Response of Guar to Fertilizer Applications

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Abstract

Fertilizer studies were carried out with guar in the field and greenhouse over two seasons. Response to N was found in terms of plant growth and bean yield. With very low available soil P, fertilizer P increased the P concentration in guar plants but not bean yields. Zinc increased yields in the greenhouse only on the soil with the lowest available Zn.

Introduction

Guar has been grown in Arizona for several decades as a cover crop and for seed. A projected demand for domestically produced guar seed was responsible for an increase in research activity in the early part of this decade. As part of this research program, the nutrient needs of guar were considered. Guar has been considered a crop with low water demand as well as a low nutrient requirement. Although guar is a legume, inoculation has been ineffective in Arizona.

Previous recommendations have included 30 to 50 lbs of N per acre. Being a hot-season crop with a deep tap root, phosphorus fertilizer requirements are expected to be low. The only other element likely to be deficient for producing guar in alkaline soils of Arizona is zinc.

Materials and Methods

Field and greenhouse studies were carried out over a two-year period with 'Kinman' guar in order to study the response to added N, P and Zn. The field study was located at the Campus Agricultural Center in Tucson on Brazito sandy loam soil. Vinton loamy sand, Hayhook sandy loam and Laveen loam were used in the greenhouse. These were selected because guar reportedly grows best on medium to sandy textured soils.

Various combinations of N, P and Zn were used in both field and greenhouse. A nitrification inhibitor (Dwell) was combined with one of the N treatments and foliar Zn application was used in the field.

Plant samples were collected and analyzed; total plants minus the beans and upper leaves were sampled from the greenhouse and field, respectively, for P and Zn analysis and petioles from the field were taken for nitrate analysis. Beans were harvested from both field and greenhouse studies at maturity.

Results

In the greenhouse, guar responded to N applications with all soils which initally tested from 4 to 18 ppm NO_3-N. In the field, a response was found one year when the soil contained 6 to 7 ppm; the following year, no response was found when the soil tests ranged from 4 to 8.5 ppm NO_3-N.

Higher concentrations are necessary in greenhouse soils due to the limited volume of soil and the restricted mobility of nitrate for root growth than in the field. It appears that the critical N level in soil is about 8 ppm NO_3-N although the Brazito soil, due to its sandy subsoil, would need a higher level of available nutrients than a deep uniform textured soil. Nitrate levels in the tissue were low (ranged from

800 to 4000 ppm) when compared to other cultivated crops such as cotton and were not well related to treatment.

Phosphorus contents were generally high in the field and greenhouse (0.2 to 2.1% total P) and were increased by P application in the greenhouse, although no yield responses were found. Soil tests ranged from a low of 1.9 (from low P plots at the U of A Mesa Farm) to a very high 24 at the Campus site; these were extracted by CO_2.

Zinc treatments tended to increase the Zn concentrations in the plants but had little effect on yields, except for the Vinton soil which had 0.2 ppm DTPA extractable Zn. The other soils tested from 1.2 to 2.0 ppm Zn. There was no significant effect of the nitrification inhibitor when compared to equal quantities of N without the inhibitor.

DISCUSSION

Soils were selected for these studies based on the best information that was available, ie. the soils were medium to coarse textured. The field site had a gravelly sandy subsoil with a low water-holding capacity. Supplying sufficient water to the soils proved to be a problem due to the low water-holding capacity and relatively low yields were produced.

One recomendation for guar production would be to select a deep unstratified soil with a loam texture for good water relationships. With such a soil, high yields could be expected with a minimum number of irrigations and a minimum use of irrigation water.

A second recommendation would be to use soil tests to aid in making fertilizer recommendations. Although additional studies are needed in order to refine soil test recommendations some general statements can be made. In a deep loamy soil, 8 to 10 ppm NO_3-N would mean that additional N would not be required at planting time and would perhaps satisfy the demand for maximum yield production.

Phosphorus requirements of guar probably can be met by most cultivated soils in the state without the addition of P fertilizer. Hot summer soil temperatures increase the availability of soil P. A response in plant P concentration but not yield was found with a soil test of 1.9 ppm in the greenhouse study with the Laveen soil which was taken from plots which had not received fertilizer for over 20 years. In addition guar has a deep tap root which can extract P from the entire soil profile.

Other elements should be in sufficient supply for guar, except for soils very low in Zn.