GLACIER farmmedia

DISCOVERY FARM

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Range Road 3083,
RM of Corman Park Section 15
Northwest of Saskatoon
on Highway 16

Research Report

A Comprehensive Research Report of the 2019 Field-Scale Demonstration Trials Conducted at the Glacier FarmMedia Discovery Farm

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EXECUTIVE SUMMARY

The 2019 season saw two field-scale trials conducted at the Glacier FarmMedia Discovery farm near Langham, Saskatchewan. The Oilseed Agronomy trial was executed on a 140 ac canola field and an 80 ac soybean field and broadly examined the impact that various combinations of treatments related to seeding equipment, seeding rates, and application of nutritional products had on crop emergence and yield. The Wheat fertility trial evaluated the performance of these same two nutritional products on wheat emergence and yield in an 80 ac field. For ease of interpretation, the methodology employed and results collected within each crop are presented as separate sections of the report, as shown below. Further, the results of the soybean trial will be presented as an addendum to this report as data collection from soybean trial was not complete at the time of this report's publication. Results and discussion presented herein relate to observations collected from a single site and year, and no attempt was made to tease out statistical differences among treatments. The intention of these trials is to stimulate meaningful agronomic conversations and to inspire future experimentation on farm. Further, the trials have been conducted using commercially relevant equipment, so that Beneficial Management Practices identified through the trials may be readily adopted on farm.

OILSEED AGRONOMY TRIAL

CANOLA

Introduction

Though once associated with the vast corn and soybean acres of the Midwestern US, more row-crop planters have been seen in fields of the Canadian Prairies in recent years. Indeed, with the general trend of expanding soybean acreage on the Canadian Prairies and increased interest in examining corn as a viable crop rotation option, many growers are wondering whether or not they should invest in a planter. A planter's ability to precisely place large seeds within the furrow is well known. Whether or not this holds true for canola while still maintaining even crop emergence however, remains largely unexamined. Further, can a grower using a planter drastically reduce their seeding rate compared to what they typically use with an air drill? A field-scale demonstration project was conducted at the Glacier FarmMedia Discovery Farm to address the above questions, along with investigating the performance of two nutritional products designed to promote early crop emergence and root growth.

Methods

This field-scale trial was conducted at the Glacier FarmMedia Discovery Farm near Langham, Saskatchewan (E½ 15-39-8 W3M). A 140 ac field was equally divided into 16 blocks, and varying combinations of treatments applied to each section in an un-replicated fashion. Half of the sections were seeded with an air drill (Morris Quantum), while the other half were seeded with a row-crop planter (Horsch Maestro). For each type of seeding equipment, canola (variety PV680 LC) was seeded at a "low" and "high" rate. For the air drill, these rates were 220,000 and 435,000 seeds per acre and for the planter, they were 190,000 and 220,000 seeds per acre respectively. Seeding of all treatments occurred on May 16, 2019. A map showing the treatment layout is shown in Figure 1 below.

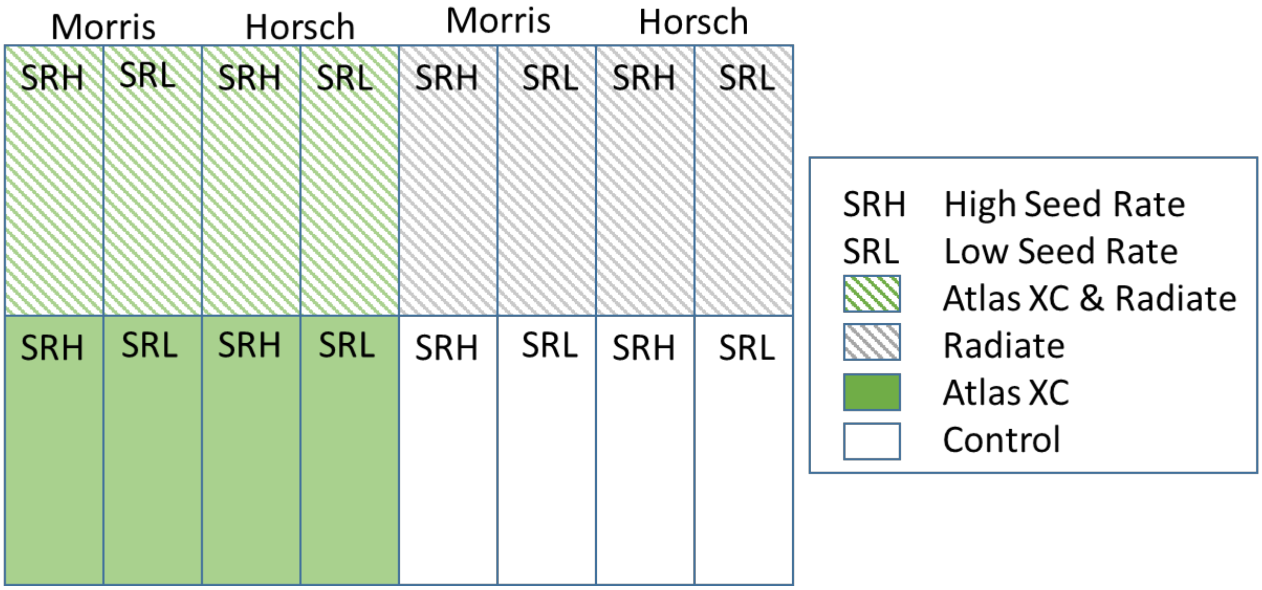

Figure 1. Field map showing treatment layout in canola Oilseed Agronomy trial.

While the rate of actual applied Nitrogen was equal in both seeding systems (target of 120 lbs N/ac), all fertility was applied at seeding with the air drill as granular 32-10-0-7, while the planter used a split application of pre-seed broadcast granular fertilizer and incorporation with a harrow followed by "starter" liquid Nitrogen (Alpine G22) at planting. The two nutritional products investigated in this trial were Atlas XC, a nutrient-mobilizing biocatalyst, and Radiate, a product composed of plant growth hormones meant to stimulate root growth. Granular monoammonium phosphate treated with Atlas XC was applied to half of the treatment blocks for each type of seeding equipment, with untreated fertilizer applied to the second half. Similarly, Radiate was applied at herbicide timing to half of the treatment blocks, while the other half served as the untreated control. Across all treatment blocks, weed control was achieved through pre-seed and in-crop application of registered herbicides applied according to label recommendations. Due to differences in maturity across treatments, half of the crop was harvested on September 19, 2019 while the other half was harvested on October 10, 2019.

It is important to note that the information presented in this article represents observations collected from a single site within a single year. Further, no attempt was made to tease out statistical differences amongst treatments. Rather, these results, along with all trials conducted on the Glacier FarmMedia Discovery Farm are meant to stimulate conversations around agronomic practices, and readers who find the results interesting are encouraged to conduct a similar trial on their operation or with their customers for further validation.

Results

Environmental Conditions

Broadly speaking, 2019 was a challenging growing season across much of the Canadian Prairies. At the Glacier FarmMedia Discovery Farm, spring soil moisture conditions were suboptimal. Early season emergence was negatively impacted, and remained variable throughout the field until the site received its first significant rainfall event of the growing season on June 15th (12 mm). Emergence vastly improved following this precipitation event, however delayed and variable germination promoted intense weed pressure and substantial variability in crop development over the growing season.

Crop Emergence

The type of seeding equipment used and application of Atlas XC fertilizer had an impact on canola emergence. Across all seeding rates, average plant stand counts were higher for the planter treatments compared to those of the air drill (Figure 2). As shown in Figure 3 below, application of Atlas XC also positively impacted canola germination as a general trend. When comparing the two equipment types at a constant seeding rate of 220,000 seeds per acre, interestingly no measurable difference in canola emergence was observed in the presence of Atlas XC application. However, in the absence of Atlas XC, slightly higher emergence was observed for the planter compared to the seeder (Figure 4).

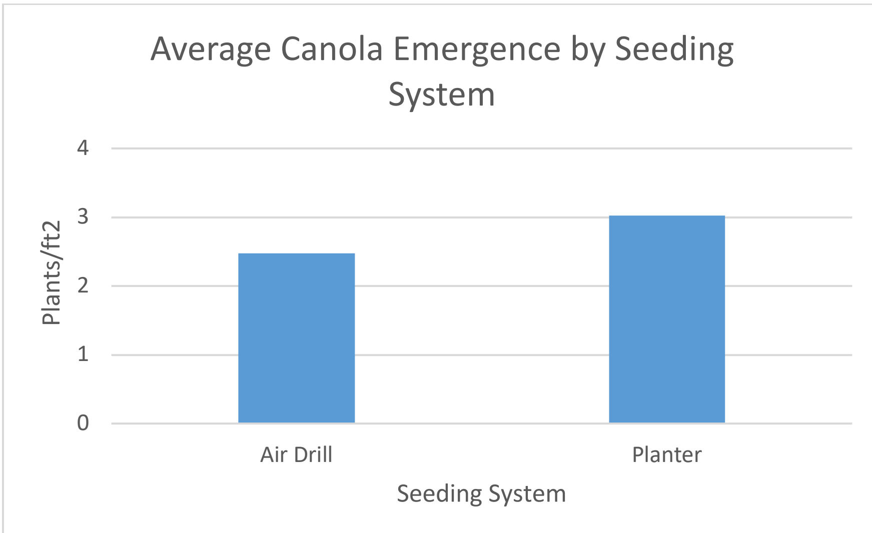

Figure 2. Average canola emergence by seeding system.

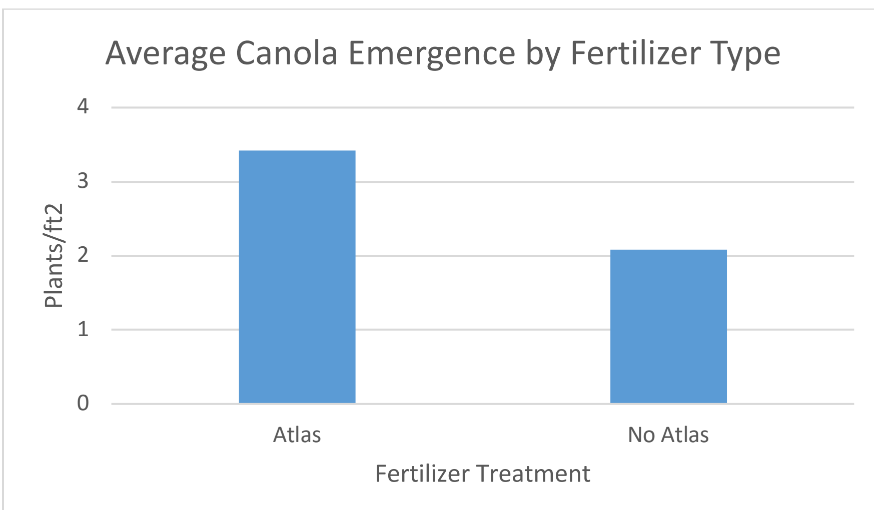

Figure 3. Average canola emergence by fertilizer type.

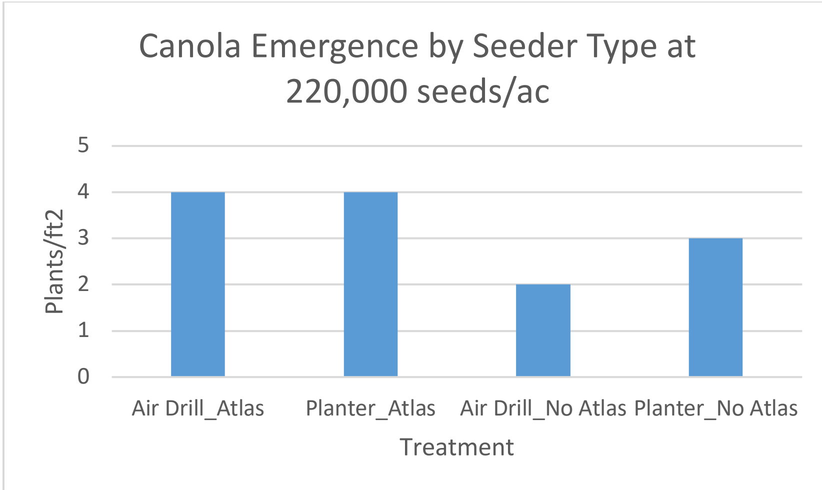

Figure 4. Average canola emergence by seeder type when seeded at common rate of 220,000 seeds per acre.

Crop Yield

Only minor differences in canola yield were observed when treatments were averaged according to seeding equipment type, with the highest yield achieved with the planter (Figure 5). While germination was positively impacted by Atlas XC treatment, canola yield was higher in the absence of Atlas XC compared to when it was applied, as shown in Figure 6. Similarly, no positive yield response was observed from Radiate application.

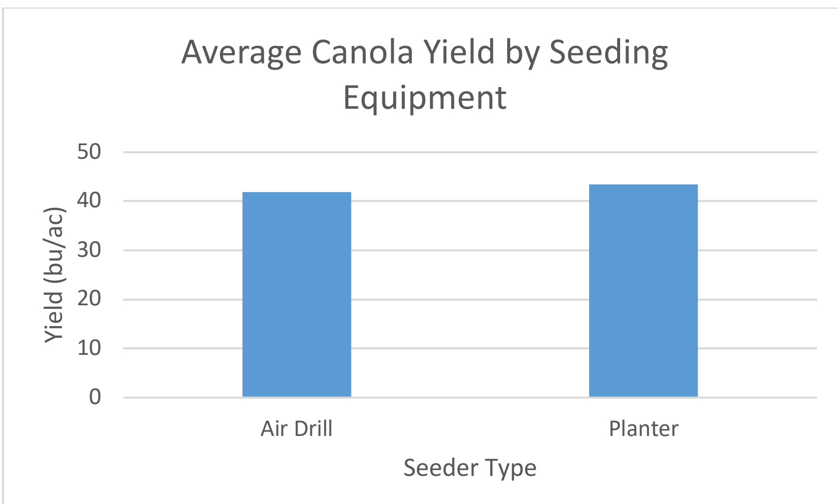

Figure 5. Average canola yield when observations were averaged according to seeder type.

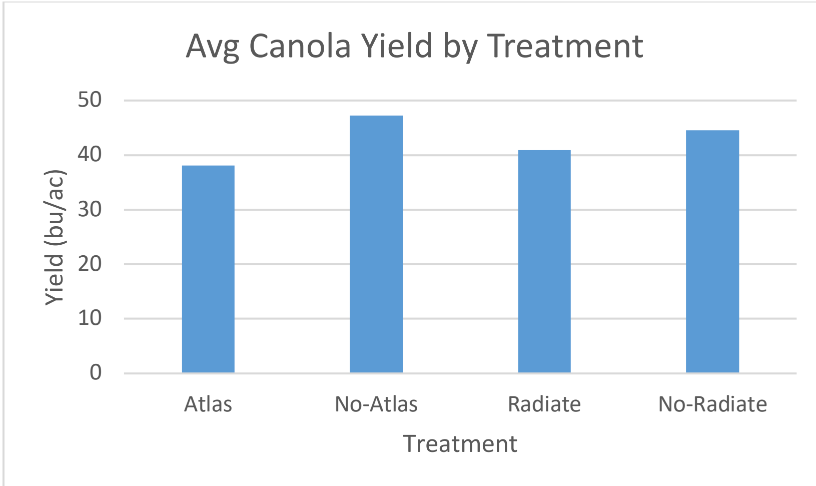

Figure 6. Average canola yield comparing Atlas and Radiate application to the untreated control.

Economic Analysis

An economic analysis of the treatments that were seeded with the air drill is presented in Table 1 below. Revenue was calculated with an assumed canola price of $10/bu. Expenses and margin are presented for each treatment, but do not take into account expenses that are relevant to all treatments including fertilizer and herbicide application. The expenses and margin are thus presented as “normalized” values. A similar analysis of the treatments seeded with the row-crop planter is presented in Table 2. For both the air drill and planter, higher normalized margins were realized in the absence of Atlas XC fertilizer compared to when it was applied. Further, regardless of the seeding equipment used, higher normalized margins were realized at the low seeding rate compared to the high rate (Figures 7 and 8).

Table 1. Economic analysis of treatments seeded with air drill.

Treatment	High Seed Rate	Low Seed Rate	Atlas XC	Radiate	Yield (bu/ac)	Revenue ($/ac)	Normalized Expenses ($/ac)	Normalized Margin ($/ac)
1	x		x	x	37	370	79.79	290.21
2	x		x		39	390	72.88	317.12
3		X	x	x	41	410	45.99	364.01
4		X	x		31	310	39.08	270.92
5	x			x	42	420	75.81	344.19
6	x				50	500	68.90	431.10
7		X		x	45	450	42.01	407.99
8		X			50	500	35.10	464.90

Table 2. Economic analysis of treatments seeded with row-crop planter.

Treatment	High Seed Rate	Low Seed Rate	Atlas XC	Radiate	Yield (bu/ac)	Normalized Revenue ($/ac)	Normalized Expenses ($/ac)	Normalized Margin ($/ac)
1	x		x	x	37	370	45.99	324.01
2	x		x		40	400	39.08	360.92
3		x	x	x	36	360	40.79	319.21
4		x	x		42	420	33.88	386.12
5	x			x	44	440	42.01	397.99
6	x				52	520	35.10	484.90
7		x		x	44	440	36.81	403.19
8		x			51	510	29.90	480.10

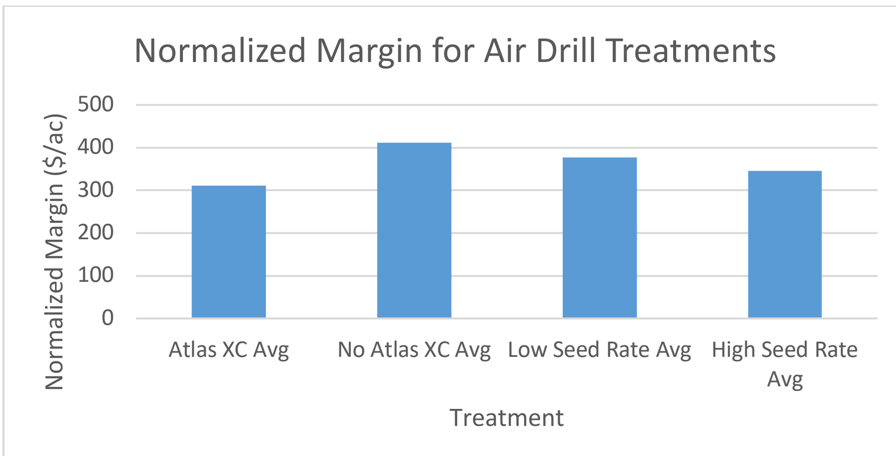

Figure 7. Normalized margin for selected treatments seeded with the air drill.

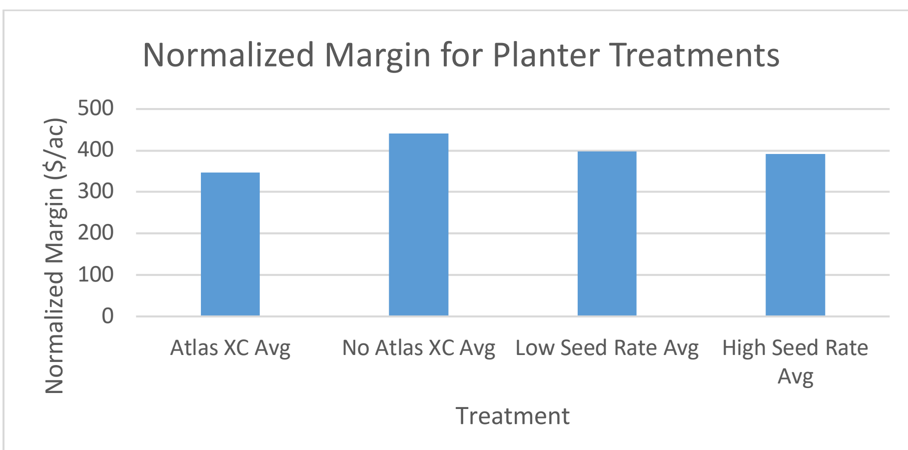

Figure 8. Normalized margin for selected treatments seeded with the row-crop planter.

Discussion

While the application of Atlas XC did not have a positive impact on crop yield at this site location, its ability to promote quick and even crop emergence in the midst of unseasonably dry conditions was clearly shown. This is unsurprising, as a plant's ability to access phosphate is critical for early root growth. Further, under the calcareous and basic soil conditions typical of the Canadian Prairies, this nutrient is relatively immobile in soil due to its strong affinity to bind with other minerals in soil. Phosphate movement in the soil profile is further inhibited under low soil moisture conditions (Brady and Weil, 2008). Atlas XC is a biocatalyst that accelerates the breakdown of phosphate fertilizer granules once applied to soil, thus increasing the pool of phosphate that is available for crop uptake (Loveland Products, Inc., n.d). This effect presumably resulted in the increased crop emergence counts compared to the untreated control (Figure 3).

The early crop emergence under the Atlas XC treatments also resulted in measurable differences in crop maturity throughout the growing season. Notably, the portions of the field receiving Atlas XC application were swathed 17 days before those that had not received Atlas XC. The environmental conditions at the Glacier FarmMedia Discovery Farm were cool and wet for much of September and October, with a snowfall event on September 28th. Consequently, the Atlas XC treated portions of the field were harvested 21 days before the untreated control, and harvesting the untreated portions at a dry moisture content was challenging. The impact of early crop development on harvest management was clearly seen in this year.

Atlas XC's ability to influence the rate of crop development may also have contributed to the lack of observed yield response from its application. The impact that air temperature at flowering has on canola yield is well documented, with daytime high temperatures of 28-30 degrees Celsius causing significant yield reductions (Canola Council of Canada, 2018). The difference in observed crop maturity from Atlas XC application exposed this treatment to a different set of environmental conditions compared to the untreated control, which may have been a factor in the lack of observed yield response. This phenomenon warrants further study, with collection of climatic data as a function of crop growth stage.

Although yield differences between the two types of seeding equipment were minor, the highest yields were recorded for those treatments seeded with the row-crop planter. Interestingly, regardless of seeding equipment used, the impact of seeding rate on crop yield was negligible. This reinforces well known observations regarding canola's plasticity. While more research is needed to revisit currently recommended seeding rates for canola, the observations from this trial suggests that growers may be able to reduce their seeding rates from "historical" values while still maintaining an acceptable yield.

Economic sustainability is also a consideration that must be taken into account when evaluating the viability of a particular product or technology. An analysis of normalized expenses and margin from the application of each treatment revealed that higher normalized margins were realized at the low seeding rate compared to the high seeding rate for each type of seeding equipment. The difference in normalized margin between the low and high seeding rate was more pronounced for the air drill because the larger range between the low and high rates (Figure 7). The economic analysis further reveals that in this study, the yield response from Atlas XC application was not able to off-set the additional expenses incurred. This must be balanced, however, with the observed ability of Atlas XC to promote early crop emergence and the positive impact that had on harvest management in the midst of challenging environmental conditions as noted above.

Strong differences are seen when examining each seeding system in light of operational efficiency. Although not always the case, in this trial all fertilizer for the portions of the field seeded with the air drill was applied at the time of seeding. Conversely, a "three-pass" system was used for the portions seeded with the row-crop planter, where the bulk of the fertilizer was pre-plant broadcast, followed by an incorporation event with a harrow, and small amounts of liquid starter fertilizer at planting. However, the planter was operated at a faster ground speed than the air drill.

Conclusion

Results from the canola portion of the oilseed agronomy trial at the Glacier FarmMedia Discovery Farm have shown that a row-crop planter's ability to precisely place large-seeded crops like corn and soybean within the furrow translates well to canola. Indeed, a grower considering adding corn or soybean into their rotation may be particularly interested in investing in a planter. However, they must consider whether or not they have access to the human and capital resources to manage a "three-pass" system of the planter compared to direct seeding with the air drill. While the highest yields were recorded from treatments seeded with the planter, differences among treatments were small. Interestingly, very little difference in yield response was shown to seeding rate, regardless of the equipment used, and the low seeding rate was consistently shown to be the most economically viable. Based solely on the results of this year's trial, growers may consider experimenting on their farm with seeding rates lower than those traditionally recommended.

While application of Atlas XC did not result in a positive yield response, its ability to influence early season crop emergence was clearly seen. The legacy of this effect was seen throughout the growing season, with the Atlas XC treated portions of the field being harvested 21 days before the untreated control. This observation was particularly desirable in a year with a cool and wet harvest season, as harvesting the untreated portions of the field at a dry moisture content proved challenging.

WHEAT FERTILITY TRIAL

Introduction

In a place historically referred to as the "world's breadbasket", wheat continues to be an important rotational crop for many growers in Saskatchewan. Through years of growing experience, many producers have recognized the importance that early crop establishment has on influencing wheat yield potential. That said, crop establishment with even emergence can be challenging at times, especially in the midst of harsh spring conditions that tend to persist on the Canadian Prairies. In response to this, several products have emerged on the marketplace, having claims of the ability to promote early-season crop growth through various mechanisms. At the Glacier FarmMedia Discovery Farm, a field-scale demonstration project was initiated to evaluate performance of two such commercially available products. Consideration was given to assessing these product's ability to influence wheat emergence and yield, along with an accompanying economic analysis.

Methods

At the Glacier FarmMedia Discovery Farm situated west of Langham, Saskatchewan (E½ 15-39-8 W3M), an 80 ac field was equally divided into four blocks to which a single treatment was applied in an unreplicated nature. Wheat (variety CDC Hughes) was seeded on May 21st at a rate of approximately 1,480,000 seeds per acre (approx. 2 bu/ac). Actual applied nutrient levels of 89-26-0-17 lbs/ac of Nitrogen (N), Phosphorus (P), Potassium (K), and Sulphur (S) respectively, were consistently applied as a dry fertilizer blend across all treatments. Atlas XC, a nutrient-mobilizing biocatalyst, and Radiate, a product composed of plant hormones meant to stimulate root growth, were the two nutritional products examined in this trial. For the "Atlas" treatment, granular monoammonium phosphate treated with Atlas XC was applied at seeding, and Radiate was applied at herbicide timing for the "Radiate" treatment. For additional comparison, both products were applied in the "Atlas XC & Radiate" treatment and neither product was applied in the untreated “Control”. A graphical representation of the treatment and field layout is shown in Figure 9 below.

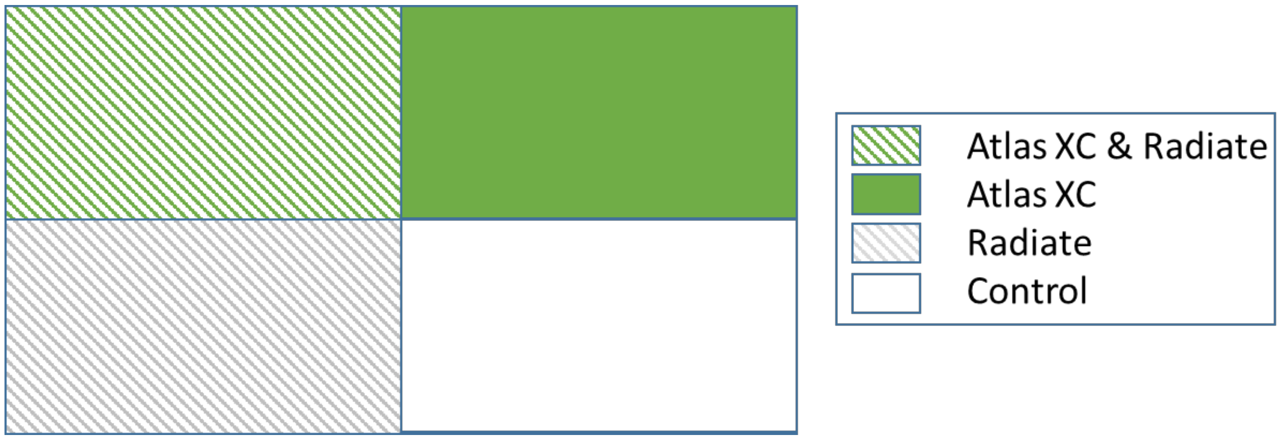

Figure 9. Field map showing treatment layout of Wheat Fertility Trial.

All field operations were carried out using commercially available equipment. Across all treatment blocks, weed control was achieved through pre-seed and in-crop application of registered herbicides applied according to label recommendations. Crop harvest occurred on October 17, 2019 with yield data being collected using a grain cart equipped with a scale.

As the reader considers the results of this trial, they should be aware that observations were collected from a single site within a single year, with no attempt to make claims of statistical differences among treatments. While there is clearly value in small-plot replicated research projects, this project has been designed at the field-scale using commercial equipment. Our intention is that the demonstrated practices can be readily implemented on farm, and as with all trials conducted at the Glacier FarmMedia Discovery Farm, these results are meant to encourage further assessment of agronomic practices. Those who find the results interesting are encouraged to evaluate these or similar products on their own farm or with their customers.

Results

Environmental Conditions

The 2019 growing season was challenging at the Glacier FarmMedia Discovery Farm, beginning with suboptimal spring soil moisture conditions. Early season wheat emergence was negatively impacted, but improved after a June 15th rainfall event of 12 mm, which represented the site’s first significant rainfall event of the growing season. Legacy effects of dry spring conditions included intense weed pressure from delayed crop emergence and substantial variability in crop development over the growing season.

Emergence and Yield

At the time of assessment, wheat emergence was slightly lower in portions of the field that received Atlas XC application compared to the untreated control (Figure 10). This trend did not persist to crop harvest, however, as higher yields were recorded for both the Atlas (57 bu/ac) and Atlas & Radiate (54 bu/ac) treatments compared to the Control (53 bu/ac) as shown in Figure 11. With an application date of June 27th, emergence counts were not collected for the Radiate treatment, as anticipated impacts were deemed negligible. The impact of Radiate application on yield was variable (Figure 11). Sole application of Radiate (41 bu/ac) resulted in lower yields compared to the control, while higher yields were recorded when both Atlas XC and Radiate were applied.

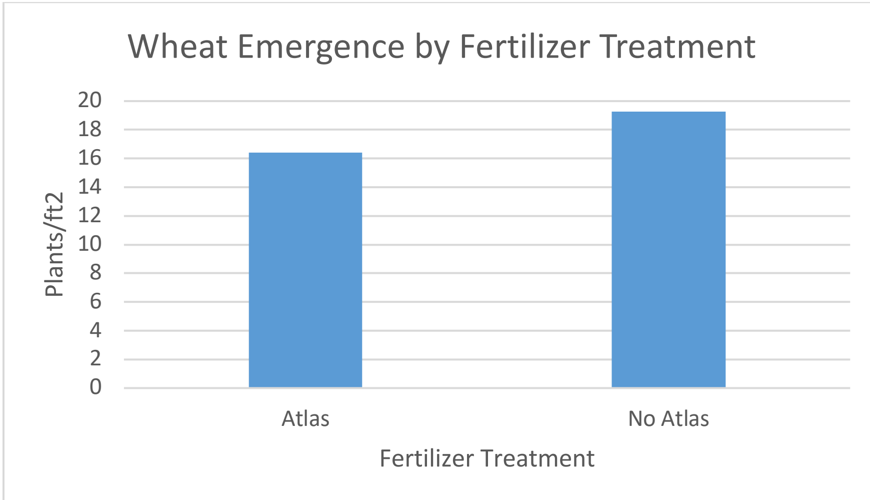

Figure 10. Wheat emergence counts by fertilizer treatment.

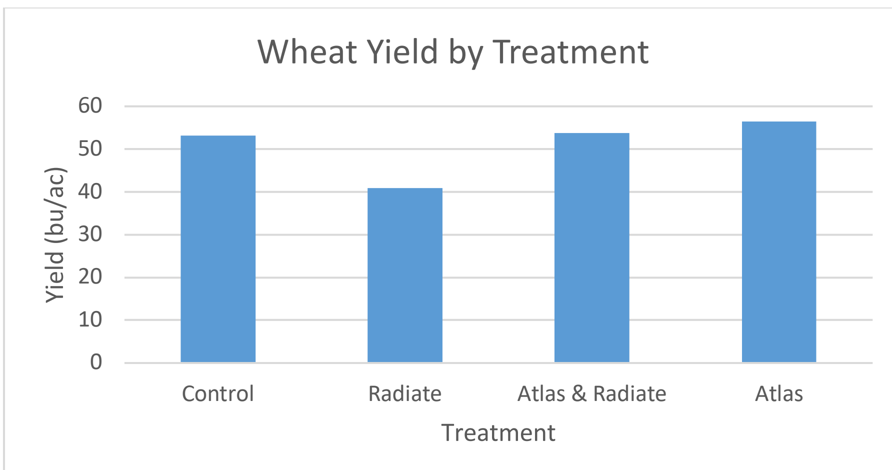

Figure 11. Wheat yield by treatment.

Economic Analysis

Table 3 below shows an economic analysis of the treatments evaluated in this trial. An assumed wheat price of $6/bu was used to calculate revenue. Revenue, expenses, and margin are presented as values normalized to the control treatment, as all other input costs were held consistent across all treatments. Application of Atlas XC alone resulted in a positive normalized margin. However, for the application of Radiate both alone and in combination of Atlas XC, the additional expenses occurred were not offset by the resulting impact on revenue.

Table 3. Economic analysis of treatments normalized to the Control.

Treatment	Yield (bu/ac)	Normalized Revenue ($/ac)	Normalized Expenses ($/ac)	Normalized Margin ($/ac)
Radiate	41	**-$72**	$6.91	**-$78.91**
Atlas XC & Radiate	54	**$6**	$9.75	**-$3.75**
Atlas XC	57	**$24**	$2.84	**$21.16**

Discussion

The harsh spring growing conditions provided an optimum backdrop to evaluate the performance of the two products demonstrated in this trial. While lower emergence counts were recorded from the portions of the field receiving Atlas XC treated fertilizer compared to those that had not, this trend was not observed at harvest. Indeed, a measurable and positive yield response was observed from both the "Atlas XC" and the "Atlas XC & Radiate" treatments compared to the Control. Rather than an antagonistic effect on emergence from Atlas XC application, variability in soil moisture levels across the field seemed to have a greater impact on crop emergence than differences in nutrient availability. As the growing season progressed and soil moisture conditions improved, the ability of Atlas XC to promote nutrient uptake, and consequently crop yield, was clearly seen. Atlas XC is a biocatalyst that accelerates the breakdown of phosphate fertilizer granules once applied to soil, thus increasing the pool of phosphate that is available for crop uptake (Loveland Products, Inc., n.d). However, this process, along with transport of phosphate within the soil profile, would be limited under low soil moisture conditions (Brady and Weil, 2008).

Wheat yield response to Radiate application was variable. Compared to the Control, lower crop yields were recorded on portions receiving Radiate alone, while the combination of Atlas XC and Radiate resulted in higher yields. Further study is warranted to continue assessment of both Radiate alone as well as any potential synergistic effects from its application along with Atlas XC. Future work could also include assessment of other variables such as the impact that Radiate application has on root biomass or nutrient uptake, which was beyond the scope of this year's trial.

Table 3 above provides an economic analysis of the treatments examined in this trial. Based on results solely from this trial, Radiate application was not found to be economically viable. When Atlas and Radiate were applied together, the additional revenue from the positive yield response was outweighed by the additional expenses occurred, resulting in a minor negative Return on Investment (ROI). The most profitable treatment in this trial was when Atlas XC was applied, resulting in a margin increase of $21.16 per acre compared to the control.

Conclusion

At the Glacier FarmMedia Discovery Farm, a field-scale trial was initiated to investigate the performance of two commercially-available products that have the ability to promote early crop emergence and root growth. While Atlas XC application did not have a positive impact on influencing wheat emergence, this product was shown to positively impact crop yield in the midst of challenging growing conditions. An economic analysis revealed its application resulted in the highest margin increase of all the products tested. The combination of Atlas XC and Radiate also resulted in a positive yield response compared to the control, but the additional revenue was outweighed by the additional expenses incurred by the application of the products. Yield response to Radiate application was variable, and warrants further study to assess its performance under different soil conditions as well as its ability to influence other growth attributes that were beyond the scope of the trial.

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