

FARMER-RESEARCHER

**Norm Lamothe**  
Woodleigh Farms Ltd.

Woodleigh Farms is located in Cavan on the treaty and traditional territory of the Mississauga (Michi Saagiig) Anishinaabeg.



EFAO Office  
● Farm

FARMER-LED RESEARCH REPORT 2021

**Oat variety trial in eastern Ontario**

 Listen to audio summary of this report

**IN A NUTSHELL**

Norm compared three varieties of oats under similar management strategies to see which variety worked best for his farm operation in eastern Ontario.

- Orford yielded the highest among the three varieties in the trial.
- Bullet had the highest test weight among the three varieties, although its yield was the most variable.

- The addition of N in a side-by-side unreplicated trial showed a promising return on investment among all three varieties but more work and replication is needed to verify and reinforce these findings.

This research was funded by the Weston Family Foundation, and in cooperation with EFAO's Small Grains Program.

**MOTIVATION**

With timely management and proper variety selection, oats can be a profitable crop in Ontario due to their low input requirements. Adding small grains to a typical rotation of corn and soy — such as disrupting weed cycles, scavenging nitrates, spreading labour over the season and boosting soil health (1,2), not to mention increasing yields and returns of corn and soybeans in the rotation and allowing earlier planting of other fall seeded grains such as winter wheat (3). Like other small grains, oats are harvested earlier in the season, which opens up a number of ecological management options for growers. These include the establishment of cover crops, perennial forage, or in-season manure application (4).

In 2020, 104,500 acres of oats were planted in Ontario with an average yield of 72 bu/ac; the five-year average yield is 79 bu/ac (5). While Ontario farmers grow the majority of their oats for feed and forage

for livestock, there is a growing opportunity for the province's high quality oats to enter the food market for human consumption as milling oats (6). Growers who intend to market to food-grade buyers should consider varieties with high test-weights as this is the most commonly used indicator of grain quality.

In this trial Norm assessed the yield and test weights of three oat varieties under the same management in eastern Ontario. In one field, he also looked at a side-by-side comparison of nitrogen response with the addition of an extra 17 lbs N/ac.

**METHODS**

For the trial Norm chose three replicate fields of approximately 10 acres each with a consistent slope across them. All three fields had identical nutrient history, consistent fertility numbers, and had been in a two-crop rotation for 20+ years. This oat planting in spring 2021 would be the first cereal crop. The

three oat varieties Norm chose for the trial were: **Certified AAC Banner**, **Certified Orford**, and **Certified Bullet**. AAC refers to varieties derived from a public breeding program.

On April 1, 2021, Norm underseed a crop of double cut red clover and applied dry fertilizer uniformly to each field: 200 lbs/ac of K-Mag, 50 lbs/ac of Urea, KCl, and MAP [28-26-74, S=45, Mg=22]. Norm divided each field into thirds, and randomly assigned one of three varieties to each section, shown in **Figure 1**. Each section was aligned with tramlines for the 60' wide sprayer



**Photo 1.** From left to right: Bullet, Orford, Banner growing as part of Norm's oat variety trial on June 1, 2021.

passes, 3 x 60' passes for field 1 and 2 x 60' passes for fields 2 and 3 for each variety. On April 5, Norm planted all three varieties at a rate of 1,000,000 seed/ac and applied Liquid Starter fertilizer 5-20-5 at 5 gal/ac [3-13-3].

On May 7, a liquid nitrogen fertilizer of 28% urea ammonium nitrate (UAN) was streamed at 12 gal UAN with 8 gal water [34-0-0] on field 2 (F5) and field 3 (F4) and the three check strips (60') in field 1 (F6). The remaining two passes per variety in field 1, Norm streamed UAN at 18 gal UAN with 12 gals water [51-0-0] to create a side-by-side nitrogen response trial (unreplicated) with the addition of 17 lbs/ac of N.

Mextral (Bromoxymil, MCPA) herbicide was applied on May 18 at 500 ml/ac to control weeds without harming the underseeded double cut red clover. The fungicide Propiconazole was applied on June 10 at 120 ml/ac in combination with the foliar fertilizer Magnesium Sulphate (Epsom Salt) at 3 lbs/ac (negligible nutrient value at that rate) at T1- stem elongation to protect from leaf diseases. An application of the fungicide Folicur (Tebuconazole) was sprayed on June 23 at 150 ml/ac at 30-40% head emergence to protect from head diseases.

Throughout the growing season Norm monitored the varieties and recorded emergence and other observations (Photos 1-3). On August 26, Norm harvested the oat crop with a 17.5' header, taking an average of 15' of harvestable crop

with each pass, for approximately 12 passes per variety in field 1 and approximately 8 passes per variety in fields 2 and 3 (Photos 4-5). His yield monitoring capabilities allowed him to record yield data for each pass and to factor in yield for incomplete passes header swaths. He did not factor in any harvest excess in the headlands. Norm recorded test weights of each plot at the grain elevator.

### DATA ANALYSIS

To evaluate the effect of variety on yield and test weight, we used a statistical model called analysis of variance (ANOVA) with a 90% confidence level to calculate the least significant difference (LSD) needed to call the treatments "statistically different". We also tested the effect of yield using a T-test with a 90% confidence level.

Using a 90% confidence level means that if we measure a difference between any two treatments that is greater than the calculated LSD, we expect this difference would occur 9 times out of 10 under the same conditions. In this case, we consider the difference reliable and refer to the results as statistically significant. On the other hand, if we measure a difference between any two treatments that is less than the calculated LSD, we consider these treatments unreliably different or statistically similar. We could make these statistical calculations because Norm's experimental design involved replication of the treatments (Figure 1).



Photo 2. Orford growing in Field 2 on June 14, 2021.



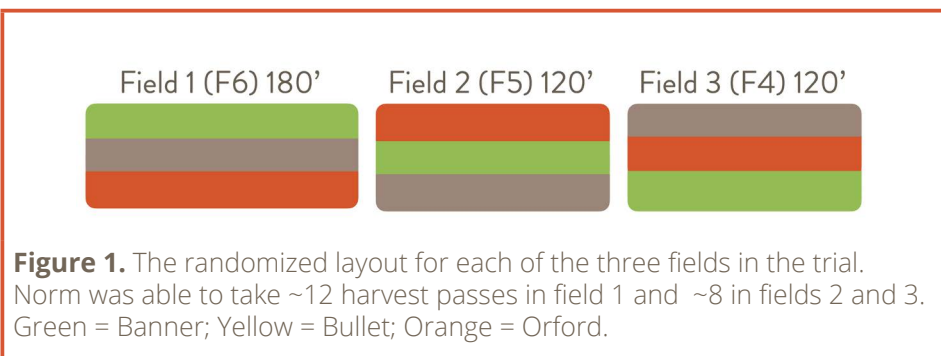
Photo 3. Banner and Bullet varieties growing on June 14, 2021.



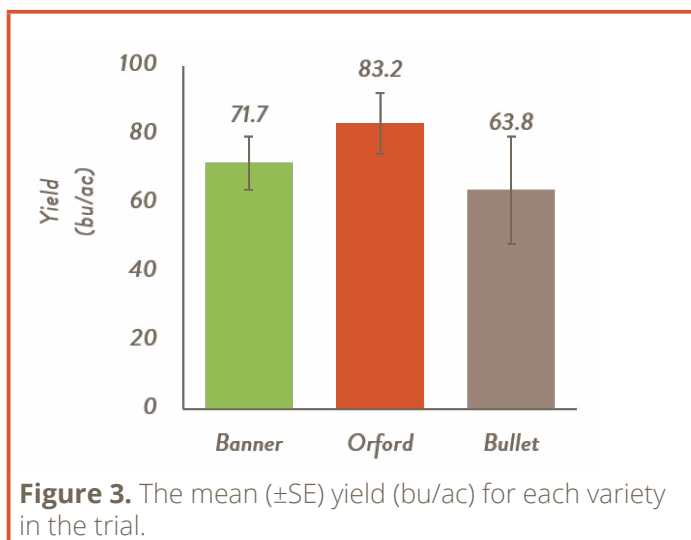
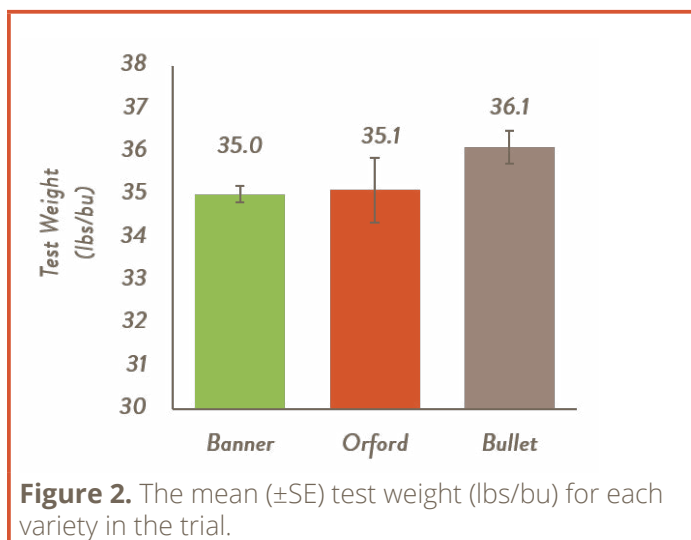
Photo 4. Field 5 at harvest. Look at that cover crop!



Photo 5. Field F, with the high N trial at harvest on August 26, 2021.







**Figure 2.** The mean ( $\pm$ SE) test weight (lbs/bu) for each variety in the trial.

**Figure 3.** The mean ( $\pm$ SE) yield (bu/ac) for each variety in the trial.

### FINDINGS

Norm experienced drought-like conditions early in the growing season. Although this allowed for a very early planting in ideal conditions, less than ~15mm of precipitation fell from May 1 through heading on June 15 resulting in a shorter crop than normal. Both emergence and stem elongation were consistent among all three varieties while heading and hard dough stage differed as seen in **Table 1**.

For test weight, Norm needed to see an LSD of 1.9 lbs/bu among the varieties to detect a significant difference in the trial. Norm found no statistically significant difference in the mean test weights ( $P=0.32$ ). Bullet had the highest test weight at 36.1 lbs/bu followed by Orford and Banner at 35.1 lbs/bu and 35.0 lbs/bu, respectively (**Figure 2**).

Similarly for yield, Norm needed to see an LSD of 22.3 bu/ac to detect a significant difference between varieties. Given this, he found no statistically significant difference ( $P=0.17$ ) in the mean yield among the three varieties. Orford had the highest yield with 83.2 bu/ac followed by Banner and Bullet at 71.7 bu/ac and 63.8 bu/ac, respectively (**Figure 3**).

Due to the high variation in the yield for Bullet among fields, we decided to compare only Orford and Banner using a T-test. The T-test was statistically significant ( $P=0.01$ ) and indicated that Orford's yield was significantly higher than Banner's.

The unreplicated side-by-side trial looking at the nitrogen response of an additional 17 lbs/ac showed some promising results. All varieties showed a response that would cover the cost of additional N per acre, but the variability was high (**Table 2**). Norm noted that the additional N helped improve plant height above the cover crop, making harvesting with a combine easier - but also noted the response from N was higher than expected. Although the side-by-side N response trial showed promising results, **more work and replication is needed to confirm these findings**.

It is interesting to note that Orford had the highest yield, but the least response to additional N. This reflects the fact that varieties differ in their ability to take up N. PhytoGene Resources Inc., which developed Orford, uses a low-N regime as part of its selection protocol in order to identify lines which have high yield potential but without requiring high levels of N.

### CAVEATS

A dry start to the growing season stunted plant height. Clover stands and weed pressure hindered the combine during harvest especially in field 1 (F6) and the Bullet variety which matured earlier and didn't green up during the late July rains causing increased variability.

**Table 1.** The mean observed date of emergence, stem elongation, heading, and hard dough stage for each variety in the trial.

	BANNER	ORFORD	BULLET
Emergence	April 11	April 11	April 11
Steam Elongation	June 2	June 2	June 2
Heading	June 14	June 16	June 2
Hard Dough	July 26	July 22	July 26

**Table 2.** Unreplicated nitrogen response side-by-side trial in Field 1 (F6), the high application received an additional 17 lbs N per acre.

VARIETY	NITROGEN APPLICATION	LBS/ACRE	INCREASE IN LBS/ACRE	NET PROFIT/AC (\$)*
Banner	Low	1501		
	High	2490	989	130.66
Orford	Low	2204		
	High	2509	305	34.62
Bullet	Low	753		
	High	1428	675	86.52

\* Net profit was calculated at a grain price of \$310.00/T and a cost of \$8.33/ac for the extra 17lbs N applied

### NEXT STEPS

Norm plans to continue to incorporate oats as a part of his crop rotation on his farm. Conducting a replicated and randomized trial on the yield benefit and return on investment of additional N at different rates would allow Norm to optimize his oat production to maximize yield and profit.

### TAKE HOME MESSAGE

Norm found that Orford performed the best out of the three varieties in the trial on his farm in eastern Ontario, and AAC Bullet had the highest test weight but the most variable yields. The addition of an underseeded cover crop of double cut red clover can cause some issues during harvest but the long-term soil health benefits outweighed these issues. In addition, the relatively early harvest of the spring cereal allowed Norm to get his winter wheat crop planted early in the fall, which might promote better wheat yields in 2022.

With the recent and growing resurgence in demand for oats for human consumption, these results shed some much needed light on ecological growing practices for other farmers interested in adding oats to their crop rotation.

“Overall the goal behind any trial, following similar management practices, is to identify a winner and we have clearly demonstrated that! Overall a success in my opinion, we learned a lot working with some of the cereal experts in our area on management practices etc., and they eagerly await the results of the trial.” - Norm Lamothe

### ACKNOWLEDGEMENTS

Norm would like to thank Joe Hickson of Midnight Acres for providing support (new seed varieties), knowledge and expertise; and Adam Bent, Eastern Territory Manager - Nufarm, for crop protection advice and expertise as an eastern Ontario oat grower.

### REFERENCES

1. A.Gaudin, et al. (2015). Wheat improves nitrogen use efficiency of maize and soybean-based cropping systems. *Agric Ecosyst Environ* 210, 1–10 (2015). <http://dx.doi.org/10.1016/j.agee.2015.04.034>.
2. A.Gaudin, et al. (2015). Increasing crop diversity mitigates weather variations and improves yield stability. *PLoS One*;10(2):e0113261.
3. K. Janovicek. (2021). Corn and soybean yields and returns are greater in rotations with wheat. *Agronomy Journal*, <https://doi.org/10.1002/agj2.20605>.
4. Practical Farmers of Iowa Cooperator Program. (2020). Oat Variety Trial 2020. <https://practicalfarmers.org/research/oat-variety-trial-2020/> (accessed October 2021).
5. Ontario Ministry of Agriculture, Food, and Rural Affairs. (2020). Area and Production Estimates by County (2004-2020) - Field Crop Statistics. <http://www.omafra.gov.on.ca/english/stats/crops/index.html> (accessed October 2021).
6. L.Schaer. (2020). Growth opportunities coming for oats - Farmtario. <https://farmtario.com/news/growth-opportunities-coming-for-oats/> (accessed October 2021).