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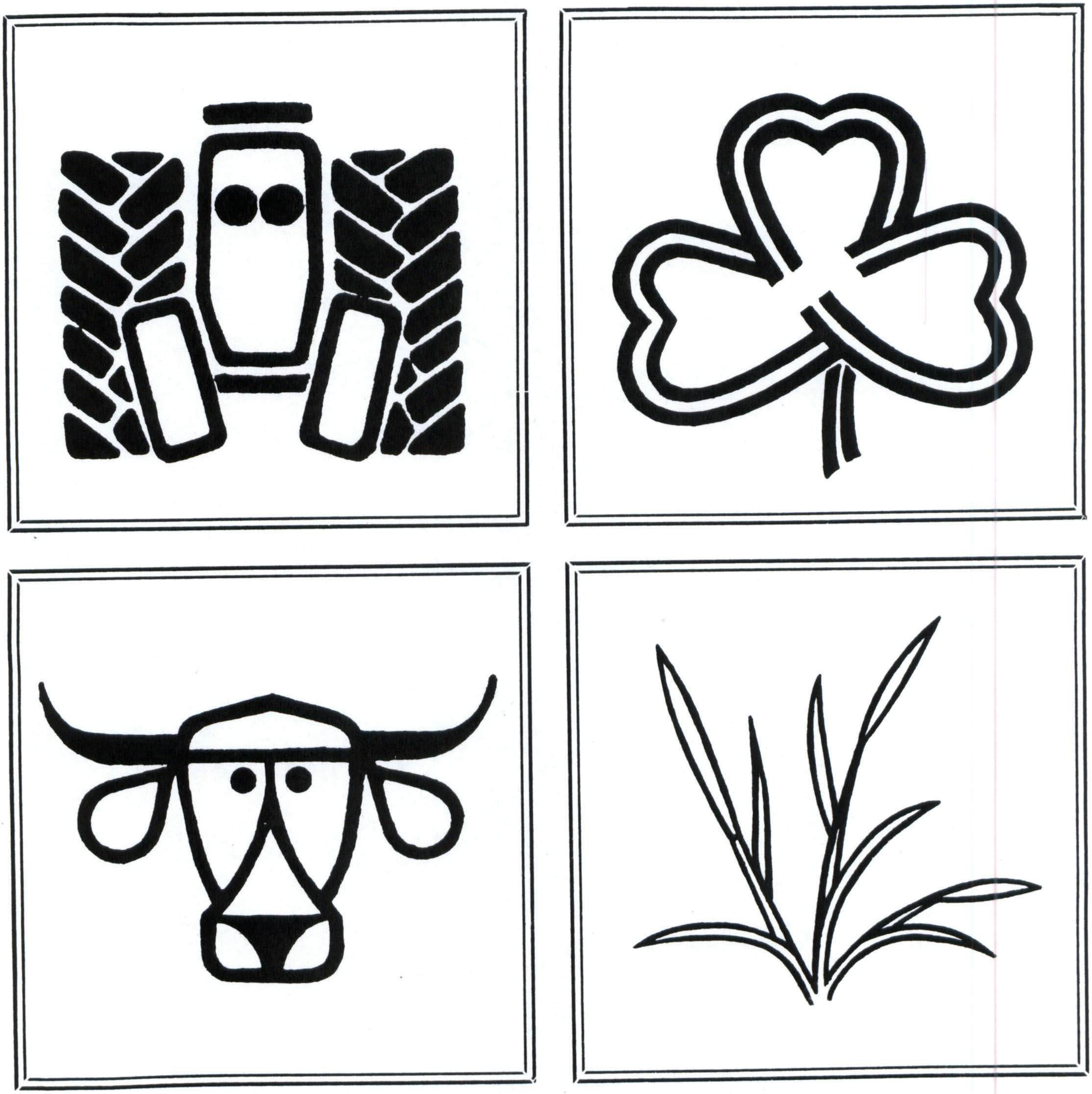

Forage Research in Texas

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Influence of Rate of Mefluidide on Nutritive Value and Dry Matter Production of Pearl Millet

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SUMMARY

Mefluidide was sprayed on 'Millex 24' at the rates of 0, 1/8, 1/4, 3/8, and 1/2 pounds active ingredient per acre (lb ai/ac) when plants were vegetative and approximately 12-15" in height. With increasing rates of mefluidide, dry matter production was dramatically reduced. Leaf:stem ratios were enhanced and seed heads were inhibited with increased rates of mefluidide. Mefluidide influenced the buildup of structural carbohydrates with advancing maturity in that neutral detergent fiber, hemicelluloses, and lignin were retarded; whereas, cellulose content was stimulated.

Introduction

Mefluidide is a plant growth regulator-herbicide and has exhibited some of the following responses: vegetative growth regulation and seed head suppression of grasses; broadleaf weed control; sucrose enhancement in sugarcane and other crops; and increased quality in certain forage crops. Pearl millet, when used as a grazing crop in East Texas, often makes such rapid growth that efficient forage management is difficult. The primary objective of this trial was to determine the influence of a single application of mefluidide on dry matter production, leaf:stem ratio, and structural carbohydrates of pearl millet.

Procedure

Mefluidide was sprayed on pearl millet forage at the rates of 0, 1/8, 1/4, 3/8 and 1/2 pounds ai/ac when plants were approximately 12-15" in height. The five treatments were replicated four times on 10'x30' subplots. The millet plots were planted on 5-13 and fertilized with 100-75-75 (N-P_2O_5-K_2O) on 6-2. Plant samples were taken to a 2-inch stubble at 0, 7, 14, and 21 days after spraying, 6-4, 6-11, 6-18, and 6-25, respectively. At each sampling date, forage was harvested from a previously non-harvested area. Thus, each sampling date represents cumulative forage growth to that point. One half of each sample was immediately frozen for subsequent residue analyses. The remaining millet sample was dried and separated into leaf and stem sections for a chemical analyses of neutral detergent solubles, neutral detergent fiber, acid detergent solubles (hemicelluloses) and acid detergent fiber (cellulose, lignin, ash) and protein.

Results and Discussion

Table 1 shows the influence of rate of mefluidide on dry matter (DM) production of pearl millet forage. Cumulative forage growth during the 3-week period resulted in approximately 5 tons per acre of forage DM from the untreated plots. At the 1/8 lb ai/ac, slightly more than 1 ton per acre DM (2756 lbs) was produced during the 3-week period. The remaining rates of mefluidide, 1/4, 3/8, and 1/2 were effective in preventing any appreciable DM production during the measurement period. Because of prolonged drought-like conditions in July and August, forage regrowth was not measured. According to visual field observations, however, DM production remained inhibited throughout the summer on those plots treated with rates of 1/4 lb ai/ac and higher.

The dramatic effect of mefluidide on leaf to stem ratio is presented in Table 2. At initiation of the trial, the pearl millet plant was approximately 88% leaf laminae and 12% stem, or a leaf:stem of 7:1. During the 3-week period, percent leaf decreased from 88% to 33% on the untreated plots. Leaf:stem declined from 7:1 to 0.5:1 with advancing chronological and physiological maturity. All rates of mefluidide were effective in maintaining a leaf:stem of >1:1. The 1/2 lb ai/ac maintained a nearly constant leaf:stem of 2:1 throughout the 3-week period. The shortened internodes due to rate of mefluidide were responsible for the high percentage of leaves and the slower rate of growth as measured by DM production.

Table 3 shows the influence of rate of mefluidide on percent protein of pearl millet forage. The increase in protein from 6-4 to 6-11 is due to the effect of fertilization which was applied on 6-2. With advancing maturity, percent protein declined in both leaf and stems. The most apparent effect of mefluidide occurred in the stem sections in that treated plants contained nearly twice as much protein as the untreated plants. The relatively high protein content of stems from treated plants may be due to the effect of shortening of the internodes or some other disruption of nitrogen metabolism.

Table 4 shows the percent neutral detergent fiber (NDF) or estimate of cell wall constituents of both leaf and stem parts. The whole plant NDF values were constructed using percent leaf and stem and percent NDF of each separate component. Percent NDF of forage from the untreated plots increased with time as was expected of the warm-season annual grass. All rates of mefluidide were effective in slowing the rate of increase of NDF. At the 1/2 lb ai/ac rate, the percent NDF remained at nearly the same level throughout the trial period.

The rate of buildup of hemicelluloses (acid detergent solubles) was slowed by mefluidide (Table 5). Expressed as a percent of the NDF, hemicelluloses on a whole plant basis increased from 42% at initiation of the trial to 52% at the end of 3 weeks. All rates of mefluidide were effective in retarding the rate of increase in hemicelluloses of the pearl millet forage. Although the sampling period was not sufficiently long enough to document the fate of hemicelluloses, it appeared that with increasing rates of mefluidide there was nearly a stabilization of hemicelluloses content. At the 1/2 lb ai/ac rate, for example, the percentage of hemicelluloses was at nearly the same level on 6-25 as on 6-4.

Table 6 shows the effect of rate of mefluidide on cellulose content of leaf and stem parts. Unlike previously reported mefluidide studies, the cellulose content of mefluidide-treated plants was slightly higher than the untreated control plants. The discrepancy in cellulose content of forage from this trial as related to others may be due to the fact that pearl millet is a warm-season annual grass; whereas, most of the past studies have included either cool-season annuals or perennial grasses. Also, mefluidide was apparently effective in slowing the rate of hemicelluloses in leaf portions; whereas, there was an opposite relationship in stem sections.

Percent lignin of leaf and stem portions from treated and non-treated plant samples are shown in Table 7. In the untreated millet, percent leaf lignin nearly doubled (1.9 to 3.0%); whereas, percent stem lignin remained nearly constant at 4%. Data from the early sampling dates implied that mefluidide restricted lignin buildup in leaves, and in the last sampling date, lignin was apparently restricted more in stems than in leaves.

Table 1. Effect of rate of mefluidide on cumulative forage dry matter of pearl millet.

Treatment (lbs ai/ac)	DRY MATTER (lbs/ac) 6-4	6-11	6-18	6-25
0	3224	5309	7484	13676
1/8	3224	3631	2951	5980
1/4	3224	2703	3243	3902
3/8	3224	3148	2269	4459
1/2	3224	2699	1623	3366

Table 2. Effect of rate of mefluidide on leaf:stem ratios.

DATE	TREATMENT (lbs ai/ac)	PERCENT LEAF	PERCENT STEM	LEAF:STEM
6-4	initiation	87.7	12.3	7.1
6-11	0	65.2	34.8	1.9
	1/8	64.3	35.7	1.8
	1/4	66.2	33.8	2.0
	3/8	64.8	35.2	1.8
	1/2	61.7	38.3	1.6
6-18	0	57.5	42.5	1.4
	1/8	61.0	39.0	1.6
	1/4	69.4	30.6	2.3
	3/8	69.6	30.4	2.3
	1/2	75.9	24.1	3.1
6-25	0	32.8	67.2	.5
	1/8	53.7	46.3	1.2
	1/4	69.0	31.0	2.2
	3/8	64.3	35.7	1.8
	1/2	73.8	26.2	2.8

Table 3. Effect of rate of mefluidide on protein of leaf, stem, and whole plant of pearl millet.

DATE	TREATMENT	% Protein Leaf	Stem	Whole Plant
6-4	initiation	15.2	13.1	15.0
6-11	0	22.1	18.4	20.8
	1/8	22.7	20.5	21.9
	1/4	21.1	19.6	20.6
	3/8	20.9	20.9	20.9
	1/2	22.8	20.8	22.0
6-18	0	15.8	12.4	14.4
	1/8	17.4	15.7	16.7
	1/4	16.2	15.2	15.9
	3/8	18.9	17.2	18.4
	1/2	17.6	16.1	17.2
6-25	0	17.8	9.8	12.4
	1/8	18.5	18.2	18.4
	1/4	18.2	15.9	17.5
	3/8	17.5	18.7	17.9
	1/2	18.0	15.9	17.5

Table 4. Effect of rate of mefluidide on percent neutral detergent fiber (NDF) of leaf and stem components of pearl millet.

DATE	TREATMENT	% NDF Leaf	Stem	Whole Plant
6-4	initiation	52.3	60.8	53.3
6-11	0	64.2	64.0	64.1
	1/8	59.3	67.0	62.0
	1/4	59.6	67.9	62.4
	3/8	56.7	66.9	60.3
	1/2	59.4	63.3	60.9
6-18	0	59.3	58.4	58.9
	1/8	50.9	60.2	54.5
	1/4	53.6	60.8	55.8
	3/8	52.5	58.9	54.4
	1/2	53.2	59.1	54.6
6-25	0	65.8	72.4	70.2
	1/8	59.1	67.2	62.9
	1/4	56.3	66.5	59.5
	3/8	54.8	65.0	58.4
	1/2	54.0	62.4	56.2

Table 5. Effect of rate of mefluidide on hemicelluloses of leaf, stem, and whole plant of pearl millet.

DATE	TREATMENT	Hemicelluloses Leaf % DM	Stem % DM	Whole Plant % DM	Whole Plant % of NDF
6-4	initiation	21.0	31.4	22.3	41.8
6-11	0	29.8	31.5	30.4	47.4
	1/8	24.6	28.1	25.8	41.6
	1/4	25.2	28.5	26.3	42.1
	3/8	23.3	27.4	24.7	41.0
	1/2	23.7	30.7	26.4	43.3
6-18	0	28.9	29.4	29.1	49.4
	1/8	23.7	25.6	24.4	44.8
	1/4	22.8	25.1	23.5	42.1
	3/8	22.3	25.3	23.2	42.6
	1/2	21.2	24.0	21.9	40.1
6-25	0	29.5	40.4	36.8	52.4
	1/8	25.2	32.5	28.6	45.5
	1/4	23.8	29.5	25.6	43.0
	3/8	23.6	29.9	25.8	44.2
	1/2	21.7	28.9	23.6	42.0

Table 6. Effect of rate of mefluidide on cellulose of leaf, stem, and whole plant of pearl millet.

DATE	TREATMENT	Cellulose Leaf	Stem	Whole Plant % DM	Whole Plant % of NDF
6-4	initiation	28.4	24.6	27.9	52.3
6-11	0	30.5	28.2	29.7	46.3
	1/8	29.6	34.6	31.4	50.6
	1/4	30.0	34.8	31.6	50.6
	3/8	29.6	34.6	31.4	52.1
	1/2	31.5	27.8	30.1	49.4
6-18	0	26.8	25.6	26.3	44.7
	1/8	24.8	31.0	27.2	48.7
	1/4	27.9	32.3	29.2	52.3
	3/8	26.9	29.5	27.7	50.9
	1/2	30.1	31.2	30.4	55.7
6-25	0	33.1	26.4	28.6	40.7
	1/8	30.7	30.2	30.5	48.5
	1/4	29.4	31.8	30.1	50.6
	3/8	28.4	28.3	28.4	48.6
	1/2	29.3	30.0	29.5	52.5

Table 7. Effect of rate of mefluidide on leaf, stem, and whole plant of pearl millet.

		LIGNIN			
DATE	TREATMENT	Leaf	Stem	Whole Plant	
				% DM	% of NDF
6-4	initiation	1.9	4.2	2.2	4.1
6-11	0	3.5	3.8	3.6	5.6
	1/8	2.6	3.5	2.9	4.7
	1/4	3.3	4.1	3.6	5.8
	3/8	2.8	3.6	3.1	5.1
	1/2	3.2	4.2	3.6	5.9
6-18	0	3.3	3.1	3.2	5.4
	1/8	3.3	3.3	3.3	6.1
	1/4	2.5	2.8	2.6	4.7
	3/8	2.8	3.2	2.9	5.3
	1/2	2.4	3.1	2.6	4.8
6-25	0	2.7	4.3	3.8	5.4
	1/8	2.4	3.9	3.1	4.9
	1/4	2.4	3.9	2.9	4.9
	3/8	2.2	3.5	2.7	4.6
	1/2	2.3	3.3	2.6	4.6