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2017 Research Report

Attaining the 300 bushel yield goal on high productive soils through climate toleranthybrids, increased population densities and nitrogen management

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We hear of 400 bushel and even 500 bushel corn yields among yield content winners. But we all know this is just the potential with new hybrids and meticulous practices. It is not yet a reality for field and farm averages. Nonetheless, George Silva, Extension Educator in Eaton County and Steve Gower, Agronomist, DeKalb/Asgrow have been experimenting with semi-flexed hybrids at non-limiting population and nitrogen rates seeking the elusive 300 bu/A on dryland corn. Their results will be summarized and published in a research magazine in the near future with full details, so we will share some generalized observations and await the full summary.

In the first three years (2013-15), 20-inch and 30-inch row spacings were compared. In 2013, the 20-row yielded 5-10 bu higher, but in 2014 and 2015, the 30-inch spacing produced 10-20 bu higher yields. The 2013 weather conditions (particularly rainfall) were conducive to corn growth whereas in 2014 and 2015 we encountered early season stress due to flooding as result of excess rain in May and June (Table 1). Changing to a 20-inch system would require investment in new equipment for planting, nitrogen side-dressing and harvesting. Besides the modern hybrids are bred and selected on 30-inch rows, so the plant architecture may still not be ideal for the 20-inch configuration. Because of the lack of consistency in performance and other compelling reasons, the 20-inch row spacing was dropped from further consideration.

Also in this time frame, populations tested were 30,000, 36,000 and 42,000 seeds per acre. The idea was to increase corn yield by harvesting more kernels per acre. Again, we noticed very little advantage at both ends of the population spectrum. This study confirmed some of the long standing thoughts on population rate. The general trends were that under less than ideal growing conditions, increased population rates amounts to more ears per acre but will have reduced kernels per row and average kernel weights. Kernels per row and average kernel weight increased with nitrogen rates, but decreased with population. These results prompted us to change the seeding rates to 32,000 and 38,000 in the 2016 and 2017 trials.

Over the years, the plots have endured unpredictable spring weather patterns that brought home the message that nitrogen management is still the most complex and unpredictable aspect of corn production. In the first three years, we included two static N rates of 120 and 240 lbs. N per acre. Forty pounds were applied at planting and the balance was sidedressed at V6 in June. The excess rainfall in May and June of 2014 and 2015, particularly soon after N sidedress, undoubtedly exposed N to denitrification and leaching losses and contributed to potential yield reductions. In all three years we observed a significant yield increase to the 240 lb N rate indicating that 120 lb N was inadequate and limiting yield. In 2014 and 2015, we also noticed premature firing at the low N rate. The end of season stalk nitrate analysis confirmed these findings showing that the low

N rate had nitrate N levels below the critical level of 700 ppm. The highest yields attained at 240 lb/A N in 2013, 2014 and 2015 were 246, 217 and 245 bu/A, respectively.

To reduce the risks of N losses to excessive spring rainfall, we decided to split the N application further by adding a Y-drop N treatment at V10. In 2016 and 2017, we increased our low N treatment to 160 lb/A and the high N treatment to 300 lb/A.

In contrast to the three previous years, we encountered back to back drought years in 2016 and 2017. Under extreme spring drought in 2016, there were hardly any significant yield differences between the N rates we tested, 160, 240, 280 and 300 lb N/A. Soil moisture that is so critical to N uptake was solely lacking that year. Even some of the higher N treatments failed to attain the critical stalk nitrate levels. Despite the unprecedented drought, the hybrids demonstrated their resiliency by attaining 203 bu/A.

In 2017 under less droughty conditions the response to N treatments was more evident. The highest yields were attained at 240-280 lb N/A. The hybrid DKC56-45 produced its highest yield of 260 bu/A at a population of 38,000 plants per acre and with nitrogen application split into three stages, of 40 lb at planting, 200 lb at V6 and 40 lb Y-drop at V10. The hybrid DKC58-06 attained its highest yield of 271 bu/A at the same population and nitrogen treatments, suggesting that applying N at all three growth stages may be important to attaining high yields.

When static N rates were used at the beginning of the season, in some years we encountered excess spring rainfall contributing to substantial N losses. In other years we encountered long periods of spring drought that drastically reduced N uptake. Ideally in Michigan it is better to have the option of waiting until V10 to determine the final N rate. This way we can use a sliding scale for N that combines soil productivity, realistic yield goals, and prevailing spring weather. If too much N was lost early season, we are able to use the V10 stage for a rescue application. If drought conditions prevail, the need for additional N at V10 may not exist. A point of caution is that driving the Y-drop applicator through the field at V10 caused some physical damage to corn plants.

When conditions are favorable and higher yields are attained, the ratio of pounds N per bushel of corn was generally below 1.00 (Table 2). This ratio increased when conditions are unfavorable to high yield.

We could not attain the elusive goal of 300 bu/A during our study. However the 2017 data showed that we may get close to that target by adjusting the variables used in this study. However, when it comes to attaining 300 bu consistently on dryland conditions, mother nature still has a strong say.

Table 1. Rainfall received at the Mason Technology Center (2013-17)

Month	Rainfall 2017	Rainfall 2016	Rainfall 2015	Rainfall 2014	Rainfall 2013	30-year Average
April	4.8	2.8	1.2	1.3	6.4	3.0
May	2.5	2.7*	3.0	4.3	2.0	3.4
June*	1.3	0.9*	7.8	4.0	5.9	3.5
July	2.6	1.4*	3.2	2.8	1.8	3.1
August	2.4	7.5	4.4	4.5	3.8	4.2
September	0.6	6.1	2.8	2.9	1.2	3.2
October	9.2	4.3	1.7	1.8	3.4	2.6
Total	23.4	25.7	24.1	21.6	24.5	22.7

Table 2. Nitrogen rates and corn yields from research trials at the Mason Technology Center (2013 – 2017)

Year	Highest corn yield (bushels per acre)	N rate (pounds) corresponding to highest corn yield	Ratio of pounds N per bushel of corn	Local weather highlights
2013	246	240	0.97	Rainfall generally favorable
2014	217	240	1.10	Wet May and June, widespread flooding, heat units 378 units below normal
2015	245	240	0.98	Wet May and June, some flooding
2016	203	300	1.47	Severe drought in May, June and July Long periods of leaf rolling
2017	271	280	0.97	Low summer rains, short periods of leaf rolling

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