LOUISIANA

Influence of Starter Fertilizer on Corn Rotated with Cotton

By H.J. Mascagni, Jr. and D.J. Boquet

The early planting dates of mid-March to early April required for optimal corn production in Louisiana often expose seedlings to lower than optimal soil temperatures. These low temperatures may result in slow growth and reduced availability of soil P, even though levels of soil P may be considered adequate for plant growth.

In-row starter fertilizer containing nitrogen (N) and phosphorus (P) increased corn yield, decreased harvest moisture in grain and advanced silking date in Louisiana studies on medium textured alluvial soils.

Phosphorus deficiency symptoms on corn seedlings are commonly seen and are most pronounced on the sandy loam and silt loam Mississippi River alluvial soils with organic matter levels of 0.5 to one percent...soils such as Commerce silt loam (fine silty, mixed, thermic, nonacid, Aeric Fluvaquents). Soil temperature at the 2-in. depth in early March on a Commerce silt loam may be as much as 5° F lower than on a clay. Thus, symptoms of P deficiency that are common on sandy and silt loam soils rarely occur on the finer-textured silty clay and clay soils.

Dr. Rick Mascagni compares increased growth of corn which received starter fertilizer versus corn without starter.

Placing small amounts of starter fertilizer in close proximity to the seed at planting could alleviate the effects of cold soil temperature on P uptake and early corn growth. The placement most thoroughly investigated has been 2 inches to the side and 2 inches below the seed. Placement of the starter directly with the seed has also been investigated. This method of application is practical and economic in a corn-cotton production system, since cotton producers typically use in-furrow equipment for insecticide and/or fungicide applications. The potential for injury to the seedling when there is direct contact between fertilizer and seed places greater emphasis on avoiding excessive starter fertilizer rates.

Experiments were conducted for several years at the Northeast Research Station near St. Joseph, LA to evaluate the effectiveness of in-furrow starter fertilizers. The experiments were conducted on Commerce silt loam from 1991 through

1997 and on Mhoon silty clay loam (fine silty, mixed, thermic, nonacid, Typic Fluvaquents) in 1996. Some of these experiments included variables other than starter fertilizer. However, for this summary, only the main effects of starter fertilizer are reported.

Corn was planted from mid-March to early April at about 28,000 seeds/A. The formulations and rates of starter fertilizer that were applied in each year are presented in **Table 1**. Nitrogen as ammonium nitrate (NH_4NO_3) was broadcast prior to emergence at rates of 180 lb/A from 1991 through 1993 and 200 lb/A from 1994 through 1997. Cotton was the previous crop each year. Soil P levels (Ap horizon) in the test area were considered high each year, according to analyses conducted by the Louisiana State University Agronomy Department Soil Testing Laboratory.

Average grain yields ranged from 135 bu/A in 1991 to 206 bu/A in 1997 (**Table 2**). The in-furrow N-P starter significantly increased grain yield in 4 of 6 years. Significant responses ranged from an 8 bu/A (5.5 percent) increase in 1993 to a 25 bu/A (14.0 percent) increase in 1995. The average starter response over years was 8 bu/A.

At a cost of $1.40 to 1.55/gal for 10-34-0 or 11-37-0, and a corn price of $2.70/bu, the net return (in responsive years) to in-furrow starter application ranged from $17.35 to $66.55/A (assuming no fertilizer application equipment purchase).

Harvest grain moisture and mid-silk date reflected the effect of starter fertilizer on maturity. Each year, harvest grain moisture was lowest when starter fertilizer was applied (**Table 2**). Averaged across years, harvest grain moisture was reduced from 18.9 percent when no starter was applied to 17.9 percent when starter was applied. Similarly, number of days after planting to mid-silk was lowest each year when starter was applied. Averaged across years, mid-silk date was 73 days after planting with no starter and 69 days after planting with starter.

TABLE 1. Starter fertilizer formulations and rates used in experiments at the Northeast Research Station at St. Joseph, LA, 1991 through 1997.

Year	Formulation $N\text{-}P_2O_5\text{-}K_2O$	Rate, gals/A
1991	11-37-0	3
1992, '93, '95	11-37-0	4
1996, '97	10-34-0	5

It cannot be determined with certainty from these experiments whether the responses to starter fertilizer were due to the N or P component of the ammonium polyphosphate or to N and P in combination. In these studies, the total N requirement was applied at planting, providing adequate N for early growth and yield and possibly minimizing a starter-N response. Typical P-deficiency symptoms were also noted each year on corn leaves in the control (no starter) plots, but not in the plots receiving starter fertilizer, suggesting that P was likely the more important component of the starter fertilizer.

There did not appear to be a consis-

Phosphorus deficiency symptoms...purpling in leaves...are indicated on these corn plants.

tent relationship between starter response and climate. Early spring (March and April) air temperatures were below normal only in 1993 and 1996, whereas the largest yield responses to starter occurred in 1991 and 1995. The large yield response to starter in 1995 (**Table 2**) was probably related to the soil type in the experimental area, which was a sandy loam. These sandy, low organic matter, light colored, soils are cold-natured, and may not require unusually low ambient temperatures for P availability to be affected. Other research suggests that P deficiency can be further exacerbated by the use of extremely early planting dates and hybrids sensitive to P deficiency.

Summary

Application of in-furrow starter N-P fertilizer (ammonium polyphosphate) increased corn yield, decreased harvest grain moisture and advanced the silking date. Yield response to starter was significant in 4 of 6 years on medium-textured (sandy loam to silt loam) Mississippi River alluvial soils. Planting from mid-March to early April and using starter fertilizer would help to ensure consistent maximum yield production and minimal conflict with cotton production practices in both spring and fall. A starter fertilizer such as ammonium polyphosphate can be applied with the same in-furrow application equipment already used by producers to apply fungicide and insecticides at planting. BC

Dr. H.J. Mascagni, Jr. is Associate Professor of Agronomy and Dr. D.J. Boquet is Professor of Agronomy at Louisiana State University Agricultural Center's Northeast Research Station at St. Joseph and Winnsboro, LA, respectively. E-mail for Dr. Mascagni: HMascagni@agctr.lsu.edu)

TABLE 2. Influence of starter fertilizer on corn yield, harvest moisture, and mid-silking date at the Northeast Research Station at St. Joseph, LA, 1991 through 1997.

Year	Starter	Yield, bu/A	Harvest moisture, %	Mid-silk date, DAP
1991	No	135*	19.9*	69.1*
	Yes	147	18.5	64.5
1992	No	170NS	23.1*	68.6*
	Yes	172	22.4	66.7
1993	No	140*	18.8*	73.9*
	Yes	148	17.9	71.2
1995	No	175*	16.1*	66.3*
	Yes	200	14.7	61.6
1996	No	178NS	20.7*	82.8*
	Yes	171	19.9	79.4
1997	No	196*	14.8*	76.3*
	Yes	206	14.2	73.3

*Indicates that yield differences are significant at the 0.05 probability level.
NSNon-significant at the 0.05 probability level.