Saskatchewan AgriARM Applied Research Management

Wheatland Conservation Area Inc.
Swift Current, SK.

Safe rates of side-banded and seed-placed phosphorus in canola

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ADOPT 2015

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Final Report

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Safe Rates of Side-banded and Seed-placed Phosphorus in Canola

2015 Report

Project Objectives

The objective of this project is to demonstrate the effects of increasing rates of phosphorus fertilizer on canola establishment and seed yield for both side-banded and seed-row placement.

Project Rationale

Canola is known to be a large user of phosphorus and it is well documented that high rates of seed-placed P fertilizer can reduce seedling survival and establishment in canola. While P fertilizer will typically result in higher canola seed yields when residual levels of this nutrient are low, often the response is most evident early in the season when more vigorous growth is frequently observed with P fertilization. This is sometimes referred to as a 'pop-up' effect and is usually attributed specifically to seed-placed P fertilizer; however, yields do not typically differ between these placement methods when using safe rates and both are considered equally effective for maintaining soil P fertility over the long-term. Due the large P requirements of canola and limits to how much P fertilizer can be placed in the seed-row, growers are often forced to choose between applying less than the required amount of P or seed-placing rates that will potentially result in crop injury. Alternatively, growers have the option to side-banding P fertilizer and most research has shown that this is an effective practice, despite concerns of reduced P availability early in the season relative to seed-placement. Both of the P fertilization practices being demonstrated are proven to be effective but with known risks to high rates of seed-placed P that need to be balanced with the potential early season benefits frequently associated with this placement method, bearing in mind that side-banding P is a viable alternative.

Most farmers in western Canada apply their phosphorus (P) fertilizer either directly in the seed-row or in a side-band due to both the efficiency of banded P fertilizer and convenience of application during the seeding operation. Canola is relatively sensitive to seed-placed P fertilizer; however, this crop requires a relatively large amount of P to reach maximum yield potential and replace what is removed from the soil compared to cereals. To satisfy canola's P requirements in the year of application and to maintain soil fertility, farmers are often required to apply P at rates that exceed the maximum recommended safe rates for seed placement. High rates of seed-placed P fertilizer may cause seeding damage resulting in delayed emergence, reduced plant stand, seed

yield, seed quality and increased weed competition. Traditionally, high seeding rates might be used to offset reductions in plant stand caused by fertilizer toxicity; however, farmers are reducing seeding rates in an effort to manage input costs. While side-banding P along with other fertilizer products is considered by most experts to be a relatively safe and effective method of applying P fertilizer, particularly when higher rates are required, questions on the efficacy of side-banded P fertilizer remain out of fear that it is less available early in the season.

Maximum recommended safe rates of P for canola in Saskatchewan are only 28 kg P2O5/ha of monoammonium phosphate (MAP), which may limit yield potential on soils with low P levels and pose challenges for growers who wish to adhere to a P replacement strategy. Recent research has shown that hybrid *Brassica napus* cultivars are more tolerant of seed-placed fertilizers than other *Brassica* crops and did not show injury with up to 30-40 kg P2O5/ha under laboratory conditions. In addition, field trials have demonstrated that 40 kg P2O5/ha of seed-placed MAP was low risk in terms of seedling toxicity and, when statistically significant reductions in plant stand did occur, these reductions did not affect seed yield. The nutritional benefit of the additional P offset any negative effects on seedling emergence and canola has an exceptional capacity to maintain consistent yields across a wide range of plant densities.

The study evaluated the risks and benefits of a range of side-banded and seed-placed phosphorus (P) rates for canola with respect to plant emergence / survival, early season growth and seed yield.

Methods

L130 canola was planted into wheat stubble on May 14 th, 2015 into relatively cool soil to increase the likelihood of a P response. The P treatments included 5 P fertilizer rates (20, 40, 60, 80 and 100 kg P2O5/ha) and two placement methods (side-band and seed-placed) plus a control. These 11 treatments were arranged in an RCBD with four replicates. All urea and ammonium sulphate fertilizer were placed in a side-band at a constant, non-limiting rate across all treatments and N rates were balanced across P treatments. The plots were seeded using a Fabro plot drill with 9 commercial Atom Jet openers on 9 inch spacing, and a seeding rate of 115 seeds/m2 was used for all treatments. Weeds were controlled and disease pressure was not an issue. The plots received a pre-harvest application and straight-combined. Other field note were as follows:

05-May Soil sampled trial composite sample of 0-15cm and 15-60cm
Analyzed for N,P,K,S, Texture, Ph, organic matter and EC

01-May pre-seed burnoff RT 540 @ .67 l/ac

14-May Seeded Trial:

Seeded L130 @ 6 lb/ac

Fertility: All UREA and S sidebanded across all treatments
14 lbs/ac of S (21-0-024) across all treatments
110 lb/ac of Total N balance across the treatments.

P2O5 Rates:

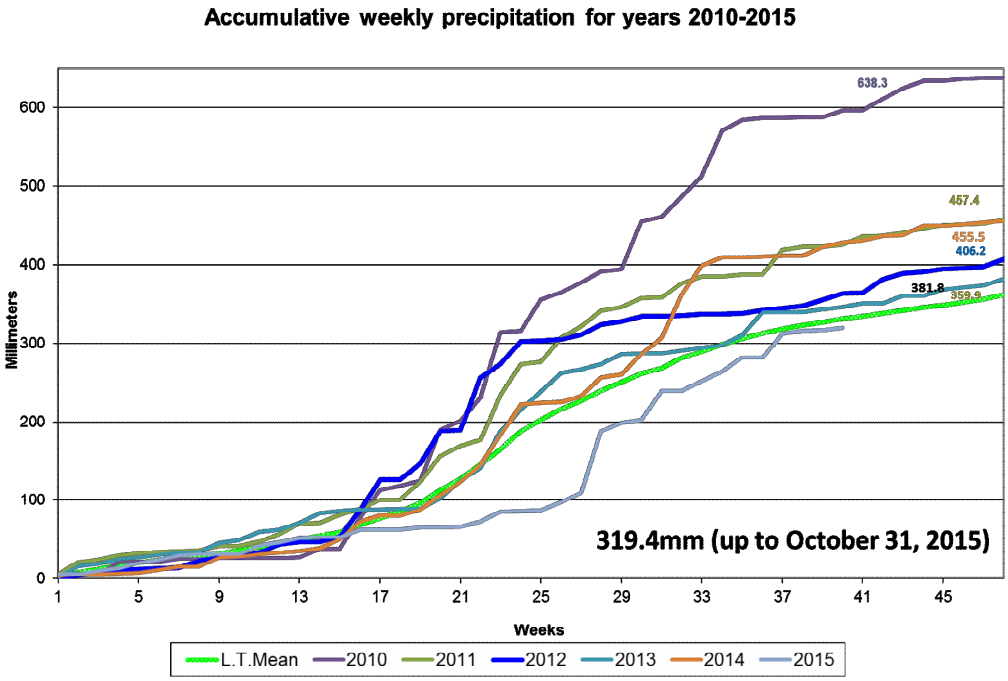
Check	0	kg/ha
Sidebanded	20	kg/ha
Sidebanded	40	kg/ha

	Sidebanded	60	kg/ha
	Sidebanded	80	kg/ha
	Sidebanded	100	kg/ha
	SeedPlaced	20	kg/ha
	SeedPlaced	40	kg/ha
	SeedPlaced	60	kg/ha
	SeedPlaced	80	kg/ha
	SeedPlaced	100	kg/ha

28-May	Emergence counts two weeks after seeding
09-Jun	Emergence counts three weeks after seeding
15-Jun	Emergence counts four weeks after seeding
15-Jun	Early season biomass taken from marked rows
22-Jun	Incrop sprayed with Liberty 150SN @ 1.35 l/ac + Centurion @ 25.4 ml/ac + Amigo @ 0.5% v/v
15-Aug	Storm with some hail went through. Minimal damage.
01-Sep	Desiccated trial with Reglone @ 0.7 l/ac + Agsurf
10-Sep	Harvested Trial: 6 rows harvested by measured plot length indicated in data spreadsheet

The following measurements were taken:
- Residual soil nutrients: Collected a composite soil sample (early spring) for analysis of N, P, K and S with texture, pH, organic matter and E.C. Required depth intervals are 0-15 cm, 15-60 cm
- Plant emergence: Measured from 2 x 1 m rows per plot at approximately 2, 3 and 4 weeks after planting.
- Early season growth: After the final emergence count was completed, we harvested the above-ground material in the marked rows (2 x 1 m per plot), dried and recorded the mass of dry matter to the nearest 0.01 g (expressed in kg/ha)
- Days to maturity: If any treatment effects are visually evident, record the julian date where approximately 60% of the seeds on the main raceme have started to turn colour.
- Grain yield: Cleaned seed and corrected to 10% seed moisture
- Seed size: Recorded mass of 1000 seeds from each plot to the nearest 0.01 g
- Green Seed: Recorded the number of distinctly green seeds in 500 seed crush

General Site Conditions



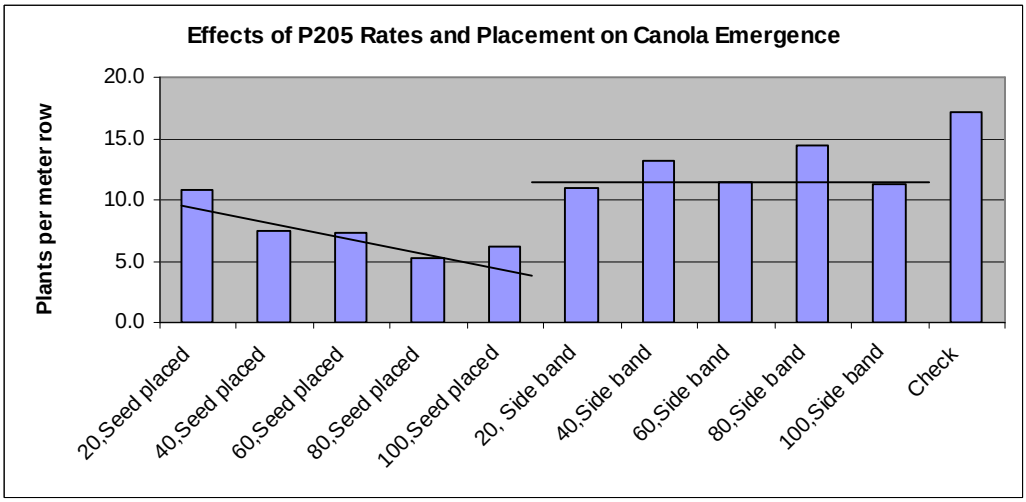
Graph 1. Accumulative weekly precipitation for years 2010-2015.

The site is situated 1 mile south of Swift Current. The soil is classified as a Swinton silty loam. For the most part in 2015, lower than average precipitation in the early growing season had a negative impact for shallow seeded crops. Severe drought like conditions continued through May, June, and July having a negative effect on yield potential and made it difficult to show treatment responses in certain trials. Overall yields for oilseed crops were lower than average due to lack of rain fall. Deeper seeded cereal crops had close to average yields. This was generally the case for area producers who experienced similar conditions resulting in similar yields.

Results

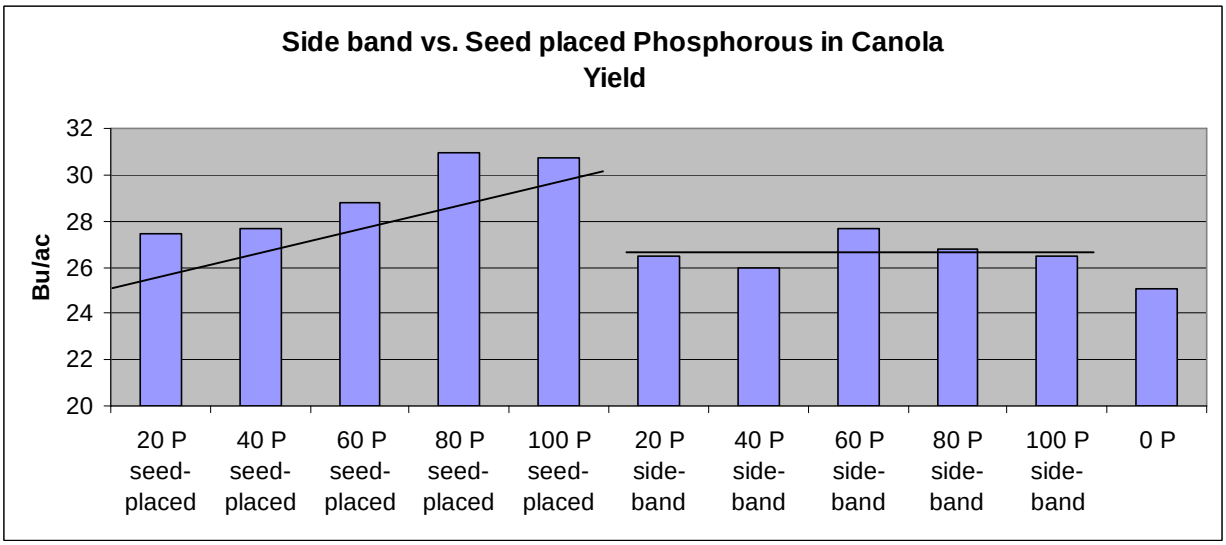
The results from this trial are typically what one would expect to see from the growing conditions we experienced in 2015. A dry start to the season showed a negative response to increasing rates of seed placed phosphorous with respect to plant emergence. This did not appear with the side banded phosphorous treatments where little response was seen from increasing rates of phosphorous. In fact, emergence counts from all seed placed phosphorous treatments were less than all emergence counts from the side banded treatments (Graph 2).

Graph 2.



The drought conditions continued throughout the early stages of the growing season. When the rains did come, growing conditions were optimum and the hybrid canola branched out very vigorously. The crop was better able to access the seed placed phosphorous compared to the side banded treatments resulting in a yield response to increasing rates of seed place phosphorous and no response to increasing rates of side banded phosphorous. However, all treatments were better than the untreated check where no phosphorous was applied (Graph 3.).

Graph 3.



Conclusions

Phosphorous is very immobile in the soil and with the drier than normal spring we expected to see problems with plant emergence when high rates of P2O5 is applied with the seed. As expected with emergence, we saw a negative response to increasing rates of seed placed phosphorous. This thinning of the plant stand did not translate into reduced yield. In fact, we saw a positive yield response to increasing seed placed phosphorous. A number of factors contributed to this response. Hybrid canola is very vigorous and can compensate for a thin stand by branching out if weather conditions are favorable. When the rains did come, growing conditions were optimum and the crop was better able to access the seed placed phosphorous compared to the side banded

treatments. Since canola is a high user of phosphorous the end result was a positive yield response to increasing rates of seed place phosphorous.

Acknowledgements

We thank the Ministry of Agriculture for all our ADOPT projects including plot signage and verbal acknowledgement at field days and on PowerPoint slides during presentations. This will continue at each venue where an extension activity occurs. We also thank Shannon Chant (Saskatchewan Ministry of Agriculture) for her help.

Summary

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This project will be promoted during Crop Production Week in Saskatoon in January and locally at Cropportunities 2016 on March 3 in Swift Current (200+ expected participants). This project was promoted on a CKSW radio program called "Walk the Plots" which we broadcast in the summer on a weekly basis. As well this topic was brought to the attention of the group on the Annual Field Day on July 16th (100 participants) as well as a number of smaller individual tours. This topic will also be posted on our website.