Starter Fertilizer Can Improve Growth and Yield of Cotton

By John L. Kovar, Eddie R. Funderburg and Robert L. Hutchinson

Research in Louisiana has shown that starter fertilizer applications may increase early-season growth and lint yields of cotton. Addition of starters containing nitrogen (N) and phosphorus (P) does not increase yields in every location, every year. Further research will help to determine situations in which starter fertilizers can consistently provide economically favorable yield responses.

RECENTLY, there has been renewed interest in the use of starter fertilizer for cotton production in the Midsouth. Changes in production practices have sparked this interest. Cotton varieties with greater yield potential and greater nutrient requirements are being grown. Many producers have adopted no-till or reduced tillage systems, which result in greater residue cover and cooler, wetter soils at the time of planting.

To increase management flexibility, growers are planting at earlier dates, which also means lower soil temperatures at planting. Research has shown that starter fertilizers often increase soil nutrient availability when seeding requirements are great. They also promote root growth and plant vigor under adverse conditions found early in the growing season.

Starter fertilizers can be mixtures of various nutrients, applied in various ways. In general, starters used in cotton production contain some amounts of N and P and are applied at the time of planting within the seed furrow, as a band 2 inches below and to the side of the seed, or as a surface band near or over the top of the furrow. In some cases, potassium (K) and micronutrients, such as zinc (Zn) and boron (B), are also included in the starter in areas where the soil availability of these nutrients is low.

Research over the last several years has shown that cotton responses to starter fertilizer can be variable. Significant increases in cotton lint yield were found at 13 of 18 locations from starter applications in three years of Mississippi field trials. Averaged over all locations, lint yields from check plots were 1,000 lb/A, while plots with starter produced 1,093 lb/A. Surface band and 2 x 2 band placements consistently resulted in yield increases, whereas a surface dribble application 2 inches to the side of the seed furrow did not.

A Louisiana study on a Bruin/Commerce silt loam showed that 4.5 gal/A of either 4-11-11 or 11-37-0 (2.5-6.9-6.9 lb/A or 6-20-0 lb/A N-P-K, respectively) applied as a 6-inch surface band or injected near the furrow at planting did not affect early-season growth. Similarly, total lint yields were not significantly greater than those harvested from plots to which starter was not applied.

In Alabama, surface banding of N-P starter significantly increased cotton lint yields at only one of 16 field locations over a two-year period. Researchers concluded that use of starter fertilizer was a “hit or miss” situation and that proper early-season weather and a lint yield potential of 1,000 lb/A was necessary for a positive response. A separate study, however, showed that a liquid N (30-0-0) and a granular blend including sulfur (S)
(10-10-10-12 with micronutrients) applied as starter, significantly increased lint yields.

North Carolina research showed that a 2 x 2 band application significantly increased lint yields at four locations during a two-year period. In this case, response to banded starter did not depend on early-season environmental stress.

Positive yield responses to starter in a three-year Texas study occurred when rainfall was above average, under both conventional and reduced tillage conditions on a sandy loam soil.

Recent studies in Louisiana have focused on rate and placement of ammonium polyphosphate (11-37-0 or 10-34-0) solutions. Application rates and placements that have been tested include: 1) low rates (1.5 gal/A) applied in-furrow; 2) higher rates (2.5 to 5 gal/A) applied in-furrow; 3) 7.5 gal/A banded 2 inches below and to the side of the seed; 4) 4 gal/A applied as a 4-inch surface band at planting; and 5) 7.5 to 12 gal/A applied as a 4-inch surface band at planting. Based on experimental results, the 1.5 gal/A in-furrow, 7.5 gal/A 2 x 2 band, and 12 gal/A surface band are the methods that justify further testing.

### Starter Effects on Shoot and Root Growth

Dramatic increases in early-season growth are sometimes observed when starter fertilizers are applied to cotton (see photos). However, visual responses do not occur at every location, every year. Even at the same location, management practices can affect the response of the crop to starter. For example, in a three-year test at the Northeast Louisiana Research Station, seedling height was not significantly increased by starter applications under conventional tillage and no-till systems compared with broadcast N and P applications. In several instances, however, other measurements of early growth, including leaf size, leaf area per plant and shoot weight, showed significant improvements with starter fertilizers. Positive responses were more consistent under no-till compared to conventional tillage.

Applications of ammonium polyphosphate (APP) starter can also stimulate early-season root growth of cotton, even in soil with high levels of available P, Table 1. As with shoots, the response does not occur every year at every location. In addition, by the early bloom stage, other environmental conditions probably influence root growth more than N-P fertilizer applied at planting, so that differences in root growth disappear, Table 1.

### Table 1. Effect of 11-37-0 starter fertilizer rate and placement on cotton root growth 33 and 56 days after planting on a Commerce silt loam soil. Samples were collected in the row.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>0-4 in.* Root length density, cm/cm³</th>
<th>4-8 in.* Root length density, cm/cm³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check</td>
<td>1.00 b</td>
<td>0.95 a</td>
</tr>
<tr>
<td>Surface band, 150 lb/A</td>
<td>1.34 ab</td>
<td>0.97 a</td>
</tr>
<tr>
<td>In-furrow, 18 lb/A</td>
<td>1.46 a</td>
<td>1.25 a</td>
</tr>
<tr>
<td>In-furrow, 30 lb/A</td>
<td>1.48 a</td>
<td>1.18 a</td>
</tr>
</tbody>
</table>

*Means followed by the same letter are not significantly different at the 0.05 level

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**QUALITATIVE COMPARISON** of the effect of 11-37-0 rate and placement on the early growth of cotton seedlings. Treatments are, from left: control, 12 gal/A surface banded, and 1.5 gal/A applied in-furrow. Seedlings were harvested 25 days after planting.
In-furrow applications of 11-37-0 at rates greater than 1.5 gal/A (18 lb/A) are not recommended. Three years of data from the Northeast Research Station showed that significant stand reductions usually occurred when 3.0 and 4.5 gal/A of 11-37-0 were applied in the seed furrow. Reduced stands have not been a problem at any location with the 1.5 gal/A rate applied in-furrow or with the 7.5 gal/A rate banded 2x2 or in a surface band.

### Yield Responses

Based on four years of research at a number of on-farm locations, in-furrow applications of 1.5 gal/A of 11-37-0 or 10-34-0 and surface band applications of 12 gal/A of 11-37-0 or 10-34-0 showed the most promise, Tables 2 and 3. Although significant yield increases were not recorded at every location in every year, starter treatments did not significantly decrease lint yields in any of the experiments. It should be noted that the starters applied in these trials were in addition to the base N-P-K rates applied to all plots.

In a three-year study at the Northeast Research Station, yield responses were inconsistent, Table 4. Significant yield increases did not occur under conventional tillage, Table 4. In a no-till system, a yield increase was observed one of three years when 7.5 gal/A of 11-37-0 was applied as a surface band over the seed furrow. Total applications of N, P-K were held constant.

#### Summary

Based on four years of research, a number of conclusions can be drawn. Applications of N-P starter fertilizers may significantly increase cotton lint yields at some locations in some years. Early-season plant and root growth often are stimulated, but this does not always lead to significant yield increases. On the other hand, significant yield increases have been observed when early-season growth was not stimulated. Further starter research is being conducted in Louisiana, Tennessee and other states to determine treatments that will provide more consistent responses.