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Monroe Rasnake

University of Kentucky, mrasnake@uky.edu

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Use of Molybdenum for Soybean Production

Monroe Rasnake

Molybdenum (Mo) is a micronutrient that is required by soybeans in very small amounts. As little as 0.5 parts per million of Mo in soybean tissue is sufficient for normal growth. Compare this with a phosphorus sufficiency level of about 2,000 parts per million. However, even though only small amounts are needed, a Mo deficiency can drastically reduce yields of soybeans.

Functions of Molybdenum

A primary function of Mo in plants is in the nitrate reduction process in which nitrate molecules are converted to the amino form. This is an early critical step in the formation of proteins which are necessary for plant growth. A more likely effect of Mo deficiency in soybeans is not on the plant itself, but is on the nitrogen fixing bacteria. Molybdenum is required by the nitrogen fixing bacteria in the soybean nodules. Without adequate Mo, soybeans fail to nodulate properly and show nitrogen deficiency symptoms. Molybdenum treatments after this happens are expensive and have a high probability of failure.

Molybdenum Availability in Soil

Soils generally contain very small amounts of Mo (4 or 5 lbs. per acre) and only a small part of this is available to soybean plants. Even so, Mo deficiency problems seldom occur in Kentucky soils if the proper soil pH is maintained. Molybdenum availability is closely related to pH and is lower in acid soils. Data in Table 1 summarizes some Georgia research in which soil pH was increased from 5.6 to 6.4. It shows that the use of Mo at

Table 1. Relationship Between Soybean Yield and Soil pH With and Without Molybdenum¹

Soil pH	Yield (Bu/A)	
	Without Mo	With Mo
5.6	32	41
5.7	34	43
6.0	37	40
6.2	40	42
6.4	42	41

¹Bulletin Y-69. Soybean Production, Marketing and Use. TVA.

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pH 5.6 produced yields equal to those when the soil was limed to a pH of 6.4. Once the soil pH increased to 6.2 or above, there was no benefit from adding Mo. Kentucky research has shown similar results, and we would not expect Mo deficiency problems with soybeans until the soil pH drops below 6.2. Coarse textured (sandy) soils could be an exception since they may be low in Mo content.

Fertilizing with Molybdenum

The most commonly available form of Mo fertilizer is sodium molybdate. The dry sodium molybdate can be mixed with the seed at planting at the rate of 1 or 2 ounces per acre. If seeds are to be inoculated with nitrogen fixing bacteria at the same time, they must be planted immediately. A delay in planting of more than 2 or 3 hours will result in the death of most of the bacteria. A safer method is to apply one pound of sodium molybdate per acre broadcast before planting soybeans. Dissolve the sodium molybdate in 20 to 40 gallons of water and spray on the soil before final seedbed preparation. Then inoculate the seed with bacteria at planting. Other sources - both dry and liquid - are available and can be used to supply the needed Mo. Some contain other ingredients such as fungicides, other micronutrients and nitrogen fixing bacteria. Tests of many of the dry mixes containing nitrogen fixing bacteria showed that most of the bacteria were dead. If they are to be used, fresh inoculum should also be used to be sure live bacteria are present.

When Should Molybdenum be Used?

Molybdenum should not be needed for soybeans in Kentucky when the soil pH is above 6.2. So the best recommendation is a good liming program. When lime hasn't been or cannot be applied far enough ahead of planting to get the pH above 6.2 (usually at least six months), Mo can be used to grow a crop. It may also be used on land rented for one year if the owner is not willing to apply lime.

Molybdenum should not be used as a substitute for a good liming program. Liming to the proper pH has many other beneficial effects in addition to Mo availability. Also, there is a limit on how much Mo can be used and the pH range in which it will be effective. Not more than two pounds of sodium molybdate per acre or its equivalent should be applied within five years. And, when the pH level is below 5.5, Mo may not be effective.

Conclusion

In Kentucky, the use of Mo should be considered an emergency treatment to permit growing a soybean crop until soil pH can be adjusted through a good liming program.