

## Starter Fertilizers in Corn

- Starter fertilizers are small amounts of key nutrients, usually nitrogen and phosphorous, placed in close proximity to a seed during planting to potentially increase early growth in corn.
- A starter fertilizer can help meet early seedling demands, especially in wet and cool soils, until the root system develops.
- An evenly emerged stand that is well fertilized can give the crop a boost, thus helping maximize corn yield potential.

### Starter Fertilizer Benefits

Moist soil and cool soil temperatures can slow seedling growth, root development, and reduce nutrient uptake, unless nutrients are placed near the seed. Low soil temperatures can potentially reduce the rate of microbial activity including nitrogen (N) released via mineralization from soil organic matter.

If the root system is restricted, corn plants may turn purple, which can be a symptom of phosphorus (P) deficiency. Interestingly, P deficiency may also occur on soils with high P levels. Because P is very immobile in the soil, the undeveloped roots cannot reach soil P reserves, which can result in P deficiency symptoms. However, these symptoms are generally temporary and can disappear soon after root growth is resumed.

Starter fertilizers may be used to overcome early slow root growth and meet early seedling demands until the plant root system develops. In addition to cool soil temperatures, low P, sandy soils with low organic matter, irrigated sandy soils, and some high pH soils are among some of the field situations where starter fertilizer applications are more likely to show a response.

Placing starter fertilizer near the seed can increase early growth in corn. However, increased early growth may not translate into increases in final yield. Yield aside, early growth can be beneficial because it can result in plants that are larger, more uniform, earlier flowering, and/or mature earlier. Establishing a uniform stand can help give the crop a boost toward pollination before heat stress arrives. In addition, established early plant growth can help improve water use efficiency, improve yield potential in years with a late spring frost, help hasten canopy closure, reduce weed development, and help ensure the crop is drier at harvest.<sup>1,2,3,4</sup> These characteristics can indirectly help maintain yield potential.

### Macronutrients

Essential elements used by plants in relatively large amounts for growth and development are called macronutrients. The major macronutrients are N, P, and potassium (K).

Generally, a starter fertilizer is used to supply N and possibly P. The addition of other nutrients should be based on the response of a corn product to starter fertilizers and soil nutrient needs driven by a soil test recommendation.<sup>5</sup>

#### Nitrogen

Nitrogen is the most limiting element in corn production and can be a beneficial part of starter fertilizer. Nitrate N in the soil is highly mobile (more so under high precipitation conditions) and can be easily lost to leaching if soil N availability is not synchronized with crop uptake. Applying N as part of a starter fertilizer program and in split applications can decrease losses to environment by leaching and denitrification compared to immobile nutrients such as P. Consequently, N is usually applied with other nutrients as part of the starter and normally not alone.

#### Phosphorus

Phosphorus is another macronutrient found in starter fertilizers. It is immobile or has limited movement within the soil profile. This makes the close proximity of starter fertilizer to the seed ideal for P applications. Starter P is especially important in soils with low P levels; however, soils with high levels of P have also shown a response to starter fertilizers.<sup>1,2,4</sup>

#### Potassium

Potassium is also involved with early plant growth, but is less common in starter fertilizers. Plant requirements early in development are relatively small for K, which reduces the need for K to be added in common starter fertilizer applications. Soil K can be tied up in soil minerals and not available to the plants, which causes the amount of K supplied in soils to vary. Soil test results should be utilized to guide the use of K in a starter fertilizer.

#### Sulfur (S)

Based on soil test recommendations, S can also be added into a starter fertilizer.

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## Placement

The most common and recommended placement of starter fertilizer is 2 inches to the side and 2 inches below the kernel at planting (2-by-2 band). Placed in this manner, the fertilizer is close to the seed but reduces the possibility for fertilizer injury (Figure 1). However, the 2-by-2 band requires additional investment to equip planters and the application process can slow down the planting process.

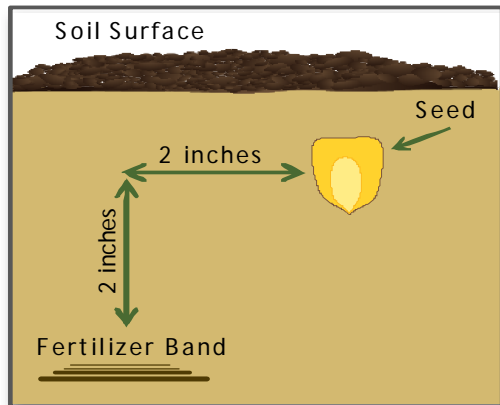


Figure 1. The 2-by-2 band is the most common placement for starter fertilizer, but in-furrow can be more practical and economical.

These drawbacks, plus the availability of low-salt fertilizers, have led to an interest in seed-placed fertilizers. Direct placement of starter fertilizer with the seed, also known as in-furrow or pop-up placement, is practical and economical for growers with a corn or corn-cotton system because growers typically use in-furrow equipment for insecticide and fungicide applications. Therefore, the only additional cost is the starter fertilizer itself. When using in-furrow or pop-up placement, care must be taken to keep rates low enough to avoid salt injury to the seed.

## Starter Fertilizer Products and Rates

An economical, high-quality, complete fertilizer that contains N and P will work as a starter fertilizer. It does not have to be labeled as “starter.” In general, a fertilizer with a high P ratio (1-2-1, 1-3-1, etc.) in a highly water soluble form, and combined with ammonium nitrogen can be used. If applied in-furrow, recommended rates are 4 to 5 gallons per acre. Formulations may change based on availability and if other nutrients are added. Monoammonium phosphate (MAP: 11-52-0) based materials are good choices, and ammonium polyphosphate (10-34-0) is also an excellent liquid starter.

If fertility levels are already adequate, a small amount of starter fertilizer (about 100 lbs/acre) can help provide an adequate response. Starter fertilizers containing only N may be sufficient for soils on farms with livestock or poultry, as those soils may already contain high levels of P. For assistance in making decisions about the use of starter fertilizers, please contact your local seed representative.

## Importance of Soil Testing

Soil testing is the best tool for growers to make fertilizer decisions. Samples can be taken anytime after harvest, but should not be completed after a fertilizer, lime, or manure application. Soil testing is recommended at least once every three years.<sup>6</sup> However, annual testing is more accurate to help determine what nutrients should be applied and at what rates.

## Summary

- Starter fertilizers can be a valuable tool for reducing the negative impact of unfavorable environmental conditions on corn production.
- Using starter fertilizers can enhance root development under moist soil and cool temperatures in the spring.
- Starter fertilizers do not always increase yields; however, in addition to root development they do offer other potential agronomic benefits such as improving N efficiencies.<sup>6</sup>
- Starter fertilizer should contain N and possibly P, and the rates should be adjusted based on soil test results.
- Depending on the procedure and equipment availability, there are several ways starter fertilizer can be applied.

For additional agronomic information, please contact your local seed representative.

### Sources:

- <sup>1</sup> Hergert, G.W. et al. 2012. Using starter fertilizer for corn, grain sorghum, and soybeans. University of Nebraska-Lincoln. NebGuide. G361.
- <sup>2</sup> Hoefl, R. 2000. Will starter fertilizer increase corn yield? University of Illinois Extension. The Bulletin.
- <sup>3</sup> Mississippi State University Extension. 2010. Corn in Mississippi: Is starter fertilizer advantageous for corn? MSUcares, <http://msucares.com> (verified 2/10/2014).
- <sup>4</sup> Mascagni, H. J. et al. 2006. Influence of starter fertilizers on corn yield on Mississippi River Alluvial soils. Louisiana State University Ag Center, <http://www.lsuagcenter.com> (verified 2/10/2014).
- <sup>5</sup> Zublena, J.P. 1997. Starter fertilizers for corn production. North Carolina State University Extension, SoilFacts AG-439-29, <http://www.soil.ncsu.edu> (verified 2/3/2014).
- <sup>6</sup> Davis, J.G. and Westfall, D.G. 2012. Fertilizing corn. Colorado State University Extension. Fact Sheet No. 0.538.
- <sup>6</sup> Zublena, J.P. 1997. Starter fertilizers for corn production. North Carolina State University Extension, SoilFacts AG-439-29, <http://www.soil.ncsu.edu> (verified 2/3/2014).

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