NITRAPYRIN EFFECTS ON MINERAL COMPOSITION OF IRRIGATED WHEAT

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ABSTRACT

Application of nitrapyrin affected the plant tissue levels of only a few nutrient elements in a given year for a given stage of growth. Nitrapyrin increased the K/(Ca + Mg) rates of wheat only at Feekes Stage 2 in 1983 and did not appear to greatly influence the grass tetany potential of wheat forage during the two years of the study.

OBJECTIVES

Nearly 500,000 acres of wheat are grown annually in New Mexico consisting of 40% of the total cropped land in the state. Although most of the wheat is grown for grain, irrigated wheat acreage also provides winter grazing for livestock and a significant source of cash flow for the grower. Nitrogen fertilization of wheat is a commonly accepted practice in wheat production but nitrification inhibitors in combination with fertilizer N have not yet been widely accepted. Recent research (Mathers, et al., 1982) in the Southern Great Plains indicates that using nitrapyrin may increase the incidence of grass tetany in livestock grazing on wheat.

The objective of this study was to measure the effects of nitrapyrin on the elemental concentrations of wheat with particular emphasis on K, Ca and Mg but also with interest in other primary, secondary and micro-nutrient elements.

MATERIALS AND METHODS

This study was initiated in October, 1982 on a Reagan loam soil (fine, carbonatic, thermic Typic Calciorthid) at the NMSU Ag Science Center near Artesia, New Mexico. Plots 20 feet wide by 40 feet long were laid out in a split plot design with 5 replications. Treatments included an unfertilized check and N rates of 30, 60 and 90 lbs N as urea per acre. A blanket application of 26 lbs P, 33 lbs K and 5 lbs Zn and 33 lbs P, 33 lbs K and 2 lbs Zn were made on the basis of a soil test in 1982 and 1983, respectively, prior to application of N treatments. The nitrapyrin was impregnated on the urea at an 0.5 lb/A a.i. rate by mixing a commercial formulation with 8, 33 or 58 ml ethanol for the urea quantities of the respective N rates. The nitrapyrin mixture was poured over the urea sample in a rotating drum and mixed for 5 minutes to ensure coating of the fertilizer granules. Both impregnated and untreated urea were then spread by hand on the respective plots and immediately disced in to a depth of 4 inches.

Centurk wheat was planted at a rate of 60 lbs/A using a grain drill. The wheat was irrigated up in 1982 but due to adequate soil moisture, no fall irrigation was necessary in 1983 to ensure emergence and early growth.

Plant samples were collected six weeks after stand emergence (Feekes Stage 2), 18 weeks after stand emergence (Feekes Stage 4), at boot stage (Feekes Stage 10) and at soft dough stage (Feekes Stage 10.7 to 10.8). The samples were washed after collection, dried at 70°C for 72 hours, and ground to pass a 1 mm screen. The

samples were then digested by an HNO_3 - $HClO_4$ procedure and analyzed by ICP-ES. Grain yield and protein data were also collected.

RESULTS AND DISCUSSION

Table 1. Significance of nitrapyrin effects on elemental composition of Centurk wheat at Feekes Stage 2.

Element	1983	1984	Average
N(%)	ns	ns	ns
P(%)	ns	ns	+
K(%)	ns	ns	+
Ca(%)	**	ns	ns
Mg(%)	**	ns	*
B(ppm)	ns	ns	ns
Zn(ppm)	ns	ns	ns
Fe(ppm)	ns	ns	ns
Mn(ppm)	ns	ns	ns
Cu(ppm)	ns	+	ns

+, *, ** Significant at the 10%, 5% and 1% levels, respectively.

ns - Not significant.

The significant effects of nitrapyrin on elemental composition of wheat at Feekes Stage 2 are reported in Table 1. Tissue calcium and magnesium were significantly reduced by nitrapyrin application in 1983 with respective decreases of 0.43% to 0.39% calcium and 0.16% to 0.15% magnesium for untreated and nitrapyrin treated plots. Copper concentration in the wheat decreased from 9.6 ppm to 9.1 ppm with nitrapyrin treatment in 1984. For the averaged two year data, phosphorus was decreased from 1.92% to 1.85%, and magnesium was decreased from 0.18% to 0.17% with nitrapyrin treatment.

Table 2. Significance of nitrapyrin effects on chemical composition of Centurk wheat at Feekes Stage 4.

Element	1983	1984	Average
N(%)	ns	ns	ns
P(%)	*	ns	ns
K(%)	+	ns	ns
Ca(%)	ns	*	*
Mg(%)	ns	ns	*
B(ppm)	ns	ns	ns
Zn(ppm)	ns	ns	ns
Fe(ppm)	ns	+	ns
Mn(ppm)	+	ns	ns
Cu(ppm)	ns	*	*

+, * Significant at the 10% and 5% levels, respectively.

ns - Not significant.

Significant effects of nitrapyrin on elemental composition of wheat at Feekes Stage 4 as reported in Table 2. Phosphorus and manganese in the tissue significantly increased from 0.23% to 0.24% and 162.8 ppm to 167.5 ppm, respectively, due to nitrapyrin in 1983. Tissue potassium decreased from 3.27 ppm to 3.15 ppm. In 1984, nitrapyrin significantly decreased tissue concentrations of calcium, iron and copper from 0.43% to 0.41%, 156 ppm to 151 ppm, and 11.8 ppm to 10.0 ppm, respectively. Significant reductions of 0.39% to 0.38% for calcium, 0.16% to 0.15% for magnesium and 11.0 ppm to 10.0 ppm for copper were observed for the averaged two year data.

Table 3. Significance of nitrapyrin effects on selected elemental ratios of Centurk wheat at Feekes stages 2 and 4.

Elemental ratio	1983		1984		Average	
	Stage 2	Stage 4	Stage 2	Stage 4	Stage 2	Stage 4
K/Ca + mg	**	+	ns	ns	ns	ns
P/Fe	ns	ns	+	ns	+	ns
P/Zn	ns	*	ns	ns	ns	*
P/Mn	ns	ns	ns	ns	ns	ns
P/Cu	ns	ns	ns	**	ns	*

+, *, ** Significant at the 10%, 5% and 1% levels, respectively.

ns - Not significant.

Significant nitrapyrin effects on selected elemental ratios are reported in Table 3. The K/(Ca + Mg) ratio is of major concern to stockmen due to relationship to grass tetany. In 1983, this ratio significantly increased with nitrapyrin treatment at Feekes Stage 2 and significantly decreased at Feekes Stage 4. No significant differences were observed in 1984 or in the averaged data. However, the K/(Ca + Mg) ratios for all treatments for both years were generally 2.2 or greater and have potential for causing grass tetany (Grunes, 1973; Grunes, et al., 1970). Nitrapyrin significantly increased P/Zn at Feekes Stage 4 in 1983 and again for the two-year average P/Fe was significantly increased by nitrapyrin application at Feekes Stage 2 in 1984 but decreased for the averaged data. It also significantly increased P/Cu at Feekes Stage 4 in 1984 and for the averaged data.

Application of the nitrapyrin generally decreased grain yield although grain protein remained the same or increased very slightly. Yield decreases were generally due to lodging of the wheat.

LITERATURE CITED

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3. Mathers, A.C., B.A. Stewart, and D.L. Grunes. 1982. Effect of a nitrification inhibitor of the K, Cu, and Mg composition of winter wheat forage.

SOIL FERTILITY RESEARCH

PROJECT: Fertilizer Management for Alfalfa.

RESEARCH LEADER: L. J. Cihacek, NMSU Ag Science Center, Artesia, New Mexico.

OBJECTIVES: (a) To evaluate effects of phosphorus fertilizer sources on alfalfa forage yield; (b) To evaluate effects of potassium fertilizer sources on alfalfa forage yield; (c) To evaluate effects of a combination of phosphorus and zinc on alfalfa forage yield; (d) To evaluate the effect different soil test recommendations on alfalfa forage yield; (e) To evaluate effects of phosphorus fertility rates and time of application on alfalfa forage yield; and (f) To evaluate method of phosphorus fertilizer placement on alfalfa forage yield.

PROJECT: Nitrogen Management S.E. New Mexico.

RESEARCH LEADER: L. J. Cihacek, NMSU Ag Science Center, Artesia, New Mexico.

OBJECTIVES: (a) To evaluate plant growth regulators on wheat grown under high nitrogen environments; (b) To evaluate long term effects of N application on cotton lint yield and quality and residual profile N; and (c) To update N fertilizer recommendations for wheat.

PROJECT: Crop Culture.

COOPERATORS: C. E. Barnes and L. J. Cihacek, NMSU Ag Science Center, Artesia, New Mexico.

OBJECTIVE: To evaluate effects of irrigation and nitrogen variables on corn grain and forage yields.

PROJECT: Effects of Irrigation, Row Spacing and Nitrogen on Lint Yield of Cotton.

COOPERATORS: C. E. Barnes and L. J. Cihacek, NMSU Ag Science Center, Artesia, New Mexico

OBJECTIVE: To examine effects of irrigation level, row spacing and N rate on optimizing cotton lint yield and lint quality.