

Wheatland Conservation Area Inc.
Swift Current, SK.

**Seed-placed versus side-banded phosphorus fertilizer
effects on faba bean establishment and yield.**

Project #20150401

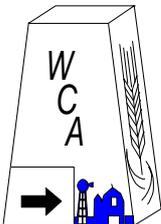
Start Date: April 1, 2016

End Date: Feb.1, 2017

ADOPT 2016

Written by
Bryan Nybo and Don Sluth
Wheatland Conservation Area Inc.

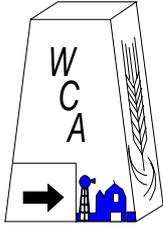
Final Report



Wheatland Conservation Area Inc.

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2016 Report

Abstract

In 2016 a trial was done in Swift Current titled "Seed-placed versus side-banded phosphorus fertilizer effects on faba bean establishment and yield". The objective of this project is to demonstrate the effects of increasing rates of phosphorus fertilizer on faba bean establishment and seed yield for both side-banded and seed-row placement. High yielding faba beans remove large amounts of P in the grain. It is suggested that a 50 bu/ac crop removes 55-67 lbs P²O⁵/ac and takes up a total 89-108 lbs/ac. Yields from this trial exceeded 50 bu/ac and we saw an increasing yield response that leveled off from 60 to 80 kg/ha. This crop is also generally seen as being sensitive to seed-placed fertilizer and, combined with the high requirements, this practice can create issues with plant injury and establishment. When placing P fertilizer in the seed-row for faba beans, it is not recommended that more than 25 kg/ha P₂O₅ be applied when using narrow openers as most modern no-till drills do. In our trial we were able to exceed these rates due to the buffering effects of abundant precipitation. In addition our AtomJet openers place the seed and phosphorous in a band that is somewhat wider than a very narrow disk drill. For side-banding, the rates that can safely be applied are higher and we saw our yield response peak out at about 60 kg/ha.

Project Objectives

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

Project Rationale

While phosphorus (P) fertilizer response in faba beans has not been thoroughly researched in Saskatchewan, the technologies being evaluated are widely available and proven to be effective with other crops. Furthermore, the basic principles of P fertility in crop production are generally understood. AARD field trials at 6 locations in Alberta over a three year period did not show a significant response to P, K or S fertilization when all sites were combined, but there was an overall tendency for higher yields with P fertilizer and the response to P was significant at two sites when looked at individually. It is worth noting, however, that the P source used in these studies was triple super phosphate (0-45-0) which is generally considered less available to crops than monoammonium phosphate (11-52-0). While most research suggests that crops respond similarly to safe rates of side-banded versus seed-placed P fertilizer, many growers prefer seed-placement and feel that the response may be superior, particularly under cool, dry conditions or

extremely low residual P levels. However, there are limits to how much P fertilizer can be placed in the seedrow before the risk of crop injury becomes unacceptably high and, for many crops/soils the rates that are considered safe fall below total crop requirements. Provincial recommendations for this crop specify that faba bean is a relatively large user of P fertilizer but also recommend that seed-placed P should not exceed 25 kg/ha when planting with drills using narrow openers.

Faba beans have been grown in limited acres on the Prairies for decades and have long been considered to be well adapted to the moister, cooler regions of Saskatchewan such the Black soil zone. While acres continue to be small, interest in this crop has been strong due to its high yield potential and ability to withstand prolonged wet periods much better than more traditional pulse crops like field pea and lentil. With the potential for increased uptake, producers need increased exposure to some of the management factors that should be considered when growing this crop. Separate field trials are in progress throughout Saskatchewan to evaluate factors such as seeding date, seeding rate, inoculation and disease management for faba beans; however, P fertilization is an important aspect of faba bean production that is not currently being addressed elsewhere.

Sound phosphorus fertility management is important for all crops, both to ensure high productivity in the year of application and also to maintain soil fertility over the long-term. While the response to fertilizer applications may vary, high yielding faba beans remove large amounts of P in the grain. For example, a 50 bu/ac crop removes 55-67 lbs P₂O₅/ac and takes up a total 89-108 lbs/ac. This crop is also generally seen as being sensitive to seed-placed fertilizer and, combined with the high requirements, questions on this practice are inevitable. When placing P fertilizer in the seed-row for faba beans, it is not recommended that more than 25 kg/ha P₂O₅ be applied when using narrow openers as most modern no-till drills do. For side-banding, the rates that can safely be applied are higher; however, some growers question the efficacy of side-banded P and are hesitant to apply P in this manner.

The proposed demonstration is intended to increase awareness of this crop, showcase its adaptation in southwest Saskatchewan and, when combined with the other faba bean agronomy trials on site, provide a forum for discussion on the production of this crop. The two factors which will be varied in the proposed field trial are P rates and P placement methods. The specific trial objectives are to demonstrate the extent to which faba beans respond to increasing P fertilizer rates and to document any negative impacts on establishment associated with high rates of seed-placed monoammonium phosphate.

Methods

This trial was established at our main site near Swift Current, Saskatchewan. To facilitate a comprehensive report, this trial was set up similar to that submitted by IHARF. The trial was established on wheat stubble south of Swift Current, Saskatchewan. A factorial combination of 4 P fertilizer rates (20, 40, 60 and 80 kg P₂O₅/ha) and 2 placement options (seed-placed versus side-banded) plus an unfertilized control were evaluated for a total of 9 treatments. The P₂O₅ source was mono-ammonium phosphate and N was not balanced across the treatments. The treatments were arranged in a Randomized Complete Block Design and replicated 4 times. The plots were seeded using a Fabro plot drill with an opener width of 1.9 cm and 23 cm row spacing, thus a seed-bed utilization of 8.2%.

A small seeded variety (Snowdrop) was chosen and the seeding rate for all treatments targeted 45 plants/m². A granular inoculant products was used and there was no additional N, K or S fertilizer applied. Weeds were controlled using registered herbicides and fungicides were utilized to ensure that disease was not a major yield limiting factor.

Data collected includes the following:

- 1) Residual Soil Nutrients: 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
- 2) Spring Plant Density: record of the actual number of plants established in 2 x 1 m paired sections of crop row at approximately 2 and 4 weeks after planting. The sections of crop row being counted was flagged during the first measurement and returned to for the second measurement.
- 3) Grain yield: Cleaned seed corrected to 16% seed moisture
- 4) Seed size: Mechanically counted and weighed 1000 seeds and convert values to g/1000 seeds.

Other field note were as follows:

Seed Place Versus Side Banded Phosphorus on Faba Bean

14-Apr-16 Soil Sampled Analyzed for NPKS, Texture, Ph, OM, E.C. (0-15cm) (15-60cm)

14-May-16 Pre-seed burnoff with RT 540 @ 0.67 l/ac

Previous durum
crop: wheat

17-May-16 Seeded Trial

Variety: **Snowdrop**

Granular Inoculant for Fababean: 3.6 lbs/ac of Tagteam

target rate: 45 plants/m² + 15%

Seeding rates: 160 lb/ac

Apron Maxx seed treatment applied to seed @ 325 ml/100kg

Seeded with fabro built 9 row plot drill, 9 inch row spacing, atomjet knife openers with one inch lateral spread.

Fertility:	Trt #	P Rate kg/ha	Placement	
	1	Check	unfertilized control	Inoculant only
	2	20P	seed placed	
	3	40P	seed placed	
	4	60P	seed placed	
	5	80P	seed placed	
	6	20P	side banded	
	7	40P	side banded	
	8	60P	side banded	
	9	80P	side banded	

6-Jun-16 Incrop sprayed with Odyssey @ 17.3 g/ac + Poast Ultra @ 190 ml/ac + Merge @ 0.5 l/100L

13-Jun-16 Plant counts (1m x 2 rows)

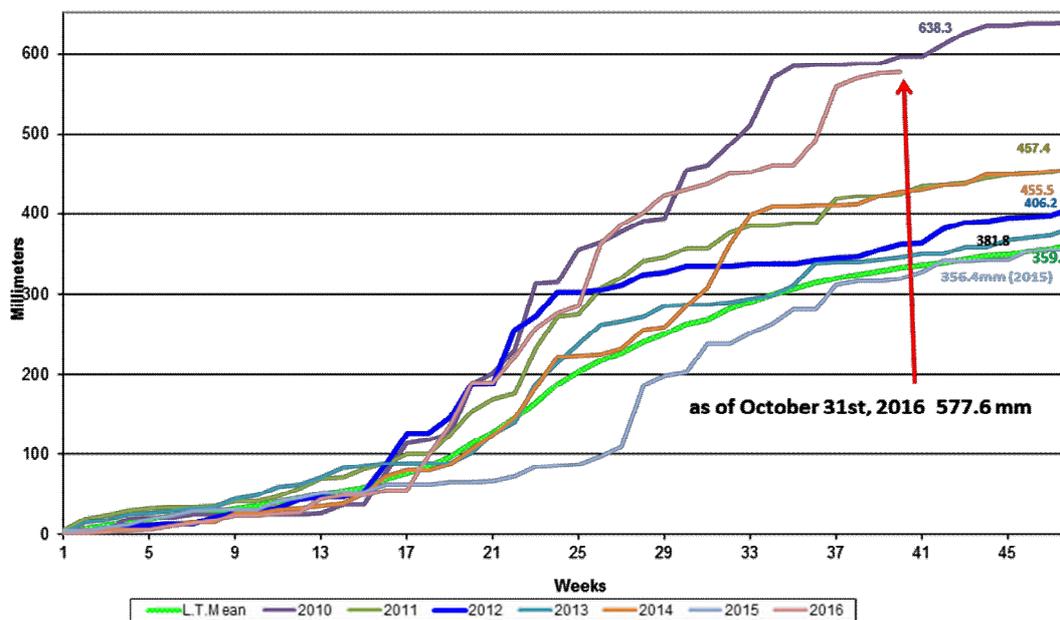
28-Jun-16 Plant counts (1m x 2 rows)

4-Jul-16 Priaxor @ 180 ml/ac at 10% flower

15-Oct-16 Combined trial

General Site Conditions

Accumulative Weekly Precipitation for Years 2010-2016

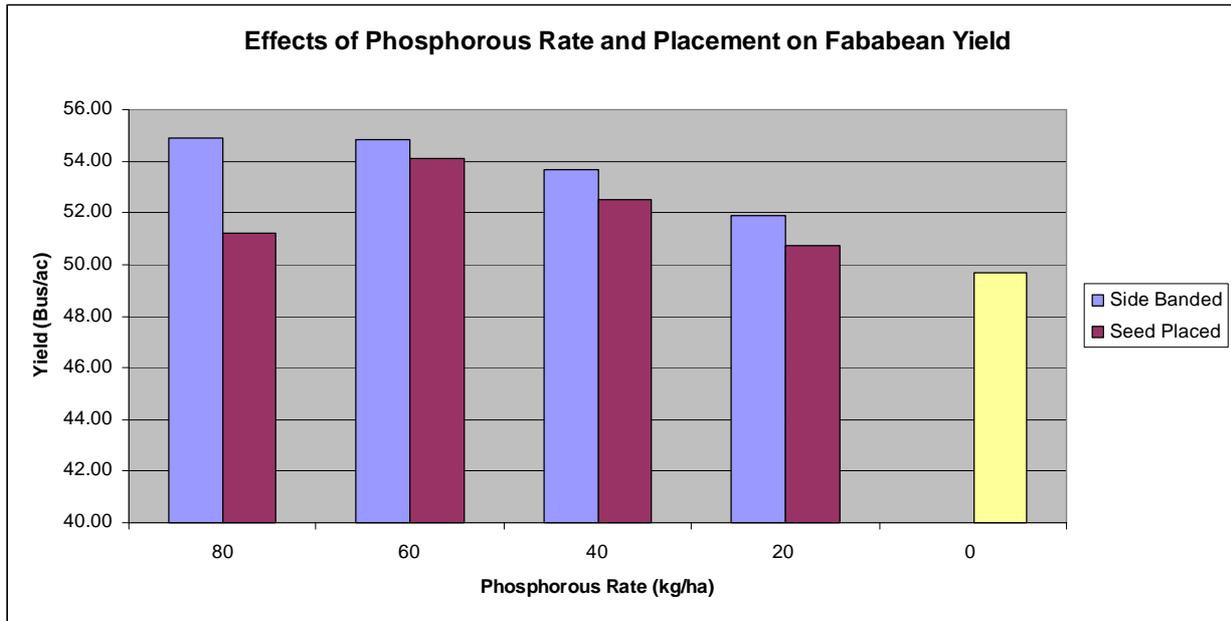


Graph 1. Accumulative weekly precipitation for years 2010-2016 (AAFC Swift Current).

Spring precipitation and soil moisture was poor, which enabled us to complete early field preparation and seeding without delay. Rain started to fall in May and continued into the growing season and through harvest. This generally resulted in good crop development and yield, however, disease and harvest delays were an issue in some cases due to abundant precipitation and two bouts of wet heavy snowfall midway through harvest.

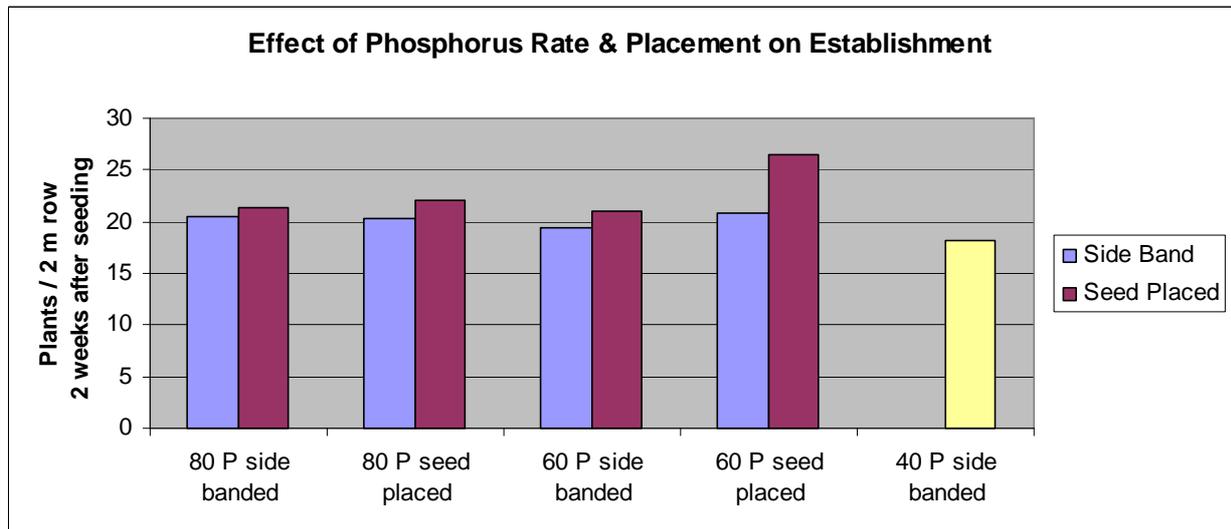
Results

The 2016 growing season was very wet which can be both good and bad when conducting fertility trials. Wet years tend to emphasize good yield responses to increasing fertility rates, however, it tends to buffer any negative effects from high rates of seed placed nutrients. We saw evidence of this in our data in 2016. We saw a good yield response to increasing rates of P^2O^5 up to 60 kg/ha with both the side band and seed placed seeding systems. From 60 to 80 kg/ha the yield response leveled off with the side band seeding system and gave a negative yield response with the seed placed seeding system. We might have expected to see a negative yield response from seed placed phosphorous at lower P^2O^5 rates, however, abundant rainfall likely had a buffer effect on plant injury. The untreated check with no P^2O^5 applied had the lowest yields (Graph 2).

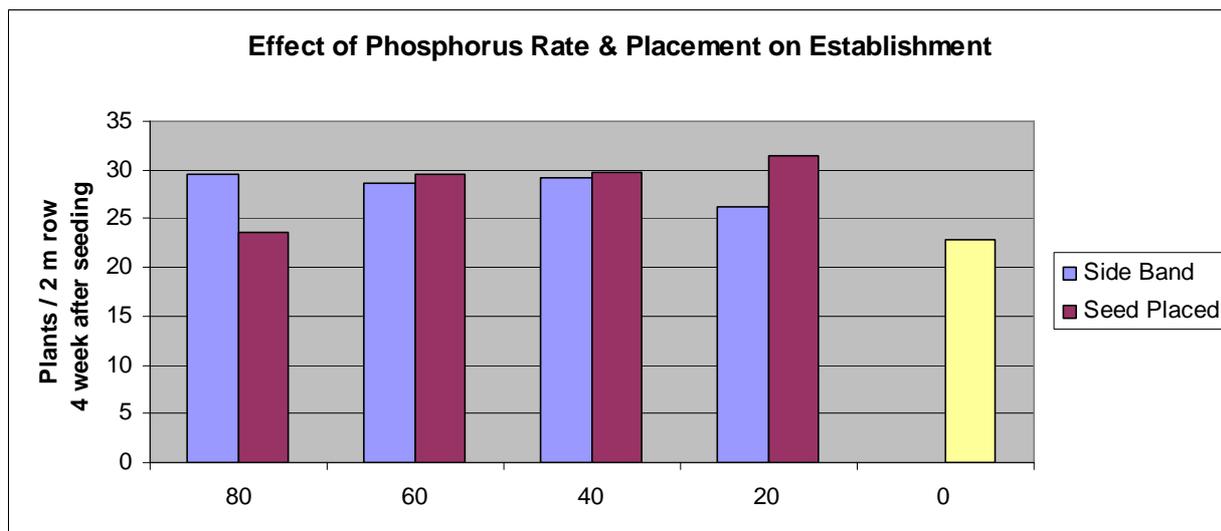


Graph 2.

Even though we saw reduced grain yield from 80 kg/ha of seed place phosphorous, we did not see early plant injury in the form of plant establishment at 2 weeks after seeding (Graph 3). We did see reduced plant establishment from 80 kg/ha of seed place phosphorous at 4 weeks after seeding, which likely continued and contributed to reduced yield from that treatment (Graph 4). Again, we might have expected to see reduced plant establishment from seed placed phosphorous at lower P₂O₅ rates, however, abundant rainfall likely buffered any negative effect on plant injury. Similar to the yield response, the untreated check with no P₂O₅ applied also had the lowest plant establishment numbers at both 2 and 4 weeks after seeding.

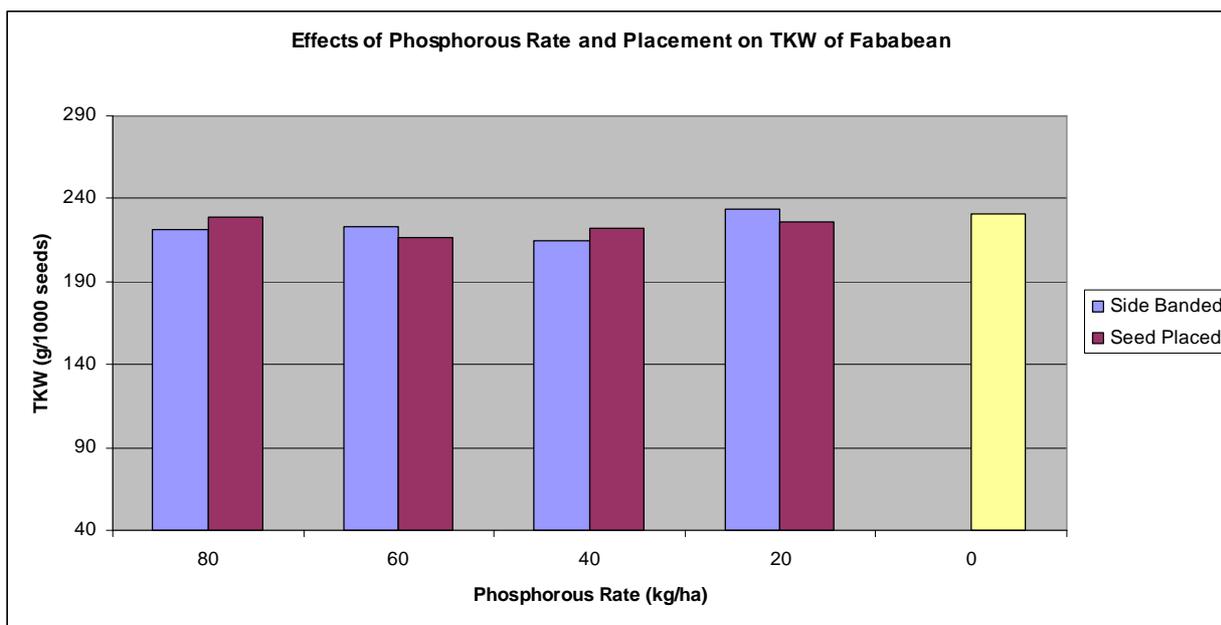


Graph 3.



Graph 4.

Phosphorous rates and placement did not appear to have any significant effect on thousand kernel weight on faba bean and no trends could be detected from the data (Graph 5).



Graph 5.

Conclusions

High yielding faba beans remove large amounts of P in the grain. It is suggested that a 50 bu/ac crop removes 55-67 lbs P²O⁵/ac and takes up a total 89-108 lbs/ac. Yields from this trial exceeded 50 bu/ac and we saw an increasing yield response that leveled off from 60 to 80 kg/ha. This crop is also generally seen as being sensitive to seed-placed fertilizer and, combined with the high requirements, this practice can create issues with plant injury and establishment. When placing P fertilizer in the seed-row for faba beans, it is not recommended that more than 25 kg/ha P₂O₅ be applied when using narrow openers as most modern no-till drills do. In our trial we were able to exceed these rates due to the buffering effects of abundant precipitation. In addition our AtomJet openers place the seed and phosphorous in a band that is somewhat wider than a very narrow disk drill. The AtomJet has an opener width of 1.9 cm and 23 cm row spacing, thus a seed-bed

utilization of 8.2%. For side-banding, the rates that can safely be applied are higher and we saw our yield response peak out at about 60 kg/ha.

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

In 2016 a trial was done in Swift Current titled "Seed-placed versus side-banded phosphorus fertilizer effects on faba bean establishment and yield". The objective of this project is to demonstrate the effects of increasing rates of phosphorus fertilizer on faba bean establishment and seed yield for both side-banded and seed-row placement.

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A small seeded variety (Snowdrop) was chosen and the seeding rate for all treatments targeted 45 plants/m². A granular inoculant products was used and there was no additional N, K or S fertilizer applied. Weeds were controlled using registered herbicides and fungicides were utilized to ensure that disease was not a major yield limiting factor.

Data collected included Residual soil nutrients, spring plant density, grain yield, and seed size.

High yielding faba beans remove large amounts of P in the grain. It is suggested that a 50 bu/ac crop removes 55-67 lbs P₂O₅/ac and takes up a total 89-108 lbs/ac. Yields from this trial exceeded 50 bu/ac and we saw an increasing yield response that leveled off from 60 to 80 kg/ha. This crop is also generally seen as being sensitive to seed-placed fertilizer and, combined with the high requirements, this practice can create issues with plant injury and establishment. When placing P fertilizer in the seed-row for faba beans, it is not recommended that more than 25 kg/ha P₂O₅ be applied when using narrow openers as most modern no-till drills do. In our trial we were able to exceed these rates due to the buffering effects of abundant precipitation. In addition our AtomJet openers place the seed and phosphorous in a band that is somewhat wider than a very narrow disk drill. For side-banding, the rates that can safely be applied are higher and we saw our yield response peak out at about 60 kg/ha.

Phosphorous rates and placement did not appear to have any significant effect on thousand kernel weight on faba bean and no trends could be detected from the data.

This project was promoted during Crop Production Week in Saskatoon in January and will be locally at Cropportunities 2017 on March 14th 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 17th (100 participants) as well as a number of smaller individual tours. This topic will also be posted on our website.





ALS Laboratory Group Agricultural Services
SOIL TEST REPORT

Phone:
1-800-667-7645

Dealer / Crop Consultant:

WHEATLAND CONSERVATION AREA INC
BOX 2015
SWIFT CURRENT, SK S9H 4M7
Phone: 306-773-4775
Fax: --
Email: wcanyh@ Sasktel.net, wcstlth@sasktel.net

Client Information:

NOT SPECIFIED

Sample / Field Information:

Crop Year 2016
Field Name INOC OPT FOR FABA
Legal Location 17 15 13 W3
Soil Climatic Zone Brown
GPS Reference
Acres 1
Previous Crop Wheat, CWRS
Yield 30
Stubble Management Spread
Rotation Continuous

Sample ID 1484165

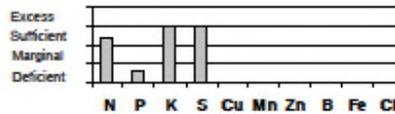
Date Sampled 14-APR-16

SOIL TEST CHARACTERISTICS

Depth (inches)	Texture	pH	E.C.		Salinity Rating	Organic Matter %	NH ₄ -N (lb/ac)	Calculated CEC meq/100g	Base Saturation				
			15-2W	Calc. Sat.					Ca	Mg	K	Na	
0-6	Loam	5.9	15-2W	0.3	Non Saline								
6-12	Loam	6.9	15-2W	1.0	Slight								

SOIL TEST NUTRIENT LEVELS

Depth (inches)	NO ₃ -N	P	K	SO ₄ -S	Cu	Mn	Zn	B	Fe	Cl
0-6	14	12	>600	>48						
6-12	10	7	425	>48						



ALS Laboratory Group
NUTRIENT RECOMMENDATION RATES (lb/ac)

Soil Available Moisture: Actual: _____ Typical: 1.5 inches

Fababeans	N	P ₂ O ₅	K ₂ O	S	Cu	Mn	Zn	B	Fe	Cl
Wet Year	0-0	30-35	0 or 15	0-0						
Normal Year	0-0	25-30	0 or 15	0-0						
Dry Year	0-0	15-20	0-0	0-0						
	0-0	25-30	0 or 15	0-0						

User Specified: Target Yield of 70 lbs/ac

Irrigation

Other Recommendations And Comments

A 0 or 15 lb/ac K₂O recommendation is made for high K soils because K may not be available to the plant in cool (particularly cool and dry) soils.
N recommendations for legumes assume appropriate inoculation of seed. Where N fixation is compromised (cool or dry soil, inoculant application problems, etc.), starter N can improve yield, particularly when side-banded.
The P₂O₅ recommendation is based on banding or seed-placement (if rate is safe). For broadcast and incorporation the P₂O₅ rate should be 2 times that shown.
K₂O recommendations < 30 lb/ac are for seed-placement or banding, and > 30 lb/ac are for broadcast and incorporation. The banding rate X 2 = the broadcast and incorporation rate.
P, K and micronutrient recommendations are based on nutrient levels in the top depth only.