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Field Crops 28.43 - 130

Corn Yield Response to Pop-up/Starter Fertilizer

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Banding fertilizer around the corn seed during planting is a common practice in the northern Corn Belt. Corn planting is frequently delayed in this region due to wet and cold soils, which result in slow root growth and limited uptake of nutrients during early developmental stages. The response of corn grain yield to starter fertilizer has been studied extensively in the United States, but the specific combinations of environmental conditions and agronomic factors that result in consistent responses remain unclear.

Starter fertilizers with a high P analysis are commonly used despite many soils testing above optimum (>50 ppm P). Increasing P soil test levels, the impending use of P-indexing as a nutrient management tool and the need to reduce costs while maintaining high yields have resulted in a need to evaluate alternatives to starter fertilizers used for corn production.

The last major evaluation of starter fertilizer in Wisconsin was conducted between 1995 and 1997. Full-season corn hybrids increased grain yield with banded fertilizer when planted late. Since then significant production changes have occurred including higher yields using transgenic crops, improved planting machinery and implements, and continued increases in soil nutrient levels. Growers question whether starter fertilizer is even necessary for modern corn hybrids and production practices, yet, often they apply it as “insurance.” Our objectives were: 1) To evaluate the agronomic and economic responses of corn to banded fertilizer as affected by hybrid relative maturity (RM), and 2) To determine the probabilities of a positive economic return associated with pop-up and starter fertilizer, especially with longer-season RM hybrids.

Materials and Methods

Research was conducted at 11 locations (Arlington, Janesville, Montfort, Fond du Lac, Galesville, Hancock, Marshfield, Chippewa Falls, Seymour, Valders, and Coleman). Fertilizer treatments included: 1) an untreated check, 2) pop-up fertilizer, 10-34-0-1(Zn), applied in the seed furrow at 4.1 gal/A, and 3) starter fertilizer, 9-11-30-6(S)-1(Zn), applied at 200 lb/A as a band 2 in. to the side of the row and 2 in. below the seed. Split-plots were eight to sixteen corn hybrids ranging in RM by 5-d increments from 80 d- to 115 d-RM. An emphasis is placed upon longer-season hybrids at each

location and selection of hybrids differing in emergence vigor.

At V5-V7, 5 plants from each plot were clipped at the soil level and composited across reps to determine early season dry matter accumulation. Samples were ground and analyzed for N, P, K and S. Corn was harvested and yields determined mechanically from the center two rows of each four-row plot.

On-farm “Challenge” trials

Replicated on-farm trials were conducted throughout the major corn growing regions of Wisconsin by farmer-agent-consultant teams. The trials use field-scale equipment and have two basic treatments (with and without starter or pop-up fertilizer). The starter fertilizer rate suggested to cooperators is at least equal to the minimum Wisconsin recommendation of 10 lb N /A, 20 lb P₂O₅ /A, and 20 lb K₂O /A. The pop-up fertilizer rate suggested to cooperators will be at least equal to the minimum Wisconsin recommendation of 5 lb N /A, 10 lb P₂O₅ /A, and 10 lb K₂O /A. Strips will be dimensioned according to farmer field equipment and field length. No P or K other than starter fertilizer or manure will be applied, and total N applications will be based on the N recommendation for corn at individual sites.

Results and Discussion

During 2017 at all locations, significant differences were found for fertilizer treatment. At 10 of 11 locations, starter fertilizer produced greater yield than the untreated check. Pop-up fertilizer had similar yield to starter fertilizer at 3 of 11 locations. At one location the untreated check plots out yielded both fertilizer treatments (Figure 1). On average starter fertilizer (229 bu/A) produced four more bushels than pop-up fertilizer (225 bu/A) and 10 more bu/A than the untreated check (219 bu/A). Pop-up fertilizer produced 6 bu/A more than the untreated check.

As corn hybrid maturity increased, grain yield increased 2.1 bu/A per RM unit (Figure 2). Using linear regression, significant differences were found for intercepts and slopes of fertilizer treatment on corn hybrid maturity. Slope was greatest for the untreated check > pop-up > starter. Starter produced the greatest corn yield responses at lower RM, while pop-up fertilizer produced greater yield response at higher RM. The untreated check produced the lowest grain yield at all RMs.

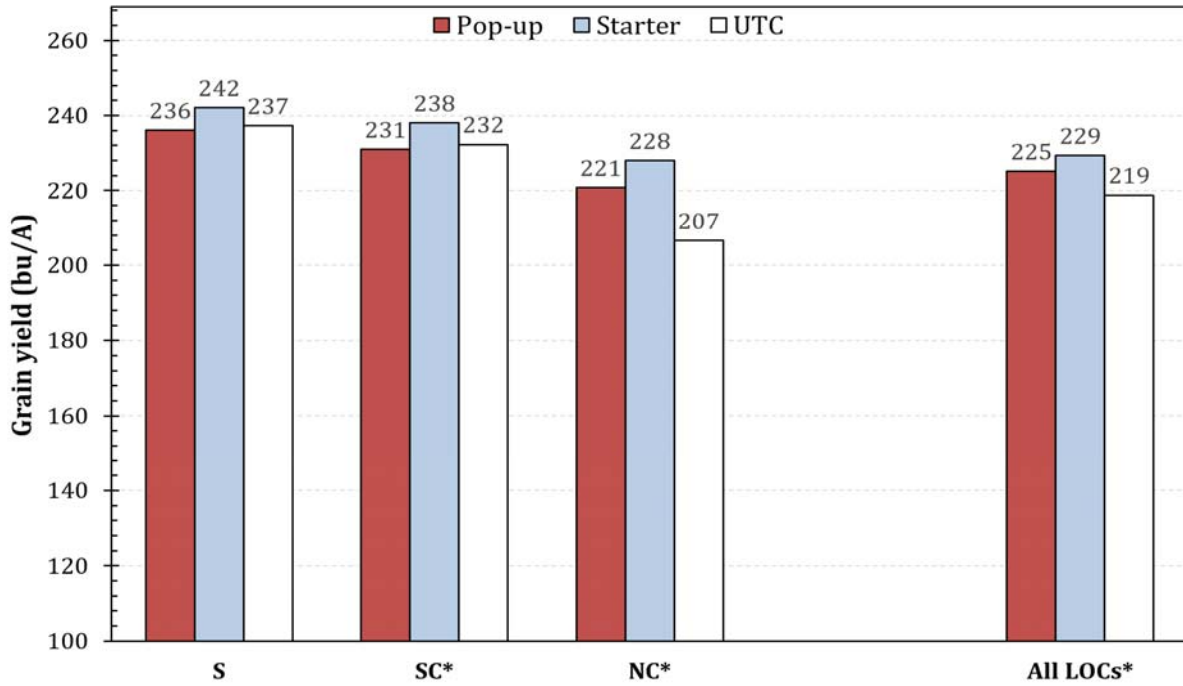


Figure 1. Zone corn grain yield response to banded fertilizer during 2017. Research is funded by the Wisconsin Fertilizer Research Council.

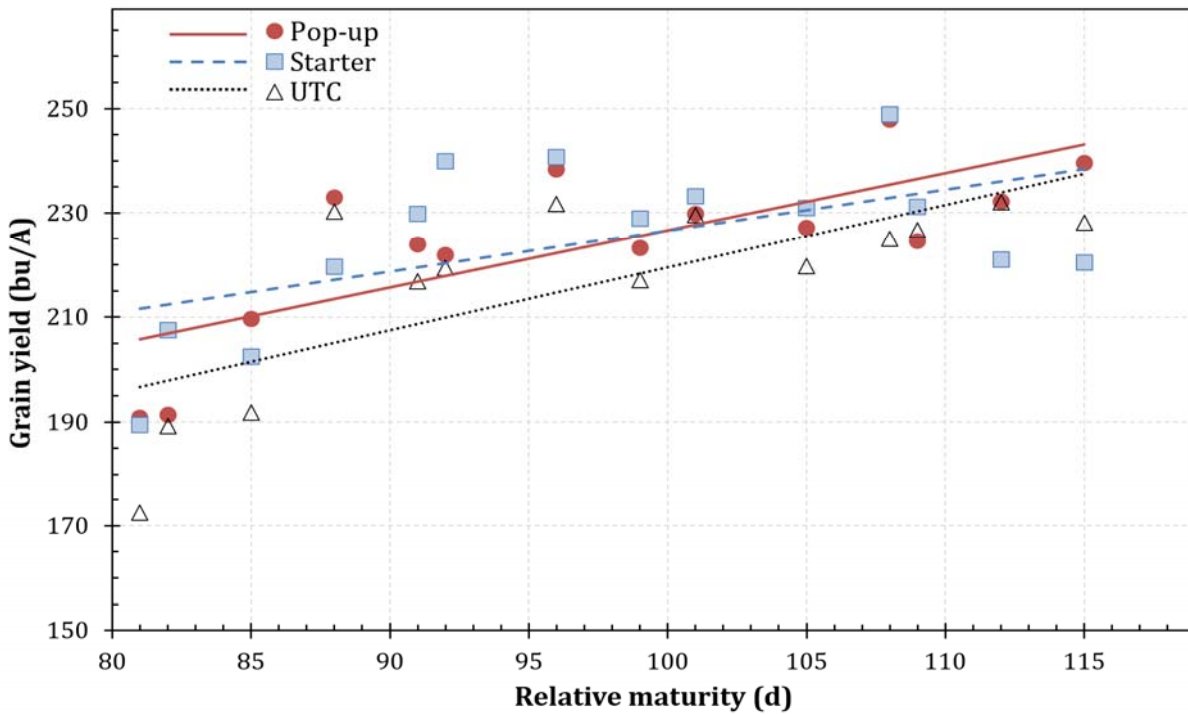


Figure 2. Corn grain yield response to hybrid maturity and banded fertilizer during 2017. Research is funded by the Wisconsin Fertilizer Research Council.