University of Wisconsin · Agronomy Department
1575 Linden Drive · Madison, WI · 53706 · (608) 262-1390
Agronomy Advice
http://corn.agronomy.wisc.edu

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Corn Yield Response to Relative Maturity and Banded Fertilizer

Joe Lauer, *Corn Agronomist*

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 production.

The last major evaluation of starter fertilizer in Wisconsin was conducted between 1995 and 1997. Results indicated that 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 objective was to evaluate the agronomic and economic responses of corn to banded fertilizer as affected by hybrid relative maturity (RM).

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) seed-placed fertilizer (10-18-4) applied in the seed furrow at 3 gal/A, and 3) starter fertilizer (10-20-20) 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 seed-placed fertilizer). The starter fertilizer rate suggested to cooperators is at least equal to the minimum Wisconsin recommendation of 10 lb N /A, 20 lb P_2O_5 /A, and 20 lb K_2O /A. The seed-placed fertilizer rate suggested to cooperators will be at least equal to the minimum Wisconsin recommendation of 5 lb N /A, 10 lb P_2O_5 /A, and 10 lb K_2O /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 and 2018 at all locations, significant differences were found for fertilizer treatment. Overall, starter fertilizer produced greater grain yield than seed-placed fertilizer and the untreated check (Figure 1). On average starter fertilizer (228 bu/A) produced four more bushels than seed-placed fertilizer (224 bu/A) and five more bu/A than the untreated check (223 bu/A).

As corn hybrid maturity increased, grain yield increased 1.6 bu/A per RM unit (Table 1). Depending upon location and year, hybrid maturity increased yield 1.3 to 4.2 bu/d RM.

In this study, unadapted long-season hybrids were used as a proxy for full-season hybrids planted late. Few interactions were measured between banded fertilizer treatments and hybrid maturity indicating that the decision to use starter fertilizer on late-planted, full-season hybrids is questionable and needs further review. This article only summarizes the effects of banded fertilizer and hybrid maturity on corn grain yield. Significant effects on grain moisture were observed and likely influenced the economics of this practice. Research is proposed for the 2019 growing season after which a full economic review will be conducted.

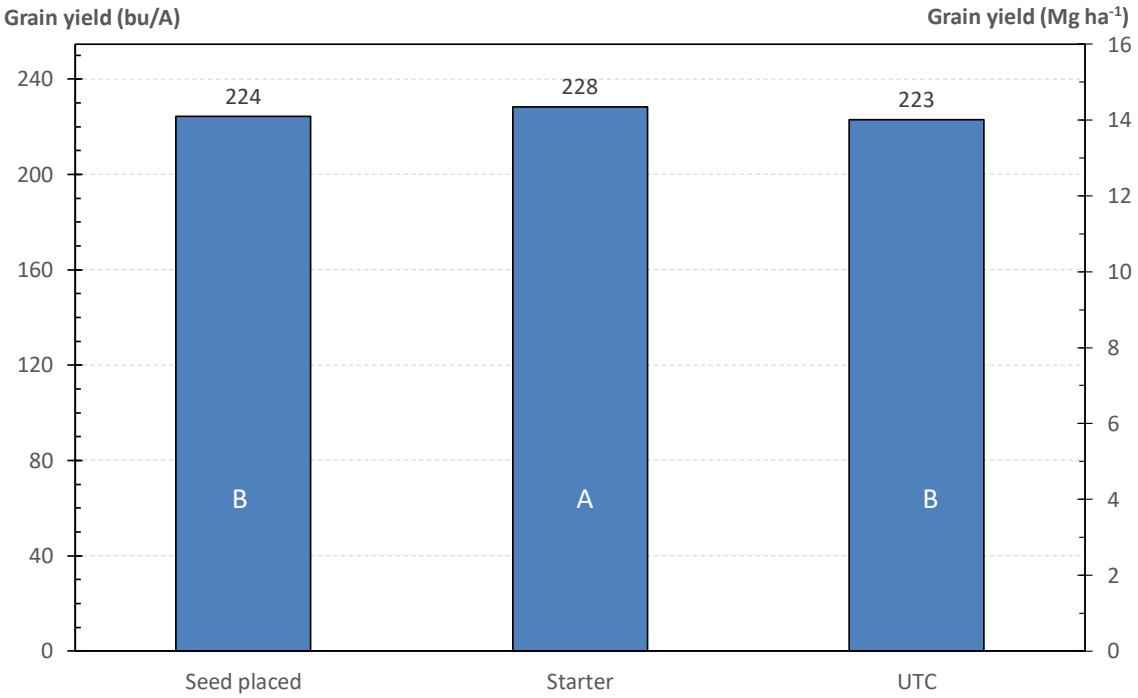

Figure 1. Corn grain yield response to banded fertilizer. Values are are derived from 578 GxE means and averaged across 2017 and 2018. Research is funded by the Wisconsin Fertilizer Research Council.

Location	2017	2018	Overall
Coleman	2.1	NS	**2.2**
Chippewa Falls	2.5	4.2	**3.2**
Marshfield	NS	NS	**NS**
Seymour	2.3	2.1	**2.2**
Valders	NS	2.3	**1.8**
Fond du Lac	1.2	NS	**2.3**
Galesville	2.4	3.8	**3.2**
Hancock	NS	2.4	**1.3**
Arlington	1.4	1.6	**1.4**
Janesville	NS	2.6	**2.2**
Montfort	2.3	2.1	**2.2**
Overall	**1.1**	**2.3**	**1.6**

Table 1. Corn grain yield response to hybrid maturity (bu/ d RM). Values are derived from 587 GxE means and regressed across 8 to 16 hybrids per location each year. Research is funded by the Wisconsin Fertilizer Research Council.