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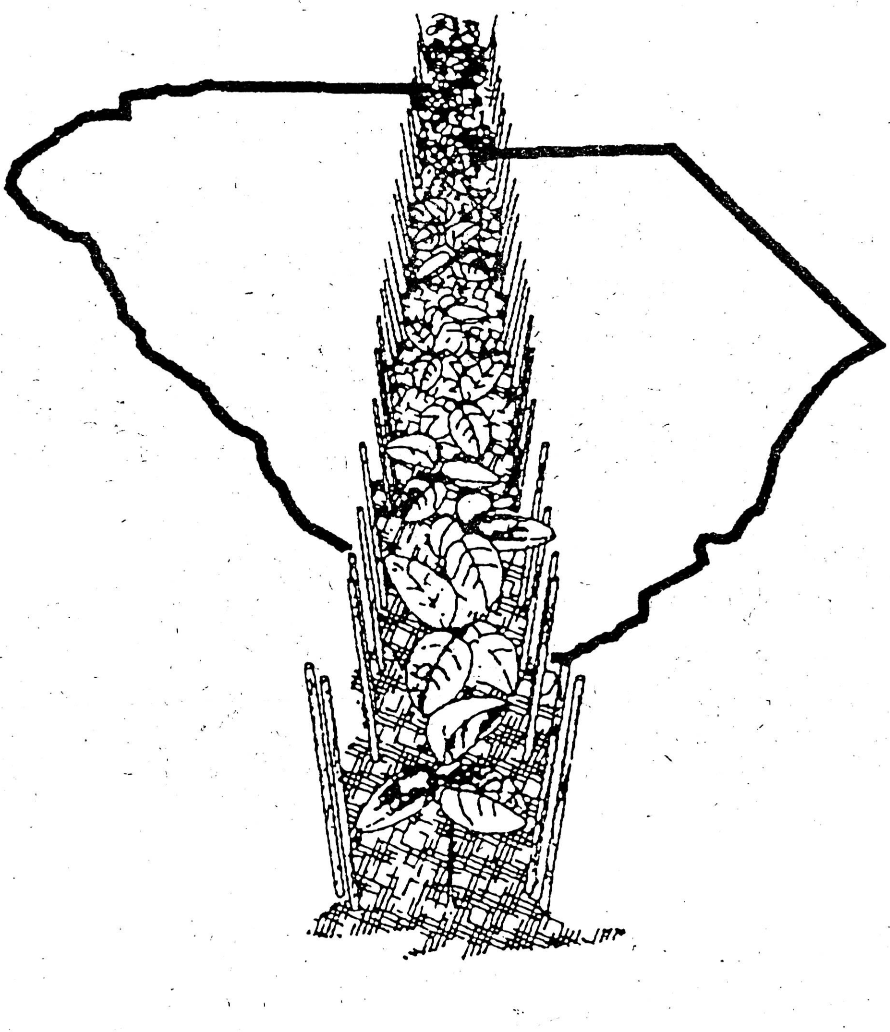

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COMPARISON OF TILLAGE METHODS ON PEARL MILLET AND TROPICAL CORN FOR SILAGE AND GRAIN

Pawel J. Wiatrak, David L. Wright, Jerzy A. Pudelko, and Brian T. Kidd[1]

ABSTRACT

Pearl Millet (*Pennisetum americanum* (L) Leek) and tropical corn (*Zea may* L.) can be grown for silage and grain in multicropping systems and can be used after winter crops when it is too late to plant temperate corn. This research was done to compare yields and quality components of these two crops for grain and silage in strip and conventional tillage systems. The research was conducted in 1992 and 1993 years on a Norfolk sandy loam soil at The North Florida Research and Education Center, Quincy, Florida using HGM - 100 Hybrid pearl millet hybrid and Pioneer brand 3072 tropical corn. Both corn and millet growth in the strip till system gave a higher yield of fresh silage than in the conventional system (corn 35680 lb./acre and 31220 lb./acre, and millet 48168 lb./acre and 42816 lb./acre, respectively). However, the fresh matter had less dry matter in the strip till system as compared to the conventional planting and dry matter yield was not different statistically (corn 11328 lb./acre and 10882 lb./acre; millet 11774 lb./acre and 12042 lb./acre, respectively). The fresh matter yield of millet was higher (45492 lb./acre) than corn (33004 lb./acre) but dry matter was not different (11060 lb./acre and 11596 lb./acre). Tillage system did not influence the neutral detergent fiber content of either crop but in vitro organic matter digestibility was higher in conventional planted millet but not different in corn. Tillage system did not influence the grain yield of millet and corn. Grain yield of corn was higher (81.9 Bu/acre) than millet (64.7 Bu/acre).

INTRODUCTION

Pearl millet is a high-quality productive grain or silage crop (Burton et al., 1986 and Kumar et al., 1983), which appears superior to sorghum (*Sorghum bicolor* L. Moench) in establishment (Smith et. al., 1989b) and production under limited soil moisture (Smith et al., 1989a). Critical growth stages receiving stress were flowering and grain fill. Grain yield and grain number, but not grain size are affected by time of stress onset in relation to flowering. Effects of time of stress are also dependent on the intensity and duration of the stress period (Mahalakshmi and Bidinger, 1985). Bationo et al. (1990) showed that increasing fertilization and plant density, increased grain yield of pearl millet in average or wet years and slightly reduces yield in a drought year. Pearl millet is highly digestible by swine (Haydon and Hobbs, 1991), beef cattle (Hill and Hanna, 1990), poultry (Smith et al., 1989b), and catfish (Burtle et al., 1992).

Tropical corn has become an important alternate crop in the southern United States in the past few years. It has been estimated that over 50,000 acres were grown in 1991, mostly for silage. Tropical corn serves as an alternative crop to soybeans (*Glycine max* L.), grains sorghum and temperate corn. Research with corn grown in conventional-tillage systems has generally shown the benefit of delaying application of the majority of N fertilizer until 4 to 6 weeks after planting (Jung et al., 1972; Bigeriego et al., 1979; Welch et al., 1971). Delayed applications of N has also been shown to increase N efficiency of corn in no-till systems (Fox et al., 1986; Frye et al., 1981).

Soil erosion is a function of vegetative cover, crop residue and degree of surface roughness (Johnson et al., 1979; Sloneker and Moldenhauer, 1977), conservation tillage systems such as strip tillage can aid in maintaining cropland productivity. Wagger and Denton (1989) reported consistent yield increases of 8 to 67 % in corn and 36 to 55% in soybean with strip tillage compared to conventional tillage systems in the Piedmont region of North Carolina. They noted greater soil water availability with strip tillage and attributed it to reduced runoff. Residue cover improves infiltration of rainfall by protecting the soil against rain drop impact and subsequent crusting and slowing the velocity of runoff

[1] Graduate Student, Agronomist, Agronomy Department Chairman (Poznan, Poland), and Biological Scientist, respectively. Institute of Food & Agricultural Sciences, Univ. of Florida, N. Florida Res. & Education Cen., Quincy, FL 32351.

Table 1. Influence of tillage systems on parameters of Tropical corn, 1992-1993.

Parameter	Tillage system	1992	1993	Mean
Height of plants (ft)	Conventional	6.76a	6.56a	6.66a
	strip till	6.72a	6.80a	6.76a
Thickness of stalk (inch)	Conventional	0.86a	0.86a	0.86a
	strip till	0.84a	0.86a	0.85a
Weight of wet roots (lbs)	Conventional	0.20a	0.45b	0.33b
	strip till	0.23a	0.72a	0.47a
Weight of dry roots (lbs)	Conventional	0.10a	0.16b	0.13a
	strip till	0.11a	0.30a	0.21a
Weight of 200 kernels (gms)	Conventional	48.45a	60.19a	54.32a
	strip till	43.67a	59.86a	51.77a
% Moisture	Conventional	42.99b	84.55a	63.77a
Bu/A - Yield	strip till	43.40b	79.22a	61.31a
Number of plants/A	Conventional	17657a	16698a	17177a
	strip till	20130a	14885b	17507a

Numbers in the same column for each separate parameter followed by the same letter indicate no difference as determined by LSD comparison at 5% level of probability.

(Denton and Cassel, 1989). Winter annual cover crops provide plant canopy cover and root mass to hold soil during the winter and spring months, which effectively reduces the soil erosion potential (Hargrove et al., 1984). In strip tillage systems, the winter crop residue remaining on the soil surface after the summer crop is planted, can serve as a moisture-conserving mulch that can considerably increase yields (Moschler et al., 1967). This research was done to compare two relatively new alternate crops in conventional vs. strip-tillage plantings for silage and grain.

MATERIALS AND METHODS

These studies were conducted on a Norfolk sandy loam (fine, loamy siliceous, thermic Typic Kandiudult) located on the North Florida Research and Education Center, Quincy, Florida. The soil has a compacted layer located 8 to 14 inches below the surface. The pearl millet hybrid used in this study was the W.W. Hanna developed hybrid from Georgia-Agra Tech HGM-100 and tropical corn was Pioneer brand 3072.

The experiment was conducted on a winter fallow field. The experimental design was a split plot with 4 replications with corn or millet being the main plots. Plots were 8 rows wide by 30 feet long with 10 ft. spaces between plot and tillage treatments being the sub plots. Before starting the experiment, the field was mowed and the conventional section was chisel plowed on May 12and s-tine harrowed. On May 18 the entire study area was irrigated and on May 21 s-tine harrowed again. All plots were planted using a Brown-Ro-Till with in-row subsoiling and KMC planters. Row spacing was 3 feet. Seeds of millet were planted 1/4 inch deep at 6.0 lbs/A and tropical corn seeds were planting 3/4 inches deep and 20,000 plants/A. On May 22 Roundup was applied at 32 oz./A for weed control in the strip till section. Corn emerged on June 2 and Atrazine at 2.0 lb./A and Dual at 2.0 pt./A were applied on June 5 for weed control. The emergence of millet was not uniform therefore the stand was treating with Gramoxone Extra 2.0 pt./A and Atrazine 1.5 lb./A to kill the existing stand. On June 10 millet was replanted and both crops were irrigated with 1" of water. Starter fertilizer, 50 lbs/A ammonium nitrate + 50 lbs/A 4-18-6 N-P-K, was applied beside rows at planting followed by 100 lbs/A N as ammonium-nitrate when corn and millet were 5-7" tall. Millet was harvested for silage 75 days after planting and corn at 35 % dry matter. Grain was harvested from both crops when moisture dropped below 20 %.

RESULTS AND DISCUSSION

Tillage did not influence height or stalk diameter of corn (Table 1). Tropical corn grown in the strip till system had a bigger mass of wet and dry roots (Table 1). Number of plants of corn were higher in the conventional system than with strip tillage while kernel weight, moisture and grains yield were not different (Table 1).

Theoretical grains yield of millet were calculated based on the regression equation $y = -0.0317 + 0.0048x$ where y=pearl millet head yield in lb./head and x=head length in inches (Wright, et al., 1994) because of bird damage. There was no difference between strip till and conventional plantings. Millet tended to have a higher number of heads per unit area in strip tillage, and longer heads in conventional tillage and grain yield was higher for millet in the strip till system but only plant height was significantly different (Table 2).

The fresh silage matter yield was different between corn and millet and between conventional and strip till plantings. Millet had the highest fresh silage yield from strip till (48168 lb./acre), followed by millet conventionally planted (42816 lb./acre) and then strip till corn (35680 lb./acre), with the lowest being conventional corn (31220 lb./acre) (Table 3). However, % dry matter was inversely related to yields of fresh matter. The highest % dry matter was for corn planted conventionally and the lowest for millet planted with the strip till system (Table 3). This resulted in there being no difference in dry matter yields between crops or tillage systems (Table 3). Both millet and corn yield grown in the strip till system were not different from conventional plantings in yield and most measured parameters. However silage moisture was higher for both crops in the strip till system.

Table 2. Influence of tillage systems on paramters of Pearl millet, 1993.

Parameter	Tillage system	Mean
Height of plants (ft)	Conventional	5.8b
	strip till	6.3a
Length of heads (inch)	Conventional	12.7a
	strip till	12.5a
Number of heads/A	Conventional	118100a
	strip till	124400a
Yield in Bu/A	Conventional	63.0a
	strip till	66.3a

Numbers in the same column for each separate parameter followed by the same letter indicate no difference as determined by LSD comparison at 5% level probability.

Table 3. Comparison of Tillage Methods on parameters of Pearl millet and Tropical corn

Parameter	Tillage system	Corn	Millet	Mean
Yield of fresh silage in lb/A	Conv.	31220d	42816b	37464b
	No-till	35680c	48168a	41924a
		33004b	45492a	
Yield of dry silage in lb/A	Conv.	10882b	12042a	11507a
	No-till	11328ab	11774ab	11507a
		11061a	11864a	
% dry matter	Conv.	35.6a	27.8c	31.7a
	No-till	31.5b	24.3d	27.9b
		33.5a	26.1b	
% organic matter	Conv.	95.1a	92.2b	93.7a
	No-till	94.6a	91.6b	93.0a
		94.8a	91.8b	
In vitro organic matter digestibility (5)	Conv.	63.5a	50.7b	57.1a
	No-till	62.1a	43.9c	53.0a
		6328a	47.3b	
Neutral detergent fiber total (%)	Conv.	63.3a	66.0a	64.8a
	No-till	63.5a	67.0a	65.2a
		63.6a	66.5a	
% neutral detergent fiber ash free	Conv.	63.5a	65.1a	64.3a
	No-till	63.9a	66.6a	65.2a
		63.7a	65.8a	

Numbers in the same column and row for each separate parameter followed by the same letter indicate no difference as determined by LSD comparison at 5% level of probability.

Laboratory analysis showed that % organic matter, % neutral detergent fiber total (% NDFt) and % neutral detergent fiber ash free (NDFaf) were not different between tillage systems or crops (Table 3). However, organic matter and in vitro organic matter digestibility were higher for corn than for millet (Table 3). Higher digestibility was expected with corn because of the higher grain content. Tillage did not influence in vitro organic matter digestibility in corn but strip till millet was lower (43.8) as compare to millet grown conventionally (50.7) (Table 3).

CONCLUSIONS

1. Grain yield of corn was higher in 1993 than grain yield of millet, tillage did not influence grain yield of corn or millet.

2. Green forage was different with tillage and was higher on both crops in the strip till system and was higher for millet than for corn.

3. Dry matter yield of conventionally planted millet was significantly higher than dry matter yield of conventionally planted corn.

4. Organic matter content was higher for corn than for millet.

5. There was a trend for higher root weight of tropical corn in strip till in 1992 and was significantly higher in 1993 than conventional planted corn.

6. IVOMD % of corn was not influenced by tillage but was lower with strip till millet than conventional planted millet.

7. NDF % was not different with tillage.

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