United States Department of Agriculture

Year 2014 Progress Report of Activities
E. “Kika” de la Garza Plant Materials Center

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Following are highlights of some of the activities of the PMC for 2014. Please contact the PMC for more detailed information.

Biofuel Grass Performance

The STPMC was part of a team evaluating perennial biomass grasses for comparative productivity across latitudes in the southern Great Plains. Five switchgrass ecotypes and one miscanthus were planted in replicated field trials at 10 locations across Texas, Arkansas, Oklahoma, and Missouri. At the E. “Kika” de la Garza PMC, we also included big sacaton in these trials.

Table 1. Dry weights in tons per hectare at the STPMC in 2010.

Species	Tons per Hectare
Switchgrass	
‘Alamo’	19.87
‘Blackwell’	2.23
‘Cave-in-Rock’	1.20
‘Cimarron’	9.60
‘Kanlow’	7.39
Miscanthus	5.08
Falfurrias Germplasm Big Sacaton	20.98

Table 1 shows the biomass results for the seven grasses at Kingsville in 2010. The highest yielding entry was Falfurrias germplasm big sacaton. No additional data was taken until January 14, 2014. At that time the only surviving plants were Alamo switchgrass and Falfurrias germplasm big sacaton. The other switchgrass entries died due to the extreme drought conditions that occurred in 2011 and 2012. The historical average annual precipitation in Kingsville is 26 inches. The annual precipitation in 2010 was 49.2 inches, but in 2011 and 2012 the precipitation was 10.5” and 18.0” respectively. We clipped and weighed samples for both specimens on January 14, 2014. Big sacaton had a 58% survival rate but still produced 5 tons/hectare/year. Alamo switchgrass had only a 10% survival rate and produced 88 pounds or 0.04 tons/hectare/year. Rainfall in 2013 was 24 inches.

This data indicates that at the western edge of switchgrass’s range, where droughts are more likely to occur, big sacaton would be a good candidate to consider as a perennial biofuels grass.

The larger study was published as Perennial Biomass Grasses and the Mason–Dixon Line: Comparative Productivity across Latitudes in the Southern Great Plains in BioEnergy Research, Issue 6:276-291 of 2013. Big sacaton was only planted at the Kingsville location thus its data was not included in this publication.

Falfurrias Germplasm big sacaton on the left and ‘Alamo’ switchgrass on the right in September 2012 during a drought.

Five Year Study on Tillage, Cover Crops, and Soil Health

With the ability to now not only determine soil fertility but to also measure the soil’s biological activity, we are closer than ever before to determining the soil’s health. Soil health in large part is determined by how well you are providing for the soil organisms. Management practices that maintain suitable habitat for these organisms will improve soil health and increase its productivity and profitability. Tilling the soil is equivalent to a hurricane in the world of soil organisms. Any tillage that results in bare or compacted soil is destructive to soil microbes. Misuse of chemicals can also be disruptive to soil organisms.

The objective for attaining good soil health are:

- Disturb the soil as little as possible
- Grow as many different species of plants as practical
- Keep living plants in the soil as long as possible
- Keep the soil covered at all times

Based on these objectives, we developed a five year study to assess the effects of tillage and cover crops on soil health. We are studying three different tillage systems, no-till, ridge-till and conventional tillage. We are measuring soil parameters including soil nutrients, soil organic matter, bulk density, microbial activity, soil moisture, and soil infiltration. We are also assessing crop yield and input costs.

Biodiversity is the other key to success for any agricultural system. Increasing the diversity of crop rotation and cover crops increases soil health, reduces disease and other pest problems, and increases long-term soil health and profitability.

The second part of our study is to evaluate the use of mixed species cover crops (cocktails) for the improvement of soil health. We will evaluate each tillage system with and without a cover crop. Measurements will be taken on cover crop species, vigor and biomass, commodity crop yield, monthly soil moisture and soil fertility changes using SSHAT (Sustainable Soil Health Assessment Tool). SSHAT provides the producer with not only a soil nutrient assessment, but also gives information on soil microbial activity and C:N (carbon to nitrogen ratios).

Our study design is a randomized complete block with two replications. Soil sampling is done at least once a year with four random samples taken per treatment.

2012/2013 Results

Table 2. PMC Tillage Study. Soil Moisture at Block J on March 4, 2013.

Date	Location	Treatment	Soil Moisture %
3/4/2013	Block J	No-till w/c	20.7
3/4/2013	Block J	No-till	25.1
3/4/2013	Block J	Ridge-till w/c	13.5
3/4/2013	Block J	Ridge-till	16.8
3/4/2013	Block J	Conventional w/c	12.9
3/4/2013	Block J	Conventional	17.9

When we took our monthly soil moisture readings on March 4, 2013, the no-till plots had more available surface soil moisture than either the conventional or ridge tillage plots (Table 2). Our March soil moisture readings also revealed that there was more soil moisture from plots with no cover in comparison to those plots with a cover crop. However, no-till plots, even with cover, had more soil moisture than either of the conventional tillage or ridge tillage plots.

We also setup individual plots replicated twice (Fields E and H) of our 30 cover crops. On the individual plots, oats did better than the black oats or rye. Chickling vetch and Cahaba vetch did better than hairy vetch. Austrian winter peas and Berseem clover had the best performance for legumes with better coverage in January and overall biomass production in March 2013. The forage collards, tillage radish, and rapeseed all produced large sized tubers in the fall.

Austrian winter peas in March 2013.

We also compared a PMC cover crop mix against a mix produced by Green Cover Seed Company. The PMC cover crop mix contained hairy vetch, crimson clover, Austrian winter peas, cowpeas, lablab, purple bushbeans, oats, purpletop turnip and tillage radish. The Green Cover mix contained wheat, Austrian winter peas, forage pea, common vetch, sudan, pearl millet, oil seed radish, canola, sunflower, and purpletop turnips.

Table 3. PMC Cover Crop Study 2013 with January Percent Ground Cover and March Biomass Production

	Jan % Cover			Dry Weight (g/ft^2)		
Mix	Field H	Field E	Mean	Field H	Field E	Mean
Green Cover	20	95	58	12	29	21
PMC	95	95	95	33	20	27

The PMC mix had better January coverage (95%) and a mean March dry weight biomass of 27 grams (2,590 #/ac) compared to the Green Cover mix which had a mean January cover of only 58% and a mean March biomass production of 21g (2,015 #/ac) (Table 3).

The PMC cover crop mix was applied to ½ of each tillage treatment on November 9, 2012. Field coverage and biomass production was a lot less on these tillage plots than on the individual plots. Evaluation of the tillage plots in March 2013 had the cover crop on the ridge tillage plot at an average of 420 #/ac, conventional tillage with 253 #/ac, and the no-till with 129 #/ac.

2014 Results

Table 4. PMC Tillage Study 2014. Soil Moisture at Block H on March 23, 2014.

Date	Location	Treatment	Soil Moisture %
3/23/2014	Block H	No-till w/c	16.7
3/23/2014	Block H	No-till	26.5
3/23/2014	Block H	Ridge-till w/c	15.2
3/23/2014	Block H	Ridge-till	17.5
3/23/2014	Block H	Conventional w/c	12.0
3/23/2014	Block H	Conventional	19.0

In March 2014, all of the plots that had cover crops had less available soil moisture (Table 4). This lack of soil moisture severely impacted our sorghum crop. Precipitation from October 2013 to March 2014 was 2.7 inches. The historical average for this period is 8.9", driving home the point that cover crops need to be terminated by January 15th. The individual cover crop plots were evaluated in April 2014. Buckwheat performed excellent. Tillage radish and purple top turnips had good performance. Austrian winter peas, black oats, safflower, flax, deer pea vetch, sainfoin and phacelia all had fair performance.

Chickling vetch in March 2013.

General Summary

After three years, it has become apparent that we have to change from a fall-winter cover crop to a summer-fall cover crop. Our problem with the fall-winter cover crop is we aren't getting it seeded until October and we need to terminate the cover crop by Jan 15th in order to save moisture for the commodity crop. This timeline does not allow the cover crop enough time to produce significant biomass. In 2015 we will be turning to a summer-fall cover crop to see if this better fits the needs of this area.

Seed Collections Needed

The PMC is seeking seed collections in 2015 including: Virginia wildrye (*Elymus virginicus*), partridge pea (*Chaemaecrista fasciculata*), and Engelmann's daisy (*Engelmannia peristenia*). Species description sheets as well as seed collecting protocols can be found on the Texas Plant Materials Program website (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/tx/plantsanimals/?cid=nrcs144p2_003036) or contact the PMC for more information.

Partridge Pea

About the PMC

The E. "Kika" de la Garza Plant Materials Center (PMC) is a 91-acre facility established to provide cost-effective vegetative solutions for soil and water conservation problems. This means identifying plants and developing techniques for successful conservation use. It also means assisting in the commercial development of these plants and promoting their use in natural resource conservation and other environmental programs.

The PMC was established in 1981. It is one of 27 centers located throughout the United States. The PMC is operated by the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), in cooperation with an Advisory Board from Texas A&M University-Kingsville, the Caesar Kleberg Wildlife Research Institute (CKWRI), South Texas Association of Soil & Water Conservation Districts, and the Gulf Coast Association of Soil & Water Conservation Districts.

The Kika de la Garza PMC serves approximately 27 million acres of the southern portion of Texas.

Program Emphasis

The mission of the Kika de la Garza PMC is to develop and transfer plant science technology to solve natural resource problems in the South Texas area. Plant testing and plant selection as well as the development of new plant science technologies are the primary products of our program. The PMC conducts plantings and studies at the Center and off-Center with cooperating partners. The PMC works with NRCS Field Offices and Resource Conservation and Development (RC&D) groups, Conservation Districts, federal and state agencies, and private landowners.

Our current program emphasis at the PMC is in the following areas:

- Rangeland Habitat Restoration and Enhancement
- Coastal Shoreline Stabilization
- Coastal Habitat Restoration and Enhancement
- Erosion Control/Water Quality Improvement on Agricultural Land
- Biofuels

Current Availability of South Texas Ecotype Releases

Common Name	Scientific Name	Available From	Date Available
Lavaca Germplasm Canada Wildrye	*Elymus canadensis*	Turner Seed Company Douglass W. King Co.	Now
Falfurrias Germplasm Big Sacaton	*Sporobolus wrightii*	Douglass W. King Co.	Now
Kinney Germplasm False Rhodes Grass	*Trichloris crinita*	Douglass W. King Co.	Now
Catarina Blend Bristlegrass	*Setaria leucopila* & *Setaria vulpiseta*	Pogue Agri Partners Douglass W. King Co. Bamert Seed Co. Turner Seed Company	Now
Mariah Germplasm Hooded Windmillgrass	*Chloris cucullata*	Douglass W. King Co. Pogue Agri Partners	Now
Welder Germplasm Shortspike Windmillgrass	*Chloris subdolichostachya*	Douglas King Seed Co. Pogue Agri Partners	Now
Dilley Germplasm Slender Grama	*Bouteloua repens*	Douglass W. King Co. Pogue Agri Partners	Now
Chaparral Germplasm Hairy Grama	*Bouteloua hirsuta*	Douglass W. King Co. Pogue Agri Partners	Now
Atascosa Germplasm Texas Grama	*Bouteloua rigidiseta*	Douglass W. King Co. Pogue Agri Partners	Now
La Salle Germplasm Arizona Cottontop	*Digitaria californica*	Pogue Agri Partners Douglas King Seed Co. Turner Seed Company	Now
Zapata Germplasm Rio Grande Clammyweed	*Polanisia dodecandra* ssp. *riograndensis*	Douglas King Seed Co.	Now, limited
Divot Talloweed Blend	*Plantago hookeriana* & *Plantago rhodosperma*	Pogue Agri Partners	Now, limited
Maverick Germplasm Pink Pappusgrass	*Pappophorum bicolor*	Douglas King Seed Co. Pogue Agri Partners	Now
Webb Germplasm Whiplash Pappusgrass	*Pappophorum vaginatum*	Douglass W. King Co.	Now
Hidalgo Germplasm Multiflower False Rhodes Grass	*Trichloris pluriflora*	Douglas King Seed Co.	Now
Oso Germplasm Hall's Panicum	*Panicum hallii* var. *filipes*	Douglas King Seed Co.	Now
South Texas Germplasm Sideoats Grama	*Bouteloua curtipendula* var. *caespitosa*	Douglas King Seed Co.	Now
Rio Grande Germplasm Prairie Acacia	*Acacia angustissima* var. *hirta*	Douglas King Seed Co.	Now, limited
Hoverson Germplasm Deer Pea Vetch	*Vicia ludoviciana*	Douglas King Seed Co.	Now, limited
Venado Germplasm Awnless Bushsunflower	*Simsia calva*	Douglas King Seed Co.	Now
Balli Germplasm Prostrate Bundleflower	*Desmanthus virgatus* var. *depressus*	Douglas King Seed Co.	Now