



Kick-Off the Fall Season with Fertilization Management Fall 2005

Best Nutrient Management Practices for Soybean Health and Nutrition



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Many growers have become frustrated with the plateaus they have seen in their soybean yields. This article provides a brief summary of some important points to remember about managing nutrients for soybean production, organized chronologically.



Before Planting

Soil pH

- If the soil pH is below 5.2, there is an increased risk of aluminum (Al) toxicity and an elevated risk of manganese (Mn) toxicity in highly weathered soils. In some conditions, Al toxicity can be a factor at soil pH levels below 5.5.
- An optimum soil pH, across most soils, is between pH 5.8 and 6.5.

Soil test phosphorus (P) and potassium (K) levels

- Bray P-1 soil test levels at or above 20 to 25 parts per million (ppm) are considered adequate.
- Ammonium acetate-extractable K levels around 130 ppm are considered sufficient in many states. Iowa State University has recent information that increases adequate levels to 175 to 180 ppm for Iowa.

P and K placement

In the U.S., when intensive tillage was common, broadcast applications of both P and K were usually superior to other placement methods for soybean. In many studies, this still seems generally to be the case. There is, however, recent evidence for considering banded applications:

- **Ridge-till systems**
In ridge-till systems, banded applications 3 to 6 in. below the surface may be a superior placement method when soil tests are low.
- **No-till systems**
Banded applications are emerging as a viable option in reduced tillage systems where nutrient stratification has become significant. For subsurface band applications of fertilizer, there is mounting evidence that it is important to match band spacing with row spacing. Recent

research in no-till systems in Ontario has shown that crop response to subsurface K bands occurred when they were 15 in. apart and soybeans rows were 15 in. apart or when bands were 30 in. apart and soybean rows were 30 in. apart. Other misaligned combinations did not show yield increases to added K.

Sulfur (S)

In coarse-textured, sandy, low organic matter soils, S applications of 10 to 20 lb S/A, applied as soluble sulfate, may provide benefits.

Manure applications

Manure may be applied ahead of the soybean crop, even though it contains nitrogen (N). In Minnesota studies, manure applied to supply N at rates as high as 500 lb N/A did not adversely affect soybean yields. Soybeans actually draw residual nitrate from the soil profile as well as fix N from the atmosphere. Deleterious environmental N losses were not seen after applying manure ahead of soybeans. Whenever possible, grass crops should receive highest priority for manure applications.

At Planting

Inoculation of seed with Bradyrhizobia

If soybeans have not been planted in a field in the last 3 to 5 years, or if nodulation of roots by N-fixing Bradyrhizobia bacteria was sparse, consider inoculating seed at planting time with live Bradyrhizobia inoculant, or consider using commercially available Bradyrhizobium inoculants that may be placed in furrow with the seed at planting.

Molybdenum (Mo)

If the soils are strongly acidic with a pH below about 5.5, it is very important to apply Mo (ammonium or sodium molybdate) as a seed treatment to deliver about 0.2 to 0.4 oz. of Mo per bushel of seed,

to encourage efficient N fixation. In the South, foliar sprays of Mo have also been effective when applied within two weeks after emergence. Responses to Mo increase as the soil pH drops below about 7.0, particularly on highly weathered soils in the southern U.S.

Starter fertilizer applications

- Fertilizer should not be placed with the seed. Soybean plants are sensitive to salts and decreased emergence will often result if seed comes in contact with fertilizer.
- In ridge-till systems, research from Kansas State University has shown that an N-P-K starter fertilizer placed 2 in. to the side and 2 in. below the seed can produce good results.

In-Season

Foliar applications of nutrients

- Early season foliar applications of N-P-K solutions have a relatively low probability of significantly increasing soybean yield.
- Late season (R2-R3 growth stage) applications of foliar N (around 20 lb N/A) have been hit or miss. Some researchers have reported increased yields to these applications while others have not. It may be more important under conditions where there has been poor nodulation or, at the opposite end of the spectrum, high yields.
- Foliar applications of K have shown benefits at rates up to about 32 lb K₂O/A when applied during early reproductive stages (R2) on soils deficient in K. However, response to these late season foliar K applications was not as good as broadcast K applied to the soil prior to planting the soybean crop.
- Foliar applications of Mn can be important in higher pH, low Mn soils and/or for soybean management systems utilizing glyphosate for weed control. Spraying foliar Mn during both early vegetative and early reproductive stages can help correct inadequate Mn nutrition and increase yields.

Tissue Testing

More farmers are considering plant tissue analyses to evaluate the success of their nutrient management programs. Monitoring nutrient concentrations in soybean tissue can help identify hidden hunger. For instance, research in the northern zone of soybean production has shown that soybean tissue K concentration may need to be higher than was previously believed, to achieve optimum no-till soybean yields.

Harvest

Nutrient removal rates

Soybeans remove about 1.0 to 1.5 lb K₂O/bu and about 0.77 to 0.88 lb P₂O₅/bu. So to maintain soil test levels about where they are would require, for a 45 bu/A crop, 60 to 65 lb K₂O/A and 35 to 40 lb P₂O₅/A.

A Note on Disease and Nutrient Interactions

Generally, proper nutrition produces healthy soybean plants, which in turn are better able to resist or withstand diseases. This has been demonstrated for purple seed stain, pod and stem blight, Asian rust, and soybean stem canker. However, nutrient applications do not always reduce disease incidence. Both increases and decreases in sudden death syndrome have been associated with nutrient applications. In isolated studies, nutrient applications have sometimes increased phytophthora root rot and soybean mosaic virus.

Although not completely straightforward, proper nutrition is thought to be important for a soybean plant's ability to withstand or resist disease. ■

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