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2021 AGRONOMY SUMMARY

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Record Smashing Corn Yields in 2021

Background:

From as far east as the Ottawa Valley and as far south as Windsor, farmers are talking record corn yields in 2021; yields that some thought they might never see on their farms. What was different in 2021 that contributed to achieving these yields? How widespread are these record yields and where does Ontario fit in the North American picture? Should hitting new yield records be viewed as 'off the charts,' or just where we need to be to meet global demand for corn?

5 Years of Yield Data:

Figure 1 outlines average corn yields from Ontario and several U.S. states for the last five years. A few things are quite noticeable from this graph. Corn yields for Indiana, Illinois and Iowa are good, but not record-breaking. On the other hand, 2021 yields for Michigan, Ohio and Ontario are off the charts! Better rainfall patterns as you moved from west to east across North America are showing up in these 2021 yield results. Safe to say that Ontario experienced the greatest yield surge in 2021 compared to either nearby or more distant neighbours.

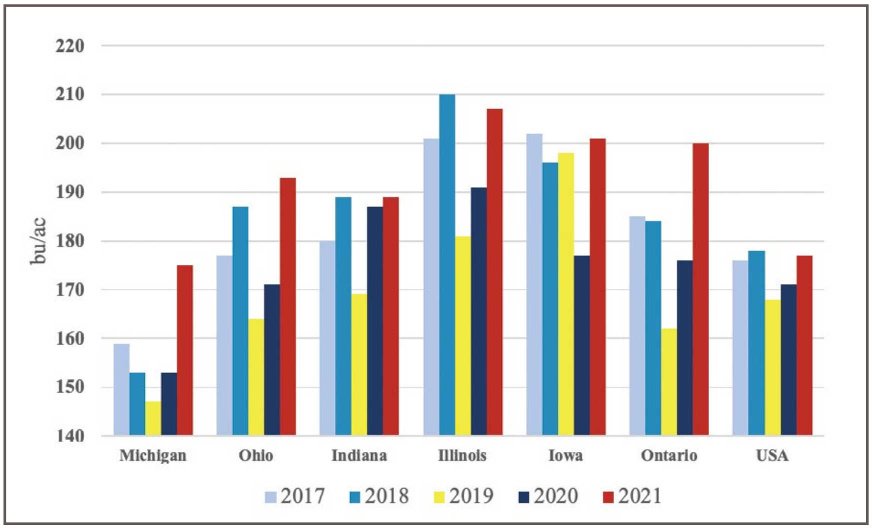


Figure 1: Average corn yields as recorded over the five-year period from 2017 to 2021 across Ontario and several key states in the U.S.
Source: USDA/NASS QuickStats & Agricorp

The 200 Bushel Ceiling:

While many fields and farms have broken the 200 bu/acre yield level for years, it has been fairly rare for Agricorp to report that an entire county, on average, could claim a 200 bu/acre yield level. Figure 2 illustrates that not only did we arrive at a provincial average of 200 bu/acre, but that several counties sailed well past that 200 bu/acre ceiling. It is quite exciting to think that if the Oxford County results are normally distributed across the county that about one-half of all the farms in Oxford County had average yields in excess of 218 bu/acre in 2021!

When one looks at just five years, it is difficult to pick out any trend in corn yields. It appears when looking at the 2021 data that a lot of factors must have come together to push yields to these heights; weather, genetics and management all played a part.

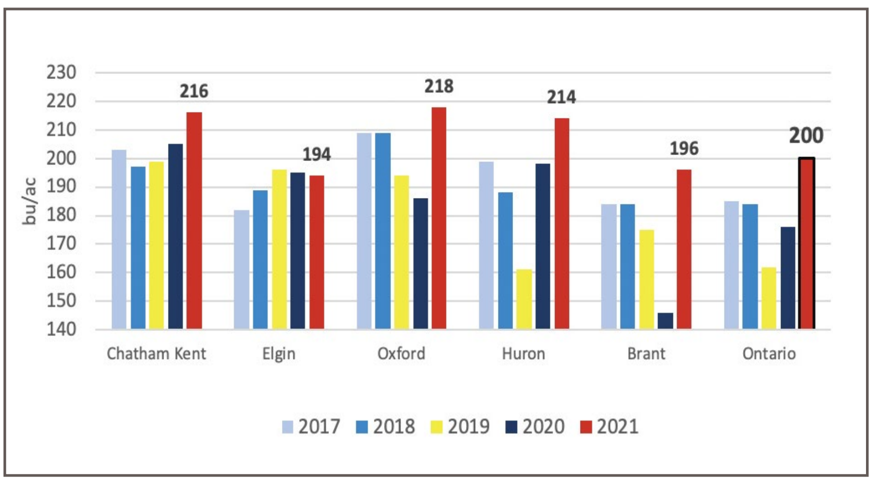


Figure 2: Corn yields at the county level across several counties in Ontario over the last 5 years. *Source: Agricorp*

The Race to 300:

Now that we have seen counties break the 200 bu/ac mark, how long will it be before we see more consistent results showing 300 bu/ac? Interestingly, there were industry experts who predicted that U.S. corn yields would hit 300 bu/acre by 2030. So far it appears that the trend in U.S. corn yields, while good, is not on pace to meet that mark. Dr. Bob Nielsen, the noted Purdue agronomist has stated that we will need a third miracle in corn yields to get the trend line to catch the 300 bu/ac mark. (see https://www.agry.purdue.edu/ext/corn/news/timeless/yieldtrends.html).

2021 was the first year for many in the Ontario corn world to have a legitimate, weighed-off, moisture-checked, full field-length yield that broke the 300 bu mark. Figure 3 lays out the results from a plot in Jarvis, ON on some high-fertility, well-drained clay soil. The field was conventionally tilled and was planted on May 19 and harvested on Nov. 1, 2021. This plot was weighed, and moistures confirmed on each hybrid, with harvest moistures ranging from 29.9% to 23.0%.

When record yields are achieved, it is interesting to examine the components within the corn crop that produced those yields. In the Jarvis example from Figure 3, MZ 4821DBR produced a yield of 302 bu/acre.

Here is how the yield was achieved when we look at the yield components:
Final Ear Count: **31,800**
Rows Around: **16**
Length: **36**
Kernel Weight: **419** TKW (grams/1,000 kernels),
60,613 KPB
(kernels per bushel)

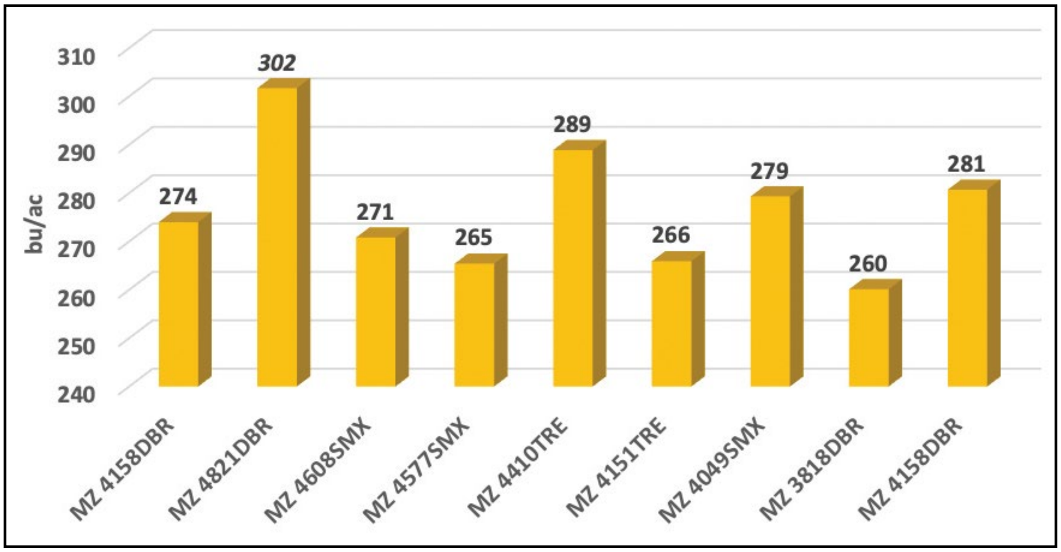


Figure 3: Corn hybrids and yields from Prinzen Farms; Jarvis, ON in 2021.

These yield components, at first glance, don't really seem that difficult to achieve. 31,800 ears per acre is above the provincial average, but certainly attainable; 16 x 36 gives you 576 kernels per ear which is great, but again doesn't seem out of reach. The component that really jumps out is the weight of the kernels at 419 grams per 1,000 kernels, or 60,613 kernels to make a bushel! In the not-too-distant past, 95,000 kernels per bushel was the benchmark.

Moving Forward:

2021 will go down as an exciting, benchmark year for corn yields. Are there lessons to be learned from 2021? Excellent planting conditions and ongoing improvements in corn stand development played a role and this was followed in most of the province with excellent weather conditions, particularly in the pollination/grain filling period. Yield component analysis in 2021 points to some interesting trends in kernel weight versus kernel number. Follow other Maizex agronomy articles and presentations to gain further insights into these ideas.

Acknowledgements:

This article was written by Chuck Belanger, Maizex Seeds, ON. It should be noted that this article used all county and provincial corn yields from Agricorp reports, not from Stats Canada/OMAFRA files.

Kernel Number versus Kernel Weight in Corn

Background:

Many of us have had the privilege of listening to Dr. Tony Vyn of Purdue University present his findings on 60 years of yield improvement in hybrids. His graphs illustrate that over this period, yield improvement was principally driven by kernels being heavier and not necessarily by hybrids that produced more kernels on an ear. Dr. David Hooker (U. of Guelph – Ridgetown Campus) joined up with Tony recently to discuss some of these trends, during the Ontario Agriculture Conference. Dave included some examples from his research where kernel number was also having a positive impact in increasing corn yields. For example, in the rotation studies at Ridgetown, yield improvements from more diverse rotations were associated with higher kernel numbers.

In 2021, corn yield levels set new records in many locations and in many cases, hybrids showed yields that had not been experienced before. Was this driven by higher kernel numbers or higher kernel weights? Table 1 illustrates our observations from more than 500 fields examined during the 2021 Great Ontario Yield Tour. In all three of the measurements that contribute to kernel number and yield, the 2021 values were above average and rough estimates would indicate that kernel number alone would have pushed the provincial yield from 175 to 192 bu/acre. However, only with heavier than average kernels could we get into the 204 bu/ac range.

Table 1: Data and estimations obtained from yield tour sampling in the period 2016 to 2021. Approximately 450 fields sampled each year to determine ear count, rows around and ear length. Kernel mass numbers are expressed as KPB (Kernels Per Bushel) and are estimations based on eventual yield records.

	Ear Count	Rows Around	Ear Length	Total Kernel Number	Kernel Mass
2016 – 2020 average	29,809	16.36	32.68		91,000 KPB
2021	31,450	16.9	34.1		86,000 KPB
Increase	641	.54	1.42		
2016 – 2020 Yield	175	175	175	175	
2021 Yield Increase	**3.8**	**5.8**	**7.6**	**17.2**	**12.0**
2021 Yield	178.8	180.8	182.6	192.2	204.1

It also appears that when we get into much higher yields, that exceptionally heavy kernels are contributing considerably more than the other kernel number-based components to the record yields. A hybrid trial at Prinzen Farms shows how kernel mass seemed to dominate the yield trend (see Figure 1). In this data set, it appears that the increase in TKW (Thousand Kernel Weight) accounted for more than 95% of the change in yield across the seven hybrids in the trial.

Table 2: Kernel number per ear and TKW from hybrids tested at Alstein Farms, Embro ON.

Hybrid	Kernels per Ear	1000 KW
MZ 4158DBR	534	451
MZ4577SMX	579	384
MZ4040DBR	641	343
MZ 4608DBR	622	340

Differences Among Hybrids:

At Maizex we are very interested in how hybrids generate above average yields. It is quite clear that some hybrids, mainly because of their girth, generate a high number of kernels while others appear to access top-end yields by having high kernel weights. Figure 2 shows some of the same trends as in the Jarvis data; that is, in many of the hybrids, yield improvement was associated with higher kernel mass.

The red line in Figure 2 represents a good relationship between yield and TKW as long as you ignore the hybrid MZ 4040DBR. The blue line represents a much less convincing relationship when you include MZ 4040DBR. MZ 4040DBR in this instance, had one of the lowest TKW but yielded at the top end of the hybrids entered. Why? MZ 4040 has a propensity to set 20 rows-around and 32 long, and can kernel number its way to high yields even when kernel mass is not stellar. One additional example comes from Alstein Farms near Embro, ON. Table 2 lays out the results from four Maizex hybrids in this trial. The results in Table 2 reinforce the idea that some hybrids excel because of high kernel mass (MZ 4158DBR and MZ 4577SMX) and others excel because of high kernel number (MZ 4040DBR and MZ 4608DBR). We need to understand whether there are ways to use information about a hybrid's kernel number and kernel weight characteristics. This will be a critical task for Maizex moving forward, but let's start with a few examples:

Planting Date: If a hybrid gains much of its top-end yield by making heavy kernels, then we would prefer to plant that hybrid early, so that grain filling occurs over a more favourable part of the season. A hybrid that sets yield potential early by generating high kernel number would be a better fit for later planting.

A Hybrid Package: A grower who builds a package of hybrids that contains both kernel number and kernel weight-dominated hybrids stands a better chance to capitalize on a range of weather and grain filling conditions.

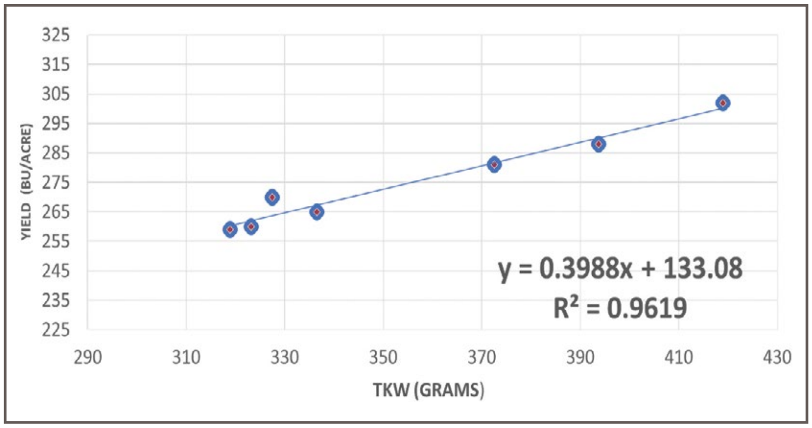


Figure 1: The relationship between Corn Yields and TKW at a corn trial at Prinzen Farms, Jarvis ON in 2021

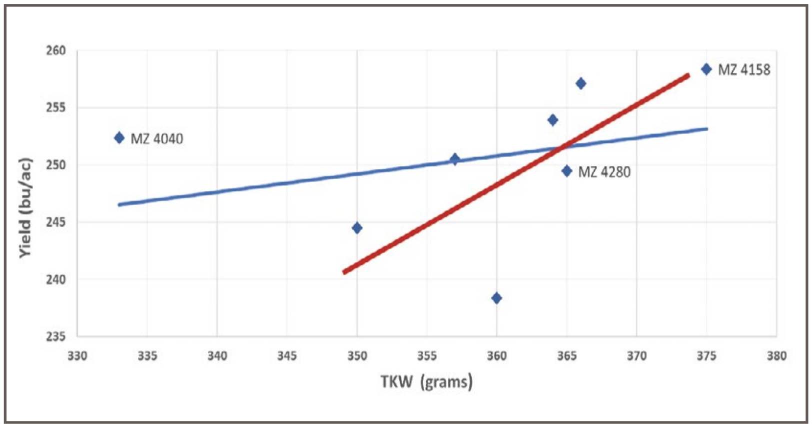


Figure 2: Corn yield results from a hybrid strip trial at Jeramel Farms, Lucan ON in 2021. The red line represents the relationship between Yield and TKW with the MZ 4040 data *excluded*. The blue line represents the same relationship with the MZ 4040 data *included*.

Moving Forward:

Much of the agronomy we have focused on in the past has had a kernel number focus: better planting, better weed control, better fertility, more uniformity, etc. Moving forward, more agronomy focus may have to be placed on understanding the grain filling window and how to maximize kernel weight.

Acknowledgements:

This article was written by Greg Stewart, Maizex Seeds (greg.stewart@maizex.com).

Corn Hybrid Intensive Management

Background:

For years, Maizex has conducted corn hybrid management research, in part to understand the influence of agronomic practices (i.e., more N, more fungicide, more seed). More importantly however, the aim has been to understand how hybrids respond differently to these inputs.

In 2021, we adjusted our management treatments slightly with the most important change bringing the High Population and Intensive treatments down to a final stand of 36,000 plants per acre, compared to the 38,000 plants used in the past. In addition, nitrogen rates were raised slightly in 2021 to 180 lbs/acre for all Standard treatments and 240 lbs/acre for the Intensive treatment. Following is the complete list of treatments used:

1) Intensive: 36,000 PPA, 240 lbs N/ac, Miravis Neo fungicide at VT (see Figure 1)

2) High Pop: 36,000 PPA, 180 lbs N/ac, no fungicide

3) Fungicide: 32,000 PPA, 180 lbs N/ac, Miravis Neo fungicide at VT

4) Standard: 32,000 PPA, 180 lbs N/ac, no fungicide

5) Low Pop: 26,000 PPA, 180 lbs N/ac, no fungicide

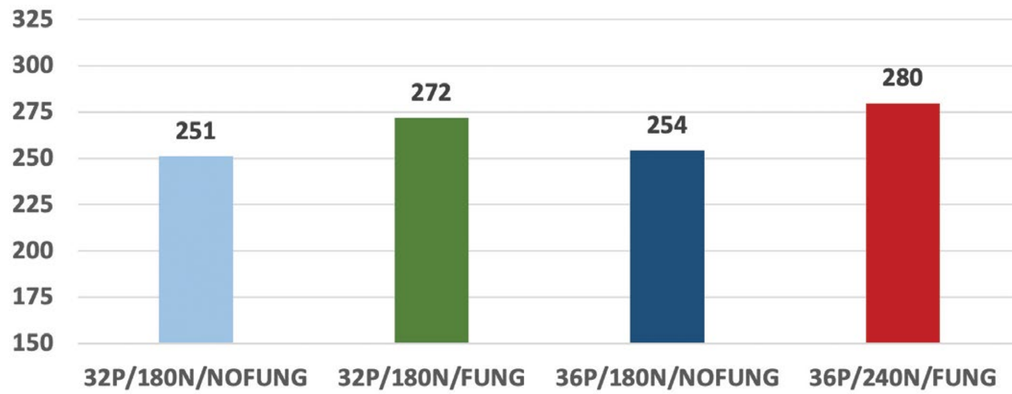
While the populations above were the desired populations for each program, some of the actual trial populations varied slightly – they are specified in the description of each site. Low (26,00 PPA) population results were not available for the Exeter site so this article will not discuss any low population results from 2021.

2021 Results:

Six to eight key hybrids were tested in each of three maturity classes. These maturity classes were tested at two sites each. Early maturity class hybrids were tested at Elora and Waterloo; mid-maturity class hybrids were tested at Belmont and Exeter, and late maturity class hybrids were tested at Dresden and Ridgetown.

At the early maturity sites (Data Set 1), there was an interesting interaction between hybrids and management options. There was a very large response (21 bu/acre) on average to fungicide, but some hybrids were even more responsive than others. These responsive hybrids are shaded cream in Data Set 1. Notice also how these hybrids tended to yield less when populations were increased without fungicide. The hybrids shaded in light blue were somewhat less responsive to a VT fungicide and also showed more stability as they were treated under High Population or Intensive management treatments. Improved late season plant health and intactness in some hybrids seems to make them less responsive to fungicides and also more stable when they are pushed with higher populations and extra nitrogen. This work allows Maizex to improve our management recommendations for hybrids across the line-up.

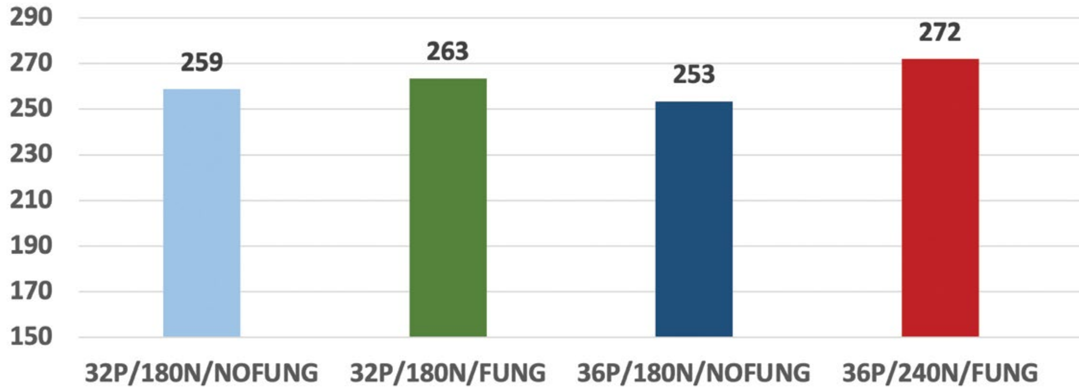
Figure 1: Fungicide applications in the Maizex hybrid management plots are done almost exclusively with a CO_2 pressurized backpack applicator with an overhead 10' wide boom. In 2021, Miravis Neo was used as the fungicide at all sites. Application rate was 500 ml/acre (1250 ml/ha) of Miravis Neo with 23 gallons/acre (220 l/ha) of water. Fungicide applications occurred in the VT to R1 stage for all hybrids in the trial. Plots are 4 rows wide and 20 feet in length with buffer plots on all sides to guard against fungicide drift on to non-target plots.



Data Set 1: The impact of management on corn yields across a range of Maizex hybrids (2600 to 2850 CHU) combined over trials at Elora and Waterloo, Ontario, 2021. Top bars (above) represent management effects when averaged over all 8 hybrids. Table values (below) illustrate yields for the individual hybrids.

Hybrid	Standard	Fungicide	High Pop	Intensive
MZ 2699DBR	235	251	213	276
MZ 2711DBR	233	249	248	262
MZ 2982DBR	245	268	207	255
MZ 3117DBR	267	274	272	287
MZ 3120SMX	261	275	275	281
E63G62 R	247	280	260	290
E65G82 R	244	285	263	289
MZ 3505DBR	278	294	296	297

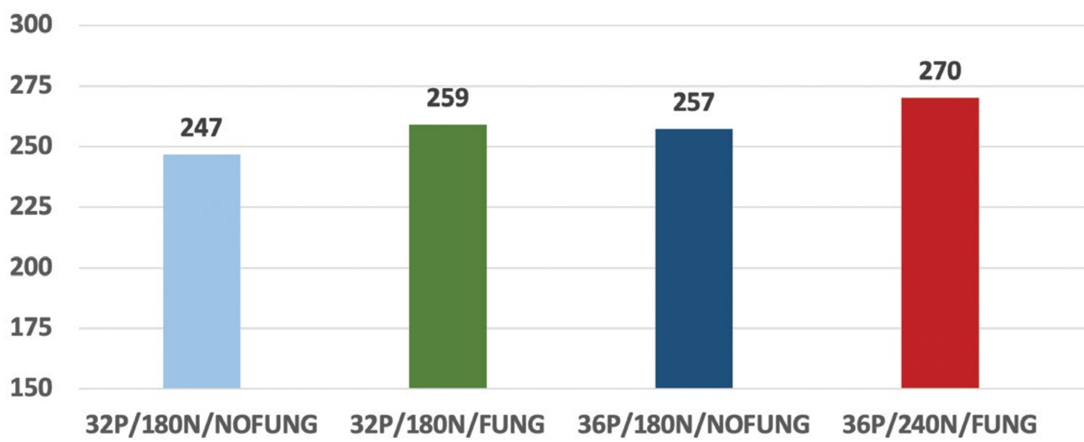
At the mid-maturity sites (Exeter and Belmont, only Belmont data illustrated) yields were exceptional but above average plant health seemed to generate very little response to VT fungicide when averaged over all hybrids; a 4-bushel/acre response to fungicide was one of the lowest that we have recorded in these trials. However, the Intensive package did push average yields to 272 bu/ac; an increase of 13 bu/ac over the Standard treatments and enough to pay for the extra input costs given the 2021 relatively high corn prices. MZ 3818DBR continued to show off its workhorse characteristics, showing minor responses to inputs. MZ 3690DBR on the other hand had a massive response to the Intensive package; moving up 33 bu/ac from the Standard yield (see Data Set 2).



Data Set 2: The impact of management on corn yields (bu/ac) across a range of Maizex hybrids (2875 to 2975 CHU) at Belmont, Ontario, 2021. Top bars (above) represent management effects when averaged over all 8 hybrids. Table values (below) illustrate yields for selected hybrids.

Hybrid	Standard	Fungicide	High Pop	Intensive
MZ 3690DBR	245	264	245	278
MZ 3818DBR	248	239	258	261

The late maturity sites at Dresden and Ridgetown generated yields that were more along the lines of patterns we have observed over the last several years; that is, a fungicide response across all hybrids that averaged 12 bu/ac and a pull-back in yields when populations were increased without the use of additional nitrogen or a fungicide application. 2021 late maturity data did illustrate a trend for Intensively managed hybrids to yield more than in other years; a full 23 bu/ac increase over the Standard program (see Data Set 3). MZ 4608SMX demonstrated high stability across all treatments, while MZ 4151TRE responded quite aggressively to the fungicide, increased nitrogen, and increased populations.



Data Set 3: The impact of management on corn yields across a range of Maizex hybrids (2975 to 3275 CHU) combined over trials at Dresden and Ridgetown, Ontario, 2021. Top bars (above) represent management effects when averaged over all 8 hybrids. Table values (below) illustrate yields for selected hybrids.

Hybrid	Standard	Fungicide	High Pop	Intensive
MZ 4151TRE	238	250	256	267
MZ 4608SMX	257	260	262	269

2021 management research has confirmed a few key points:

1) A fungicide applied at VT frequently provides a good return on investment; however, it is a good strategy to know ahead of time which hybrids are the most responsive so good decisions can be made in prioritizing fungicide applications.

2) Frequently, increased populations (final stands moving from 32,000 PPA to 36,000 PPA) did not improve yields when not accompanied with a VT fungicide or additional nitrogen.

Moving Forward:

As a result of this work, we continue to build a solid basis for recommending agronomic practices that are most profitable and help us advise on how best to manage hybrids to maximize profits. This year marked an effort to understand how hybrids respond either in kernel number or in kernel mass when inputs are changed. Be sure to check out other Maizex articles that delve more into this subject. Please examine the Intensive Management ratings (see maizex.com) for your hybrids and take advantage of other agronomic information as you move into the 2022 season.

Acknowledgements

This article was written by Greg Stewart, Maizex Seeds and Stirling Stewart, Maizex Intern in 2020. Appreciation is expressed to Syngenta Canada (Miravis Neo) for collaboration on this project.

OMAFRA Soybean Trials: 2021 Results

1) Soybean Planting Depth

Purpose: Soybean planting depth is an often debated question before each growing season. Some growers prefer to plant soybeans two inches or deeper. This idea comes from the well-known fact that if corn is planted shallow, it will not develop proper roots. There has also been speculation that when planting ultra-early it may be beneficial to plant deeper to avoid air temperature fluctuations. The purpose of these trials was to determine the optimal planting depth for soybeans across various planting dates. All trials were planted in 20 X 110-foot plots replicated three times. Trials were planted in 15-inch rows with a John Deere 7200 vacuum planter.

Table 1*: Plant Stands at Various Planting Depths (plants/ac X 1000)

Planting Depth	April	May	June	Average (plants/acre)
1.0 inches	129	144	162	**145**
1.5 inches	136	142	158	**145**
2.0 inches	132	127	150	**136**
2.5 inches	107	124	137	**123**

Table 2*: Yields at Various Planting Depths (bu/ac)

Planting Depth	April	May	June	Average Yield (bu/ac)
1.0 inches	63.1	65.8	56.0	**61.6** ab
1.5 inches	63.3	67.3	56.1	**62.2** a
2.0 inches	61.5	62.7	54.5	**59.6** ab
2.5 inches	59.7	62.9	53.8	**58.8** b

*Seeding rate was 175,000 seeds/acre in 2020 and 161,000 in 2021. Planting dates were April 22, 2020 and April 26, 2021; May 22, 2020 and May 18, 2021; June 10, 2020 and June 7, 2021. Variety: RX Response in 2020 and Woden R2X in 2021.

Summary: The best plant stands were achieved from planting at 1.0 or 1.5 inches. A reduction of 22,000 plants/acre was realized when planting was 2.5 inches compared to 1.0 or 1.5 inches. The highest yields were achieved from planting at 1.0 to 2.0 inches. The 1.5-inch depth yielded the best numerically across all three dates. A target depth of 1.5 inches seems to strike the best balance between getting good seed-to-soil contact and adequate moisture, but also placing seed shallow enough for quick emergence. It should be noted that the June planting date had the smallest reduction in yield when planting at 2.5 inches compared to 1.5 inches. This suggests that deeper planting may be less problematic as soils warm up in late spring. There was no evidence that April-planted soybeans should be planted deeper than normal; in fact the 1.0 and 1.5-inch depth yielded better than the 2.5 inch depth.

Figure 1:

Late planted soybeans on the left are not able to take advantage of summer sunlight.

Soybeans planted June 7 (left) yielded 9.6 bu/ac less compared to May 18, averaged across planting depths. Picture taken on July 22, 2021

2) Planting Depth for Late Planted Fields (warm soils)

Purpose: Soybeans should be planted about 0.5 inches into soil moisture (total depth of 1.0 – 2.0 inches) so the seed does not dry out before it can emerge. However, planting deeper than 2.5 inches significantly reduces plant stands. Since dry soils are often associated with later planting when soils are warmer, is it possible to plant deeper when planting is delayed to June or July? The purpose of this demonstration was to determine how many plants emerged when seeding up to 4.0 inches when soils were 24 degrees C.

Table 3: Planting Depth Plant Stands from 2 Varieties

Planting Depth (inches)	Woden R2X (plants/ac X 1000)	P09A53X (plants/ac X 1000)
0	43	89
0.5	86	108
1.5	156	154
2.0	155	121
3.0	93	89
3.5	50	66
4.0	43	48

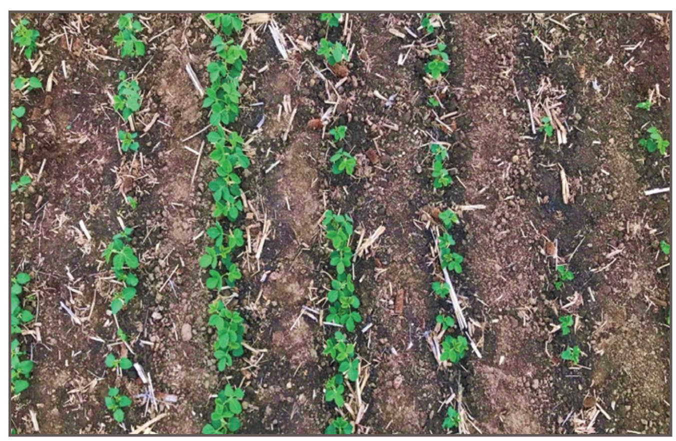


Figure 2: Single row plots demonstrating plant stand reductions at planting depths of greater than 3.0 inches or when seed was placed on the soil surface.

Summary: Seed placed on the soil surface (0 inches) established a surprising number of plants, but not enough to be considered an acceptable plant stand. A seeding depth of 1.5 inches and 2.0 inches provided the best plant stands, and at 3.0 inches or deeper, suffered large reductions. At a 4.0-inch depth, plant stands were reduced by over two-thirds. These single row plots were not taken to yield, but clearly demonstrate that even when soils are relatively warm, reduced plant stands can be expected when planting deep.

3) Yield Response to Spring-Applied Fertilizer

Purpose: Nutrient crop removal budgets demonstrate the high nutrient requirements for excellent soybean yields. For example, an 80 bu/ac crop requires 390 lbs/ac of total N, 80 lbs/ac of P, and 140 lbs/ac of K. It's possible that higher yielding soybeans (60-80 bu/ac) may respond better to added spring fertilizer than soybeans at a lower yield potential. There is also speculation that nitrogen may become limiting at these high yield levels and that present fertilizer recommendations are insufficient to meet the needs of high yielding soybeans. A combination of fertilizers that included N, P, K, Mg, S, Zn and B were applied in these trials to assess the value of these blends.

Table 4: Yield Response to Spring Applied Fertilizer

	Yield (Bu/ac)	Advantage (Bu/ac)
1) Untreated	57.5	
2) Urea (50 lbs/ac)	59.8	2.3
3) Ammonium sulphate (100 lbs/ac)	60.2	2.7
4) Aspire (100 lbs/ac)	61.9	4.4
5) Aspire + KMag + MESZ (83 lbs/ac + 45 lbs/ac + 100 lbs/ac)	62.5	5.0

*8 trials 2020-2021. Average soil test P = 17 ppm, K = 126 ppm.
Urea = 0-0-46
AMS = 21-0-0-24S
KMag = 0-0-22-10.8Mg-22S
Aspire = 0-0-58-0.5B
MESZ = 12-40-0-10S-1Z

Summary: A relatively large yield gain was realized even though soil test values for P and K were not considered low at most of these sites. An average yield gain of 5.0 bu/ac was achieved with the most comprehensive fertilizer blend (treatment #5). The majority of the yield gain likely came from the potassium part of the blend since Aspire by itself provided 4.4 bu/ac. These trials suggest that potassium should remain as the main component when fertilizing soybeans, but other nutrients should not be ignored. It should also be noted that sites with high organic matter and higher soil test values showed no benefit to spring-applied fertilizer. The four sites with the lowest testing soil analysis gained 6.1 bu/ac from the Aspire and 7.1 bu/ac to the full blend (data not shown). This is a good reminder that systematic soil sampling is still the best way to predict potential yield gains from applied fertilizer. Figures 3 and 4 also show that sufficient nutrients are required for soybeans to mature evenly in the fall, which can be a factor in timely harvest.

Figure 3:

Untreated on left. Aspire, Kmag, and MESZ on right. Elora research station 2021.
The soybeans that were fertilized have more pods per plant, resulting in faster and more even maturity in the fall. This effect is only evident in lower testing soils

Figure 4:

Aspire on left, untreated on right.

Acknowledgements

This article was written by Horst Bohner, OMAFRA Soybean Specialist. Appreciation is expressed to Grain Farmers of Ontario, Perth Soil and Crop Improvement Association and Maizex Seeds for funding support.

P and K Strategies for 2022

Background:

With record high Phosphorous and Potash prices this year, many growers are looking for recommendations on what their fertilizer strategy should be for this season. This sparks a bunch of questions: Should they 'take a year off' and not worry about applying P and K? How recently have soil tests been taken? How significant can the draw-down be in soil nutrient levels from one year of crop removal with no fertilizer added? What might the impacts be on crop yields, both now and in the future?

Various Approaches:

There are perhaps three approaches to fertility management to be reviewed:

1) Sufficiency: Apply fertilizer based on soil test levels. Apply just the amount that will maximize return on fertilizer investment for that year. OMAFRA P and K fertility recommendations (Tables 1 and 2) are based on this approach and hence have been developed and tested under Ontario conditions. This approach is based on fertilizing for crop response and not for crop removal or to build to any particular soil test level.

2) Build and Maintain: Apply fertilizer to cover off crop removal and any additional amount that might be needed to move soil tests to some pre-determined level. This requires producers to select a soil test level that they are confident maximizes yields, and then apply fertilizer to either build to or maintain that level.

3) Opportunistic: This uses principles from both of the other approaches. Producers are aware of fertilizer recommendations that can maximize returns for any given situation (Sufficiency) but are also aware that soil tests cannot be allowed to slide if long-term yield and profitability are to be maintained (Build and Maintain). In this approach, producers are more likely to not apply any fertilizer in years of high fertilizer prices when they are confident that soil test levels are more than adequate in any given farm or field. Similarly, they may capitalize on high commodity prices or lower fertilizer prices in certain years to apply additional P and K.

Table 1: Soil test-based recommendations for phosphorous application in corn.

Soil Test P (PPM) (Sodium Bicarb.)	P Recommended (P_2O_5) (lbs/acre)
6–7	80
8–9	62
10–12	44
13–15	18
16–20	18
21–30	18
31 – over	0

Table 2: Soil test-based recommendations for potassium application in corn.

Soil Test K (PPM) (Ammonium Acetate)	K Recommended (K_2O) (lbs/acre)
16–30	141
31–45	123
46–60	97
61–80	70
81–100	44
101–120	26
121 – over	0

Crop Yields, Nutrient Removal and Soil Tests:

It is critical that producers understand the potential crop removal in any given situation and how that might influence soil test levels. Table 3 outlines some potential crop yields, the removal of nutrients associated with those yields and the potential impact on soil test levels.

Table 3: Typical yields, nutrient removal rates and soil test impacts for corn, soybeans and winter wheat.

Crop	Corn		Soybeans		Winter Wheat	
Yield (bu/ac)	180	**240**	45	70	90	125
P_2O_5 removal (lbs/ac)	72	**96**	39	60	54	75
11-52-0 equivalent (lbs/ac)	138	**185**	74	116	104	144
Impact on Soil Test P (PPM)	-2	**-3**	-1	-2	-2	-2
K_2O removal (lbs/ac)	47	62	63	**98**	32	45
0-0-60 equivalent (lb/ac)	78	104	105	**163**	54	75
Impact on Soil Test K (PPM)	-2	-3	-3	**-5**	-2	-2

Notes: 1) Based on P_2O_5 removal rates of 0.4, 0.86 and 0.6 and K_2O removal rates of 0.28, 1.4 and 0.36 for corn, soybeans and wheat respectively, all in lbs/bu of yield. Grain removal only; no stover removal included.

2) Based on soil test changes requiring 35 lbs P_2O_5 or 20 lbs K_2O per acre to move soil test levels by 1 PPM.

There are lots of ways of looking at the data in Table 3. If a grower had a soil test of 145 PPM for K, and 70 bu/ac soybeans were grown with Zero additional potash applied in 2022, the theoretical draw-down would be 5 PPM. The new soil test would be 140 PPM and the grower moves forward, having made a decision that worked well for 2022. However, if a grower had a K soil test of 95 PPM it would be a mistake to apply no K. If the ground was rented, the Sufficiency recommendation of 35 lbs/ac K_2O (58 lbs/ac of 0-0-60) could be the most appropriate recommendation, however on owned ground it would make sense to employ a Build and Maintain rate of 150 lbs/ac of K_2O (250 lbs/ac of 0-0-60) to cover removal, with some left over to build up from the 95 PPM. Similarly, a 240-bushel corn crop could pull soil test P levels down by 3 PPM; not a big deal if your soil test P is 28 PPM, a yield-limiting proposition if your soil test is a 9.

Some other considerations:

1) Recent OMAFRA / U of Guelph research has indicated the soil tests of 20 PPM for P and 120 PPM for K are good benchmarks for maintaining yields in the long term.

2) Well-structured, medium-textured soils are more likely to produce good yields with lower application rates or lower soils tests than are heavier, poorly structured soils.

3) Soils with high variability are more likely to need more fertilizer than what the average field soil test indicates; there are too many low spots that can't survive the skip-a-year fertilizer approach.

4) Regardless of the approach you take for the bulk of your P and K fertilizer, starter fertilizer when planting corn can be critical. Corn seedlings need that fertilizer readily available when the roots are first developing. If you have the ability to apply starter on your planter, whether it is liquid or dry, always apply a starter! With dry starters, N and P are the dominant consideration, but on soils testing lower than 90 PPM for K, some potash in the starter has shown to pay big yield dividends.

Moving Forward

As producers grapple with high fertilizer prices, they will need to factor in not only the price of fertilizer, but the commodity prices as well. The ratio of fertilizer price to corn price may not be as far out of line as what you first think when you see your fertilizer bill. All approaches to fertilizer in 2022, and especially the idea of skipping a potassium or phosphorous application, need to be guided by recent soil tests. Whether you're considering a fertilizer holiday, following the OMAFRA recommendations, or continuing to replace every pound of P and K you removed in 2021, there is always someone at Maizex interested in discussing the options with you.

Acknowledgements:

This article was written by Chuck Belanger and Greg Stewart, Maizex Seeds.

Planting Wide Row Soybeans

What Should You Know?

Introduction: We have noticed an increase in the prevalence of wide row soybeans. Whether it's the ease of being able to plant corn and soybeans with one planter, or looking to cut down on seed cost with the reduced population, or even looking to widen the rows to allow airflow between the rows to reduce the chances of disease, there seems to be an increase in 30-inch row soybeans. Most research data indicate yields are lower in 30-inch rows compared to row widths that are between 7.5 and 20 inches. However, there are several key factors that can narrow that yield gap and, in some cases, produce yields that are equal to or higher than narrow row soybeans.

Figure 1: Soybeans planted on May 6 in 30-inch rows on a loam soil. Picture taken on July 10. Different varieties were planted in this section of the field. How quickly or completely a soybean variety closes the canopy can be an indicator of yield performance in wide rows.

What You Need to Know:

Variety Selection: Studies over the years have shown that the sooner you can fill the row spacing, the better the chances of narrowing the gap in yield experienced between 30-inch and 15-inch rows. Knowing this, we need to select a variety that is more likely to branch and have a bushier canopy. The Maizex Product Guide identifies some of the varieties that are more likely to be successful in wider rows. (see maizex.com).

Planting Date: When planting in 30-inch rows, it is recommended to plant earlier to provide the crop more time to grow vegetatively and to fill the row sooner. According to studies by Horst Bohner, maximum yield potential is determined by having 95% light interception by early pod set. With the increased interest in planting soybeans early, and by early we mean before corn and often in the April 20 to May 5 window, there is an increased interest in how well these early planted soybeans may do in wide rows. Figure 2 data from Ohio shows the yield decline in soybeans as planting date is delayed. Note how wide rows perform relatively better in the early planting dates. Generally, if planting is delayed into later May or into June, wide rows are not recommended. There is not a great deal of data available from Ontario on the relationship between ultra-early planting and wide row performance. Maizex intends to explore this more carefully beginning in 2022.

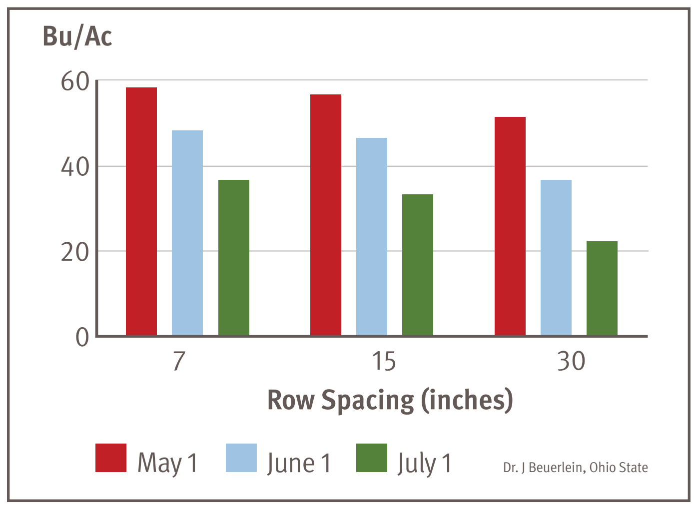


Figure 2: Impact of planting date and row width on soybean yield in Ohio.

Tillage: The tillage system used can also impact the performance of various row widths. Table 1 below indicates that there is more of a yield penalty associated with 30-inch rows in no-till than there is in moldboard tillage. There are many factors to consider when evaluating economic or environmental advantages of different tillage systems, but it generally appears that the movement to wider rows is more successful if at least some tillage is done to promote early growth.

Table 1: Impact of tillage systems and row widths on soybean yields.
Source OMAFRA Publication 811

Tillage[1]	Row Width: Single 76 cm (30 in.)	Twin 76 cm (30 in.)	56 cm 22.5 in.)	38 cm (15 in.)	19 cm (7.5 in.)
	Soybean Yields (bu/ac)				
No-till	40.4	45.3	43.6	45.5	45.5
Fall moldboard	43.8	44.9	43.6	46.4	47.7
Fall zone-till	41.3	43.6	–	–	–
Spring zone-till[2]	40.3	45.0	–	–	–

Least Significant Difference (P = 0.05) = 2.42 bu

[1] Trials were conducted on clay loam, silty-clay loam, silt loam and Guelph loam soil types.
[2] Spring zone-tillage conducted approximately 1 day prior to planting

Populations: Planting populations can be reduced when planting wide rows. Populations should be in the range of 140,000 to 155,000 seeds per acre. There are areas in the U.S. that are planting as low as 130,000 and finishing at 110,000 emerged population. Higher seeding rates can create competition among the plants and create a potential issue with lodging and reducing air flow which is at cross purposes to widening the rows in the first place.

Increased Management: When planting in wider rows there is increased opportunity to apply extra nutrients with dry or liquid fertilizer bands, or apply foliar fertilizers or a fungicide without causing much damage to the crop. Table 2 illustrates that increased inputs in 30-inch rows could reduce the 4 bu/ac yield gap for the 30-inch rows down to approximately 2 bu/ac.

Geography and Disease: Two of the final factors to mention are the prevalence of disease (predominantly white mould) and the total season length available. It is increasingly apparent that white mould is more easily controlled when planting soybeans in wide rows and at the same time employing a carefully timed fungicide strategy. The extra space to allow for air movement and the ability to spray without damage are key factors. Finally, the odds of wide row success will improve as your available CHUs increase.

Table 2: Row Width Management Impact on Soybean Yields

Treatment		Average bu/ac
1	15" rows seeded at 170 000 s/ac (no-till)	**63.2** b
2	15" rows seeded at 170 000 s/ac (all practices)	**66.5** a
3	30" rows seeded at 130 000 s/ac (no-till)	**59.0** c
4	30" rows seeded at 130 000 s/ac (all practices)	**64.6** b

Trial locations – Bornholm, Lucan, Elora, Winchester (2015-2017), all practices included:

1) 2x2 band of fertilizer (180 lbs/ac of product, 50% MESZ, 50% 6-28-28
2) Liquid starter (3 gallons 6-24-6) in furrow
3) Foliar fungicide (Priaxor, Acapela)
4) Vertical tillage for 15" rows and strip tilling for 30" rows

Source: Horst Bohner, OMAFRA Soybean Specialist

Moving Forward:

If you have not tried 30-inch soybeans, hopefully we have provided some ideas and factors to consider to evaluate the likelihood of it being a success on your farm or perhaps ideas to tweak your current wide row approaches. If you need assistance, be sure to talk to your Maizex representative.

Acknowledgements:

This article was written by Chuck Belanger, Maizex Seeds.

Maizex Corn Stand Audits: The Planter Report Card

Background:

Pondering how to really evaluate your corn planter's performance? We have the tool to help growers understand the effect of the planter on a corn stand. In 2021, we visited 24 different fields to complete the Maizex Corn Stand Audit. Here are the audit steps:

1) Visit the corn field sometime between V4 and V8.
2) Measure out 1/1000th of an acre (17' 5" in 30" rows) to determine plant population.
3) Count 20 plants within that section, record the precise spacing between each plant.
4) Count the number of leaf tips on each of these 20 plants.
5) Dig up plants 5, 10, 15 and 20 and measure the planting depth of each one.

We replicate this three times in different areas of the field. Below is the final report once all measurements are taken. This whole process can take up to two hours for two people. We also document information on the planter, soil type, tillage method and precision tools used.

Table 1: Results from a completed Maizex Corn Stand Audit.

Grower: Farmer #1
Field: Home
Plating Date: May 2, 2021
Audit Date: June 9, 2021

Soil Texture: Sand Loam
Tillage: Conventional
CHU Zone: 3100

Planter Make: Case 2150 16 row
Auto Down Pressure: Yes
Seed Firmers: Yes

Location	Sample 1	Sample 2	Sample 3	Field Average	Targets
Planting Depth, Population and Spacing					
Planting depth (inches)	1.94	2.13	2.25	**2.10**	**2.0**
Population (,000)	37.0	35.0	35.0	**37.5**	**32.0**
Spacing (cm)	15.0	15.4	15.7	**15.4**	**16.6**
Spacing Deviation (cm)	3.21	5.41	4.43	**4.35**	**5.0**
Development					
Leaf Tips	7.8	8.0	8.1	**7.9**	**NA**
% of plants 1 leaf or more behind average	5%	5%	0%	**3%**	**10%**
% of plants 2 leaves or more behind average	5%	5%	0%	**3%**	**5%**

Notes: Field very consistent and even. Healthy crop with few problems with emergence.

Table 2: A listing of the 2021 Corn Stand Audit sites by soil type and tillage practice.

Site Information				
Soil Type	Sites	No Till	Minimum	Conventional
Clay	4	1	3	0
Clay Loam	11	0	0	11
Loam	3	1	0	2
Sandy Loam	6	1	0	5

2021 Results

Generally speaking, the spring of 2021 had excellent planting conditions. The whole idea behind this process was to look at how consistent and even emergence was in each field. This is important because an evenly emerged crop maximizes yield potential and reduces the odds of ear moulds developing on late-emerging runt plants.

Planting Depth: The standard depth for planting corn is two inches for many farmers. Over the last three years we proved at many locations that planting depth should be a minimum of two inches to allow for a consistent emergence. In 2021, the results demonstrated that planting depth was generally in the two-inch range with a few exceptions.

Table 3: Results (below) from 2021 planting depth measurements. Some fields were discovered to have been planted very shallow. Note seed position in figure 1 to the right.

Planting Depth (in) › Target Depth - 2 inches		
Soil Type	Sites	No Till
Clay	4	1.83
Clay Loam	11	2.11
Loam	3	2.37
Sandy Loam	6	2.01

Figure 1

Table 4: Summary of plant spacing deviations from the 2021 Corn Stand Audit sites.

Spacing Deviation (in) › Target Deviation - 2 inches		
Soil Type	Sites	Deviation (in)
Clay	4	2.17
Clay Loam	11	2.21
Loam	3	1.71
Sandy Loam	6	2.33

Spacing Deviation: This is a measurement of how uniformly the plants are spaced down the length of the row. A spacing deviation of zero would mean that every plant was exactly the same distance apart. For ease in the field, we measure this in centimetres (cm) and then convert to inches, since most producers think in inches when looking at their spacings. A very good plant spacing deviation is 5 cm or 2 inches, so we set that as our benchmark. See Table 4 for this year's spacing deviation results.

Leaf Tips: By looking at emerged leaf tips we can get a sense of how uniform the emergence and early development was of each plant. It can lead to a discussion as to whether speed, depth, poor planting conditions or seed vigour may have contributed to less than the desired result, which is to have every plant be exactly like the one beside it. Plant development was quite uniform in all the sites we examined in 2021. Tables 5 and 6 list the results from two parts of the trial, one being % of plants that were one or more leaf stages behind average and the other showing the % of plants being two leaf stages or more behind average. Most sites fell within the acceptable levels. There were two occasions where plant development was less uniform than expected; one was a clay loam site, and the other was on sandy loam. It was determined that the problem at one site was due to hybrid vigour and the other site was planting speed.

Table 5: Leaf stage uniformity measurements across 2021 sites.

% Plants 1 leaf or more behind avg	›	Target % ‹10
Soil Type	**Sites**	**% Plants**
Clay	4	6.00
Clay Loam	11	5.91
Loam	3	5.33
Sandy Loam	6	5.16

Table 6: Leaf stage uniformity measurements across 2021 sites.

% Plants 2 leaf or more behind avg	›	Target % ‹5
Soil Type	**Sites**	**% Plants**
Clay	4	1.00
Clay Loam	11	1.54
Loam	3	2.00
Sandy Loam	6	1.66

Figure 2: A field with a very uniform stand of corn; even emergence and spacing. Most plants emerged within 24 hours of each other, and the results showed it. Every aspect of the audit showed well within the limits.

Moving Forward:

The Maizex Corn Stand Audit generates information critical in assessing steps to improve corn yields: they are plant population, planting depth, spacing uniformity, and developmental uniformity. All cooperators were very receptive to the Corn Stand Audit and to discussing the results and where improvements might be made going forward. We will continue to work with growers who are interested in digging deeper into the attributes of their corn stands and of their planter performance.

Interestingly, out of the 24 fields tested, all cooperators used seed firmers and 14 of 24 had auto down pressure on their planters.

Final thought, most of the planting issues found were attributed to the lack of getting off the tractor and verifying depth from field to field. Growers depend heavily on planter monitors in the cab. Green lights build confidence to keep planting! However, as of today, these monitors are not telling us the planting depth. Until they do, we need to be sure to verify by getting out of the cab and checking.

Acknowledgments:

This article was written by Chuck Belanger, Maizex Seeds. Appreciation is extended to all the cooperators that worked with me this season. Special thanks to our Summer Interns for their patience in doing these trials.

Foliar Feeding: Fact or Fancy?

Background:

Since the time I started working in agricultural retail in 1999, there has always been talk of correcting nutrient deficiencies or enhancing yield potential by applying a foliar fertilizer. Sometimes this fertilizer was included in a herbicide application or sometimes as a stand-alone application. Is there a benefit to doing this? Some agronomists contend that foliar fertilizers should only be applied when a specific nutrient has been diagnosed as deficient. Is there increased yield potential when applied broadly regardless of nutrient deficiencies? The last time I did any real testing on foliar nutrient packages was about 10 years ago. Back then I was lucky to see a two or three-bushel per acre increase. What made me decide to jump back in and retest these theories? There has been a lot of chatter about a few products out today that are showing some really interesting yield increases, so I decided this was the right time. The products tested this season from NutriAg Ltd. were: FertiBoost-D™, TruPhos Platinum™ and BoronMax™.

2021 Layout:

Six sites were tested with three sites in Chatham Kent, one site in Elgin County, one site in Wellington County and one site in Haldimand County. Each plot was 8 rows wide x 100 ft in length; replicated twice.

Harvest consisted of hand-pulling all ears within a 17' 5" length. Row 4 or 5 was always used, and the first ear was pulled at 25 ft into the plot. Three sites were harvested a second time to verify yields. Ears were shelled, moisture recorded, and total weight taken.

Figure 1: Field layout for foliar fertilizer trial in 2021

Border Rows	TruPhosPlatinum and Boron Max @V8	FertiBoost D @V4	Border Rows
	Control	TruPhosPlatinum and Boron Max @V8	
	FertiBoost D @V4	Control	

2021 Results:

Results from this year's trials are highlighted in Table 1; they are averaged across all six sites. A fairly consistent advantage in grain corn yield was observed for the foliar treatments over the untreated check plots in five of the six sites and in the treatment averages. There were no visually apparent nutrient deficiencies in any of these plots. There is a growing interest to examine the nature of critical nutrient concentrations and to test whether these critical concentrations are still accurate for high corn yields like we experienced in 2021. We also tried to evaluate where the yield increase was coming from – more kernels or heavier kernels – but the results from 2021 were inconclusive.

Table 1: Impact of foliar fertilizer treatments on corn yield and harvest moisture. Results are averages from six sites in 2021.

Plot Treatment	Timing	Rate	Harvest Moisture (%)	Yield bu/ac)	Gain over Control (bu/ac)
FertiBoost D	V4	1L/ac	29.5	241	7
TruPhos Platinum + Boron Max	V8	.7L/ac & .5L/ac	29.2	245	11
Control			28.9	234	NA

Moving Forward:

Maizex views this as a preliminary data set and the results are encouraging. Have we finally found products that will give us a yield increase by simply adding it to our herbicide pass? There are lots of questions still to answer and so we will be expanding our efforts in 2022. Most significant among these questions is: can we get a yield boost without tissue nutrient concentrations being low, and if so, where does the yield come from in the final yield component analysis? We will be testing this again in 2022, hoping to confirm our findings.

Acknowledgments:

This article was written by Chuck Belanger, Maizex Seeds. Special thanks to NutriAg for supplying the product.

Product Information:

FertiBoost D™ Analysis:
3-0-3 (NPK), 2% Zn, 2% Mn

TruPhos Platinum™ Analysis:
5-18-2 (NPK), 0.4% Mg, 0.8% S, 0.8% Zn, 0.1% Fe, 0.1% Cu, 0.1% B, 0.05% Mo, 0.05% Co, 0.04% Mn

Boron Max™ Analysis:
0-0-0 (NPK), 8.1 % Boron

Project Girth: Changing the Dimensions of Corn Yield

Background:

Our interest at Maizex in the girth (rows around) in corn was driven by two factors:

1) In the Great Ontario Yield Tour, it was obvious that fields with increased rows around (i.e., 18 versus 16) almost always had higher kernel numbers. Hybrids that had 14 or 16 rows around never had ear lengths long enough to have them compete with the high kernel numbers produced by girthy hybrids with 18 or 20 rows around. If you then divide by a constant kernel weight, the yield predictions always favour the girthy hybrids (see Table 1). Sometimes the high kernel number fields do hit the high yield mark, but how consistently?

Table 1: Sampling of fields from the 2021 Great Ontario Yield Tour based on ear size measurements and predicted yields.

# of Fields	Rows Around	Length	Predicted Yield
128	**16**	34.4	192.9
76	**18**	33.2	210.2

Maizex has a nice portfolio of hybrids; some that are larger in girth and some smaller. How do we manage them differently, if at all? This project aimed at answering the question; is there anything management-wise that can hold row number higher, and do some hybrids flex down more readily than others?

Figure 1: Project Girth attempted to examine if early season management practices could have any significant impact on final ear girth as measured by rows around on corn ears.

2021 Results:

In our 2021 agronomy sites, where we examined rows around in hybrids, the following treatments, alone or in combination, were implemented.

1) Hybrid – testing hybrids that had differences in normally occurring rows around.
2) Starter – increased starter fertilizer (Alpine G241 -S) applied both in furrow and in a 2x2 band at 19 litres (5 US gal.) /acre.
3) Foliar – foliar fertilizer was applied twice in the early growth stages (i.e., V3-V4 and V5-V6) using a fertilizer that was a broad spectrum NPK plus micros (YieldMax™).
4) Nitrogen – boosting the N concentration in the row zone by applying 40 lbs. of N as UAN in a band 4" wide over the row area sometime between planting and V2.
5) Combinations of the above treatments.

Moving Forward:

Seasoned agronomists claim that there is very little a producer can do to move kernel number upwards by changing the number of rows around in any given hybrid. However, some yield contest winners seem to claim that there are a range of management possibilities that can boost girth. Maizex tackled this question in 2021 and so far, it appears that rows around remained reasonably consistent regardless of management options deployed. We will re-examine treatment options for 2022, but in the meantime, the project did help to highlight some interesting trends in how corn hybrids generate yield, either by increased kernel number or by having higher kernel weight.

Acknowledgements

This article was written by Greg Stewart, Maizex Seeds. Appreciation is expressed to Alpine for supplying the liquid starter fertilizer (G241-S) and to NexusBioAg for supplying the foliar fertilizer (YieldMax™). Thanks also to our Maizex co-operators Mike Brodie (Kerwood site) and Mike Strang (Exeter site).

Table 2:. This table illustrates the results from the Kerwood, 2021 location. Various treatments were applied to influence ear girth and yield.

Hybrid	KERWOOD				
Treatment	Rows	Length	Kernels/ear	TKW (g)	Full Plot Yield (bu/acre)
MZ 4158DBR					
Control	15.4	38.0	583	346	262
Starter + Nitrogen	15.0	39.5	593	337	243
Starter + Foliar	14.3	41.4	589	353	263
Average	**14.9**	**39.6**	**588**	**345**	**256**
MZ 4040DBR					
Control	19.6	34.0	667	306	230
Starter + Nitrogen	18.5	34.4	636	312	223
Starter + Foliar	17.9	35.3	631	340	236
Average	**18.7**	**34.6**	**645**	**319**	**230**

At the Exeter site (Table 3) there were no significant changes in ear girth caused by any of the early season treatments. MZ 4158DBR and MZ 404DBR have distinctly different ear characteristics with row numbers 14-16 versus 18-20, respectively. Although MZ 4040DBR has higher kernel numbers than MZ 4158DBR in the full plot yields, it appears that the higher kernel mass of MZ 4158DBR pushed it to a higher yield level. Interestingly, it appears that within the measured ears, when row numbers edged downwards, it often triggered some compensation in increased ear length. Table 3 lays out the results from the Exeter site. The same trend was noticed that the early season treatments seemed to have no consistent impact on ear girth. Although the hybrids followed the same measurement patterns as the Kerwood site, it appears that the TKW advantage of MZ 4158DBR was not significant enough to push it much past the yield of MZ 4040DBR.

Table 3: This table illustrates the results from the Exeter (2021) location. Various treatments were applied to influence ear girth and yield.

Hybrid	EXETER				
Treatment	Rows	Length	Kernels/ear	TKW (g)	Full Plot Yield (bu/acre)
MZ 4158DBR					
Control	15.5	39.5	614	380	264
Starter + Nitrogen	14.8	39.3	582	375	262
Starter + Foliar	14.3	40.2	575	401	265
Average	**14.9**	**39.2**	**590**	**385**	**264**
MZ 4040DBR					
Control	19.7	31.1	612	348	260
Starter + Nitrogen	19.7	32.8	648	344	258
Starter + Foliar	20.0	32.1	643	339	265
Average	**19.8**	**32.0**	**634**	**343**	**261**

Nitrogen Fixation in Corn

Background:

It has often been thought of as the 'Holy Grail' of crop production innovation – to be able to get corn to fix its own nitrogen. Think of the economic and environmental impact if you could reduce N fertilizer use and replace it with N from the atmosphere.

The idea of having a free-living cell infect corn plant tissue and draw N from the atmosphere has its roots in sugarcane. In fact, sugarcane in Brazil was creating big tonnage with little N applied because of a certain bacterium that consistently infected the sugarcane plant and fixed nitrogen. The known bacteria were first made public in 1988. For decades, there has been ongoing research and refinements to the ideas and potential products.

Figure 1:

Can bacteria living in the cells of the corn plant contribute enough nitrogen to guarantee yield boosting nitrogen status through the entire grain filling period?

In 2021, Maizex conducted several trials in our agronomy research program to examine the potential N-fixing impact of a newly registered product called Envita™ distributed by Azotic North America. This product was capable of being applied either in-furrow or as a foliar solution in early vegetative stages of the corn crop. The Envita label indicates the active ingredient to be the bacteria, *Gluconacetobacter diazotrophicus*. This is the bacteria first discovered in sugarcane and is discussed in numerous scientific publications. Table 1 illustrates the yields, harvest moistures and in some cases the ear-leaf tissue N concentration from the various plots. In some cases, the Envita product was applied in-furrow at planting; in other cases, it was applied as a foliar solution in the V3 to V6 stage of corn growth. Across all sites there was no significant improvement in corn yield with the application of Envita.

Moving Forward:

Producers that are looking for more information and yield comparisons involving Envita can visit their website (https://nexusbioag.com/products/envita). The following are some key reminders coming out of our 2021 efforts:

1) It appears, based on our 2021 experience, that there needs to be considerable care taken in getting the bacteria to infect the corn plant. This means that in-furrow applications may perform better when liquid fertilizer has been diluted with water. Similarly, foliar applications should be made away from the heat of the day to avoid heat stress inhibiting the bacteria.

2) Some scientific publications imply that high levels of nitrogen may reduce the bacteria's ability to infect the plant. Maizex will investigate the use of Envita in lower N rate situations in 2022.

3) Some sort of lab test for identifying whether or not the bacteria is present in the corn plant will be essential moving forward.

The enthusiasm for nitrogen fixing technology in corn is huge among corn growers. The 2021 results were not very encouraging, but Maizex will continue to explore the options in 2022.

Acknowledgements

This article was written by Greg Stewart, Maizex Seeds. Appreciation is expressed to Nexus BioAg for supplying the Envita™ product for trials in 2021. Thanks also to all the farm co-operators that participated in the trials.

Table 1: The impact of the applications of nitrogen fixing bacteria (Envita ™) on corn grain yield, harvest moisture and tissue N concentrations measured at the VT stage in 2021.

Site Hybrid Treatment	Envita™ Placement Timing	Harvest Moisture (%)	Grain Yield (bu/acre @ 15.5 %)	N Tissue (%)
Dungannon MZ 3117DBR				
Control	–	21.3	238	–
Envita	Foliar V5	21.3	231	–
Winchester MZ 3117DBR				
Control	–	24.4	201	2.59
Envita	Foliar V6	25.6	193	2.64
MZ 3117DBR				
Control	–	27.4	210	–
Envita	Foliar V6	27.2	218	–
Exeter MZ 4040DBR				
Control	–	23.3	246	2.95
Envita	In-Furrow	23.7	247	3.02
Kerwood MZ 4040DBR				
Control	–	25.2	222	2.84
Envita	In-Furrow	25.3	222	2.86
Fullarton MZ 4040DBR				
Control	–	28.9	278	–
Envita	Foliar V4	28.8	275	–
Wallacetown MZ 4577SMX				
Control	–	23.4	231	2.84
Envita 2 PM	Foliar V4	24.0	239	–
Envita 8 PM	Foliar V4	23.8	230	2.97
Woodstock MZ 4049SMX				
Control	–	22.1	235	2.87
Envita	Foliar V5	22.0	230	2.61

There was generally no observable difference in plant colour, nor could we detect any increase in tissue N concentration resulting from the Envita application. There is no process in place for detecting if the bacterium is present in the tissue.

Nitrogen Timing, Rate and Placement

Background:

Nitrogen considerations are on the top of many producer's minds for this coming 2022 growing season. Questions about nitrogen rate, timing and placement seem more important when corn growers are paying up to $1.25 per pound of N!

One of the key questions we posed in the spring of 2021 centered on soil nitrate concentration in the row zone. Corn Belt research had indicated that a soil nitrate concentration in the row zone should be in the range of at least 40-50 PPM to ensure a great start to the corn plant's development. Maizex sampled 25 fields in 2021 to measure in-row soil nitrates concentrations. Of those 25 fields, only five registered a row-zone nitrate less than 40 PPM. It appears from our data that when total N applications are less than 50 lbs N/acre and when the majority of that 50 lbs is broadcast, there is a chance of inadequate early N supply. Other combinations of manure or N fertilizer that exceeded 50 lbs, or when more of it was banded in the row zone, were able to reach the threshold of 40 PPM consistently.

Our investigation into these 25 fields also carried on through the growing season to pull soil nitrate samples in the pre-sidedress window and to examine ear leaf tissue N concentrations at VT (tassel emergence). These are all factors that a producer can monitor, and the Maizex N Tracker (See Figure 1) gives guidance as to what each of the sample results might mean in terms of N recommendations. On four of these fields, we also applied 40 additional lbs/acre of nitrogen to look for yield improvements. Table 1 illustrates the results from these four sites. On sites that had been fully fertilized (200 + lbs N/acre broadcast) there was no yield improvement to spiking an additional 40 lbs at the corn emergence stage. That seems pretty reasonable as there was no way those fields would have been short of in-row N. Interestingly there was also no yield improvement when the 40 lbs was applied right at tassel emergence (VT). Where planting time N rates were lower (35 or 110 lbs/ac), there was a clear yield boost to applying 40 lbs additional nitrogen and it didn't seem to matter whether it was applied at the V1 or VT stages.

These findings reinforce several ideas and raise a few questions. Does a producer need 200 lbs of N to grow 200 bu corn? The broad Ontario data would suggest that especially on loam soils after soybeans and where at least part of the N is side-dressed it is rare that 200 lbs of N are required. In addition, it appears that there can be a fairly wide window for sidedress application. The dribble band approach (i.e., Y-drop) does come with some risks of being surface applied and thus not allowing the nitrogen to get incorporated into the soil matrix if it is dry after application.

Table 1: Results from four sites in 2021 that explored the advantage of top-up nitrogen, whether it was applied at V1 (emergence) or at VT (tasselling).

Site	Upfront N (lbs N/acre)	No Extra N	Plus 40 lbs N/ac @ V1	Plus 40 lbs N/ac @ VT
		Corn Yield (bu/ac)		
Chatham-Kent	110	155	186	190
Elgin	35	91	130	138
Wellington	210	239	245	251
Perth	220	262	253	256

Figure 1. The Maizex N Tracker illustrates key factors in a sample nitrogen recommendation for a 2022 field and provides some examples of what soil and tissue testing might reveal in a given field about N status.

General Field Based N Recommendations			Imperial	Metric
2	**Soil Texture Adjustment:**		(lb/ac)	(kg/ha)
	Select soil type	Loam	28	32
3	**Yield Adjustment:**			
	Enter proven yield (bu/ac)	225	173	194
4	**Heat Unit Adjustment:**			
	Enter CHU for your area	2900	4	4
5	**Soil Organic Matter Adjustment**			
	Enter Soil Organic Matter (%)	3.4	0	0
6	**Previous Crop Adjustment:**			
	Select previous crop	Soybeans	-27	-30
7	**Price Ratio Adjustment: ($N:$corn)**			
	Enter expected corn price ($ / bushel)	$6.50		
	Fertilizer product	UAN (28-0-0)		
	Enter fertilizer price ($ / tonne of fertilizer)	$620		
	Price Ratio and Rate Adjustment	8.65	-22	-24
	Total N Recommendation		**156**	**176**
8	Enter Starter Band N (lb/ac)		3	3
9	Enter Manure Credit (lb/ac)		0	0
10	Enter Planting Time Broadcast N (lb/ ac)		60	67
11	Additional Planting Time N Required		93	105
	OR, if applying N as sidedress:			
12	Additional SideDress N Required		74	84
In Row N Status (Soil Sampling May 25 to June 5 - Emergence to V2) Samples are taken in a zone 8" wide x 6" deep centered on the row.				
13	In Row Test # 1 (Nitrate) PPM	25	Low	
14	In Row Test # 2 (Nitrate) PPM	45	Adequate	
Sidedress N Status (Sampling June 5 - June 20; V5-V8) and Sidedress N Recommendations. Samples taken at least 30 days after manure or broadcast N, avoid all banded fertilizer. (12" Deep)				
15	Sidedress N Test # 1 (Nitrate + Ammonia) PPM	13	178	200
16	Sidedress N Test # 2 (Nitrate + Ammonia) PPM	29	73	82
Tassel / Silk Stage N Status (Tissue Samplinging July 15-31; VT-R1) (Ear leaf samples)				
17	Corn Tissue Test # 1 (% N)	2.2	Low	
18	Corn Tissue Test # 2 (% N)	2.8	Sufficient	

However, there are quite a few examples, as in Table 1, that if N is needed it can be applied right up to VT, and with some timely rainfall, do the job. In 2021, N applied at VT was easily accessible since there was ample moisture for plant uptake.

Moving Forward:

The other issue that has been top of mind is the impact that much higher N prices might have on the most economical N rate recommendations. In Figure 1 on the Maizex N Tracker we entered $6.50 for corn and $620 for a tonne of UAN. You will notice that this price ratio does pull N rates down about 25 lbs per acre compared to using UAN priced at $310/tonne. We encourage growers to run various scenarios in the N Tracker to get a feel for how they can make the best N management decision this year. The Maizex N Tracker can be found at www.maizex.com.

We will be running a new series of N Tracker trials this year so be sure to reach out to someone at Maizex if you would like to be involved. We will also be chasing the kernel number and kernel weight discussion to see if late N can boost kernel weight. Stay tuned!

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