SDSU Extension

iGrow Soybean

BEST MANAGEMENT PRACTICES

Chapter 22:
Use of Starter Fertilizers for Soybean

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Many producers routinely use starter fertilizer to stimulate early-season soybean growth (Fig. 22.1). The use of starter fertilizer in soybean production has produced mixed results. Keys for using starter are provided in Table 22.1. Care must be used with starter fertilizer in soybeans because the soybean seed is much more sensitive to salt injury than the corn seed. High rates of starter fertilizer can damage seed and seedlings, reducing stands and yield. This chapter discusses the use of starter fertilizers in soybean production.

Figure 22.1. The application of starter fertilizer to a soybean field. (Photo courtesy of Montag Manufacturing, Emmetsburg, IA)

Table 22.1 Keys for using starter fertilizer

1. The field has a very low P concentration.
2. Soybeans are planted into cool soils. Many soils are relatively cool:
   a. early in the season (early planting),
   b. in residue covered no-tillage fields, and
   c. in poorly drained areas.
3. Planting in newly drained or previously flooded field. In newly drained fields (high O_2), extractable P levels may decrease. This decrease is assocated with: 1) Fe^{+3} being a dominant ion in aerobic soils (high O_2), while Fe^{+2} is the dominant ion in anaerobic soil (water logged); and 2) Fe^{+3} form more stable complex with the phosphate ion than Fe^{+2}.
4. When poorly drained soils are drained or when a flood recedes, soil P levels can drop rapidly.
5. Planting CRP land that is being converted to crop land.
6. In many situations, soybeans have a minimal response to starter fertilizers. The mixed results are attributed to:
   a. Soybean is twice as sensitive to salt injury than is corn. Salt injury is also higher in dry and course course-texture soils.
   b. Soybean are generally seeded following corn, which results in warmer soil temperatures. Warmer soils encourage root growth and soil P uptake.
   c. High P rates are generally applied to corn prior to soybean in the rotation.
   d. Germinating soybean are very sensitive to fertilizer salts, therefore, extreme caution should be followed when using starter in soybeans.

Starter fertilizer

Starter fertilizer is usually a planter-applied band placing relatively small amounts of nutrients with or near the seed. With soybeans, phosphorus (P) is generally the nutrient of concern. Fertilizer P is placed near the developing root system to stimulate early-season nutrient uptake and crop vigor. Early-season response to starter fertilizer is common in corn, but not as predictable in soybean.

Starter fertilizer has a chance of increasing yield when considering the width of the planter and the starter fertilizer selected. These can greatly influence the amount of nutrient that can be applied with the seed at planting (Table 22.2). Starter fertilizer rates are not influenced by seeding rate. Table 22.2 provides maximum recommended fertilizer rates assuming moist, medium-fine textured soil and a tolerable stand loss of 20%.

More precise recommendations can be calculated using a computer application (Fertilizer Seed Decision Aid) available at http://www.sdstate.edu/ps/extension/soil-fert/index.cfm.

Placing fertilizer farther away from the seed reduces the risk of stand loss and allows increased fertilizer rates. Starter fertilizer can be applied over the top of the row after seed furrow closure or in a band to the side and/or below the seed. Starter fertilizer bands commonly have been applied two inches below and two inches to the side of the seed (2x2).

Double disk opener planter attachments with liquid or dry fertilizer holding and delivery systems are available for these types of applications. Liquids traditionally have been used for starter applications but are more prone to spills and equipment corrosion. Planter air carts easily and effectively handle dry fertilizers for starter application. Cost difference between liquid and dry fertilizers on a plant nutrient

Table 22.2. Maximum fertilizer rate to apply with soybean seed. [1,2]

Planter Row Width	MAP (11-52-0) - dry	10-34-0 - liquid	9-18-9 - liquid
inches	lb/a	lb/a (gallons/a)	
30	18	42 (3.6)	29 (2.6)
15	36	84 (7.2)	58 (5.3)
7.5	72	167 (14.4)	116 (10.6)

[1] From Fertilizer Seed Decision Calculator found at http://www.sdstate.edu/ps/extension/soil-fert/index.cfm

[2] Listed rates assume a moist, medium-fine texture soil and tolerated possible stand losses of 20%.

basis should be considered when investing in new or retrofitting planting equipment for starter fertilizer application.

Comparing banded and broadcast applied P fertilizer

Soybean grain yield response to banded fertilizers is similar to broadcast placement for Minnesota (Rehm, 2005); Iowa (Malarino et al., 2005); Nebraska (Ferguson et al., 2006); and North Dakota (Franzen, 1999). Research comparing the two methods of P application is lacking in South Dakota, but it is assumed that soybean response will be similar to neighboring states. Therefore, method of application should be selected based on cost, equipment availability, and ease of application. It is not uncommon to apply two years of P on corn in a corn-soybean rotation. Studies confirm soybean yield responses to P when applied the previous year (Claypool et al., 1990; Woodard et al., 1992; Randall et al., 2001).

Band application of recommended P fertilizer at planting is an option especially if relatively low rates are needed. Spring broadcast application prior to planting is a viable option. However, P fertilizers commonly available in the marketplace include nitrogen (N) (e.g., 11-52-0). Although only small amounts of N are applied, it is unlikely that soybeans will benefit from additional N and may suppress N fixation via symbiosis of soybean and N fixing bacteria *(bradyrhizobia japonicum)*.

Some soils may limit plant P availability by "fixing" fertilizer P with soil calcium. These soils may benefit from band applying P compared to broadcast applications. However, there are relatively few of these soils in South Dakota. If long-term P soil test values have not been increasing even though P application rates have exceeded P crop removal, P fixation may be occurring.

Using starter to reduce iron chlorosis

Soybeans growing in high pH soils may appear yellow, resulting from iron chlorosis deficiency (IDC). This deficiency can be reduced by seeding plants with improved Fe uptake characteristics and/or a Fe seed treatment. IDC has also been linked to high nitrate concentrations. Iron chlorosis or IDC in soybean is not uncommon in South Dakota (Chapter 21). Starter application of the iron chelate, ortho EDDHA, at 2-3 lbs per acre has proved to be effective. The linkage between nitrate and IDC suggests that Fe seed treatments may critical when the prior year was a drought.

References and additional information

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