1. PROJECT TITLE:

Broadleaf Herbicide and Foliar Fungicide Options for Flax

2. PROJECT NUMBER: #20120436

3. PRODUCER GROUP SPONSORING THE PROJECT

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SaskFlax and IHARF appreciated the support of FMC Canada Inc.

4. PROJECT LOCATION

This project was conducted on rented land near Agriculture and Agri-Food Canada's Indian Head Research Farm. The legal land description: NE 31 18 12 W2 (RM #156).

5. PROJECT START AND END DATES

Start date: April 1, 2013
End date: January 15, 2014

6. PROJECT CONTACT PERSONS

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7. PROJECT OBJECTIVE

To demonstrate some of the herbicide and fungicide options that are currently registered for flax in Saskatchewan and provide a forum for discussion on the advantages and disadvantages of the different products.

8. RATIONALE

There are relatively few broadleaf herbicide options for flax, those that are available have distinct modes of action and also vary in their ability to control specific spectrums of weeds. While there are important benefits to rotating modes of action, growers must also consider the specific weed populations they are aiming to control when selecting herbicides.

With respect to foliar fungicide, only Headline EC is registered for control of pasmo, the most common disease affecting flax in southeast Saskatchewan, but producers frequently question the potential return on investment for fungicide application on flax. Deciding whether or not a foliar fungicide application is warranted can be difficult. Field trials completed in recent years near Indian Head have shown a consistent response to fungicide applications on flax and past research and producer testimonials suggest that with application, higher levels of fertility are possible without lodging. This demonstration provided a forum for discussing the options for controlling broadleaf weeds and disease in flax and helped to further educate producers on this matter.

9. METHODOLOGY

Two separate field demonstrations were completed in 2013 by the Indian Head Agricultural Research Foundation (IHARF) on behalf of the Saskatchewan Flax Development Commission. The trials were located near Indian Head, Saskatchewan (R.M. #156) on an Indian Head Heavy Clay (Rego thin Black Chernozem) soil. The first of the trials focussed on broadleaf herbicide options for flax while the second demonstrated the effects of registered foliar fungicide applications on flax. The plots were arranged in a randomized complete block design (RCBD) with treatments in the broadleaf herbicide demonstration replicated four times and those in the fungicide demonstration replicated eight times. The treatments which were evaluated are listed in Table 1.

For both demonstrations the variety CDC Bethune was seeded directly into standing cereal stubble on May 13 using a Conserva-Pak plot drill equipped with 14 openers spaced 30 cm apart and a trimmed plot length of 10.5 m. The seeding rate used was 49 kg ha^{-1} and urea, monoammonium phosphate, potassium chloride and ammonium sulphate were sided banded at seeding to supply 90 kg N ha^{-1}, 22 kg P_2O_5 ha^{-1}, 11 kg K_2O ha^{-1} and 11 kg S ha^{-1} across all treatments. All plots received a pre-emergent burnoff of 590 g glyphosate ha^{-1} on May 17 and, unless dictated otherwise by the protocols, weeds were controlled with 280 g bromoxynil ha^{-1} plus 280 g MCPA ester ha^{-1} (June 24) along with two separate applications of 40 g tepraloxydim ha^{-1} (June 12 and June 28) to control multiple flushes of wild oats and a single application of 99 g pyraclostrobin ha^{-1} on July 10 to minimize the potential effects of pasmo. In the broadleaf herbicide demonstration, weeds were counted and identified in four 0.25 m2 quadrants per plot on July 11.

Check plots in the fungicide demonstration were monitored throughout the reproductive growth stages but pasmo was not observed at any point and therefore formal disease ratings were not completed. The centre five rows of each plot were straight-combined on September 23-24 using a Wintersteiger plot combine and all harvest samples were cleaned, weighed and yields were converted to kg ha^{-1} and corrected to 10% seed moisture content. Weed survey data were not statistically analysed and yield data were analysed using the GLM procedure of SAS and Fisher`s protected Least Significant Difference test with treatment differences declared significant at $P \leq 0.05$. Growing season weather data were monitored and recorded using the nearest Environment Canada weather station which was located approximately 1.75 km southwest of the field site.

Table 1. Herbicide and Fungicide Treatments	
A. Broadleaf Herbicide Treatments*	B. Fungicide Treatments**
1) No in-crop broadleaf herbicide	1) No foliar fungicide
2) 505 g MCPA ester ha^{-1}	2) 99 g pyraclostrobin ha^{-1}
3) 141 g sulfentrazone ha^{-1}	
4) 141 g sulfentrazone ha^{-1} + 280 g bromoxynil ha^{-1} + 280 g MCPA ester ha^{-1}	
5) 280 g bromoxynil ha^{-1} + 280 g MCPA ester ha^{-1}	
6) 560 g MCPA ester ha^{-1} + 100 g clopyralid ha^{-1}	

*All broadleaf herbicides were applied in 168 l ha^{-1} solution on June 24 with the exception of sulfentrazone which was applied on May 17
**Fungicide treatments applied in 224 l ha^{-1} solution on July 10

10. RESULTS

10-A. PROJECT RESULTS

<u>Weather</u>

Table 2. *Mean monthly temperatures and precipitation amounts along with long-term (1981-2010) normals for the 2013 growing season at Indian Head, Saskatchewan*

Year	*May*	*June*	*July*	*August*	*Avg. / Total*
	Mean Temperature (°C)				
2013	11.9	15.3	16.3	17.1	15.2
Long-term	10.8	15.8	18.2	17.4	15.6
	Precipitation (mm)				
2013	17.1	103.8	50.4	6.1	177
Long-term	51.8	77.4	63.8	51.2	244

There were above-average temperatures in May and cooler than normal temperatures in July; otherwise close to normal temperatures. It was drier than normal overall, but well above normal precipitation in June. It was very dry late in summer.

A: Broadleaf Herbicide Options

Table 3. Weed survey results

Weed Species	Herbicide Treatment					
	1	2	3	4	5	6
	# of weeds m^{-2}					
Wild buckwheat	6.75	9.25	1.25	0	1.5	2.0
Wild mustard	3.5	0	5.75	0	0	0
Volunteer canola	3.0	0	3.5	0	0	0
Prickly lettuce	3.0	0	0	0	0	0
Lamb's Quarters	2.75	0	0	0	0	0
Canada thistle	1.75	0.25	0.75	0.25	0	0
Thyme-leaved spurge	0.75	0.25	0	0	0	0
Stinkweed	0.25	0	0	0	0	0
Round-leaved mallow	0	0	0	0.25	0	0
Total	21.75	9.75	11.25	0.5	1.5	2.0

- Predominant weed species present were wild buckwheat, wild mustard, volunteer canola, prickly lettuce and lambs quarters.
- Sulfentrazone does not control wild mustard or volunteer canola but greatly reduced incidence of wild buckwheat and lambs quarters relative to check.
- MCPA on its own did not provide long term control of wild buckwheat but provided adequate control of most other weed species.
- Treatments 4, 5 and 6 had similar levels of weed control although wild buckwheat was most thoroughly controlled when pre-emergent sulfentrazone was used in combination with bromoxynil plus MCPA in-crop.

Table 4. Broadleaf herbicide effects on dockage and yield.

Treatment	Dockage (%)	Seed Yield (kg ha^{-1})
1) No in-crop broadleaf herbicide	29.0 a	1698 c
2) 505 g MCPA ester ha^{-1}	4.9 c	2619 b
3) 141 g sulfentrazone ha^{-1}	12.5 b	2696 ab
4) 141 g sulfentrazone ha^{-1} + 280 g bromoxynil ha^{-1} + 280 g MCPA ester ha^{-1}	3.0 c	3113 a
5) 280 g bromoxynil ha^{-1} + 280 g MCPA ester ha^{-1}	3.4 c	3058 ab
6) 560 g MCPA ester ha^{-1} + 100 g clopyralid ha^{-1}	4.0 c	2939 ab
CV	48%	12%
SE	2.2	158
Pr > F	<0.001	<0.001

- Percent dockage in the check was significantly higher than for all other treatments followed by sulfentrazone applied on its own; similar dockage levels were observed for Treatments 2, 4, 5 and 6.

- Grain yield in the check was significantly lower than all other treatments and yields for Treatments 4, 5 and 6 were very similar.

B: Foliar Fungicide Options

Table 5. Foliar fungicide effects on flax yield.	
Treatment	Seed Yield (kg ha^{-1})
1) No foliar fungicide	3040 a
2) 99 g pyraclostrobin ha^{-1}	3158 a
CV	4.0%
SE	44.0
Pr > F	0.102

- Yield difference between the check and Headline treatment was not statistically significant when this data were analysed alone; however, when combined with trial results from 5 site –years at Indian Head and Swift Current, the response at Indian Head in 2013 was in fact, significant (data not shown).

11. CONCLUSIONS AND RECOMMENDATIONS

- Flax yields were significantly reduced with excessive weed competition and increased with all herbicide treatments.
- Sulfentrazone applied on its own only controls a narrow spectrum of weeds and additional in-crop herbicide is generally recommended.
- MCPA on its own did not provide season long control of buckwheat, but was effective against many of the weeds present.
- Similar yields for remaining herbicide treatments.
- Foliar fungicide did not provide a statistically significant yield benefit in the absence of disease., however there was a tendency for higher yields with fungicide application.

12. ACKNOWLEDGEMENTS

These demonstrations were jointly funded by FMC Canada and the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward bi-lateral agreement, with in-kind support provided by Bayer CropScience and BASF.

13. APPENDICES

No additional appendices are included with this report.

14. ABSTRACT/SUMMARY

Indian Head Agricultural Research Foundation conducted a field demonstration on behalf of SaskFlax to demonstrate some of the herbicide and fungicide options that are currently registered for flax in Saskatchewan.

Two separate field demonstrations were completed. The first focused on broadleaf herbicide options for flax while the second demonstrated the effects of registered foliar fungicide applications on flax. The demonstration showed that flax yields were significantly reduced with excessive weed competition and increased with all herbicide treatments. In addition, it was found that sulfentrazone applied on its own only applies a narrow spectrum of weeds and additional in-crop herbicide is generally recommended. MCPA on its own did not provide season long control of buckwheat, but was effective against many of the weeds present. Foliar fungicide did not provide a significant yield benefit in the absence of disease.

The project was demonstrated at the IHARF Crop Management Field Day (194 attendees) on July 23, 2013 and at the Flax Crop Tour on July 25, 2013 with 68 participants.