

Suppression of Anthracnose on Soybeans with Potassium Fertilizer and Benomyl

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Many studies have linked potassium (K) to suppression of plant diseases. Texas studies have found that anthracnose in soybeans is suppressed by adequate K nutrition.

STUDIES linking K with less disease in certain crops have stimulated interest in the benefits of K in plant disease protection. There have also been indications that increased K availability levels suppress soybean cyst nematode effects on the plant roots.

In the 1960s, researchers found that increasing K levels reduced the number of shrunken, moldy and discolored soybean seeds and resulted in increased seed weight, germination and yield. Researchers in Brazil during the mid-1970s reported that symptoms of pod and stem blight on soybean stems, pods and seeds were much less severe in plots receiving K. Additional studies on the effects of K on mold of soybean seeds indicated that as K fertilization levels increased, significantly fewer moldy seeds occurred, although seed yield was not affected.

Research reported in 1977 showed that K significantly reduced pod and stem blight effects on seed and reduced purple seed stain. Phosphorus (P) applications had no influence on the incidence of these diseases, and the action of K in reducing disease appeared to be independent of P.

A K fertilization study on soybeans in Ohio in 1982 showed that the number of moldy seeds was nearly always decreased by K fertilization. The researchers concluded that K fertilizer absorbed by plants possibly limited fungal growth after infection occurred.

Texas Studies

Anthracnose is considered to be one of the major diseases affecting soybeans in the South. Yield losses from this disease can be 20 percent or more. In recent years, the use of foliar fungicides has been instrumental in controlling certain soybean diseases and raising yields, particularly in the warm, humid southern U.S. soybean-production region. A study designed to evaluate K effects on anthracnose included the following objectives.

- To determine if anthracnose development in soybeans can be reduced by K fertilizer.
- To compare the control afforded by benomyl fungicide alone and in conjunction with various rates of K fertilizer.

The study was conducted at the Texas Agricultural Experiment Station at Beaumont on a Morey silt loam soil. Davis soybeans were planted from mid-May to late June during the 3-year study.

Soil sample analysis indicated that available K levels were in the low to medium range while P was medium to very high. The P and K fertilizers (triple superphosphate and potassium chloride) were applied at rates of 0, 60 and 120 lb P_2O_5/A and 0, 60, 120, 240, 360 and 480 lb K_2O/A and worked into the soil prior to planting. Split applications of fungicide

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PLANT AT RIGHT received adequate K, while stunted, deficient plant at left received no K.

(benomyl) were applied at the beginning of pod set and two weeks later.

Results

Year-to-year environmental conditions affected disease pressure. As expected, the foliar fungicide exerted its greatest effect on yield in high disease-pressure years. There was a significant year \times K level interaction with respect to anthracnose and yield. The first year was characterized by excellent growing conditions and low disease pressure, resulting in minimal effects of applied K on yield. But the 3-year average anthracnose disease

ratings decreased significantly with increased K level. Phosphorus had little influence on anthracnose development.

The effect of benomyl on anthracnose suppression was less pronounced as K levels increased. At 240 lb K_2O/A , benomyl provided no further disease reduction since the anthracnose rating was near zero. However, application of benomyl resulted in significant yield increases in the second and third years with high anthracnose pressure. The data indicated that the actions of K and benomyl are additive, although the mechanism of disease suppression between K and benomyl may be different.

Potassium increased yield significantly each year, regardless of disease pressure. Benomyl and K plus benomyl resulted in slightly higher yields than did K only, except at the highest level of K. Yields generally increased with increasing K up to 240 lb K_2O/A in both the benomyl-treated and untreated soybeans.

Summary

Over the years, soybean producers have had variable success with certain fungicides applied to soybeans. Disease pressure and environmental conditions at or during maturity play a major role in disease development. However, results of this study indicate that adequate K can also be a positive factor suppressing the incidence of anthracnose and other fungal diseases. ■



THE dark-colored mature soybeans on the right (which received no K) are infected with anthracnose.