TEFF (*Eragrostis tef*) VARIETY PERFORMANCE

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Introduction

In years when the water supply is short or if an emergency crop is needed due to crop failure, or producers desire a quick growing annual forage in mid-summer, few options are available to them. Teff (*Eragrostis tef*) is a warm season annual grass that has the potential to be a viable alternative, but further research is needed on this new crop. The objective of this trial was to examine the differences in teff varieties used as a warm season forage crop in the Pacific Northwest.

Methods

The teff experiment was planted on June 6, 2006 on Nyssa silt loam at the Malheur Experiment Station on a field that was in teff the previous year. Seedbed preparation included disking and cultivating. Seed was broadcast at a rate of 6 lb/acre by using a hand fertilizer spreader. The experimental design was a randomized complete block. Varieties included in the experiment were 'Dessie' and 'Pharoah' from First Line Seeds, 'VA-T1-Brown' from Hankins Seed, 'Tiffany' from Target Seeds, and 'X9' and 'XP10' from United Seed. The experiment was conducted at three locations: Ontario and Klamath Falls, Oregon, and Othello, Washington. Results only from the Ontario site are given in this report.

Nitrogen was applied at the rate of 100 lb N/acre (urea), with half applied on June 7 (at planting) and half on July 26 (just after the first harvest). Treatments were replicated six times. A soil test taken prior to planting indicated that the soil contained 312 lb/acre N in the top two feet, 15 ppm P (Olson method), 242 ppm K, 25 ppm SO_4/acre, and 3.1 percent organic matter.

The experiment was irrigated starting on June 7 with a microsprinkler irrigation system using R10 Turbo (Nelson Irrigation Corp., Walla Walla, Washington) sprinkler heads. Sprinkler heads were placed every 12.5 ft on the sides of the plot to provide uniform coverage. To monitor soil moisture content, Watermark soil moisture sensors model 200SS (Irrometer Co. Inc., Riverside, CA) were installed at 12- and 24-inch depths to monitor soil water tension. Sensors were connected to a 900M Watermark data logger (Irrometer Co. Inc., Riverside, CA) equipped with a thermister to correct soil moisture calculations for soil temperature.

Weed control included hand weeding of barnyard grass and the use of bromoxynil (Bronate Advanced®) on June 28 at 1 pt/acre (which is the labeled rate for wheat) to control broadleaf weeds. No crop injury was apparent after spraying.

Teff was harvested when seed heads were beginning to emerge. Harvest of the first cutting occurred on July 25 and the second harvest occurred on September 12, 2006. Plots were harvested using a Jari sickle bar mower set to cut the teff at a height of 3 inches. Plots were 20 ft long by 2.5 ft wide. A sample of approximately 1.0 lb of forage was taken from each plot and oven dried to determine moisture and calculate dry matter (DM) yield.

Dried samples were ground to 2-mm-sieve size in a Wiley Mill (Arthur H. Thomas Co.) and to 1-mm-sieve size in an Udy Mill (UDY Corp.) before being analyzed in a near infrared spectrophotometer (NIRS) (NIRSystems) to determine forage quality. Treatment significance was based on an Analysis of Variance (ANOVA) F test at the P = 0.05 level. If this analysis indicated significant treatment effects then Least Significant Difference (LSD) values were calculated based on alpha at 0.05.

Results

The amount of irrigation water and precipitation the plots received in 2006 from planting to first harvest was 15.14 inches, and the amount applied between first and second harvest was 14.12 inches, with a total of 29.26 inches. Irrigation rate was 0.12 inch/hour. This is the second year that teff was produced in this field, and since there are no registered herbicides to control annual grasses, barnyard grass was a serious problem this year.

Results from the first harvest taken July 26 are found in Table 1. Yields between varieties were not significantly different and ranged from 2.70 to 3.06 ton/acre. Lodging from a wind storm made harvest difficult. Harvest of teff should be done before significant lodging occurs, if possible. Lodging ranged from 42 to 78 percent and was not significantly different between varieties. Many of the quality traits were not significantly different, including crude protein, acid detergent fiber (ADF) and relative feed quality (RFQ), with mean values of 11.9, 42.3, and 91.0 percent, respectively. Compared to the irrigation and nitrogen study last year, hay quality dropped. Crude protein dropped from 17 to 12 percent, ADF increased from 30 to 40, neutral detergent fiber (NDF) increased slightly from 58 to 61, relative feed value (RFV) dropped from 100

to 85, and RFQ dropped from 108 to 91. Decreased quality may be related to the fact that 2006 was a hotter summer than 2005. The mean maximum temperature averaged over the months of June, July, and August was 3°F warmer in 2006 than in 2005.

A lower value of NDF or ADF indicates better quality hay. Teff X9 produced significantly lower NDF than Tiffany, XP10, and Pharoah, but was not significantly different than VA-T1 Brown, or Dessie. This corresponded to a significantly higher RFV in X9 than Tiffany, XP10, and Pharoah but was not significantly different than VA-T1 Brown, or Dessie. No significant variety differences were found in any of the yield or quality parameters measured. Probably the most interesting thing is the decrease in crude protein from the first harvest. Figure 1 shows that not much water was leached through the profile. Irrigation was done every 2 to 3 days. The soil test showed 312 lbs of nitrogen at the beginning of the experiment, which should have been adequate even without the 50 lb N/acre applied prior to planting and after the first harvest. The crop appeared to be nitrogen deficient.

No significant variety differences were found in yield of either first or second cuttings, with yields ranging from 4.6 to 5.4 ton/acre (see Table 3). Converting those yields to 12 percent dry matter teff produced 5.3 to 6.1 ton/acre in 97 growing days.

Conclusion

Teff appears promising as an alternative annual forage grass. Teff grew well during the warm summer weather in Malheur County. Minimal differences between varieties occurred in the six that were tested. The RFV in 2006 averaged 85 and 86 for first and second harvests, respectively. The RFQ averaged 91 and 90 for first and second harvests, respectively. General feed quality was less in 2006 than 2005 and that may have been due to the hotter summer. Barnyard grass was the most difficult weed to control in the teff.

Acknowledgement

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Table 1. Teff yield and quality results for the first harvest (July 26) at the Malheur Experiment Station, Oregon State University, Ontario, OR, 2006.

Variety	Yield[a]	Lodging	Crude protein	ADF	NDF	RFV	RFQ
	ton/acre	%	%				
X9	2.9	68	12.5	41.8	60.2	87	94
VAT 1 Brown	2.9	42	12.2	42.2	60.4	86	92
Dessie	3.0	78	12.6	42.2	60.3	86	91
Tiffany	3.0	65	11.2	42.3	62.3	84	92
XP10	3.1	52	11.0	42.8	62.8	82	89
Pharoah	2.7	70	11.8	42.5	61.2	85	91
LSD (0.05)	NS	NS	NS	NS	1.5	3	NS

[a]Yield is presented on 100 percent dry matter basis. To convert to 88 percent dry matter divide yield by 0.88.

Table 2. Teff yield and quality results for the second harvest (September 12) at the Malheur Experiment Station, Oregon State University, Ontario, OR, 2006.

Variety	Yield[a]	Lodging	Crude protein	ADF	NDF	RFV	RFQ
	ton/acre	%	%				
X9	2.4	0	8.2	42	61.8	85	90
VAT 1 Brown	2.4	0	8.7	41.5	62.0	85	90
Dessie	2.1	0	8.9	41.5	62.1	85	88
Tiffany	2.1	0	8.1	41.8	61.6	85	89
XP10	1.9	0	8.1	40.8	61.0	87	90
Pharoah	1.9	0	8.1	41.2	60.6	87	91
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS

[a]Yield is presented on 100 percent dry matter basis. To convert to 88 percent dry matter divide yield by 0.88.

Table 3. Teff yield for both harvests (July 26 and September 12) at the Malheur Experiment Station, Oregon State University, Ontario, OR, 2006.

Variety	Yield[a]
	ton/acre
X9	5.4
VAT 1 Brown	5.3
Dessie	5.1
Tiffany	5.1
XP10	5.0
Pharoah	4.6
LSD (0.05)	NS

[a]Yield is presented on 100 percent dry matter basis. To convert to 88 percent dry matter divide yield by 0.88.

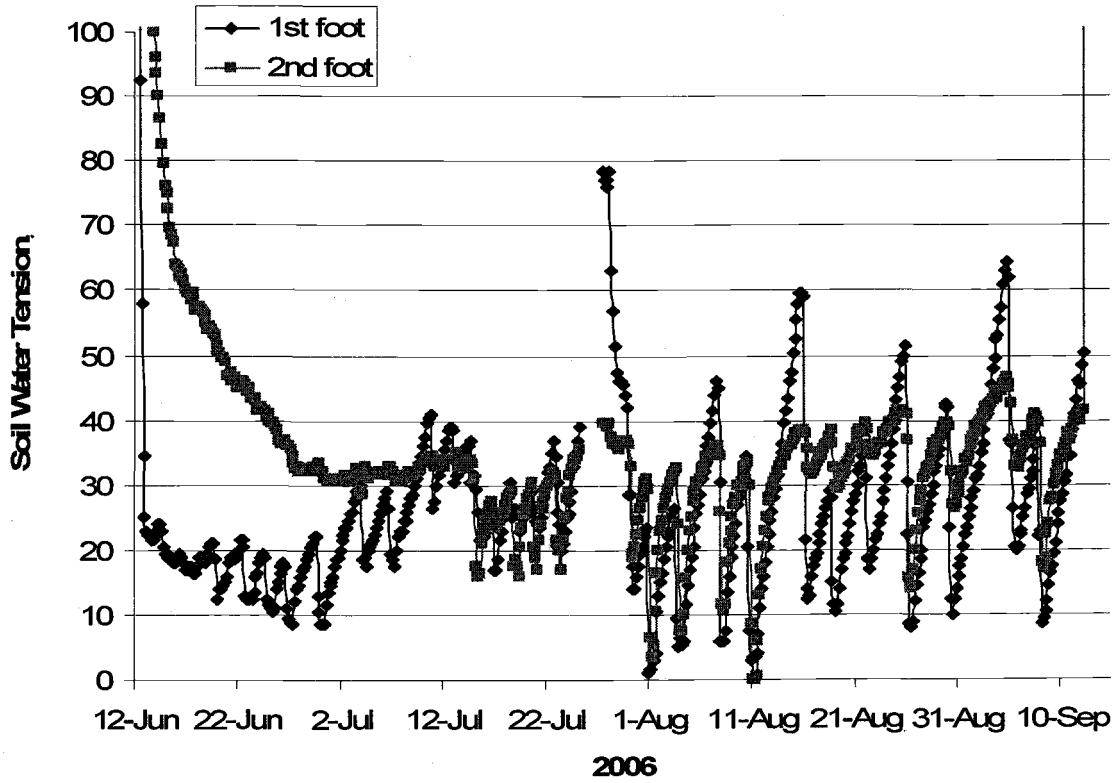

Figure 1. Soil moisture tension (cb) at the 1-ft and 2-ft levels in the experiment at the Malheur Experiment Station, Oregon State University, Ontario, OR, in 2006.