Application of Starter Fertilizers in Corn

• Placing small amounts of key nutrients such as nitrogen and phosphorus in starter fertilizers can help increase corn yield potential.
• Starter fertilizer can help meet the early demands of seedlings until the development of plant root systems.
• Fields with cool soil temperatures, low phosphorus, sandy soils low in organic matter, and high pH soils are more likely to show a positive response to starter fertilizer applications.

Benefits
Starter fertilizers help mitigate slower or sub-optimal growth rates, decreased mineralization in soil, and lack of nutrient mobility common in cool, wet soils. Low soil temperatures at planting can slow root growth, preventing young roots from taking up nutrients outside of the immediate root zone. Additionally, low soil temperatures can reduce the rate of microbial release of nitrogen from soil organic matter.

In addition to mitigating effects of cool soil temperatures, starter fertilizer applications may also respond positively with the following field conditions:

• Conservation tillage. No-till corn may respond to starter fertilizer more than conventional tillage corn systems as no-till soils may retain more moisture and have cooler soil temperatures than conventionally-tilled soils.
• Soil compaction. Starter fertilizer may help reduce the negative impact soil compaction may have on seedlings.
• Soil type and fertility. Corn planted in sandy soils with low organic matter, sandy soils with irrigation, some high pH soils, soils with low levels of available nutrients, and clay soils with high nutrient fixing capacities may benefit from starter fertilizer application.

Placing starter fertilizer near the seed may help increase early growth in corn, which may or may not translate into increased potential yield. Early growth may be beneficial as growth may 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 and tolerance to heat stress. 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, and reduce weed development. These characteristics can indirectly help maintain yield potential.

Key Nutrients
The macronutrients used in large amount by corn plants are nitrogen, phosphorous, and potassium. Generally, a starter fertilizer is used to supply nitrogen and possibly phosphorus. 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.

Nitrogen (N). Nitrogen is the most limiting element in corn production and can be a beneficial part of starter fertilizer. Nitrogen is highly mobile in soil, especially under high precipitation conditions, and can be easily leached if N availability is not synchronized with crop uptake. Applying N as part of a starter fertilizer program in addition to splitting applications during crop growth can help decrease potential for leaching and denitrification in the soil.

Potassium (K). Potassium is also involved with early plant growth, but is less common in starter fertilizers. Seeding nutrient requirements are relatively small for K, which reduces the need for K to be added in common starter fertilizer applications. However, soil K can be tied up in soil minerals and become unavailable to 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.

Starter Fertilizer 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 2). However, applying a 2-by-2 band may require additional investment to equip planters and a slower planting speed.
These drawbacks, plus the availability of low-salt fertilizers, have led to an interest in furrow-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. As the seed will have direct contact with starter fertilizer, care must be taken to keep rates low enough to avoid fertilizer injury to the seed.

Products and Rates
An economical, high-quality, complete fertilizer containing N and P can work as a starter fertilizer. 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 applying 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 (APP 10-34-0) is also a widely used liquid starter fertilizer.

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 regularly applied with livestock or poultry manure, as those soils may already contain high levels of P.

Results from a university trial conducted in an irrigated corn field with high P, showed that applying 15 gallons of 10-34-0 starter fertilizer per acre, in a 2-by-2 placement, increased corn yield by 11 bushels per acre and reduced grain moisture at harvest by 2.7%. Therefore, starter fertilizer can also hasten maturity and potentially reduce dockage due to high moisture content.

Soil Analysis
Soil testing is the best tool for growers to make fertilizer decisions. Samples can be taken any time after harvest, but should not be completed after a fertilizer, lime, or manure application. Samples should also be taken prior to tillage to increase sample reliability. Soil testing is recommended at least once every three years. However, annual testing is more accurate to help determine what nutrients should be applied and at what rates. The amount of N and/or P used as a starter fertilizer can be deducted from the total recommended nutrient requirement for the season.

Summary
Starter fertilizers use should be based on soil nutrient needs and adverse field conditions that may prevent or reduce early plant growth and development. Environmental and soil conditions that reduce nutrient uptake, especially N and P, can be offset in part by placing a starter fertilizer close to corn seed. Starter fertilizers can enhance root development under adverse soil conditions in the spring, but may not directly increase yield potential. However, they do offer other potential agronomic benefits that may help maximize yield potential. Starter fertilizer should contain N and possibly P, but the addition of other nutrients should be based on soil test results and recommendations. Depending on farm operation and equipment availability, there are different methods available for applying starter fertilizers.

Sources
Web sources verified 01/07/16.