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Effect of Mefluidide on Growth and Heading of *Triticum aestivum* L.

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Abstract. Previous studies have shown that N-[2,4-dimethyl-5[[(trifluoromethyl)sulfonyl]amino]phenyl]acetamide (mefluidide) represses seedhead formation in gramineae. The objective of this study was to determine the effect of mefluidide on growth and reproduction of wheat (*Triticum aestivum* L. cv TAM 105). Mefluidide was applied to field grown wheat at 140 and 280 g/ha on March 4, 1985 and at 70, 140, and 280 g/ha on March 18, 1985. Mefluidide suppressed heading to a greater extent when applied 6 weeks after the onset of spring growth than when applied 2 weeks earlier. Leaf area index was reduced by the higher application rates at the second date of application but not the first. Total biomass was reduced to a greater extent at the second application date. Both seed weight and number of seeds per spike were reduced with the higher rates of mefluidide especially at the second application date.

Mefluidide (N-[2,4-dimethyl-5[[trifluoromethyl)sulfonyl]amino] phenyl]acetamide) is recognized for its ability to control height and suppress seed head formation (Christians and Nau 1984, Field and Whitford 1983, Haferkamp et al. 1984, Tautvydas 1983). However, little research has been reported on the effect of mefluidide on reproductive structures beyond the observation that their formation has been suppressed. Therefore, the objective of this research was to examine the effect of mefluidide on reproduction and reproduction structures of wheat.

Materials and Methods

Winter wheat (*Triticum aestivum* L. cv TAM 105) was planted at the Amarillo Research Center, Amarillo, Texas in late August 1984. Mefluidide was sprayed on plots in 234 ℓ/ha of water at the rate of 140 and 280 g/ha on March 4, 1985 and at the rate of 70, 140, and 280 g/ha on March 18, 1985. Applications were made approximately 4 and 6 weeks after the onset of spring growth when the wheat was in growth stage 5 of Feekes scale (Large, 1954) and plants were approximately 10 and 15 cm tall on the respective application dates. An untreated check for each date was included in the study. The study was conducted in a randomized complete block with three replicates. Half of each plot was clipped to a height of 5 cm on April 1 to simulate a late defoliation.

At 2 week intervals beginning March 25, 1 or 2 m length of row was clipped from the half of each plot that had not been defoliated on April 1 to determine total aboveground biomass and leaf area index. Clipped leaf area index was determined on a Licor* 3100 leaf area meter. Samples were oven dried at 60° C. Visual estimates of heading were taken periodically of all plots in the spring to determine suppression of head formation. At maturity, a 1.0 m^2 area was harvested from each plot. The number of spikes were counted and the grain threshed to determine total grain weight. Seed weight was determined by weighing 1,000 seeds. The number of seeds per spike were calculated from the plot yield, seed weight, and number of spikes per plot.

Data was analyzed statistically as a split plot in time. Where significant F values occurred, Duncan's multiple range test was used to separate means.

Results and Discussion

Mefluidide effectively suppressed onset of heading when applied at 280 g/ha 1 month after the onset of growth (March 4) but did not significantly affect the final percentage of heading (Table 1). Similarly, mefluidide, applied at 70 or 140 g/ha 6 weeks after the initiation of spring growth, delayed the onset of heading in relation to the amount of compound applied but did not affect the final heading percentage. The 280 g/ha rate applied on March 18 drastically delayed heading and reduced the final heading percentage in the plots. Both Gerrish and Dougherty (1983) and Field and Whitford (1983) observed delayed reproduction development while Haferkamp *et al.* (1984) observed reduced numbers of reproductive shoots per land area with increasing rates of mefluidide.

Clipping (on April 1) suppressed the rate of head formation on untreated checks (0 rate of application) in Table 1 but did not significantly affect the final heading percentage. Because of the general heading suppression from clipping, little effect of mefluidide was observed except at the 280 g/ha rate applied on March 18 where additional heading suppression occurred and the final heading percentage was reduced to 45%.

The leaf area index increased from 3.65 to 5.36 during the sampling period from March 25 to May 9 (Table 2). Mefluidide did not significantly affect leaf area index. Gerrish and Dougherty (1983) observed a decrease in canopy leaf

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* Trade names are presented for information purposes only and do not constitute an endorsement or denial of the suitability of a product for any application by the Texas Agricultural Experiment Station.

Table 1. Heading percentage of wheat at various dates after treatment with mefluidide.

	Date of Melfluidide Application	Rate (g/ha)	Heading Percentage				
			Apr 23	Apr 29	May 2	May 9	May 21
Clipped April 1	Mar 4	0	95	95	97	100	93 a†
		140	82	90	95	95	88 a
		280	60	63	67	74	98 a
	Mar 18	0	75	85	86	90	100 a
		70	55	75	78	90	98 a
		140	6	15	18	80	98 a
		280	0	0	0	11	60 b
Not Clipped	Mar 4	0	0	1	4	20	83 a
		140	3	3	5	13	82 a
		280	0	4	8	24	85 a
	Mar 18	0	2	7	17	47	87 a
		70	3	5	13	50	88 a
		140	0	1	2	23	86 a
		280	0	0	0	5	45 b
$S_{\bar{x}} = 7.2$							

† Means followed by the same letter are not significantly different, Duncan's multiple range test, P = .05.

Table 2. Leaf area index of TAM 105 wheat after treatment with mefluidide.

Date of Mefluidide Application	Rate (g/ha)	Leaf Area Index			
		Mar 25	Apr 4	Apr 23	May 9
Mar 4	0	3.78	4.52	4.39	5.48
	140	3.50	4.77	5.85	6.31
	280	4.27	5.37	6.11	5.65
Mar 18	0	3.41	5.44	5.15	5.59
	70	2.81	5.15	4.18	5.43
	140	3.57	4.06	5.11	4.59
	280	4.15	3.61	4.90	4.52
Mean		3.65 b†	4.73 a	5.10 a	5.37 a
$S_{\bar{x}} = 0.378$					

† Means followed by the same letter are not significantly different, Duncan's multiple range test, P = .05.

area index of tall fescue shortly after application but no difference later in the season.

Total aboveground biomass reached a maximum of 1,014 to 1,071 g/m^2 for the untreated plots and the lowest rate of application at each date (Table 3). Mefluidide at 280 g/ha applied March 4 and March 18 reduced total above-

Table 3. Total biomass of wheat after treatment with mefluidide.

Date of Mefluidide Application	Rate (g/ha)	Total Biomass (g/m^2) Mar 25	Apr 4	Apr 23	May 9
Mar 4	0	304 ns§	414 ns	487 ns	1071 a†
	140	317	520	784	1014 ab
	280	374	587	783	740 bc
Mar 18	0	310	516	690	1015 ab
	70	292	539	510	1041 ab
	140	341	447	632	746 abc
	280	361	416	488	596 c
$S_{\bar{x}}$ = 103					

§ Not significant.
† Means followed by the same letter are not significantly different, Duncan's multiple range test, $P = .05$.

ground biomass on May 9. Aboveground biomass decreased when leaf area index did not. This result arose from head suppression caused by mefluidide at higher rates; i.e., the biomass from untreated plots and lowest rates included significant stem and spike weight while the biomass from the higher rates of mefluidide did not. Other authors (Field and Whitford, 1983; Gerrish and Dougherty, 1983; Christians and Nau 1984) have reported reduced shoot growth.

Grain yield was not affected by mefluidide treatment at the first application date (Table 4). The results are in agreement with the previous data where the final heading percentage and leaf area index were unaffected by mefluidide at the early date. Additionally, total aboveground biomass of unclipped plots was not affected except when mefluidide was applied at 280 g/ha and then only at the final sampling period (Table 3).

Similar yield responses were seen where mefluidide was applied on March 18 to either clipped or unclipped plots on April 1. The only difference was that all the yields were in a lower range of values on the clipped plots (61 to 199 g/m^2) than on the unclipped plots (86 to 284 g/m^2). At the March 18 application date the 70 g/ha rate of mefluidide had no effect on grain yield. Higher rates of mefluidide tended to reduce grain yield but differences were not significant except at the highest rate of application where grain yield was reduced to 86 and 61 g/m^2 for unclipped and clipped plots, respectively. The decreased grain yield was due to two factors: decreased seed weight (from 18.7 to 13.5 mg/seed for unclipped and 16.9 and 12.8 mg/seed for clipped plots) and decreased number of kernels per spike (20.5 to 9.7 for unclipped plots and 16.0 to 8.4 for clipped plots). The final number of spikes/m^2 were unaffected by mefluidide treatment.

The lower number of kernels per spike that occurred could have resulted either from lack of fruiting structure initiation or, more likely, abortion, either of which may have resulted from delayed seed head formation that caused kernels to develop later in the spring and, therefore, under higher temperatures. The lower kernel numbers and decreased seed weight may have been due to the decreased amount and duration of leaf area providing lower photo-

Table 4. Yield and yield components of wheat after treatment with mefluidide on two dates.

Date of Mefluidide Application	Rate (g/ha)	Yield (g/m²)	Seed Weight (mg)	Spikes/m²	Kernels/ Spike	Kernel Density (g/ℓ)
			unclipped			
Mar 4	0	230 a†	17.5 ab	683 ns§	20.0 ab	733 ab
	140	204 ab	15.9 cd	668	19.4 ab	703 bcd
	280	225 a	16.9 bc	796	16.5 b	720 abc
Mar 18	0	284 a	18.7 a	727	20.5 ab	756 a
	70	272 a	18.5 ab	624	23.4 a	751 a
	140	181 ab	14.9 d	692	17.6 b	680 cd
	280	86 b	13.5 e	636	9.7 c	668 d
			clipped April 1			
Mar 4	0	124 ab	14.3 bc	718 ns	12.2 b	688 abc
	140	146 ab	14.6 b	813	12.8 b	689 ab
	280	190 a	15.6 ab	711	17.2 a	698 ab
Mar 18	0	199 a	16.9 a	766	16.0 a	707 a
	70	203 a	15.5 ab	683	19.4 a	708 a
	140	149 ab	14.0 bc	838	12.8 b	661 bc
	280	61 b	12.8 c	574	8.4 c	648 c
$S_{\bar{x}}$		39	0.5	73	1.2	12

† Means within a column are not significantly different, Duncan's multiple range test, P = .05.
§ Not significant.

synthetic production. Lighter seed weight may also have resulted from the higher rate of respiration in C_3 species in relation to photosynthesis known to occur at elevated temperatures.

When mefluidide was applied on March 4, and plots were clipped on April 1, the compound tended to increase grain yield with increasing rates of mefluidide. This may have related to the heat suppressing effect; i.e., those plots that were not as far developed were better able to recover from the late defoliation.

The kernel density was lower from the clipped plots and from the 280 g/ha rate of mefluidide on the unclipped plots. In both cases grain development was significantly delayed and therefore occurred during periods of higher temperatures. Increased respiration associated with higher temperatures may have been responsible for the lower grain density of the later developing grain.

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