NEW JERSEY GRAIN AND FORAGE JOURNAL

A COMPILATION OF RESEARCH AND EXTENSION PROJECTS IN CORN, SOYBEAN, SMALL GRAIN AND FORAGE

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PREFACE

This is the sixth edition of the New Jersey Grain and Forage Journal, an annual journal highlighting research and extension projects in field crops. Traditionally the publication has presented work conducted in New Jersey. This year articles from Delaware and Pennsylvania are included as a result of collaborative efforts by field and forage crop agents, specialists and researchers from the Mid-Atlantic region.

Grain and forage production represents the largest agricultural acreage in the Mid-Atlantic States, adding significantly to and supporting related industries. Not only does this support the local and regional economy, but also provides the benefits of open space to the residents of the region.

We would like to acknowledge and thank the New Jersey Soybean Board and Grain and Forage Producers' Association for their financial support. The Soybean Board allocates soybean checkoff funds for research and promotional activities that benefit the soybean industry. The Grain and Forage Producers' Association promotes research, marketing, legislation and education related to the grain and forage industry.

We hope that these results will be helpful to you as you plant and produce crops in the 2000 growing season and beyond. Your suggestions for research and educational projects are always welcome, as it is our desire to develop programs that serve you most important needs.

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Crop Safety of Foliar Applied Potassium Fertilizers on Soybean

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Research Question

Potassium deficiency (symptoms expressed as yellow leaf margins) appears in a few soybean fields each year. Ideally, the deficiency should have been predicted by soil sampling/testing and avoided by proper fertilization. Nevertheless, the question is asked: "How can I safely apply potassium during the growing season?"

Literature Review

Atlantic coastal plain soils are typically sandy and generally do not hold large reserves of exchangeable potassium (K) for intensive crop production. Soybean accumulates as much as 200 pounds K_2O per acre in the above ground biomass and removes from the soil 1.4 pounds of K_2O per bushel of soybean yield. When straw from small grain crops is removed from the field prior to planting soybean, this also removes significant amounts of K from the soil and leaves the double crop soybeans more vulnerable to K deficiency. Cycles of crop K removal, without a balanced K fertility program managed for nutrient replacement, sets the stage for K deficiency.

Characteristics of a fertilizer material desired for foliar application include solubility in water and crop safety when applied at high concentrations. Two potassium containing fertilizer materials that may be useful for foliar application are monopotassium phosphate (MKP) and potassium thiosulfate (KTS). MKP is a relatively new fertilizer material that is soluble in water and has a low salt index. The fertilizer grade of MKP, 0-51.5-34, indicates that it is a high analysis product that supplies both phosphorus and potassium. Potassium thiosulfate (KTS) is a liquid fertilizer product that supplies both potassium and sulfur. KTS has a 0-0-25-17S fertilizer grade.

Study Description

Field experiments were conducted with soybean in 1997 and 1998 on Freehold sandy loam soil at the Rutgers Plant Science Research Station near Adelphia, New Jersey. The soils at the study sites in both years had Mehlich-3 soil test P and K levels in the above optimum/very high range. Potassium deficiency was not expected on these soils and none was exhibited in the growing crops. Conducting the experiment on a potassium deficient soil would have been ideal. Since no suitable fields could be found, we decided to conduct the experiments on land available to us and focus on evaluating crop safety of foliar applied potassium fertilizers. Two types of water soluble potassium fertilizer, monopotassium phosphate (MKP) or potassium thiosulfate (KTS) were compared as foliar applied treatments. Potassium application rates were 0, 10, 20, 40 and 80 lb/A K_2O in 1997. In 1998, the same application rates were used in addition to a 5 lb/A K_2O rate. Potassium treatments were sprayed on soybean during the early bloom growth stage. Injury to the leaves was evaluated three days after spraying, and was rated according to the percentage of leaf area exhibiting injury. Once the crop was mature, soybean was harvested by combine to determine grain yield.

Applied Questions

What are safe application rates of MKP or KTS fertilizers foliarly applied to soybean?

KTS caused significantly more injury to soybean leaves than the application of MKP. In 1997, no injury was observed from the application of MKP and in 1998 only slight injury was observed with MKP applied at 40 and 80 lb/A K_2O. In 1998, the application of KTS at the 5 lb/A K_2O rate did not cause any observable injury to soybean but the higher application rates did cause injury.

Were soybean yields reduced as a result of leaf injury from application of MKP or KTS?

High application rates of MKP (40 and 80 lb/A K_2O), which caused slight injury to soybean leaves in only one of the two years, did not reduce soybean grain yield. Moderate application rates of KTS (10 and 20 lb/A K_2O), which caused some injury to soybean leaves, did not reduce soybean yield. The highest application rate of KTS (80 lb/A K_2O) significantly reduced soybean grain yield.

Recommendations

Field crop growers should use soil testing and appropriate nutrient management practices to prevent potassium deficiency. The current research does not provide an answer to the question: "Can foliar application of potassium fertilizers rescue potassium deficient soybean and economically increase grain yield?" If, however, a soybean grower discovers that a crop has become potassium deficient during the growing season and that grower elects to treat the problem, this research defines safe methods of treatment. MKP may be applied safely up to 20 lb/A K_2O and KTS up to 5 lb/A K_2O without causing injury to soybean leaves. Higher application rates of MKP and KTS may cause crop injury.

Crop Safety of Foliar applied Potassium Fertilizers on Soybean

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Introduction

Atlantic coastal plain soils are typically sandy and generally do not hold large reserves of exchangeable K for intensive crop production. Soybean accumulates as much as 200 pounds K_2O per acre in the above ground biomass and removes from the soil 1.4 pounds of K_2O per bushel of soybean yield. When straw from small grain crops is removed from the field prior to planting soybean, this also removes significant amounts of K from the soil and leaves the double crop soybeans more vulnerable to K deficiency. Cycles of crop K removal, without a balanced K fertility program managed for nutrient replacement, sets the stage for K deficiency. A recent survey of soybean fields in southern New Jersey found that one of twelve fields sampled had a plant tissue K concentration below the sufficiency level for this nutrient (Bamka and Heckman, 1998).

Potassium deficiency (symptoms expressed as yellow leaf margins) appears in a few soybean fields each year. Ideally, the deficiency should have been predicted by soil sampling/testing and avoided by proper fertilization. Nevertheless, the question is asked of Extension: "How can I safely apply potassium during the growing season?".

Characteristics of a fertilizer material desired for foliar application include solubility in water and crop safety when applied at high concentrations. Two potassium containing fertilizer materials that may be useful for foliar application are monopotassium phosphate (MKP) and potassium thiosulfate (KTS). MKP is a relatively new fertilizer material that is soluble in water and has a low salt index. The fertilizer grade of MKP, 0-51.5-34, indicates that it is a high analysis product that supplies both phosphorus and potassium. Potassium thiosulfate (KTS) is a liquid fertilizer product that supplies both potassium and sulfur. KTS has a 0-0-25-17S fertilizer grade.

Materials and Methods

Field experiments were conducted with soybean in 1997 and 1998 on Freehold sandy loam soil (fine-loamy, mixed, mesic Typic Hapludult) at the Rutgers Plant Science Research Station near Adelphia, New Jersey. The soils at the study sites in both years had Mehlich-3 soil test P and K levels in the above optimum/very high range. Soybean [*Glycine max* (L.) Merr.] was planted on May 23, 1997 and May 24, 1998 in 30 inch rows. The soybean cultivar in 1997 was maturity group III Northup King Roundup Ready[1] and in 1998 was maturity group III Garst Roundup Ready. Foliar fertilizer treatments were 0, 10, 20, 40 and 80 lb/A K_2O, for K sources monopotassium

[1] The use of trade names in this publication does not imply endorsement by the New Jersey Agricultural Experiment Station of the product named or criticism of similar ones not mentioned.

phosphate (MKP) or potassium thiosulfate (KTS). In 1998, a treatment rate of 5 lb/A K_2O was also included. Treatments were arranged in a completely randomized design with 4 replications. A plot consisted of 4 rows 20 feet long.

The MKP and KTS fertilizers were dissolved in 0.26 gallon of water except for the 40 and 80 lb/A K_2O rates of MKP which had to be dissolved in 0.8 gallon of water in order to completely solubilize MKP in water. The treatments were sprayed on the plots with a CO_2 backpack sprayer when the plants were in the early bloom growth stage. Injury to the leaves was rated 3 days later according to the percentage of leaf area exhibiting injury. Mature plants were harvested by combine from the center two rows of each plot to determine grain yield. Seed yields were reported at 13% moisture.

Results and Discussion

KTS caused significantly more injury to soybean leaves than the application of MKP. In 1997, no injury was observed from the application of MKP and in 1998 only slight injury was observed with MKP applied at 40 and 80 lb/A K_2O. In 1998, the application of KTS at the 5 lb/A K_2O rate did not cause any observable injury to soybean but the higher application rates did cause injury.

High application rates of MKP (40 and 80 lb/A K_2O), which caused slight injury to soybean leaves in only one of the two years, did not reduce soybean grain yield. Moderate application rates of KTS (10 and 20 lb/A K_2O), which caused some injury to soybean leaves, did not reduce soybean yield. The highest application rate of KTS (80 lb/A K_2O) significantly reduced soybean grain yield.

Field crop growers should use soil testing and appropriate nutrient management practices to prevent potassium deficiency. The current research does not provide an answer to the question: "Can foliar application of potassium fertilizers rescue potassium deficient soybean and economically increase grain yield?". If, however, a soybean grower discovers that a crop has become potassium deficient during the growing season and that grower elects to treat the problem, this research defines safe methods of treatment. MKP may be applied safely up to 20 lb/A K_2O and KTS up to 5 lb/A K_2O without causing injury to soybean leaves. Higher application rates of MKP and KTS may cause crop injury.

References

Bamka, W.J., and J.R. Heckman. 1998. Plant Tissue and Soil Analysis Survey of Soybean in Southern New Jersey. New Jersey Grain and Forage Journal. 5:6-15.

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Potassium Thiosulfate fertilizer was supplied by Tessenderlo Kerely, Inc., 310 Clapp Farm Road, Greensboro, NC 27405.

Table 1. The influence of foliar applied monopotassium phosphate (MKP) and potassium thiosulfate (KTS) on leaf injury and grain yield of soybean in 1997 and 1998.

Fertilizer	K_2O[1] (lb/A)	Yield (bu/A)		Leaf Injury (%)	
		1997	1998	1997	1998
Control	0	44.3	57.3	0	0
MKP	5	---	54.4	---	0
MKP	10	45.4	54.4	0	0
MKP	20	45.6	56.9	0	0
MKP	40	43.6	57.0	0	5
MKP	80	48.6	60.2	0	8
KTS	5	---	49.1	---	0
KTS	10	48.0	52.4	12	6
KTS	20	45.1	57.1	29	15
KTS	40	43.5	48.8	51	22
KTS	80	39.7	41.8	70	36
$LSD_{0.05}$		3.6	9.2	4.7	4.1

[1] The 5 lb/A K_2O application rate treatment was included only in 1998.

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