

by Jerry Huffman

Nitrification Inhibitor/Fluid Starter Combinations Benefit Corn Yields

Research shows possible synergy from combining two seemingly unrelated corn production practices.

Summary: Fluid starter fertilizers stimulate faster early season growth and often boost yields, particularly when soil P is low or when early season growing conditions are cool. Nitrification inhibitors reduce N loss by stabilizing N as ammonium. Their use is of greatest benefit in soils prone to high levels of N loss. Recent research has shown benefit from combining the two practices even though levels of N are low in starters. It appears that the possible synergy between the two practices is a result of enhanced levels of ammonium near the plant that can stimulate greater uptake of N and P.

Faster early season growth is normally observed when a starter fertilizer is applied to corn. This quicker start frequently results in higher yields. Research shows that starters tend to benefit corn most when planted early in cold soils, when soils are compacted, and when soil levels of P and K are low. The boost in early season growth is often credited with producing quicker soil cover, which helps reduce soil erosion and moisture evaporation from soil. Earlier maturing corn and lower grain moisture are also observed.

Nitrification inhibitors are widely recognized as N management tools that can improve corn yield in situations where potentials of N losses are high, such as on sandy soils and on poorly drained soils. Their use is also increasing in environmentally sensitive

areas where groundwater nitrate levels are of concern. Inhibitors reduce N leaching by stabilizing applied N in the ammonium form for an extended period of time. The resulting enhanced ammonium nutrition produces higher yields and greater levels of N and P uptake.

Combining starters and nitrification inhibitors is a new practice that has proven to be beneficial to corn production in many situations. Adding nitrification inhibitors to starters appears to enhance the benefits of

starters in situations where early season nutrient uptake is reduced by adverse growing conditions and in situations where high levels of residual soil N03-N can reduce phosphate uptake.

Fine tuning

N:P ratios. Standard starter fertilizers generally have had a N :phosphate ratio of 1:3. In recent years, however, 1:1 starters are proving to be very effective. For example, Touchton of Auburn University observed that a 1:1 starter produced corn yields equal to

Table 1. Response of corn to N and NP starters with and without nitrification inhibitor, Anderson, Iowa State University, 1988.

Starter Nitrogen	Phosphate	N-Serve	Yield	Grain Moisture
0	0	0	90	19.7
16	0	0	90	17.8
16	0	0.4	111	22.3
0	54	9	85	20.8
10	50	0	90	17.7
16	54	0.4	109	21.4
LSD (0.05)			16	2.2

Table 2. Influence of nitrification inhibitors applied with a fluid starter, Rehn, University of Minnesota.

Product	Soil NO3-N 0-3 feet	Bray P1	Yield
Lamberton			
Starter*	—	—	126.6
Starter+DCD	186	9.1	120.1
Starter +N-Serve	—	—	135.1**
Renville County			
Starter *	—	—	162.8
Starter + DCD	53	10	170.1
Starter + N=Serve	—	—	167.4

* 10-20-0 at 100 lbs/A
 ** Significant difference at the 0.05 confidence level

a 1:3 starter during four-year trials in Alabama (1984-87). These results, when combined with other observations, have led many to believe that high N starters are preferable to 1:3 starters, particularly when soil P levels have been built up to medium to high levels.

Tillage. Reduced tillage is opening new opportunities for increased use of both nitrification inhibitors and starter fertilizers. Corn growers are turning to inhibitors to help boost corn yields in reduced tillage because increases in surface residues result in wetter soils and greater N loss. More and more are also turning to starters to overcome slow early season growth caused by cooler reduced tillage soils. For example, starters are recommended for no-till corn production by agronomists at Purdue University, but aren't recommended for corn grown under conventional tillage methods.

Combination works

Iowa. In 1988 studies, Anderson of Iowa State University applied N-Serve' nitrogen stabilizer with fluid starters. His results were quite dramatic as shown in Table 1. Near the end of the season, he observed that corn in plots

receiving the inhibitor combined with either UAN or 10-34-0 (2 x 2 placement at planting) stayed green and continued to grow for several days after corn in all other plots in the trial matured and turned brown. Perhaps the stabilized starter stimulated greater root growth that was able to use the limited water supply more efficiently.

Illinois. Numerous trials with starters plus a nitrification inhibitor have been conducted in several states since 1988. Corn yield responses have been frequent, but inconsistent. However, a pattern seems to be emerging. It appears that yield responses often occur following early season stress conditions such as dry or cool weather, or excessively wet weather. All these conditions can limit uptake of N or P. For example, in four corn grower trials in 1991, Ron Olson of Top Soil Testing Service Co. in Frankfort, Illinois, reported that nitrapyrin (N-Serve) combined with a starter produced 5.5 bu/A more than a starter alone. Responses were greater in fields where early season growing conditions were dry.

Minnesota. Other situations where responses to a nitrification inhibitor in starters have occurred are in soils testing

low in P and in situations where residual NO₃-N was high. One example of this is shown in Table 2. In these two trials on soils testing low in P, Rehm of the University of Minnesota observed a significant yield response on the site with high residual soil NO₃, but not on the other site that had a much lower N level. Differences in plant P concentration were not detected among the treatments in this research and plant N concentration was not monitored. Early season effects on P uptake could have disappeared by the time the plants were sampled.

Precautions

When using N-Serve with fluid starters: 1) maintain agitation of the nitrification inhibitor/starter mixture or add a compatibility agent, 2) use only with 2 x 2 or similar placement techniques, 3) do not apply on the corn seed, and 4) use rate of one to two pints per acre. For other inhibitors, check with supplier.

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