12

2016 Data

Table 13. Emergence ratings at 7 and 14 days after planting (DAP) for warm-season grass cover crop plots planted 23 June 2016 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	7 DAP	14 DAP
Billion-dollar Grass	Chiwapa	1	104	1	2
Billion-dollar Grass	Chiwapa	2	208	1	2
Billion-dollar Grass	Chiwapa	3	310	1	3
Browntop Millet	Common	1	103	1	3
Browntop Millet	Common	2	209	2	2
Browntop Millet	Common	3	303	1	2
Japanese Millet	Common	1	108	2	3
Japanese Millet	Common	2	210	0	2
Japanese Millet	Common	3	301	1	3
Pearl Millet	Leafy 22	1	102	2	3
Pearl Millet	Leafy 22	2	201	1	2
Pearl Millet	Leafy 22	3	308	2	3
Proso Millet	Common (white)	1	107	0	0
Proso Millet	Common (white)	2	202	0	0
Proso Millet	Common (white)	3	302	0	0
Proso Millet	Dove	1	106	2	3
Proso Millet	Dove	2	204	2	3
Proso Millet	Dove	3	305	1	3
Sorghum-Sudan	Honey Graze BMR	1	109	0	1
Sorghum-Sudan	Honey Graze BMR	2	205	1	0
Sorghum-Sudan	Honey Graze BMR	3	304	0	0
Sterile Sorghum	Common	1	110	0	0
Sterile Sorghum	Common	2	207	0	0
Sterile Sorghum	Common	3	307	0	0
Teosinte	Chapingo	1	105	0	0
Teosinte	Chapingo	2	203	1	1
Teosinte	Chapingo	3	306	0	0
Teosinte	Common	1	101	0	0
Teosinte	Common	2	206	0	1

Species	Cultivar	Rep	Plot	7 DAP	14 DAP
Teosinte	Common	3	309	0	0

¹ Rating Scale 0-3 where 0 = Poor (<25%); 1 = Moderate (30-60%); 2 = Good (65-85%); 3 = Excellent (90-100%).

Table 14. Vigor and canopy ratings at 28, 42, and 50 days after planting (DAP) for warm-season grass cover crop plots planted 23 June 2016 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	28 DAP	42 DAP		50 DAP	
				Canopy ¹	Vigor ²	Canopy	Vigor	Canopy
Billion-dollar Grass	Chiwapa	1	104	9	5	10	5	8
Billion-dollar Grass	Chiwapa	2	208	6	4	9	5	9
Billion-dollar Grass	Chiwapa	3	310	6	5	10	5	9
Browntop Millet	Common	1	103	10	5	10	5	10
Browntop Millet	Common	2	209	9	5	10	4	9
Browntop Millet	Common	3	303	7	5	8	5	7
Japanese Millet	Common	1	108	10	5	10	5	8
Japanese Millet	Common	2	210	7	4	8	5	8
Japanese Millet	Common	3	301	7	3	9	5	7
Pearl Millet	Leafy 22	1	102	10	5	10	4	9
Pearl Millet	Leafy 22	2	201	9	5	10	5	8
Pearl Millet	Leafy 22	3	308	9	5	10	5	9
Proso Millet	Common (white)	1	107	0	2	1	2	1
Proso Millet	Common (white)	2	202	0	2	1	3	1
Proso Millet	Common (white)	3	302	0	2	1	3	1
Proso Millet	Dove	1	106	8	5	10	5	8
Proso Millet	Dove	2	204	6	5	10	5	10
Proso Millet	Dove	3	305	8	5	8	5	7
Sorghum-Sudan	Honey Graze BMR	1	109	6	5	9	5	6
Sorghum-Sudan	Honey Graze BMR	2	205	6	5	8	5	8
Sorghum-Sudan	Honey Graze BMR	3	304	3	5	7	5	6
Sterile Sorghum	Common	1	110	4	5	8	5	6
Sterile Sorghum	Common	2	207	4	5	7	4	5
Sterile Sorghum	Common	3	307	2	3	5	4	4
Teosinte	Chapingo	1	105	3	3	4	3	5

Species	Cultivar	Rep	Plot	28 DAP	42 DAP		50 DAP	
				Canopy ¹	Vigor ²	Canopy	Vigor	Canopy
Teosinte	Chapingo	2	203	4	3	7	4	5
Teosinte	Chapingo	3	306	2	3	5	3	4
Teosinte	Common	1	101	5	4	8	4	5
Teosinte	Common	2	206	4	4	7	4	4
Teosinte	Common	3	309	3	3	3	4	4

¹ Vigor rating scale 1-5 where 1 = Poor; 2 = Fair; 3 = Good, 4 = Very Good, and 5 = Excellent.

² Canopy rating scale 0-10 where 0 = less than 10%; 1 = 10%; 2 = 20% 3 = 30%; 4 = 40%, 5 = 50%; 6 = 60%; 7 = 70%; 8 = 80%; 9 = 90%; and 10 = 100% cover.

Table 15. Flowering observations at 28, 42 and 50 days after planting (DAP) for warm-season grass cover crop plots planted 23 June 2016 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	28 DAP	42 DAP	50 DAP
Billion-dollar Grass	Chiwapa	1	104	0	BL	BL
Billion-dollar Grass	Chiwapa	2	208	0	0	BO
Billion-dollar Grass	Chiwapa	3	310	BO	0	BL
Browntop Millet	Common	1	103	0	BL	BL
Browntop Millet	Common	2	209	0	BL	BL
Browntop Millet	Common	3	303	0	BL	BL
Japanese Millet	Common	1	108	BL	BL	BL
Japanese Millet	Common	2	210	BL	BL	BL
Japanese Millet	Common	3	301	0	BL	BL
Pearl Millet	Leafy 22	1	102	0	BL	BL
Pearl Millet	Leafy 22	2	201	0	BL	BL
Pearl Millet	Leafy 22	3	308	0	0	BL
Proso Millet	Common (white)	1	107	BL	BL	BL
Proso Millet	Common (white)	2	202	BL	BL	BL
Proso Millet	Common (white)	3	302	0	BL	BL
Proso Millet	Dove	1	106	BL	BL	BL
Proso Millet	Dove	2	204	BL	BL	BL
Proso Millet	Dove	3	305	0	BL	BL
Sorghum-Sudan	Honey Graze BMR	1	109	0	0	0
Sorghum-Sudan	Honey Graze BMR	2	205	0	0	0

Species	Cultivar	Rep	Plot	28 DAP	42 DAP	50 DAP
Sorghum-Sudan	Honey Graze BMR	3	304	0	0	0
Sterile Sorghum	Common	1	110	0	0	BO
Sterile Sorghum	Common	2	207	0	0	BO
Sterile Sorghum	Common	3	307	0	0	0
Teosinte	Chapingo	1	105	0	0	0
Teosinte	Chapingo	2	203	0	0	0
Teosinte	Chapingo	3	306	0	0	0
Teosinte	Common	1	101	0	0	0
Teosinte	Common	2	206	0	0	0
Teosinte	Common	3	309	0	0	0

Flowering – 0 = vegetative stage; BO = boot stage, inflorescence still enclosed within the sheath of the flag leaf; BL = blooming, flowers fully exerted.

Table 16. Insect and disease damage ratings at 28, 42, and 50 days after planting (DAP) for warm-season grass cover crop plots planted 23 June 2016 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	28 DAP		42 DAP		50 DAP	
				Insect ¹	Disease ¹	Insect	Disease	Insect	Disease
Billion-dollar Grass	Chiwapa	1	104	2	3	1	1	1	1
Billion-dollar Grass	Chiwapa	2	208	1	0	1	1	1	1
Billion-dollar Grass	Chiwapa	3	310	1	0	1	1	-----	-----
Browntop Millet	Common	1	103	1	3	1	1	1	1
Browntop Millet	Common	2	209	1	1	1	1	1	1
Browntop Millet	Common	3	303	1	1	0	1	1	2
Japanese Millet	Common	1	108	0	1	1	1	1	1
Japanese Millet	Common	2	210	1	0	1	1	2	2
Japanese Millet	Common	3	301	1	1	1	1	1	2
Pearl Millet	Leafy 22	1	102	3	1	2	3	2	2
Pearl Millet	Leafy 22	2	201	2	1	2	2	1	2
Pearl Millet	Leafy 22	3	308	3	1	1	1	2	2
Proso Millet	Common (white)	1	107	3	2	1	1	1	1
Proso Millet	Common (white)	2	202	3	3	1	1	1	1
Proso Millet	Common (white)	3	302	3	1	1	1	1	1
Proso Millet	Dove	1	106	1	3	1	1	1	2

Species	Cultivar	Rep	Plot	28 DAP		42 DAP		50 DAP	
				Insect ¹	Disease ¹	Insect	Disease	Insect	Disease
Proso Millet	Dove	2	204	2	2	1	1	1	1
Proso Millet	Dove	3	305	2	1	0	1	1	1
Sorghum-Sudan	Honey Graze BMR	1	109	0	1	1	1	2	1
Sorghum-Sudan	Honey Graze BMR	2	205	1	3	1	1	1	1
Sorghum-Sudan	Honey Graze BMR	3	304	1	2	1	1	1	1
Sterile Sorghum	Common	1	110	0	3	1	0	1	1
Sterile Sorghum	Common	2	207	0	2	1	1	1	1
Sterile Sorghum	Common	3	307	1	4	1	1	1	1
Teosinte	Chapingo	1	105	1	2	1	1	1	2
Teosinte	Chapingo	2	203	1	2	1	1	1	1
Teosinte	Chapingo	3	306	1	2	1	1	1	1
Teosinte	Common	1	101	1	2	1	2	2	2
Teosinte	Common	2	206	2	2	1	1	1	1
Teosinte	Common	3	309	1	3	1	1	1	1

¹ Insect and disease rating scale 0-5 where 0 = No Damage and 5 = Severe Damage.

Table 17. Growth stage and plant height measured at harvest and dry matter (DM) yield of biomass harvested from warm-season grass cover crop plots planted 23 June 2016 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	Date	Growth Stage ¹	Height 1	Height 2	Height 3	DM Yield ²
						-----in-----			---(lb/ac)---
Billion-dollar Grass	Chiwapa	1	104	8/25/2016	10	59	59	51	5020
Billion-dollar Grass	Chiwapa	2	208	8/25/2016	11	55	55	51	3459
Billion-dollar Grass	Chiwapa	3	310	8/25/2016	11	59	59	51	2821
Browntop Millet	Common	1	103	8/12/2016	11	16	16	20	6252
Browntop Millet	Common	2	209	8/12/2016	11	24	24	20	3650
Browntop Millet	Common	3	303	8/12/2016	11	16	16	16	2797
Japanese Millet	Common	1	108	8/12/2016	11	43	43	39	5799
Japanese Millet	Common	2	210	8/12/2016	11	20	20	28	2084
Japanese Millet	Common	3	301	8/12/2016	11	16	16	16	2664
Pearl Millet	Leafy 22	1	102	8/12/2016	10.5	60	60	47	1855
Pearl Millet	Leafy 22	2	201	8/12/2016	10.5	47	47	43	4189

Species	Cultivar	Rep	Plot	Date	Growth Stage ¹	Height 1	Height 2	Height 3	DM Yield ²
						-----in-----			---(lb/ac)---
Pearl Millet	Leafy 22	3	308	8/12/2016	11	55	55	41	2592
Proso Millet	Common (white)	1	107	8/12/2016	11	20	20	20	420
Proso Millet	Common (white)	2	202	8/12/2016	11	16	16	20	855
Proso Millet	Common (white)	3	302	8/12/2016	11	12	12	11	737
Proso Millet	Dove	1	106	8/12/2016	11	35	35	18	3572
Proso Millet	Dove	2	204	8/12/2016	11	28	28	31	3281
Proso Millet	Dove	3	305	8/12/2016	11	31	31	24	1284
Sorghum-Sudan	Honey Graze BMR	1	109	8/12/2016	11	67	67	63	5181
Sorghum-Sudan	Honey Graze BMR	2	205	8/25/2016	11	71	71	63	4150
Sorghum-Sudan	Honey Graze BMR	3	304	8/25/2016	10.5	71	71	51	9286
Sterile Sorghum	Common	1	110	8/25/2016	11	91	91	59	11397
Sterile Sorghum	Common	2	207	8/25/2016	11	79	79	63	7569
Sterile Sorghum	Common	3	307	8/25/2016	10	71	71	83	8527
Teosinte	Chapingo	1	105	9/27/2016	11	71	71	55	12003
Teosinte	Chapingo	2	203	9/27/2016	11	71	71	75	15265
Teosinte	Chapingo	3	306	9/27/2016	11	63	63	59	4509
Teosinte	Common	1	101	9/27/2016	11	65	65	59	14157
Teosinte	Common	2	206	9/27/2016	11	63	63	63	8231
Teosinte	Common	3	309	9/27/2016	11	59	59	67	1801

¹ See Table 2 for growth stage descriptions.

² A 5.4 ft² (0.5 m²) area in the center of each plot 4 ft x 20 ft plot was harvested to determine yield.

Table 18. Carbon and nitrogen content determined by tissue analysis of plant material harvested from warm-season grass cover crop plots planted 23 June 2016 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	Total C	Total N
				-----%-----	
Billion-dollar Grass	Chiwapa	1	104	42.60	2.02
Billion-dollar Grass	Chiwapa	2	208	44.49	1.07
Billion-dollar Grass	Chiwapa	3	310	43.30	1.23
Browntop Millet	Common	1	103	43.10	2.66
Browntop Millet	Common	2	209	44.67	1.91
Browntop Millet	Common	3	303	44.35	1.24

Species	Cultivar	Rep	Plot	Total C	Total N
				-----%-----	
Japanese Millet	Common	1	108	44.10	1.61
Japanese Millet	Common	2	210	45.28	1.85
Japanese Millet	Common	3	301	44.95	1.21
Pearl Millet	Leafy 22	1	102	43.90	3.34
Pearl Millet	Leafy 22	2	201	44.03	2.40
Pearl Millet	Leafy 22	3	308	43.89	2.49
Proso Millet	Common (white)	1	107	44.10	2.85
Proso Millet	Common (white)	2	202	44.60	2.88
Proso Millet	Common (white)	3	302	45.56	2.60
Proso Millet	Dove	1	106	44.30	2.06
Proso Millet	Dove	2	204	46.87	1.65
Proso Millet	Dove	3	305	45.24	1.46
Sorghum-Sudan	Honey Graze BMR	1	109	44.50	1.33
Sorghum-Sudan	Honey Graze BMR	2	205	45.19	0.78
Sorghum-Sudan	Honey Graze BMR	3	304	44.72	1.22
Sterile Sorghum	Common	1	110	43.80	1.25
Sterile Sorghum	Common	2	207	45.52	1.21
Sterile Sorghum	Common	3	307	45.16	1.34
Teosinte	Chapingo	1	105	45.80	1.37
Teosinte	Chapingo	2	203	46.76	0.93
Teosinte	Chapingo	3	306	46.42	0.89
Teosinte	Common	1	101	45.60	1.66
Teosinte	Common	2	206	46.78	1.07
Teosinte	Common	3	309	46.48	1.45

2017 Data

Table 19. Emergence ratings at 7, 14, and 21 days after planting (DAP) for warm-season grass cover crop plots planted 21 June 2017 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	7 DAP	14 DAP	21 DAP	Notes
Billion-dollar Grass	Chiwapa	1	104	1	1	2	14 DAP yellow
Billion-dollar Grass	Chiwapa	2	208	1	2	2	14 DAP yellow
Billion-dollar Grass	Chiwapa	3	310	1	2	2	14 DAP some yellowing
Browntop Millet	Common	1	108	2	3	3	
Browntop Millet	Common	2	209	2	2	3	
Browntop Millet	Common	3	303	1	2	2	14 DAP some yellowing
Japanese Millet	Common	1	103	2	2	3	
Japanese Millet	Common	2	210	1	2	2	14 DAP yellow
Japanese Millet	Common	3	301	1	1	2	14 DAP some yellowing
Pearl Millet	Leafy 22	1	105	2	2	3	14 DAP yellow
Pearl Millet	Leafy 22	2	201	2	2	2	14 DAP yellow
Pearl Millet	Leafy 22	3	308	2	3	3	
Proso Millet	Common (white)	1	107	0	0	0	
Proso Millet	Common (white)	2	202	0	0	0	
Proso Millet	Common (white)	3	302	0	0	0	
Proso Millet	Dove	1	106	1	3	3	14 DAP disease
Proso Millet	Dove	2	204	2	2	2	14 DAP disease
Proso Millet	Dove	3	305	2	2	2	14 DAP disease
Sorghum-Sudan	Honey Graze BMR	1	109	1	2	3	
Sorghum-Sudan	Honey Graze BMR	2	205	1	2	2	
Sorghum-Sudan	Honey Graze BMR	3	304	2	2	2	14 DAP interveinal chlorosis
Sterile Sorghum	Common	1	110	1	1	2	21/DAP interveinal chlorosis
Sterile Sorghum	Common	2	207	1	2	2	
Sterile Sorghum	Common	3	307	1	3	3	14 DAP some yellowing
Teosinte	Chapingo	1	102	0	1	2	
Teosinte	Chapingo	2	203	1	1	1	
Teosinte	Chapingo	3	306	0	2	2	14 DAP yellow
Teosinte	Common	1	101	1	2	3	14 DAP yellow
Teosinte	Common	2	206	1	1	1	14 DAP yellow

Species	Cultivar	Rep	Plot	7 DAP	14 DAP	21 DAP	Notes
Teosinte	Common	3	309	1	2	2	

¹ Rating Scale 0-3 where 0 = Poor (<25%); 1 = Moderate (30-60%); 2 = Good (65-85%); 3 = Excellent (90-100%).

² Accurately rating emergence at 21 days was difficult because plants were tillering.

Table 20. Canopy ratings at 10, 20, and 30 days after planting (DAP) for warm-season grass cover crop plots planted 21 June 2017 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	10 DAP	20 DAP	30 DAP
Billion-dollar Grass	Chiwapa	1	104	3	3	6
Billion-dollar Grass	Chiwapa	2	208	3	6	6
Billion-dollar Grass	Chiwapa	3	310	3	6	6
Browntop Millet	Common	1	108	6	9	9
Browntop Millet	Common	2	209	6	6	9
Browntop Millet	Common	3	303	3	6	6
Japanese Millet	Common	1	103	6	6	9
Japanese Millet	Common	2	210	3	6	6
Japanese Millet	Common	3	301	3	3	6
Pearl Millet	Leafy 22	1	105	6	6	9
Pearl Millet	Leafy 22	2	201	6	6	6
Pearl Millet	Leafy 22	3	308	6	9	9
Proso Millet	Common (white)	1	107	0	0	0
Proso Millet	Common (white)	2	202	0	0	0
Proso Millet	Common (white)	3	302	0	0	0
Proso Millet	Dove	1	106	3	9	9
Proso Millet	Dove	2	204	6	6	6
Proso Millet	Dove	3	305	6	6	6
Sorghum-Sudan	Honey Graze BMR	1	109	3	6	9
Sorghum-Sudan	Honey Graze BMR	2	205	3	6	6
Sorghum-Sudan	Honey Graze BMR	3	304	6	6	6
Sterile Sorghum	Common	1	110	3	3	6
Sterile Sorghum	Common	2	207	3	6	6
Sterile Sorghum	Common	3	307	3	9	9
Teosinte	Chapingo	1	102	0	3	6
Teosinte	Chapingo	2	203	3	3	3

Species	Cultivar	Rep	Plot	10 DAP	20 DAP	30 DAP
Teosinte	Chapingo	3	306	0	6	6
Teosinte	Common	1	101	3	6	9
Teosinte	Common	2	206	3	3	3
Teosinte	Common	3	309	3	6	6

¹ Canopy rating scale 0-10 where 0 = less than 10%; 1 = 10%; 2 = 20% 3 = 30%; 4 = 40%, 5 = 50%; 6 = 60%; 7 = 70%; 8 = 80%; 9 = 90%; and 10 = 100% cover.

Table 21. Canopy ratings and plant height measurements at 40, 50, 60, 70, 80 and 100 days after planting (DAP) for warm-season grass cover crop plots planted 21 June 2017 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	40 DAP			
				Canopy ¹	Height 1	Height 2	Height 3
					-----in-----		
Billion-dollar Grass	Chiwapa	1	104	10	31	28	30
Billion-dollar Grass	Chiwapa	2	208	9	36	26	28
Billion-dollar Grass	Chiwapa	3	310	10	48	36	40
Browntop Millet	Common	1	108	10	23	26	24
Browntop Millet	Common	2	209	10	29	24	32
Browntop Millet	Common	3	303	10	26	28	30
Japanese Millet	Common	1	103	9	22	30	28
Japanese Millet	Common	2	210	9	25	27	24
Japanese Millet	Common	3	301	9	26	30	32
Pearl Millet	Leafy 22	1	105	9	46	52	48
Pearl Millet	Leafy 22	2	201	10	36	40	38
Pearl Millet	Leafy 22	3	308	9	30	36	34
Proso Millet	Common (white)	1	107	1	11	12	10
Proso Millet	Common (white)	2	202	0	8	-----	-----
Proso Millet	Common (white)	3	302	1	20	12	12
Proso Millet	Dove	1	106	10	22	24	25
Proso Millet	Dove	2	204	9	21	24	23
Proso Millet	Dove	3	305	10	31	28	30
Sorghum-Sudan	Honey Graze BMR	1	109	9	56	36	48
Sorghum-Sudan	Honey Graze BMR	2	205	9	66	46	40

40 DAP							
Species	Cultivar	Rep	Plot	Canopy ¹	Height 1	Height 2	Height 3
					-----in-----		
Sorghum-Sudan	Honey Graze BMR	3	304	9	56	46	40
Sterile Sorghum	Common	1	110	9	58	56	54
Sterile Sorghum	Common	2	207	9	66	46	52
Sterile Sorghum	Common	3	307	9	66	46	58
Teosinte	Chapingo	1	102	8	36	35	30
Teosinte	Chapingo	2	203	6	24	26	28
Teosinte	Chapingo	3	306	7	24	26	30
Teosinte	Common	1	101	8	48	40	38
Teosinte	Common	2	206	7	34	27	30
Teosinte	Common	3	309	8	36	28	30
50 DAP							
Species	Cultivar	Rep	Plot	Canopy ¹	Height 1	Height 2	Height 3
					-----in-----		
Billion-dollar Grass	Chiwapa	1	104	8	36	38	34
Billion-dollar Grass	Chiwapa	2	208	7	34	36	34
Billion-dollar Grass	Chiwapa	3	310	10	32	36	34
Browntop Millet	Common	1	108	10	24	28	24
Browntop Millet	Common	2	209	10	28	34	36
Browntop Millet	Common	3	303	10	28	32	30
Japanese Millet	Common	1	103	10	24	18	20
Japanese Millet	Common	2	210	10	31	28	26
Japanese Millet	Common	3	301	8	29	26	32
Pearl Millet	Leafy 22	1	105	8	56	46	45
Pearl Millet	Leafy 22	2	201	10	36	46	48
Pearl Millet	Leafy 22	3	308	9	36	40	32
Proso Millet	Common (white)	1	107	1	6	7	6
Proso Millet	Common (white)	2	202	1	6	7	6
Proso Millet	Common (white)	3	302	1	12	20	14
Proso Millet	Dove	1	106	10	25	24	26
Proso Millet	Dove	2	204	8	22	28	24
Proso Millet	Dove	3	305	10	32	28	30

50 DAP							
Species	Cultivar	Rep	Plot	Canopy¹	Height 1	Height 2	Height 3
					-----in-----		
Sorghum-Sudan	Honey Graze BMR	1	109	8	70	68	64
Sorghum-Sudan	Honey Graze BMR	2	205	10	68	58	64
Sorghum-Sudan	Honey Graze BMR	3	304	10	56	58	46
Sterile Sorghum	Common	1	110	8	66	58	54
Sterile Sorghum	Common	2	207	9	70	66	64
Sterile Sorghum	Common	3	307	9	72	66	64
Teosinte	Chapingo	1	102	8	36	42	38
Teosinte	Chapingo	2	203	7	28	30	32
Teosinte	Chapingo	3	306	7	32	40	44
Teosinte	Common	1	101	8	46	36	42
Teosinte	Common	2	206	5	25	32	24
Teosinte	Common	3	309	5	30	32	34
60 DAP							
Species	Cultivar	Rep	Plot	Canopy¹	Height 1	Height 2	Height 3
					-----in-----		
Billion-dollar Grass	Chiwapa	1	104	9	36	29	32
Billion-dollar Grass	Chiwapa	2	208	7	34	38	36
Billion-dollar Grass	Chiwapa	3	310	10	38	36	38
Browntop Millet	Common	1	108	Harvested			
Browntop Millet	Common	2	209	Harvested			
Browntop Millet	Common	3	303	Harvested			
Japanese Millet	Common	1	103	Harvested			
Japanese Millet	Common	2	210	Harvested			
Japanese Millet	Common	3	301	Harvested			
Pearl Millet	Leafy 22	1	105	Harvested			
Pearl Millet	Leafy 22	2	201	Harvested			
Pearl Millet	Leafy 22	3	308	8	48	46	44
Proso Millet	Common (white)	1	107	Harvested			
Proso Millet	Common (white)	2	202	-----	-----	-----	-----
Proso Millet	Common (white)	3	302	Harvested			
Proso Millet	Dove	1	106	Harvested			

60 DAP							
Species	Cultivar	Rep	Plot	Canopy¹	Height 1	Height 2	Height 3
					-----in-----		
Proso Millet	Dove	2	204	Harvested			
Proso Millet	Dove	3	305	Harvested			
Sorghum-Sudan	Honey Graze BMR	1	109	10	72	86	79
Sorghum-Sudan	Honey Graze BMR	2	205	10	38	58	68
Sorghum-Sudan	Honey Graze BMR	3	304	10	72	76	78
Sterile Sorghum	Common	1	110	9	87	82	84.5
Sterile Sorghum	Common	2	207	10	72	82	76
Sterile Sorghum	Common	3	307	10	72	78	76
Teosinte	Chapingo	1	102	8	56	59	57
Teosinte	Chapingo	2	203	7	36	30	34
Teosinte	Chapingo	3	306	7	56	36	47
Teosinte	Common	1	101	8	46	56	48
Teosinte	Common	2	206	8	38	48	51
Teosinte	Common	3	309	8	42	62	58
70 DAP							
Species	Cultivar	Rep	Plot	Canopy¹	Height 1	Height 2	Height 3
					-----in-----		
Billion-dollar Grass	Chiwapa	1	104	Harvested			
Billion-dollar Grass	Chiwapa	2	208	Harvested			
Billion-dollar Grass	Chiwapa	3	310	Harvested			
Browntop Millet	Common	1	108	Harvested			
Browntop Millet	Common	2	209	Harvested			
Browntop Millet	Common	3	303	Harvested			
Japanese Millet	Common	1	103	Harvested			
Japanese Millet	Common	2	210	Harvested			
Japanese Millet	Common	3	301	Harvested			
Pearl Millet	Leafy 22	1	105	Harvested			
Pearl Millet	Leafy 22	2	201	Harvested			
Pearl Millet	Leafy 22	3	308	Harvested			
Proso Millet	Common (white)	1	107	Harvested			
Proso Millet	Common (white)	2	202	-----	-----	-----	-----

70 DAP							
Species	Cultivar	Rep	Plot	Canopy ¹	Height 1	Height 2	Height 3
					-----in-----		
Proso Millet	Common (white)	3	302	Harvested			
Proso Millet	Dove	1	106	Harvested			
Proso Millet	Dove	2	204	Harvested			
Proso Millet	Dove	3	305	Harvested			
Sorghum-Sudan	Honey Graze BMR	1	109	Harvested			
Sorghum-Sudan	Honey Graze BMR	2	205	Harvested			
Sorghum-Sudan	Honey Graze BMR	3	304	Harvested			
Sterile Sorghum	Common	1	110	Harvested			
Sterile Sorghum	Common	2	207	Harvested			
Sterile Sorghum	Common	3	307	Harvested			
Teosinte	Chapingo	1	102	8	56	62	58
Teosinte	Chapingo	2	203	8	46	36	38
Teosinte	Chapingo	3	306	8	56	58	64
Teosinte	Common	1	101	8	60	68	74
Teosinte	Common	2	206	7	52	48	56
Teosinte	Common	3	309	9	56	64	56
80 DAP							
Species	Cultivar	Rep	Plot	Canopy ¹	Height 1	Height 2	Height 3
					-----in-----		
Billion-dollar Grass	Chiwapa	1	104	Harvested			
Billion-dollar Grass	Chiwapa	2	208	Harvested			
Billion-dollar Grass	Chiwapa	3	310	Harvested			
Browntop Millet	Common	1	108	Harvested			
Browntop Millet	Common	2	209	Harvested			
Browntop Millet	Common	3	303	Harvested			
Japanese Millet	Common	1	103	Harvested			
Japanese Millet	Common	2	210	Harvested			
Japanese Millet	Common	3	301	Harvested			
Pearl Millet	Leafy 22	1	105	Harvested			
Pearl Millet	Leafy 22	2	201	Harvested			
Pearl Millet	Leafy 22	3	308	Harvested			

80 DAP							
Species	Cultivar	Rep	Plot	Canopy ¹	Height 1	Height 2	Height 3
					-----in-----		
Proso Millet	Common (white)	1	107	Harvested			
Proso Millet	Common (white)	2	202	-----	----	----	----
Proso Millet	Common (white)	3	302	Harvested			
Proso Millet	Dove	1	106	Harvested			
Proso Millet	Dove	2	204	Harvested			
Proso Millet	Dove	3	305	Harvested			
Sorghum-Sudan	Honey Graze BMR	1	109	Harvested			
Sorghum-Sudan	Honey Graze BMR	2	205	Harvested			
Sorghum-Sudan	Honey Graze BMR	3	304	Harvested			
Sterile Sorghum	Common	1	110	Harvested			
Sterile Sorghum	Common	2	207	Harvested			
Sterile Sorghum	Common	3	307	Harvested			
Teosinte	Chapingo	1	102	9	56	72	68
Teosinte	Chapingo	2	203	8	48	46	54
Teosinte	Chapingo	3	306	7	72	68	66
Teosinte	Common	1	101	9	72	66	70
Teosinte	Common	2	206	7	66	68	56
Teosinte	Common	3	309	9	78	68	72
100 DAP							
Species	Cultivar	Rep	Plot	Canopy ¹	Height 1	Height 2	Height 3
					-----in-----		
Billion-dollar Grass	Chiwapa	1	104	Harvested			
Billion-dollar Grass	Chiwapa	2	208	Harvested			
Billion-dollar Grass	Chiwapa	3	310	Harvested			
Browntop Millet	Common	1	108	Harvested			
Browntop Millet	Common	2	209	Harvested			
Browntop Millet	Common	3	303	Harvested			
Japanese Millet	Common	1	103	Harvested			
Japanese Millet	Common	2	210	Harvested			
Japanese Millet	Common	3	301	Harvested			
Pearl Millet	Leafy 22	1	105	Harvested			

Species	Cultivar	Rep	Plot	100 DAP			
				Canopy ¹	Height 1	Height 2	Height 3
					-----in-----		
Pearl Millet	Leafy 22	2	201	Harvested			
Pearl Millet	Leafy 22	3	308	Harvested			
Proso Millet	Common (white)	1	107	Harvested			
Proso Millet	Common (white)	2	202	-----	----	----	----
Proso Millet	Common (white)	3	302	Harvested			
Proso Millet	Dove	1	106	Harvested			
Proso Millet	Dove	2	204	Harvested			
Proso Millet	Dove	3	305	Harvested			
Sorghum-Sudan	Honey Graze BMR	1	109	Harvested			
Sorghum-Sudan	Honey Graze BMR	2	205	Harvested			
Sorghum-Sudan	Honey Graze BMR	3	304	Harvested			
Sterile Sorghum	Common	1	110	Harvested			
Sterile Sorghum	Common	2	207	Harvested			
Sterile Sorghum	Common	3	307	Harvested			
Teosinte	Chapingo	1	102	10	70	55	57
Teosinte	Chapingo	2	203	8	40	58	70
Teosinte	Chapingo	3	306	8	65	67	70
Teosinte	Common	1	101	10	70	40	60
Teosinte	Common	2	206	9	70	72	60
Teosinte	Common	3	309	9	55	77	83

¹ Canopy rating scale 0-10 where 0 = less than 10%; 1 = 10%; 2 = 20% 3 = 30%; 4 = 40%, 5 = 50%; 6 = 60%; 7 = 70%; 8 = 80%; 9 = 90%; and 10 = 100% cover.

Table 22. Flowering percentage ratings at 40, 50, 60, 70, 80, and 100 days after planting (DAP) for warm-season grass cover crop plots planted 21 June 2017 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	40 DAP	50 DAP	60 DAP	70 DAP	80 DAP	100 DAP
				-----%-----					
Billion-dollar Grass	Chiwapa	1	104	0	0	30	Harvested	Harvested	Harvested
Billion-dollar Grass	Chiwapa	2	208	Boot ¹	Boot	30	Harvested	Harvested	Harvested
Billion-dollar Grass	Chiwapa	3	310	0	Boot	50	Harvested	Harvested	Harvested
Browntop Millet	Common	1	108	90	100	Harvested	Harvested	Harvested	Harvested

Species	Cultivar	Rep	Plot	40 DAP	50 DAP	60 DAP	70 DAP	80 DAP	100 DAP		
				-----%-----							
Browntop Millet	Common	2	209	100	100	Harvested	Harvested	Harvested	Harvested		
Browntop Millet	Common	3	303	100	100	Harvested	Harvested	Harvested	Harvested		
Japanese Millet	Common	1	103	80	100	Harvested	Harvested	Harvested	Harvested		
Japanese Millet	Common	2	210	85	100	Harvested	Harvested	Harvested	Harvested		
Japanese Millet	Common	3	301	80	100	Harvested	Harvested	Harvested	Harvested		
Pearl Millet	Leafy 22	1	105	0	0	Harvested	Harvested	Harvested	Harvested		
Pearl Millet	Leafy 22	2	201	0	0	Harvested	Harvested	Harvested	Harvested		
Pearl Millet	Leafy 22	3	308	0	Boot	50	Harvested	Harvested	Harvested		
Proso Millet	Common (white)	1	107	50	100	Harvested	Harvested	Harvested	Harvested		
Proso Millet	Common (white)	2	202	0	10	-----	-----	-----	-----		
Proso Millet	Common (white)	3	302	50	100	Harvested	Harvested	Harvested	Harvested		
Proso Millet	Dove	1	106	90	100	Harvested	Harvested	Harvested	Harvested		
Proso Millet	Dove	2	204	95	100	Harvested	Harvested	Harvested	Harvested		
Proso Millet	Dove	3	305	100	100	Harvested	Harvested	Harvested	Harvested		
Sorghum-Sudan	Honey Graze BMR	1	109	0	0	20	Harvested	Harvested	Harvested		
Sorghum-Sudan	Honey Graze BMR	2	205	0	0	20	Harvested	Harvested	Harvested		
Sorghum-Sudan	Honey Graze BMR	3	304	0	0	0	Harvested	Harvested	Harvested		
Sterile Sorghum	Common	1	110	0	0	40	Harvested	Harvested	Harvested		
Sterile Sorghum	Common	2	207	0	Boot	40	Harvested	Harvested	Harvested		
Sterile Sorghum	Common	3	307	0	Boot	40	Harvested	Harvested	Harvested		
Teosinte	Chapingo	1	102	0	0	0	0	0	100		
Teosinte	Chapingo	2	203	0	0	0	0	0	100		
Teosinte	Chapingo	3	306	Boot	0	0	0	0	100		
Teosinte	Common	1	101	0	0	0	0	10	100		
Teosinte	Common	2	206	0	0	0	0	5	95		
Teosinte	Common	3	309	0	0	0	0	0	100		

¹ Boot stage – seedhead still enclosed within the sheath of the flag leaf.

Table 23. Plant height measured at harvest and dry matter (DM) yield of biomass harvested from warm-season grass cover crop plots planted 21 June 2017 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	Date	Height 1	Height 2	Height 3	DM Yield ¹
					-----in-----			---(lb/ac)---
Billion-dollar Grass	Chiwapa	1	104	8/24/2017	35	28	29	6146
Billion-dollar Grass	Chiwapa	2	208	8/24/2017	36	42	40	6873
Billion-dollar Grass	Chiwapa	3	310	8/24/2017	38	36	46	6696
Browntop Millet	Common	1	108	8/11/2017	26	19	21	3698
Browntop Millet	Common	2	209	8/11/2017	19	21	28	11940
Browntop Millet	Common	3	303	8/11/2017	26	30	32	14115
Japanese Millet	Common	1	103	8/11/2017	26	27	22	9152
Japanese Millet	Common	2	210	8/11/2017	32	28	26	2981
Japanese Millet	Common	3	301	8/11/2017	31	37	24	6625
Pearl Millet	Leafy 22	1	105	9/28/2017	70	55	57	7249
Pearl Millet	Leafy 22	2	201	8/11/2017	46	52	42	8525
Pearl Millet	Leafy 22	3	308	8/24/2017	65	35	45	11742
Proso Millet	Common (white)	1	107	8/11/2017	11	11	9	151
Proso Millet	Common (white)	2	202	8/11/2017	----	----	----	-----
Proso Millet	Common (white)	3	302	8/11/2017	27	10	10	500
Proso Millet	Dove	1	106	8/11/2017	28	24	22	2163
Proso Millet	Dove	2	204	8/11/2017	28	22	30	3464
Proso Millet	Dove	3	305	8/11/2017	27	27	33	5217
Sorghum-Sudan	Honey Graze BMR	1	109	8/24/2017	72	85	60	25601
Sorghum-Sudan	Honey Graze BMR	2	205	8/24/2017	62	70	97	38304
Sorghum-Sudan	Honey Graze BMR	3	304	8/24/2017	70	85	74	27726
Sterile Sorghum	Common	1	110	8/24/2017	80	90	70	32895
Sterile Sorghum	Common	2	207	8/24/2017	80	90	70	19755
Sterile Sorghum	Common	3	307	8/24/2017	65	95	70	19056
Teosinte	Chapingo	1	102	8/11/2017	57	36	50	13361
Teosinte	Chapingo	2	203	9/28/2017	40	58	70	9152
Teosinte	Chapingo	3	306	9/28/2017	65	67	70	14654
Teosinte	Common	1	101	9/28/2017	70	40	60	14413
Teosinte	Common	2	206	9/28/2017	70	72	60	11621
Teosinte	Common	3	309	9/28/2017	55	77	83	15677

¹ A 5.4 ft² (0.5 m²) area in the center of each 3.5 ft x 20 ft plot was harvested to determine yield.

Table 24. Carbon and nitrogen content determined by tissue analysis of plant material harvested from warm-season grass cover crop plots planted 21 June 2017 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	Total C	Total N
				-----%-----	
Billion-dollar Grass	Chiwapa	1	104	43.27	1.69
Billion-dollar Grass	Chiwapa	2	208	43.46	1.42
Billion-dollar Grass	Chiwapa	3	310	43.01	1.24
Browntop Millet	Common	1	103	43.78	1.43
Browntop Millet	Common	2	209	43.45	1.72
Browntop Millet	Common	3	303	43.77	1.62
Japanese Millet	Common	1	108	44.27	1.44
Japanese Millet	Common	2	210	43.32	1.78
Japanese Millet	Common	3	301	43.73	1.77
Pearl Millet	Leafy 22	1	102	43.19	2.02
Pearl Millet	Leafy 22	2	201	43.82	2.43
Pearl Millet	Leafy 22	3	308	43.08	2.38
Proso Millet	Common (white)	1	107	-----	-----
Proso Millet	Common (white)	2	202	-----	-----
Proso Millet	Common (white)	3	302	43.27	1.87
Proso Millet	Dove	1	106	45.41	1.68
Proso Millet	Dove	2	204	45.35	1.50
Proso Millet	Dove	3	305	45.12	1.44
Sorghum-Sudan	Honey Graze BMR	1	109	44.80	1.12
Sorghum-Sudan	Honey Graze BMR	2	205	44.77	1.08
Sorghum-Sudan	Honey Graze BMR	3	304	44.82	1.16
Sterile Sorghum	Common	1	110	45.24	1.10
Sterile Sorghum	Common	2	207	45.05	1.00
Sterile Sorghum	Common	3	307	44.68	1.04
Teosinte	Chapingo	1	105	46.30	1.18
Teosinte	Chapingo	2	203	46.25	1.40
Teosinte	Chapingo	3	306	45.58	1.25

Species	Cultivar	Rep	Plot	Total C	Total N
				-----%-----	
Teosinte	Common	1	101	46.26	1.29
Teosinte	Common	2	206	45.92	1.19
Teosinte	Common	3	309	45.62	1.14

2018 Data

Table 25. Emergence ratings at 7 and 14 days after planting (DAP) for warm-season grass cover crop plots planted 26 June 2018 at the Brooksville Plant Materials Center

Species	Cultivar	Rep	Plot	7 DAP	14 DAP	Notes
Billion-dollar Grass	Chiwapa	1	104	2	3	
Billion-dollar Grass	Chiwapa	2	207	2	3	
Billion-dollar Grass	Chiwapa	3	309	2	3	
Billion-dollar Grass	Chiwapa	4	403	2	2	
Browntop Millet	Common	1	109	2	2	
Browntop Millet	Common	2	208	2	2	
Browntop Millet	Common	3	303	2	3	
Browntop Millet	Common	4	402	1	1	
Japanese Millet	Common	1	105	2	2	
Japanese Millet	Common	2	209	2	2	
Japanese Millet	Common	3	301	2	2	
Japanese Millet	Common	4	407	2	3	
Proso Millet	Common (white)	1	106	1	2	
Proso Millet	Common (white)	2	201	2	2	
Proso Millet	Common (white)	3	302	1	2	
Proso Millet	Common (white)	4	406	2	3	
Proso Millet	Dove	1	107	2	2	
Proso Millet	Dove	2	203	2	2	
Proso Millet	Dove	3	305	1	2	
Proso Millet	Dove	4	405	0	2	lots of competition
Sorghum-Sudan	Honey Graze BMR	1	108	1	2	
Sorghum-Sudan	Honey Graze BMR	2	204	2	3	
Sorghum-Sudan	Honey Graze BMR	3	304	1	2	
Sorghum-Sudan	Honey Graze BMR	4	408	2	2	
Sterile Sorghum	Common	1	103	2	3	
Sterile Sorghum	Common	2	206	2	3	
Sterile Sorghum	Common	3	307	2	2	
Sterile Sorghum	Common	4	409	2	2	lots of competition
Teosinte	Chapingo	1	101	1	3	

Species	Cultivar	Rep	Plot	7 DAP	14 DAP	Notes
Teosinte	Chapingo	2	202	1	1	
Teosinte	Chapingo	3	306	1	2	
Teosinte	Chapingo	4	404	2	3	competition
Teosinte	Common	1	102	1	2	
Teosinte	Common	2	205	0	2	
Teosinte	Common	3	308	0	1	
Teosinte	Common	4	401	2	2	

¹Rating Scale 0-3 where 0 = Poor (<25%); 1 = Moderate (30-60%); 2 = Good (65-85%); 3 = Excellent (90-100%).

Table 26. Canopy ratings and plant height measurements at 10, 20, and 30 days after planting (DAP) for warm-season grass cover crop plots planted 26 June 2018 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	10 DAP			
				Canopy ¹	Height 1	Height 2	Height 3
					-----in-----		
Billion-dollar Grass	Chiwapa	1	104	1	3	3	3
Billion-dollar Grass	Chiwapa	2	207	1	6	3	4
Billion-dollar Grass	Chiwapa	3	309	2	5	6	6
Billion-dollar Grass	Chiwapa	4	403	2	4	5	3
Browntop Millet	Common	1	109	2	4	3	4
Browntop Millet	Common	2	208	2	5	4	5
Browntop Millet	Common	3	303	3	5	5	4
Browntop Millet	Common	4	402	2	3	4	3
Japanese Millet	Common	1	105	1	3	3	2
Japanese Millet	Common	2	209	1	4	4	4
Japanese Millet	Common	3	301	1	4	4	3
Japanese Millet	Common	4	407	1	3	4	3
Proso Millet	Common (white)	1	106	2	2	3	2
Proso Millet	Common (white)	2	201	1	2	2	2
Proso Millet	Common (white)	3	302	1	2	2	2
Proso Millet	Common (white)	4	406	1	2	2	3
Proso Millet	Dove	1	107	1	2	2	2
Proso Millet	Dove	2	203	1	2	3	2
Proso Millet	Dove	3	305	1	3	4	3

10 DAP							
Species	Cultivar	Rep	Plot	Canopy ¹	Height 1	Height 2	Height 3
					-----in-----		
Proso Millet	Dove	4	405	1	2	3	3
Sorghum-Sudan	Honey Graze BMR	1	108	1	5	5	6
Sorghum-Sudan	Honey Graze BMR	2	204	2	6	5	5
Sorghum-Sudan	Honey Graze BMR	3	304	1	6	6	5
Sorghum-Sudan	Honey Graze BMR	4	408	2	4	6	5
Sterile Sorghum	Common	1	103	2	4	3	5
Sterile Sorghum	Common	2	206	2	5	5	7
Sterile Sorghum	Common	3	307	2	3	4	5
Sterile Sorghum	Common	4	409	1	10	8	7
Teosinte	Chapingo	1	101	1	4	3	3
Teosinte	Chapingo	2	202	1	5	4	3
Teosinte	Chapingo	3	306	1	5	4	4
Teosinte	Chapingo	4	404	1	5	4	8
Teosinte	Common	1	102	1	4	5	3
Teosinte	Common	2	205	1	4	3	4
Teosinte	Common	3	308	1	4	4	4
Teosinte	Common	4	401	1	5	5	5
20 DAP ²							
Species	Cultivar	Rep	Plot	Canopy	Height 1	Height 2	Height 3
					-----in-----		
Billion-dollar Grass	Chiwapa	1	104	5	15	16	18
Billion-dollar Grass	Chiwapa	2	207	4	16	18	17
Billion-dollar Grass	Chiwapa	3	309	3	16	16	15
Billion-dollar Grass	Chiwapa	4	403	4	19	20	19
Browntop Millet	Common	1	109	5	20	19	23
Browntop Millet	Common	2	208	3	18	20	20
Browntop Millet	Common	3	303	4	22	21	22
Browntop Millet	Common	4	402	5	19	22	21
Japanese Millet	Common	1	105	5	15	14	16
Japanese Millet	Common	2	209	4	18	17	19
Japanese Millet	Common	3	301	3	14	14	14

20 DAP ²							
Species	Cultivar	Rep	Plot	Canopy	Height 1	Height 2	Height 3
					-----in-----		
Japanese Millet	Common	4	407	4	17	14	14
Proso Millet	Common (white)	1	106	3	14	12	15
Proso Millet	Common (white)	2	201	2	13	11	14
Proso Millet	Common (white)	3	302	2	10	8	9
Proso Millet	Common (white)	4	406	2	16	16	15
Proso Millet	Dove	1	107	3	12	12	13
Proso Millet	Dove	2	203	2	15	14	13
Proso Millet	Dove	3	305	3	16	15	16
Proso Millet	Dove	4	405	1	10	10	11
Sorghum-Sudan	Honey Graze BMR	1	108	3	25	19	18
Sorghum-Sudan	Honey Graze BMR	2	204	4	21	24	19
Sorghum-Sudan	Honey Graze BMR	3	304	2	23	21	20
Sorghum-Sudan	Honey Graze BMR	4	408	3	20	20	20
Sterile Sorghum	Common	1	103	4	26	22	25
Sterile Sorghum	Common	2	206	4	24	25	25
Sterile Sorghum	Common	3	307	3	25	23	26
Sterile Sorghum	Common	4	409	2	16	16	17
Teosinte	Chapingo	1	101	3	12	14	10
Teosinte	Chapingo	2	202	2	11	12	12
Teosinte	Chapingo	3	306	2	11	11	15
Teosinte	Chapingo	4	404	2	16	16	11
Teosinte	Common	1	102	2	10	13	11
Teosinte	Common	2	205	2	12	12	13
Teosinte	Common	3	308	2	10	12	16
Teosinte	Common	4	401	2	12	15	13
30 DAP							
Species	Cultivar	Rep	Plot	Canopy	Height 1	Height 2	Height 3
					-----in-----		
Billion-dollar Grass	Chiwapa	1	104	5	28	31	31
Billion-dollar Grass	Chiwapa	2	207	4	24	27	25
Billion-dollar Grass	Chiwapa	3	309	4	24	26	21

Species	Cultivar	Rep	Plot	Canopy	30 DAP		
					Height 1	Height 2	Height 3
					-----in-----		
Billion-dollar Grass	Chiwapa	4	403	5	30	30	29
Browntop Millet	Common	1	109	5	33	31	31
Browntop Millet	Common	2	208	3	20	25	22
Browntop Millet	Common	3	303	4	29	27	25
Browntop Millet	Common	4	402	4	32	31	28
Japanese Millet	Common	1	105	5	24	22	30
Japanese Millet	Common	2	209	4	27	23	22
Japanese Millet	Common	3	301	4	28	27	21
Japanese Millet	Common	4	407	5	29	31	31
Proso Millet	Common (white)	1	106	3	19	24	15
Proso Millet	Common (white)	2	201	2	21	25	24
Proso Millet	Common (white)	3	302	2	18	17	12
Proso Millet	Common (white)	4	406	2	19	18	20
Proso Millet	Dove	1	107	4	28	26	26
Proso Millet	Dove	2	203	3	29	22	21
Proso Millet	Dove	3	305	4	27	25	27
Proso Millet	Dove	4	405	1	14	16	10
Sorghum-Sudan	Honey Graze BMR	1	108	5	42	35	45
Sorghum-Sudan	Honey Graze BMR	2	204	5	40	36	32
Sorghum-Sudan	Honey Graze BMR	3	304	3	24	27	18
Sorghum-Sudan	Honey Graze BMR	4	408	5	41	39	40
Sterile Sorghum	Common	1	103	5	35	52	54
Sterile Sorghum	Common	2	206	5	52	48	39
Sterile Sorghum	Common	3	307	5	45	46	44
Sterile Sorghum	Common	4	409	2	18	21	16
Teosinte	Chapingo	1	101	4	26	28	31
Teosinte	Chapingo	2	202	2	19	23	15
Teosinte	Chapingo	3	306	4	24	28	26
Teosinte	Chapingo	4	404	2	22	23	19
Teosinte	Common	1	102	3	23	24	23
Teosinte	Common	2	205	3	28	26	23

Species	Cultivar	Rep	Plot	Canopy	30 DAP		
					Height 1	Height 2	Height 3
					-----in-----		
Teosinte	Common	3	308	2	16	26	22
Teosinte	Common	4	401	2	25	20	23

¹Canopy rating scale 1-5 where 1 = 0-15%; 2= 20-35%; 3 = 40-60%; 4 = 65-80%; 5 = 85-100%.

²There was standing water from heavy rains in many of the plots in reps 2, 3, and 4 on the 20 DAP evaluation date.

Table 27. Insect and disease damage ratings for warm-season grass cover crop plots planted 26 June 2018 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	Date	Insect ¹	Disease ¹	Date ²	Insect	Disease
Billion-dollar Grass	Chiwapa	1	104	7/23/2018	1	0	8/20/2018	1	1
Billion-dollar Grass	Chiwapa	2	207	7/23/2018	1	0	8/29/2018	1	1
Billion-dollar Grass	Chiwapa	3	309	7/23/2018	1	0	8/29/2018	1	1
Billion-dollar Grass	Chiwapa	4	403	7/23/2018	1	0	8/20/2018	1	1
Browntop Millet	Common	1	109	7/23/2018	1	1	8/2/2018	1	1
Browntop Millet	Common	2	208	7/23/2018	1	1	8/2/2018	1	3
Browntop Millet	Common	3	303	7/23/2018	1	0	8/2/2018	0	0
Browntop Millet	Common	4	402	7/23/2018	1	0	8/2/2018	0	1
Japanese Millet	Common	1	105	7/23/2018	1	0	8/2/2018	1	0
Japanese Millet	Common	2	209	7/23/2018	1	0	8/2/2018	1	0
Japanese Millet	Common	3	301	7/23/2018	1	0	8/2/2018	1	0
Japanese Millet	Common	4	407	7/23/2018	1	0	8/2/2018	0	0
Proso Millet	Common (white)	1	106	7/23/2018	0	2	8/2/2018	1	3
Proso Millet	Common (white)	1	201	7/23/2018	1	0	8/2/2018	1	2
Proso Millet	Common (white)	3	302	7/23/2018	0	3	8/2/2018	0	3
Proso Millet	Common (white)	4	406	7/23/2018	1	1	8/2/2018	1	2
Proso Millet	Dove	1	107	7/23/2018	0	2	8/2/2018	0	1
Proso Millet	Dove	2	203	7/23/2018	1	1	8/2/2018	1	2
Proso Millet	Dove	3	305	7/23/2018	1	2	8/2/2018	0	2
Proso Millet	Dove	4	405	7/23/2018	0	1	-----	-----	-----
Sorghum-Sudan	Honey Graze BMR	1	108	7/23/2018	1	1	8/29/2018	1	2
Sorghum-Sudan	Honey Graze BMR	2	204	7/23/2018	2	0	9/11/2018	1	2
Sorghum-Sudan	Honey Graze BMR	3	304	7/23/2018	1	1	9/21/2018	0	1

Species	Cultivar	Rep	Plot	Date	Insect ¹	Disease ¹	Date ²	Insect	Disease
Sorghum-Sudan	Honey Graze BMR	4	408	7/23/2018	1	1	9/11/2018	1	3
Sterile Sorghum	Common	1	103	7/23/2018	1	0	8/20/2018	1	2
Sterile Sorghum	Common	2	206	7/23/2018	2	0	8/20/2018	1	2
Sterile Sorghum	Common	3	307	7/23/2018	2	0	8/20/2018	1	2
Sterile Sorghum	Common	4	409	7/23/2018	1	0	-----	-----	-----
Teosinte	Chapingo	1	101	7/23/2018	1	2	9/21/2018	1	1
Teosinte	Chapingo	2	202	7/23/2018	1	1	9/26/2018	2	1
Teosinte	Chapingo	3	306	7/23/2018	0	1	9/21/2018	0	2
Teosinte	Chapingo	4	404	7/23/2018	1	1	9/26/2018	1	2
Teosinte	Common	1	102	7/23/2018	1	2	9/21/2018	1	2
Teosinte	Common	2	205	7/23/2018	1	2	9/21/2018	1	2
Teosinte	Common	3	308	7/23/2018	1	1	9/21/2018	1	2
Teosinte	Common	4	401	7/23/2018	1	2	9/21/2018	0	2

¹Insect and disease rating scale 0-5 where 0 = none; 1 = 1-15%; 2 = 20-35%; 3 = 40-60%; 5 = 85-100%

²Date 2 – insect and disease occurrence rated at harvest.

Table 28. Flowering dates and observations for warm-season grass cover crop plots planted 26 June 2018 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	Date 1	Notes ¹	Date 2	Notes
Billion-dollar Grass	Chiwapa	1	104	8/10/2018	boot start to emerge	8/13/2018	emerged
Billion-dollar Grass	Chiwapa	2	207	8/17/2018			
Billion-dollar Grass	Chiwapa	3	309	8/10/2018	boot	8/17/2018	
Billion-dollar Grass	Chiwapa	4	403	8/13/2018			
Browntop Millet	Common	1	109	7/27/2018	just emerging	7/31/2018	emerged
Browntop Millet	Common	2	208	7/27/2018	boot	7/31/2018	emerged
Browntop Millet	Common	3	303	7/27/2018	just emerging	7/31/2018	emerged
Browntop Millet	Common	4	402	7/27/2018	just emerging	7/31/2018	emerged
Japanese Millet	Common	1	105	7/23/2018	emerged		
Japanese Millet	Common	2	209	7/27/2018	emerged		
Japanese Millet	Common	3	301	7/27/2018	emerged		
Japanese Millet	Common	4	407	7/27/2018	emerged		
Proso Millet	Common (white)	1	106	7/23/2018			
Proso Millet	Common (white)	1	201	7/23/2018			

Species	Cultivar	Rep	Plot	Date 1	Notes ¹	Date 2	Notes
Proso Millet	Common (white)	3	302	7/23/2018			
Proso Millet	Common (white)	4	406	7/23/2018			
Proso Millet	Dove	1	107	7/27/2018	emerged		
Proso Millet	Dove	2	203	7/27/2018	emerged		
Proso Millet	Dove	3	305	7/27/2018	emerged		
Proso Millet	Dove	4	405	7/27/2018	just emerging - competition affected stand		
Sorghum-Sudan	Honey Graze BMR	1	108	8/24/2018			
Sorghum-Sudan	Honey Graze BMR	2	204	8/28/2018			
Sorghum-Sudan	Honey Graze BMR	3	304	8/24/2018			
Sorghum-Sudan	Honey Graze BMR	4	408	8/24/2018			
Sterile Sorghum	Common	1	103	8/10/2018	boot start to emerge	8/13/2018	emerged
Sterile Sorghum	Common	2	206	8/10/2018	boot start to emerge	8/13/2018	emerged
Sterile Sorghum	Common	3	307	8/10/2018	boot	8/13/2018	
Sterile Sorghum	Common	4	409	-----	competition affected stand		
Teosinte	Chapingo	1	101	9/14/2018			
Teosinte	Chapingo	2	202	9/14/2018			
Teosinte	Chapingo	3	306	9/14/2018			
Teosinte	Chapingo	4	404	9/14/2018			
Teosinte	Common	1	102	9/11/2018			
Teosinte	Common	2	205	9/11/2018			
Teosinte	Common	3	308	9/11/2018			
Teosinte	Common	4	401	9/11/2018			

¹Boot stage – inflorescence still enclosed within the sheath of the flag leaf.

Table 29. Plant height measured at harvest and dry matter (DM) yield of biomass harvested from warm-season grass cover crop plots planted 26 June 2018 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	Date	Height 1	Height 2	Height 3	DM Yield ¹
					-----in-----			---(lb/ac)---
Billion-dollar Grass	Chiwapa	1	104	8/20/2018	50	51	50	10467
Billion-dollar Grass	Chiwapa	2	207	8/29/2018	42	42	32	9683
Billion-dollar Grass	Chiwapa	3	309	8/29/2018	46	47	46	5861
Billion-dollar Grass	Chiwapa	4	403	8/20/2018	59	58	52	14282

Species	Cultivar	Rep	Plot	Date	Height 1	Height 2	Height 3	DM Yield ¹
					-----in-----			---(lb/ac)---
Browntop Millet	Common	1	109	8/2/2018	28	32	35	10169
Browntop Millet	Common	2	208	8/2/2018	24	26	22	2133
Browntop Millet	Common	3	303	8/2/2018	31	29	32	3643
Browntop Millet	Common	4	402	8/2/2018	34	30	32	8562
Japanese Millet	Common	1	105	8/2/2018	44	41	40	9957
Japanese Millet	Common	2	209	8/2/2018	36	37	30	10175
Japanese Millet	Common	3	301	8/2/2018	41	37	39	11203
Japanese Millet	Common	4	407	8/2/2018	42	35	39	7464
Proso Millet	Common (white)	1	106	8/2/2018	17	14	16	3489
Proso Millet	Common (white)	1	201	8/2/2018	26	20	25	3458
Proso Millet	Common (white)	3	302	8/2/2018	17	16	12	3594
Proso Millet	Common (white)	4	406	8/2/2018	22	26	24	2779
Proso Millet	Dove	1	107	8/2/2018	35	32	28	4548
Proso Millet	Dove	2	203	8/2/2018	26	23	22	2071
Proso Millet	Dove	3	305	8/2/2018	31	28	27	3035
Proso Millet	Dove	4	405	-----	-----	-----	-----	-----
Sorghum-Sudan	Honey Graze BMR	1	108	8/29/2018	85	78	83	16126
Sorghum-Sudan	Honey Graze BMR	2	204	9/11/2018	50	73	57	8511
Sorghum-Sudan	Honey Graze BMR	3	304	9/21/2018	50	40	55	7829
Sorghum-Sudan	Honey Graze BMR	4	408	9/11/2018	61	58	65	9308
Sterile Sorghum	Common	1	103	8/20/2018	82	72	75	15068
Sterile Sorghum	Common	2	206	8/20/2018	74	72	69	12421
Sterile Sorghum	Common	3	307	8/20/2018	71	67	73	8110
Sterile Sorghum	Common	4	409	-----	-----	-----	-----	-----
Teosinte	Chapingo	1	101	9/21/2018	71	65	70	23621
Teosinte	Chapingo	2	202	9/26/2018	54	44	50	3526
Teosinte	Chapingo	3	306	9/21/2018	66	59	74	12110
Teosinte	Chapingo	4	404	9/26/2018	54	50	38	6427
Teosinte	Common	1	102	9/21/2018	72	81	77	19308
Teosinte	Common	2	205	9/21/2018	66	64	69	17964
Teosinte	Common	3	308	9/21/2018	46	52	57	4803
Teosinte	Common	4	401	9/21/2018	56	64	63	5430

¹A 5.4 ft² (0.5 m²) area in the center of each 3.5 ft x 20 ft plot was harvested to determine yield.

Table 30. Carbon and nitrogen content determined by tissue analysis of plant material harvested from warm-season grass cover crop plots planted 26 June 2018 at the Brooksville Plant Materials Center.

Species	Cultivar	Rep	Plot	Total C	Total N
				-----%-----	
Billion-dollar Grass	Chiwapa	1	104	44.01	1.14
Billion-dollar Grass	Chiwapa	2	207	44.42	0.86
Billion-dollar Grass	Chiwapa	3	309	43.91	0.76
Billion-dollar Grass	Chiwapa	4	403	43.69	1.04
Browntop Millet	Common	1	109	44.97	2.13
Browntop Millet	Common	2	208	45.26	0.80
Browntop Millet	Common	3	303	44.91	1.06
Browntop Millet	Common	4	402	45.71	1.69
Japanese Millet	Common	1	105	44.50	1.85
Japanese Millet	Common	2	209	45.28	1.71
Japanese Millet	Common	3	301	45.74	1.88
Japanese Millet	Common	4	407	45.15	1.68
Proso Millet	Common (white)	1	106	44.03	2.10
Proso Millet	Common (white)	1	201	44.87	2.34
Proso Millet	Common (white)	3	302	45.19	2.15
Proso Millet	Common (white)	4	406	45.27	1.57
Proso Millet	Dove	1	107	46.34	1.85
Proso Millet	Dove	2	203	46.07	1.56
Proso Millet	Dove	3	305	45.91	1.43
Proso Millet	Dove	4	405	-----	-----
Sorghum-Sudan	Honey Graze BMR	1	108	46.17	0.71
Sorghum-Sudan	Honey Graze BMR	2	204	45.42	0.57
Sorghum-Sudan	Honey Graze BMR	3	304	46.27	0.53
Sorghum-Sudan	Honey Graze BMR	4	408	45.55	0.71
Sterile Sorghum	Common	1	103	46.19	0.49
Sterile Sorghum	Common	2	206	43.99	0.50
Sterile Sorghum	Common	3	307	45.69	0.78

Species	Cultivar	Rep	Plot	Total C	Total N
				-----%	-----
Sterile Sorghum	Common	4	409	-----	-----
Teosinte	Chapingo	1	101	46.14	0.61
Teosinte	Chapingo	2	202	45.98	1.25
Teosinte	Chapingo	3	306	46.28	0.74
Teosinte	Chapingo	4	404	45.87	1.00
Teosinte	Common	1	102	45.58	0.60
Teosinte	Common	2	205	46.24	0.66
Teosinte	Common	3	308	46.50	0.96
Teosinte	Common	4	401	46.48	0.91

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