Evaluation of new Sorghum-sudangrass and Pearl Millet hybrids as feedstock for the Oklahoma beef production system – Year 2.

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Introduction

New varieties of Sorghum-sudangrass (*Sorghum vulgare* Pers. X *Sorghum sudanense* Stapf.) and Pearl millet (*Pennisetum americanum* L.), which are capable of producing high forage quantity and quality, have not been fully investigated as part of Oklahoma forage system production. Forage characteristics such as forage yield, quality and prussic acid accumulation had been not evaluated at different cutting heights and water regimes in Oklahoma. Therefore, the objectives of this study are:

1. To evaluate / compare three sorghum-sudangrass and two pearl millet hybrids forage quantity and quality for hay production.

2. To determine the effect of cutting stubble height and water regimes on hybrids forage production and quality.

Material and Methods

This ongoing study was initiated in 2016 at the Oklahoma State University South Central Research Station at Chickasha, OK. **Two distinct experimental fields such as rainfed and irrigated** were established on late June in 2016 and on late May in 2017. Both fields were on a fine, mixed, superactive, thermic Pachic Argiustolls previously cropped with switchgrass (*Panicum Virigatum* L.) for 6 years.

For both Rainfed and Irrigated trials, a split-split plot design with 3 replications was developed with 2 different sets of **treatments:**

(1) Five hybrids as main plots (RCBD):

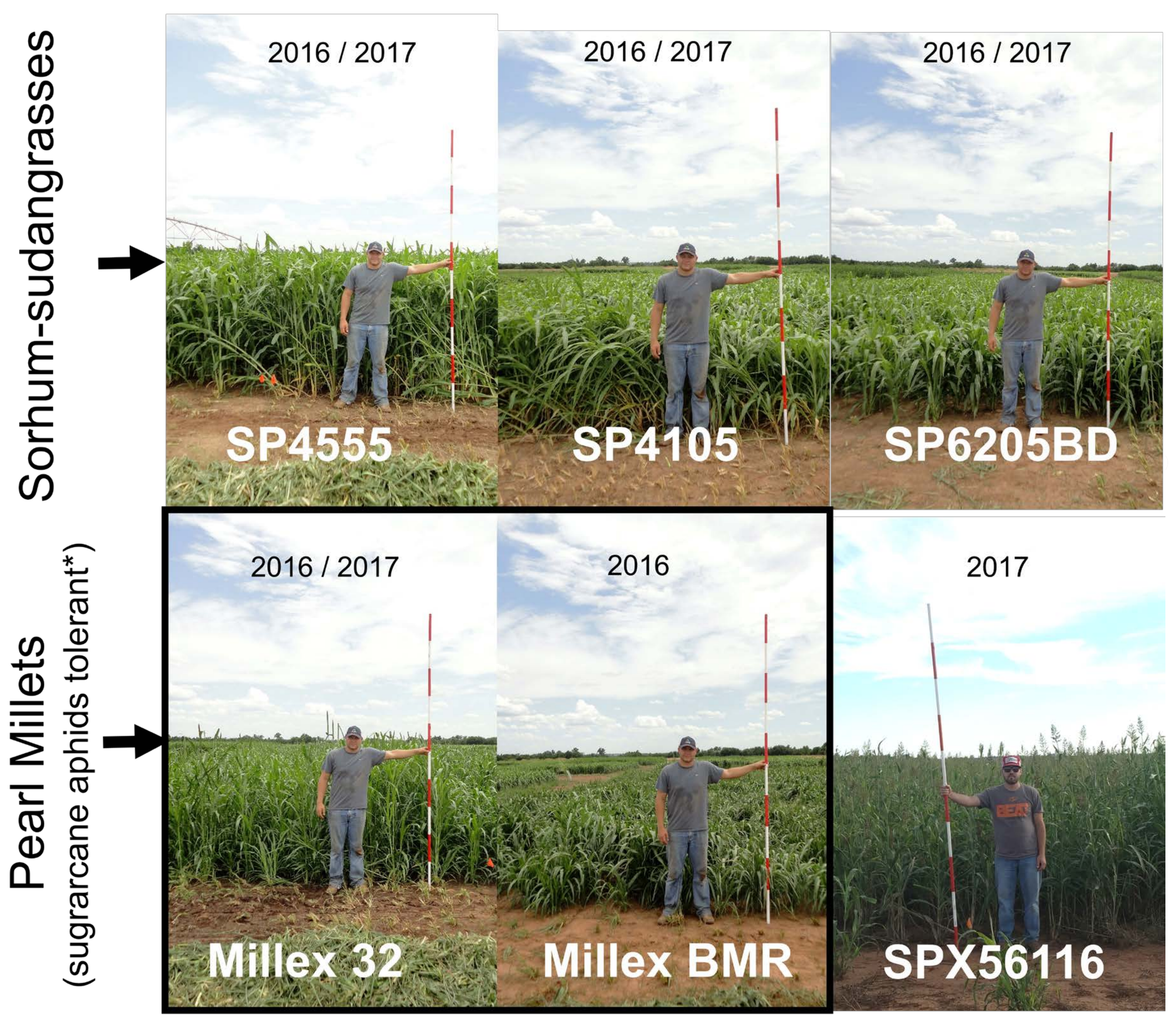

Figure 1: Evaluated hybrids growth at 7 weeks after planting (WAP) – Irrigated trail.

Chromatin Inc., 2016

(2) Two cutting regimes as sub-plot/split:
7.5 cm (3 inches) and 15 cm (6 inches) stubble height.

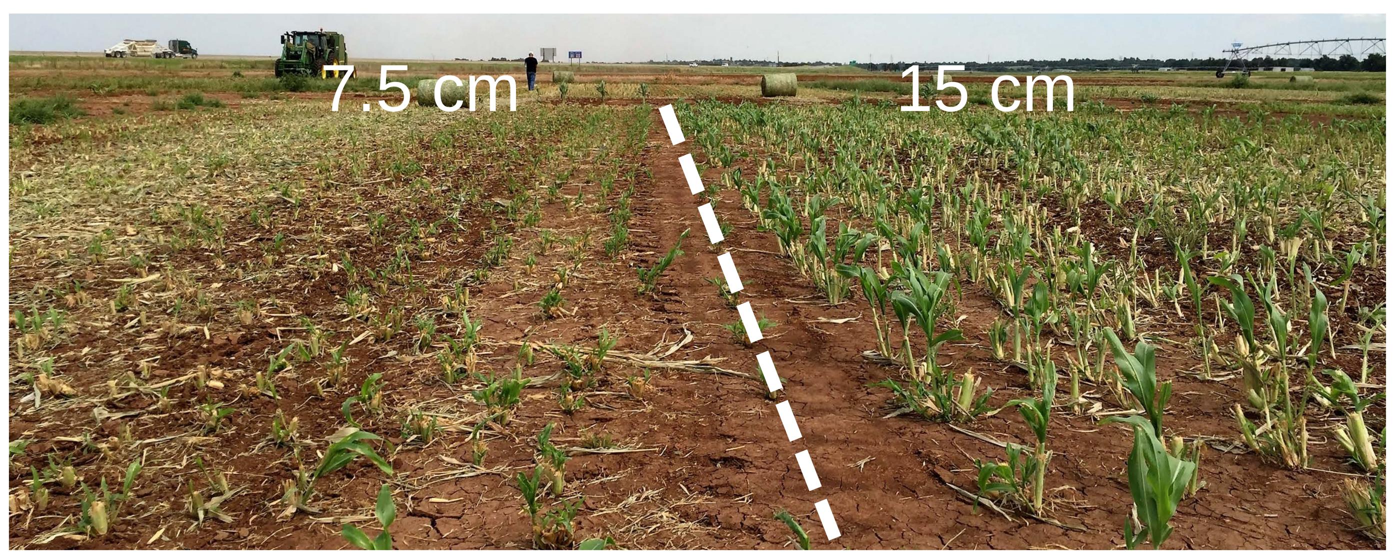

Figure 2: SP4555 hybrid re-growth after five days of first cut for two different cutting heights: 7.5 and 15 cm in 2016.

Each sub-plot was cut according to its assigned stubble height at 7 weeks after planting (WAP) and regrowth totally harvested (less than 5 cm height) at 15 WAP (final cut). After cut, each subplot (2,800 m^2 / 30,000 ft^2) was baled after 5-6 days of drying period (moisture content target = 15%).

Bales were weighted. Samples from windrows were taken after cutting and before bailing, ground and dried at 55ºC until constant weight in order to estimate dry moisture content and biomass production. These subsamples were processed and Near-Infrared Spectrometry procedures were used for determining Forage quality estimators such as: TDN, NDF, ADF and CP.

Figure 3: Harvest procedures.

Results and Discussion

Forage production

1.1. Cutting time effect (2016, only)

Dry **forage yield was significantly higher at 7 WAP cut** (3.34 Mg ha^{-1}) **than at 15 WAP cut** (1.37 Mg ha^{-1}, $\rho \leq 0.01$) in the rainfed trial. Similar results were found in the irrigated trial, forage yield was significantly higher at 7 WAP (4.18 Mg ha^{-1}) than at 15 WAP (3.2 Mg ha^{-1}, $\rho \leq 0.01$). **Therefore, harvests were analyzed separated in both trials.** Furthermore, forage yield at 7 WAP were 41 and 23% higher than at 15 WAP for rainfed and irrigated trial, respectively. This relative yield discrepancy between harvests in both trials (41 vs. 23%, numerical comparisons, only) might be **explained by water and solar radiation variation along the season:**

- **Solar radiation (GDD as its proxy):** the total GDD (Tb=10˚C) cumulated from planting to 7 WAP and 15 WAP were respectively 872˚C and 1,514˚C for both trials (24% less GDD cumulated during regrowth).
- **Water:** The total cumulative rain from planting to 7 WAP and 15 WAP were respectively 112 mm and 146 mm for rainfed trial (70% less water during regrowth). Nevertheless, the irrigated trial had supplemental weekly irrigation of 25 mm (1 inch). The irrigation mostly favored the regrowth after first cut (7 WAP) decreasing the relative yield gap between harvests in the irrigated trial.

1.2. Hybrids

Roughly, irrigation increased sorghum-sudangrasses yield in at least 40%. However, it had lower effect in the pearl millets. Millex 32 and BMR yield increased in 35% and 10% when irrigated, respectively (numerical comparisons only). **In dryland conditions, the top 3 yielding forages were Millex BMR, SP4555. In irrigation conditions, the top 2 were SP4555 and SP1405.** Nowadays, **sugarcane aphids** are a major concern in Oklahoma, and both **pearl millets are tolerant** to this pest. Therefore, it would be advantageous to **select Millex BMR in dry land** conditions due to its high yield sugarcane aphid tolerance. In irrigated conditions, it is unclear how much the sorghum-sundangrasses could yield if sugarcane aphid infested.

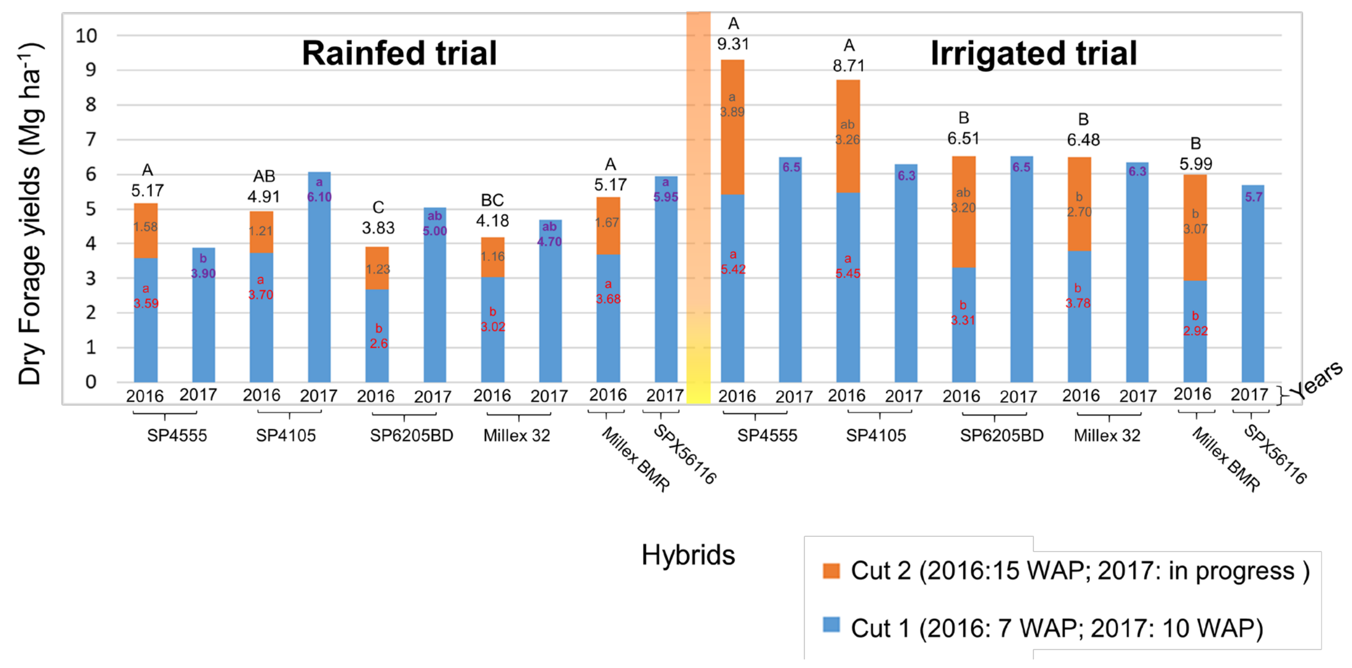

Figure 4: Dry forage yield among hybrids. Letters denote significant differences within same cut or total yields.

1.2. Stubble Height

Different stubble height cuts did not affect the total forage yield in both trials in 2016. In both cases, the lower forage yield harvested during first cut due to a higher stubble height (15 cm) was compensated for a slighter, but significant higher yield during second harvest. The forages were established on June 20, 2016 which was considered late but within the planting window for Oklahoma conditions. Therefore, the regrowth after cutting was late in the season resulting in less GDD accumulation than expected. **We speculate that earlier planting may increase the potential regrowth of the evaluated crops which might favor forage production at higher stubble height cuts. This is the scope for 2017 year data collection; however, regrowth data for 2017 was cut, but not baled at this moment. Excessive rain on early October 2017 delayed second cut.**

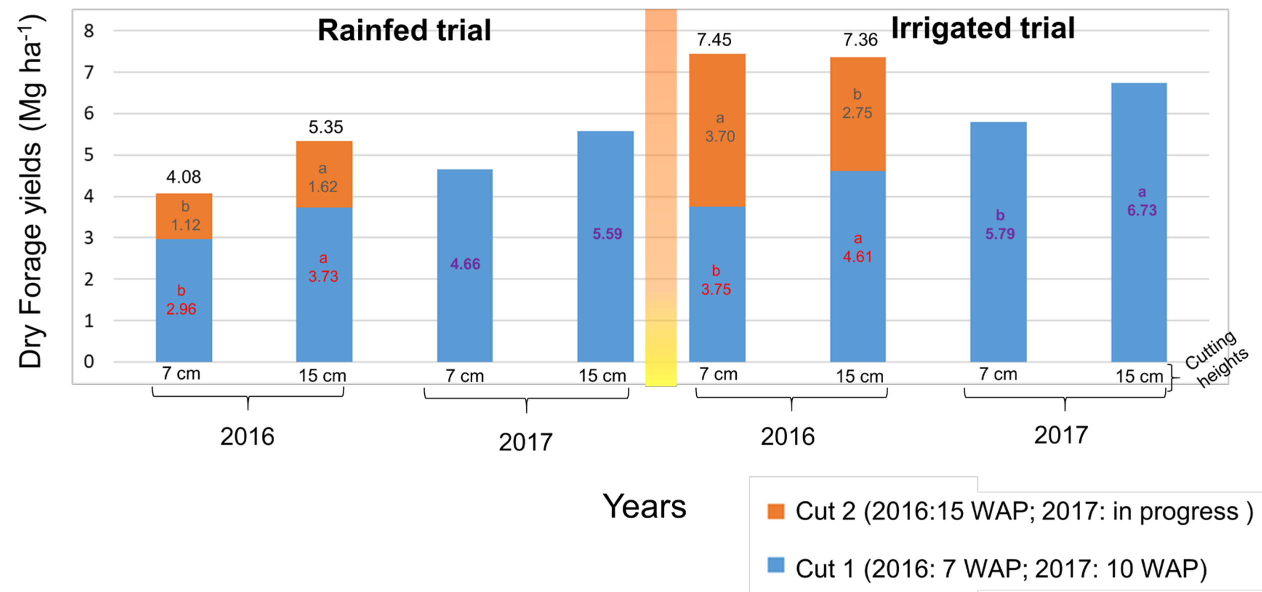

Figure 5: Dry forage yield between stubble height cuts. Letters only denote significant differences within same cut or total yields.

Forage Quality

Forage quality was available only for the 2016 rainfed trial at first cut (7 WAP) at this time. Significant differences were found only among hybrids. Total digestible nutrients (TDN) ranged from 64 to 66%. Neutral detergent fibers (NDF) ranged from 50 to 55%. Acid detergent fiber (NDF) ranged from 33 to 37%. Crude Protein (CP) ranged from 13 to 17%. **Millex BMR showed the highest quality: TDN = 66% (highest), NDF = 50% (average), ADF = 33% (lowest), CP = 17% (highest).**

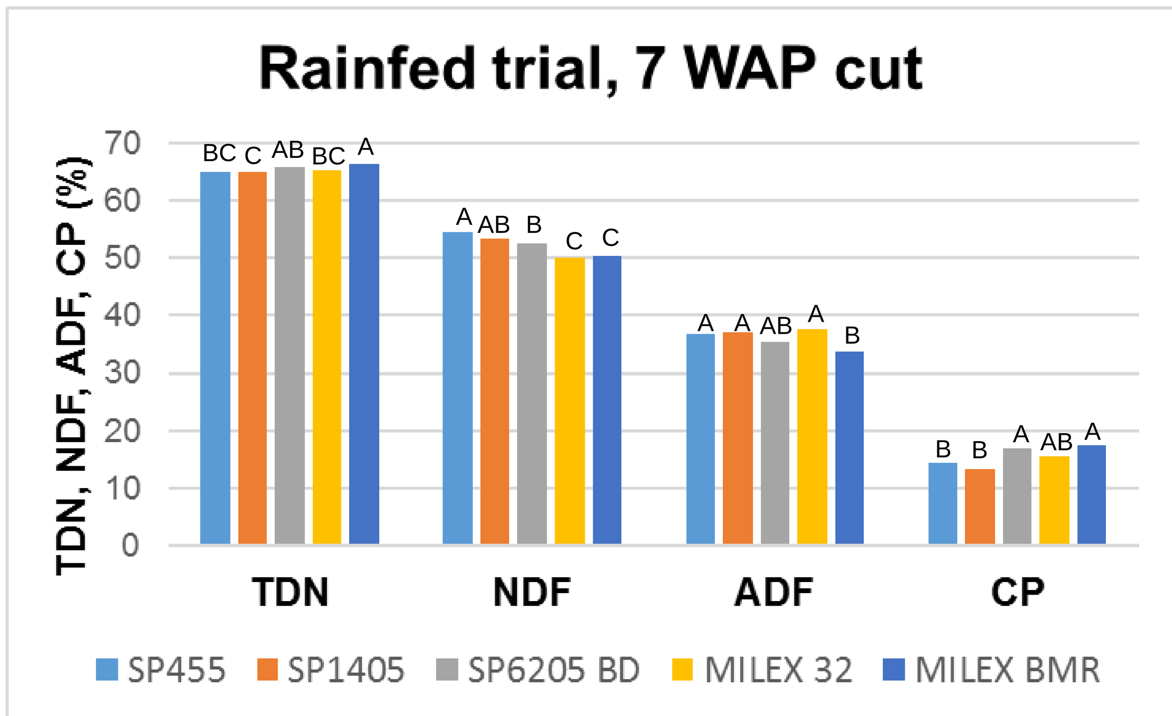

Figure 6: Forage quality indicators. Letters only denote significant differences within each indicator.

Conclusions

1. Second cut (15 WAP) had lower forage production than first cut (7 WAP). Much lower soil radiation during regrowth due to late planting and less water availability aggravated their differences even though low yields at late cuts are normally expected.

2. Millex BMR (2016, only), SP4555, SP4105 were the top 3 yielding forages in rainfed conditions. SP4555 and SP4105 were the top 2 yielding forages at irrigation conditions

3. Lower forage yield at first cut due to higher stubble height (15 cm) was compensated for slight high yield during second harvest. However, total yields was not significant between stubble heights.

4. Millex BMR showed the highest forage quality among all tested hybrids (2016, only).

✓ **Our findings indicated Millex BMR is the best alternative for rainfed conditions due to high forage yield and quality. In addition, it is tolerant to sugarcane aphids which is an ongoing issue in Oklahoma.**