2011 Inputs to Target Very High Canola Yield 2011 Report

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ABSTRACT:

Most progressive growers attempt to optimize inputs and management practices to target high canola yield. There are a number of practices and products that have the potential to enhance yield but many growers are reluctant to use them because information on economic returns is limited. This demonstration was conducted to determine if economic yield benefits in canola can be achieved by adding inputs or management practices in which information on economic return is uncertain. The demonstration was conducted at Melfort and Scott and started with an

input/management package that targets optimum yield. Additional inputs were added individually to see if yields could be enhanced further. The additional inputs added were micronutrients, Avail treated phosphorus, increased nitrogen rates, increased seeding rates, foliar fungicide, bioboost seed treatment, soil fracturing. The final treatment was a combined application of all additional inputs. Increasing the N rate lengthened the flowering period and resulted in denser growth during flowering and podding. Yields did not differ significantly between treatments at either Scott or Melfort, indicating that applying additional inputs did not provide an economic return. Results of this demonstration suggest that growers wishing to target high yields should first ensure that their practices optimize tried and true technologies like recommended rate of seed, fertilizer and pesticides combined with optimal application methods.

Project locations: Agriculture and Agri-Food Canada (AAFC) Melfort Research Farm, Melfort Saskatchewan and AAFC Scott Research Farm (RM 380, NE 17-39-21 W3), Scott Saskatchewan

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Objectives

The objective of this demonstration was to demonstrate whether economic yield benefits can be achieved by adding inputs or management practices to a management system that already targets high canola yield.

Rationale

Most progressive growers attempt to optimize inputs and management practices to target relatively high canola yield. There are a number of products on the market that have been shown to enhance yield. Similarly these are practices that also have potential to enhance yield. However, many progressive growers are reluctant to use them because information on economic returns is lacking or limited. At the same time growers may question whether they are missing an economic opportunity by not taking advantage of such products or practices.

In an attempt to provide better information to farmers upon which to make decisions we demonstrated a number of potential yield enhancing practices and products. Descriptions of these products or practices and the rationale for including them in the demonstration are as follows:

Micronutrients are essential for plant growth but are only needed in small quantities. Most soils in the region are well equipped to meet crop micronutrient needs, but exceptions do exist. Where micronutrient deficiencies exist, adding them as fertilizers can be highly effective. Where fertilizer macronutrients are applied to target high yield there are suggestions that

imbalances between some macro and micro nutrients are created; and the applying micronutrients is an effective way of recreating an appropriate balance. To demonstrate whether this was beneficial, we applied Simplot BM86 at 1 L/ac in 10 gallons/ac of water at the start of flowering.

When phosphate fertilizer is applied to the soil a portion of the fertilizer becomes unavailable (fixed) due to reaction with iron, aluminum, calcium and magnesium in the soil solution. The proportion that is fixed in this way depends on the properties of the soil and can vary considerable in different soils. Avail is a chemical treatment that is applied to phosphate fertilizer to prevent this happening, thereby increasing the amount that crops can use and in turn increasing yield. Where high yields are being targeted, the amount of phosphate available to the crop may be a factor preventing yield responses to other yield enhancing technologies. To demonstrate the effectiveness of Avail, we compared untreated triple super phosphate fertilizer with the same fertilizer treated with Avail at the same rates as recommended by soil tests.

Recent research with high yielding canola cultivars indicated that higher rates of nitrogen (N) are needed to optimize yield compared with older lower yielding cultivars. Current cultivars have higher yield potential than even those used when this research was conducted, raising questions regarding whether they might respond to even higher N rates. To demonstrate any possible response we added a treatment where an additional 40 lb/ac of fertilizer N was applied over that recommended by soil tests.

Other recent research also indicated that adequate plant densities were needed where high yields are targeted with high fertility and high yielding cultivars. To test whether current seed rate recommendations were adequate to optimize yield we added a treatment where the seed rate was increased by 1 lb/ac.

Environments that support high canola yields are often environments that are conducive to increased foliar disease severity. In such environments, it is sometimes suggested that additional fungicide treatments are beneficial. Thus it may be advantageous to apply foliar fungicides where they are not normally used for foliar disease control, or to apply two foliar fungicides where only one treatment is typically used. To demonstrate this we applied two aplications of Lance at both Scott and Melfort. The second application of Lance occurred 7-10 days after the first application.

Recently plant growth promoting rhizobacteria (PGPR) strains have been identified that play a role in improving crop stress tolerance and ultimately yield. Bioboost is a PGPR that was developed for use on canola. It acts by colonizing the zone surrounding canola roots, improving crop vigor and enhancing yield potential of the crop. To demonstrate effects of Bioboost we added a treatment where Bioboost was applied to the crop at 0.25 l/ac at the 2-4 leaf stage of crop development.

Soil compaction, due to heavier than normal rainfall, has been cited as a potential yield limiting factor in the region. Concern has increased in the Melfort region because rain has been more abundant than normal throughout much of the canola growing area for several years. Added to this has been the widespread use of direct seeding where soil disturbance is limited, and compaction that occurs may not be corrected. To alleviate compaction, it is suggested that using coulter type tillage equipment to fracture soil near the surface. To demonstrate any benefit from this practice we obtained a prototype coulter machine and used it to fracture soil before seeding at Melfort only (a suitable machine was unavailable at Scott).

When we combine yield enhancing practices we often see yield improvement that exceeds what we would calculate based on the individual contributions of the practices applied in

isolation. This is termed a synergistic response. To demonstrate whether there were any synergies between the practices being tested, we applied all of the practices in a combined treatment.

Methodology

The study was conducted on stubble land at the NARF site at Melfort and the WARC site at Scott in 2011. The trials were seeded with medium size No-Till plot equipment at each site, as a replicated (4reps) field trial. Treatments were as follows:

Treatment 1 - Normal Inputs: Input/management package that targets optimum yield based on consensus from NARF and WARC farmer board members. At Melfort, Roundup Ready 9557 hybrid canola was sown at 5 lb/ac with fertilizer nitrogen pre seed banded at 85 lb/ac and phosphate applied at seeding at 44 lb/ac. At Scott the same cultivar was seeded at 4.5 lb/ac with N side banded at 92 lb/ac and P_2O_5 applied at 25 lb/ac. Seeding was done May ?? at Melfort and May 16 at Scott. Fertilizer potassium (K) and sulfur (S) were applied at both locations at rates adequate to ensure that these nutrients were not yield limiting. Glyphosate was applied prior to seeding and again as near as possible to the 2-3 leaf stage (180 g active/ac) of the crop, and Lance was applied (142 g/ac) at 20-50% bloom at both locations.

Treatment 2 - Add Micros: Micronutrients as Simplot BM86 were applied at 1 l/ac in 10 gallons/ac of water at the 2-3 leaf stage of the crop.

Treatment 3 – Avail: Avail treated phosphorus fertilizer was substituted for untreated at equal rates as used at each site.

Treatment 4 – Increased N: The fertilizer N rate was increased by 40 lb/ac at time of seeding.

Treatment 5 – Increased Seeding Rate: The seed rate was increased to 6 lb/ac at Melfort and 7 lb/ac at Scott.

Treatment 6 – Fungicide: A second application of Lance at 142 g/ac 7-10 days after first application was applied.

Treatment 7- Bioboost: Bioboost was applied at 8.8 oz/ac (0.25 l/ac) as a foliar treatment in a tank mix with glyphosate in at the 2-3 leaf stage of the crop.

Treatment 8 – Fracturing: Fracturing was done to break up any hardpan created by running a disc fracturing machine two times over the plots at 7 mph several days prior to seeding at Melfort only.

Treatment 9 – All treatments: Combined application of 1 through 8 at Melfort and 1 through 7 at Scott.

Results

At both locations we were able to achieve high yield with ‘normal’ inputs. This was a pre-requisite for testing the value of additional inputs under high yield conditions.

At Melfort the trial was sown on tall barley stubble that interfered with seed placement. The fracturing treatment appeared to cut the cereal straw quite effectively and visibly improved crop emergence, however emergence data was not collected at this site. Other visual effects of treatments were not evident.

Overall, increasing the N rate lengthened the flowering period by 2 days at Melfort and delayed maturity at Scott (Table 1). At Scott, increasing seed rate by 55% increased plant

density by about 25%, and hastened maturity. However, where seed rate was increased along with other inputs (combined treatment) plant density was unaffected. Effects of increased N in treatments 4 and 9 were evident as denser growth during flowering and podding, and flowering persisted longer. Test weight and dockage at Melfort and emergence ratings at Scott were generally affected in only a minor manner at both locations.

Yield varied between treatments, but when subjected to statistical analysis yield differences between treatments were not significant at either location (Table 2). At Melfort, there were weak indications of yield responses to increased seed rate or adding N, fungicides or Bioboost. Taken alone this might suggest some potential for these inputs to enhance yield. However at Scott, these same treatments either had minimal impact or tended to decrease yield. This would suggest that yield responses would be expected to be small and variable.

Table 1: Length of flower, test weight, dockage and yield of the 10 treatments at Melfort and Scott.

	Melfort			Scott		
Treatment	Flowering period (days)	Test weight (kg/hl)	Dockage (%)	Emergence Rating 1-5 (Poor-good)	Plant density (#/m2)	Flowers remaining* (%)
Normal inputs	25	67.2	0.9	4.00	38.75	30.0
Normal + micros	25	67.3	0.8	3.75	44.25	30.0
Normal + Avail	26	67.9	0.9	4.00	39.00	25.0
Normal + Nitrogen	27	67.4	0.8	3.50	35.00	57.5
Normal + incr. seed	26	67.5	1.0	4.75	48.75	17.5
Normal + Fungicide	26	67.3	0.8	4.00	41.00	30.0
Normal + Bioboost	26	67.4	0.9	3.50	38.75	32.5
Normal + Fracturing	26	67.5	0.7	na	na	na
Combined inputs	27	67.3	0.6	3.75	47.50	47.5

*Percent flowers remaining when most the normal treatment had 30% of plants with some flowers remaining was estimated for other treatments as an indicator of maturity differences.

Table 2: Yield and economic impact of adding inputs to canola where high yield is being targeted.

Treatment	Yield (bu/ac)			Average cost increase ($/ac)	Average impact* ($/ac)
	Melfort	Scott	average		
Normal Inputs	63.2	52.8	58.0	0	0
Add Micros	63.7	52.5	58.1		

Add Avail	64.0	50.0	57.0		
Add Nitrogen	66.7	53.6	60.1		
Increase seed rate	68.6	50.0	59.3		
Add Fungicides	65.7	52.2	59.0		
Add Bioboost	66.8	50.1	58.5		
Fracturing	61.8	n/a	n/a		
Add Combined	63.3	56.6	60.0		

*Impact based on canola @$12/bu

The NARF Field Day was held on July 21 and had approximately 165 people in attendance. The Scott Field Day held on July 13th had approximately 200 people in attendance. Due to poor weather during the Scott Field Day we were not able to take attendees to the location of the demonstration, but it was mentioned at the field day. The results from this project were written up in a WARC research update in the winter issue of the CCSA Prairie Steward Newsletter and also presented at the Agronomy Research Update in Saskatoon in December 2011. The results of this demonstration will be included in the NARF and WARC annual reports.

Conclusions and Recommendations

From this trial we conclude that we were unable to demonstrate yield responses to added inputs where high yield is targeted with a 'normal' input package that growers would typically use to target high yields. This is not to suggest that these inputs never have value; however it does indicate that growers will need improved tools to target specific conditions where such added inputs have consistent potential to provide economic returns.

We can make some speculations based on this project and knowledge of canola agronomy. We can speculate that soils with marginal capacity to supply micronutrients might be more responsive to foliar micronutrients, that soils with a high capacity to fix applied fertilizer phosphate would be more responsive to Avail, that soils with low capacity to supply N would be more responsive to added N, that fields with very high disease inoculum might respond to extra fungicide treatment, that fields with more serious soil compaction may respond to fracturing. Hybrid canola cultivars may have improved stress tolerance that may offset any stress benefit from products like Bioboost, and that this product may be more beneficial on non-hybrids. To move our knowledge base beyond speculation on these issues will require more development and testing of well-founded hypotheses that are beyond the scope of demonstrations like this.

Results of this demonstration suggest that growers wishing to target high yields should first ensure that their practices optimize 'tried and true technologies' like recommended rates of seed, fertilizer and pesticides combined with optimal application methods. (Note: Economic analysis is planned and will be completed as soon as we confirm all input costs).

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