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2021 Interim Report
for the
Saskatchewan Pulse Crop Development Board

Project Title: Faba Bean Agronomy to Enhance Yield, Hasten Maturity, & Reduce Disease
(Project #AP-2105a)

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1. **Project Code (as is in contract):** AP2105a

2. **Project Title:** Faba bean agronomy to enhance yield, hasten maturity, and reduce disease.

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5. **Introduction** (background and rationale for project, include references to original research projects where necessary)

Although much of Saskatchewan has been drier than normal the past several years, many pea and lentil growers continue to struggle with root disease and are interested in alternative pulse crop options such as faba bean. Marketing concerns aside, the Saskatchewan Pulse Growers have identified disease and maturity as two of the greatest challenges in producing this crop. The Agri-ARM sites also strive to promote diversity by working with numerous crop types and this network is well-positioned to generate results applicable to all the major crop producing regions of Saskatchewan. This project was intended to benefit farmers by demonstrating the capacity for basic agronomic practices and technologies to facilitate higher faba bean yields, reduce disease, and get the crop harvested as early as possible. An additional intended benefit was to bring attention to this less prominent crop and improve our understanding of its broader adaptation across a range of Saskatchewan environments.

Seeding dates have been evaluated on numerous occasions and generally show that faba beans should be seeded as early as possible to maximize yields and increase the likelihood that the crop will reach maturity in a timely manner. In a four-year study focussed on soybean adaptation relative to other pulse crops, faba beans seeded in early- to mid-May consistently yielded higher and matured earlier than later seeding dates and yield losses were occasionally severe when seeding was delayed until late-May or early-June (Holzapfel and Nybo, 2018). Early work in central Alberta evaluated seeding dates ranging from May 2 to June 11 and even minor delays from May 2 to May 15 resulted in a 43-47% yield loss. Delaying seeding to June 11 led to 83-85% yield losses (Kondra 1975). Over a two-year period in Winnipeg, delaying seeding from April 25 to May 23 led to

yield reductions of 28-36% while May 9 seeding resulted in a significant yield loss relative to the earliest date in 1 of 2 years (McVetty et al. 1986).

Focussing on seed rates, Shirtliffe et al. (2019) recently found that relatively low populations of 20-30 plants/m^2 were sufficient for maximum yield; however, these somewhat marginal populations could occasionally delay maturity and lead to challenges with weed competition. Kondra (1975) tested rates of 100, 150, and 200 kg/ha and only reduced yields at the lowest rate; however, information on actual plant populations or seed size were not provided. McVetty, et al. (1986) looked at seed rates of 23, 35, 46, and 58 plants/m^2 only ever reported yield reductions at the lowest rate. In combination with varying row spacing treatments and under dry conditions, Holzapfel (2018) saw a slight linear yield increase with seed rates of 25, 45, and 65 seeds/m^2; however, the effect was small with only 139 kg/ha (≈2 bu/ac) observed between the highest and lowest rates. Increasing seed rate accelerated maturity by 3 days when averaged across row spacing levels.

Faba bean response to fungicide is less well understood; however, several diseases can affect faba bean and have been observed in western Canada. Chocolate spot (*Botrytis spp.*) has traditionally been thought to be the most important of these; however, over the last two-years of monitoring and surveying there has also been Stemphylium blight and Alternaria present as presented during the Western Forum of Pest Management meetings (2019 and 2020). Ascochyta blight, powdery mildew, rust and white mould can also occur but have had limited prevalence in Saskatchewan to date. Yield increases with fungicide applications have been elusive in research to date; however, anecdotally, growers and agronomists have seen beneficial responses on occasion. There is also uncertainty surrounding the optimal timings of application and effects on maturity. Shirtliffe et al. (2019) frequently reduced disease severity with fungicide applications, but the most effective products only resulted in a 10% yield increase in 10% of the site-years. Under relatively dry conditions at Indian Head in 2015, dual fungicide applications (Headline followed by Priaxor 10 days later) did not significantly impact yield relative to the control but increased seed size from 398 g/1000 seeds to 416 g 1000/seeds (Holzapfel 2016). This increase in seed size coincided with visual differences in late-season disease severity and maturity but, without a yield response, was not economically viable.

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6. Objective(s) or purpose of the project

The objectives of the project are to demonstrate:

1. The ability of early seeding to optimize yield and allow for earlier faba bean harvest
2. The effects of higher seeding rates on disease development, maturity, and yield.
3. The capacity for foliar fungicide applications to reduce disease, enhance yield, and potentially delay maturity

7. Materials and Methods – experimental design, methods used, details of growing the crop(s), materials used, sites, etc. Statistical analysis used

Field trials with faba bean were established at seven locations which were representative of most of the major grain producing regions in Saskatchewan. Two sites were in the Brown soil zone, Swift Current which was dryland and Outlook which was irrigated. Five locations were in the Black soil zone, which is generally best suited for faba bean production. These included two southern (Redvers and Indian Head), one central (Yorkton), and two more northern (Melfort and Prince Albert) locations.

The treatments were a factorial combination of two seeding dates (early vs. delayed), two seed rates (45 vs. 65 viable seeds/m^2, and two fungicide treatments (untreated vs. treated). Early seeding was targeted for April 25 to May 7 while delayed seeding was targeted for May 20-30. The fungicide was either Priaxor® or Dyax®, depending on product availability, applied approximately 7-10 days after the initiation of flowering. These products contain the same active ingredients but in different proportions, providing 75-99 g/ha of fluxapyroxad and 99-148 g/ha pyraclostrobin. The eight treatments were arranged in a split-plot design with seeding dates as the main plots and seed rate and fungicide treatments as the sub-plots. Each treatment was replicated four times.

Seeding equipment and general crop management varied across locations, depending on equipment and other factors (i.e., environment). The plots were always direct seeded into cereal stubble. Weeds were controlled using a combination of pre-emergent and in-crop herbicides. Some locations tailored in-crop herbicide applications to the individual seeding dates while others did not. Pre-harvest herbicides or desiccants were applied at the discretion of individual site managers and the centre rows of each plot were straight combined when it was fit do so. The harvest dates were usually, but not always, tailored to the two seeding dates.

Various data were collected over the course of the growing season and from the harvested grain samples. Emergence was measured by counting plants in 4 x 1 m sections of crop row per plot and calculating the average number of plants/m^2. The Julian date where the plants were first starting to flower was recorded (not for individual plots) where the start of flowering was defined as when approximately 10% of the plants had at least one flower open. This was used to calculate days to flowering and is a useful reference for the relative timing of the fungicide applications. Disease ratings were completed for each plot at two separate stages, once just prior to the fungicide applications and again during pod filling, a minimum of two weeks after the fungicide applications but prior to senescence. The plots were rated on a scale of 0-9 where 0 = no disease, 1 = less than 10% of the plant affected, 2 = 10-20% of the plant affected, and 9 = greater than 90% of the plant infected. While these ratings are subjective, they were useful to confirm the presence of disease and the relative severity across treatments. Three locations (Indian Head, Outlook, and Prince Albert) submitted plant samples to the Saskatchewan Crop Protection Laboratory to confirm the presence of disease and identify specific pathogens. The Julian date where each plot reached maturity was recorded and used to calculate days from seeding to maturity. Maturity was defined as where approximately 80% of the pods had at least started to turn colour and 33% of the pods had completely turned (dark brown to black). Two locations (Melfort and Yorkton) measured seed moisture content immediately after combining the plots as an additional indicator of relative maturity. The other five locations missed this measurement; however, we question its utility depending on the timing of harvest, weather leading up to harvest, and whether pre-harvest herbicides or desiccants were used. Yields were determined from the mass and area of the harvested grain samples and are

corrected for dockage and to a uniform seed moisture content of 16%. Seed weight, a proxy for seed size, was determined by counting and weighing a minimum of 200 whole seeds (i.e., no splits) per plot and calculating g/1000 seeds. Mean monthly temperatures and total precipitation amounts were compiled from the nearest Environment and Climate Change Canada or privately owned weather stations.

Where appropriate, response data were analyzed using the generalized linear mixed model (GLIMMIX) procedure of SAS Studio. For plant density and initial disease ratings, only the effects of seeding date (D), seed rate (R), and the D x R interaction were included in the model as fixed effects. For the remaining variables, seeding date, seed rate, fungicide (F), and all possible two and three-way interactions were included as fixed effects. Replicate and D x Replicate interactions were always included as random effects. Tukey's range test was used to separate individual treatment means. Treatment effects and differences between means were generally considered significant at $P \leq 0.05$; however, P-values ≤ 0.10 were often highlighted as potentially important trends.

8. Results & Discussion – results presented and discussed in the context of existing knowledge and relevant literature or comparison to existing recommendations. Detail any major concerns or sources of error. Provide proper statistical significance.

Weather

Mean monthly temperatures and precipitation amounts for each location are presented relative to the long-term (1981-2010) averages for the 2021 growing season (May-September) in Tables 1 and 2, respectively. The weather in September will not always be relevant for individual seeding dates and locations, depending on when the faba beans reached maturity. Overall, the 2021 growing season was considerably warmer than the long-term average over the five months (106-112%). Precipitation amounts were often well below average; however, the extent of the drought varied from location to location. Indian Head received the most natural precipitation; however, with extremely dry initial conditions and warm temperatures, even this location was considered drier than optimal for faba beans, despite receiving 106% of average precipitation over the five months. Redvers received 85% of average precipitation over the five months; however, the total precipitation for the remaining sites ranged from 40-66% of average. Outlook was the driest of the locations with only 97 mm from May-September (40% of average); however, this site also received 218 mm of irrigation water.

Table 1. Mean monthly temperatures along with long-term (1981-2010) averages for the 2021 growing seasons at Indian Head, Scott, and Swift Current, Saskatchewan.

Location	Year	May	Jun	Jul	Aug	Sep	Avg.
		---------- Mean Temperature (°C) ----------					
Indian Head	2021	9.0	17.7	20.3	17.1	14.5	15.7 (107%)
	Long-term	10.8	15.8	18.2	17.4	11.3	14.7
Melfort	2021	9.6	18.2	20.1	16.9	14.0	15.8 (110%)
	Long-term	10.7	15.9	17.5	16.8	10.8	14.3
Outlook	2021	10.2	18.6	21.6	17.9	14.4	16.5 (108%)
	Long-term	11.5	16.1	18.9	18.0	12.3	15.4
Prince Albert	2021	9.5	18.0	19.4	16.5	13.1	15.3 (108%)
	Long-term	10.4	15.3	18.0	16.7	10.5	14.2
Redvers	2021	10.0	18.7	20.8	17.5	14.3	16.3 (106%)
	Long-term	11.1	16.2	18.7	18.0	12.5	15.3
Swift Current	2021	9.5	18.3	21.6	17.9	14.7	16.4 (109%)
	Long-term	11.0	15.7	18.4	17.9	12.0	15.0
Yorkton	2021	8.9	19.1	21	17.3	14.6	16.2 (112%)
	Long-term	10.4	15.5	17.9	17.1	11.1	14.4

Table 2. Total monthly precipitation amounts along with long-term (1981-2010) averages for the 2021 growing seasons at Indian Head, Scott, and Swift Current, Saskatchewan.

Location	Year	May	Jun	Jul	Aug	Sep	Avg.
		---------- Precipitation (mm) ----------					
Indian Head	2021	81.6	62.9	51.2	99.4	0.4	296 (106%)
	Long-term	51.7	77.4	63.8	51.2	35.3	279
Melfort	2021	31.4	37.6	0.2	69.3	7.5	146 (55%)
	Long-term	42.9	54.3	76.7	52.4	38.7	265
Outlook	2021[Z]	44.1	13.1	1.5	37.7	0.2	97 (40%)
	Long-term	42.6	63.9	56.1	42.8	34.1	240
Prince Albert	2021	28.8	63.4	3.7	55.9	6.0	158 (54%)
	Long-term	44.7	68.6	76.6	61.6	43.4	295
Redvers	2021	41.4	95.2	38.4	72.1	7.0	254 (85%)
	Long-term	60.0	95.2	65.5	46.6	32.7	300
Swift Current	2021	30.0	26.8	36.6	53.5	0.5	147 (66%)
	Long-term	42.1	66.1	44.0	35.4	34.1	222
Yorkton	2021	24.6	18.1	35.2	69.7	15.0	163 (51%)
	Long-term	51.3	80.1	78.2	62.2	44.9	317

[Z] Outlook site also received 218 mm of precipitation during the 2021 growing season

Results Across Locations

For the purposes of this interim report, data were not combined across locations and, primarily due to the extreme weather and poor growing conditions, data from several locations may need to be discarded prior to doing so. However, data from all sites were analyzed and summarized individually. To help interpret results across locations, overall F-test results for each response variable are presented across locations in Tables 11-17 of the Appendices. Aside from this, all results are organized by location and the specific results will largely be discussed one location at a time.

Site 1: Indian Head 2021

Main effect means for Indian Head 2021 are provided in Table 3 while two-way and three-way interactions are in Tables 18 and 19 of the Appendices. While the overall conditions were not ideal for faba beans, everything went well for the trial at this location and the data appeared to be of good quality. Seed moisture content at harvest was missed at this location; however, the plots were desiccated and generally uniform and dry at the time of combining. As such, we do not expect that this measurement would have provided useful information.

Establishment at Indian Head was excellent and affected by seed rate ($P < 0.001$), but not date ($P = 0.549$), and the D x R interaction was not significant ($P = 0.816$). Averaged across seeding dates, the final plant numbers were 42 and 62 plants/m^2 for the 45 and 65 seeds/m^2 rates.

Prior to the fungicide applications, low levels of disease were observed, and these ratings were affected by seeding date ($P < 0.001$) but not seed rate ($P = 0.407$). The seeding date effects were such that disease was higher with early (1.8/9) versus late seeding (0.5/9); however, it is possible that some of the reported symptoms were due to drought and environmental stressors as opposed to actual disease. For the final disease ratings, no treatment effects or interactions were significant ($P = 0.124$-0.933); however, the trend for seeding date was similar with slightly higher values recorded with early seeding. The plots were, however, damaged by hail, which was more severe with the early seeding date and difficult to distinguish from disease. The Saskatchewan Crop Protection Laboratory confirmed the presence of Chocolate Spot (*Botrytis spp.*) at this location (Fig. 1).

Maturity at Indian Head was affected by seeding date ($P < 0.001$), seed rate ($P < 0.001$), and fungicide ($P < 0.001$); however, no interactions were detected ($P = 0.196$-0.792). Seeding date had the greatest effect on maturity, with the early seeded faba beans taking 5.1 more days to mature than with delayed seeding. This is a common occurrence, generally attributable to more rapid establishment and early season growth when seeding later into warmer soils. Maturity was accelerated by 1.8 days with higher seed rates and delayed by 0.9 days with fungicide.

With an overall mean of 1856 kg/ha, yields were below average, but reasonably consistent. Yields were not affected by any of the main effects at Indian Head ($P = 0.110$-0.536) or interactions ($P = 0.237$-0.777). Individual treatments ranged from 1741-1947 with a tendency for the lowest yields with early seeding at the low rate with no fungicide and the highest yields with delayed seeding and a foliar fungicide application (Table 19).

Seed weights were affected by seeding date ($P < 0.001$) and seed rate ($P < 0.001$), but not fungicide ($P = 0.575$). The seeds were larger with delayed seeding and at the lower seed rate. The seeding date effect was likely attributable to the timing of precipitation being generally more favourable with delayed seeding. The lighter, or smaller, seeds at the higher seed rate were attributed to increased competition between seedlings at the higher populations, particularly with moisture being frequently limiting throughout the growing season. The D x R and R x F interactions were also significant (Table 18; $P < 0.001$-0.004). The D x R interaction was due to there being relatively little seed rate effect with early seeding but heavier seeds at the lower rate with delayed seeding. The R x F interaction was subtle, with a tendency for seed rate to have less impact on seed size when combined with a fungicide; however, the heaviest seeds were observed with the combination of the lower seed rate and no foliar fungicide.

Site 2: Melfort 2021

Like Indian Head, the weather at Melfort was also hotter and drier than optimal for faba beans; however, the trial went well overall and data quality was good for all variables. Main effect means for this location are provided in Table 4 while means for the 2-way and 3-way interactions are in Tables 20 and 21, respectively.

Plant densities at Melfort were affect by seed rate ($P < 0.001$), while seeding date effects were marginally significant ($P = 0.091$) and there was no D x R interaction ($P = 0.224$). The seeding date trend showed slightly better establishment with delayed seeding (44 plants/m^2) compared to early seeding (39 plants/m^2). Across seeding dates, the mean densities were 36 plants/m^2 at the 45 seeds/m^2 rate and 46 plants/m^2 at the 65 seeds/m^2 rate. Mortality was slightly higher at Melfort than Indian Head, particularly at the higher seed rate. Higher mortality at high seed rates is commonly observed and attributable to increased competition for space and moisture between seedlings.

Initial disease ratings at Melfort were affected by seeding date ($P = 0.022$) but not seed rate ($P = 0.655$) and there was no D x R interaction ($P = 0.871$). Overall, however, initial disease was extremely low at Melfort with average ratings of 0.7/9 with early seeding and 0.0/9 with delayed seeding. Under the dry conditions, disease severity did not increase as the season progressed and, for the final ratings, all values were negligible with no significant main effects or interactions ($P = 0.174$-1.000). No Saskatchewan Crop Protection Laboratory report was provided to identify species or verify the presence of disease at Melfort.

Maturity at Melfort was affected by seeding date ($P = 0.010$) but not seed rate ($P = 0.367$), fungicide ($P = 0.367$), or any interactions ($P = 0.367$-1.000). Like Indian Head and as expected, the faba beans took longer to mature when seeded early (95 days) relative to delayed seeding (89.5 days).

Melfort was one of only two locations who measured seed moisture content at harvest; however, no significant treatment effects or interactions were observed for this variable ($P = 0.062$-0.840). Seed moisture content at the time of harvest averaged 16.9%. The factor which had the greatest impact on seed moisture was fungicide ($P = 0.062$); however, the trend was not as expected with slightly higher seed moisture in the control (17.1%) relative to the treated plots (16.6%). Overall, seed moisture content was reasonably consistent, ranging from 16.4-17.3% for individual treatments.

Seed yields at Melfort averaged 2236 kg/ha and were quite consistent with low standard error values; however, like Indian Head, no significant treatment effects or interactions were detected ($P = 0.511$-0.980).

Yields were similar for all main effect means and the range for individual treatments was only 2158-2308 kg/ha.

Seed weights at Melfort were affected by seeding date (P = 0.003) but not seed rate or fungicide (P = 0.555-0.945) and no interactions were significant (P = 0.106-0.964). The seeding date effect was like Indian Head in that larger, heavier seeds were observed with delayed seeding (422 g/1000 seeds) than with early seeding (379 g/1000 seeds). Again, this was not necessarily expected but attributed to the timing of precipitation (i.e., above average rainfall in August) being more beneficial with delayed seeding.

Site 3: Outlook 2021

Outlook 2021 was amongst the driest locations but was able to alleviate this to a certain extent with irrigation. Establishment was excellent and maturity and seed weights for this location were typical; however, disease levels were negligible, and yields were reasonably high but extremely variable. The high yield variability may have been due to heat stress and, perhaps to some extent, spatially and temporally variable soil moisture. As such, it is recommended that data from this site be excluded from future combined analyses. Main effect means for Outlook 2021 are provided in Table 5 while two and three-way interactions are in Tables 22 and 23.

Plant densities at Outlook were affected by seed rate (P < 0.001) and the seeding date effect was marginally significant (P = 0.063); however, the D x R interaction was not (P = 0.815). The trend for seeding dates was for slightly better establishment with early (53 plants/m^2) versus delayed (47 plants/m^2) seeding. Focussing on seed rates, mean plant densities were 42 plants/m^2 and 58 plants/m^2 at the 45 seed/m^2 and 65 seeds/m^2 rates, respectively.

No disease was reported at Outlook either at the time of the fungicide applications or for the final ratings. All plots received a value of zero for both assessment times. As such, these data could not be statistically analyzed. Despite the lack of disease reported in the visual ratings, the Saskatchewan Crop Protection Laboratory did detect the presence of chocolate spot (*Botrytis spp.*) with a mild severity (Fig. 2).

Faba bean maturity at Outlook was affected by seeding date (P = 0.003) but not seed rate (P = 0.166), fungicide (P = 0.850), or any interactions (P = 0.240-0.989). The seeding date effect was like the previous locations whereby early seeded faba beans took 5.5 days longer to mature than with delayed seeding.

Again, while yields were relatively high at Outlook, averaging 3712 kg/ha across treatments, extreme variability made it nearly impossible to detect treatment effects and made the validity of differences between means questionable. To put the extent of this variability into perspective, the standard error values for seeding date were 15% of the average yields, compared to 2-5% for Indian Head and Melfort. According to the overall F-tests, no main effects or interactions were significant for seed yields at this site (P = 0.124-0.812).

Seed weights at Outlook 2021 were affected by seeding date (P = 0.008), while seed rate effects were marginally significant (P = 0.088). Fungicides did not affect seed size at this site (P = 0.500) and no interactions were detected (P = 0.166-0.918). The seeding date effect was opposite of Indian Head and Melfort with substantially larger/heavier seeds observed with early (461 g/1000 seeds) versus delayed (418 g/1000 seeds) seeding. For seed rates, the tendency was for heavier seeds at the lower rate (448 versus 432 g/1000 seeds).

Site 4: Prince Albert 2021

Like the other locations, Prince Albert was hot and dry relative to the long-term average, but not to the same extent as some of the sites. Yields were below what would likely be considered average for the region, but higher than more severely drought affected locations; however, high variability and unusual results make it questionable whether data from this location should be included in future combined analysis. It is possible that some of the unexplained variability may have been due to Group 2 and 4 herbicide carryover. Main effect means for Prince Albert are presented in Table 6, while those for the two and three-way interactions are in Tables 24 and 25, respectively.

Plant densities at Prince Albert were affected by seed rate ($P < 0.001$), but not seeding date ($P = 0.627$), and there was no D x R interaction detected ($P = 0.723$). The overall average plant densities were 36 and 50 plants/m^2 for the 45 and 65 seeds/m^2 seed rates.

Initial disease ratings were affected by seeding date ($P = 0.022$) but not seed rate ($P = 0.655$) or the D x R interaction ($P = 0.881$). The seeding date effect was such that initial disease severity was higher with delayed (2.1/9) versus early seeding (0.8/9). For the final disease ratings, there was no effect of seeding date ($P = 0.096$), seed rate ($P = 0.413$), fungicide ($P = 0.270$), or any interactions ($P = 0.295$-0.768). The trend for seeding dates was opposite of what was initially observed (i.e., values trended higher with early seeding) and, despite relatively high pressure, there was no trend for less disease with fungicide. The Saskatchewan Crop Protection Laboratory confirmed heavy presence of chocolate spot (*Botrytis spp.*) in addition to alternaria for this site.

Maturity was affected by seeding date ($P <0.001$) but not seed rate, fungicide, or any two-way interactions ($P = 0.470$-1.000) at Prince Albert 2021. The three-way interaction was, however, significant ($P = 0.009$). The seeding date effect on maturity was opposite of what was expected and observed for the previously discussed locations. The early seeded plots matured in 97 days, but the delayed seeding plots took 111 days to mature. While this could be explained by timing of precipitation favouring the late seeded plots to some extent, it is also possible that the actual maturity dates were missed with delayed seeding. The absolute Julian dates where each plot reached maturity were not provided for this location but estimated from dated notes on percent pod colour change. It was also noted that maturity was variable and difficult to assess due to heavy disease pressure. The three-way D x R x F interaction appeared to be due to inconsistent but unimportant variation amongst seed rate and fungicide treatments within each seeding date.

The overall average seed yield at Prince Albert was 2388 kg/ha and the main effects of both seeding date and seed rate were significant ($P = 0.016$-0.048). Neither the effects of fungicide ($P = 0.545$) or any interactions were significant at the desired probability level ($P = 0.095$-0.955). Unexpectedly, but possible given the timing of precipitation, yields were much higher with delayed (2785 kg/ha) versus early seeding (1991 kg/ha). There was also a yield advantage to the higher seed rate (2569 kg/ha) compared with the more typical 45 seeds/m^2 rate (2207 kg/ha). This seed rate response was not specifically expected as past research has shown that rates exceeding 45 seeds/m^2 are generally not advantageous with respect to yield but can potentially compete better with weeds and promote earlier maturity. The D x F interaction was marginally significant, but difficult to explain and not as expected. This interaction showed a tendency for slightly higher yields with fungicide when combined with early seeding, but a large yield reduction with fungicide with delayed seeding. Again, yield variability was extremely high at this location and these means may not be reliable. For context, the standard error for seeding date means was 473 kg/ha, 19% of the overall means, compared to 15% for Outlook (also flagged for quality issues) and 2-5% for Indian Head and Melfort.

Seed weight at Prince Albert was high overall and affected by seeding date ($P < 0.001$) but no other main effects or interactions ($P = 0.179$-0.848). Consistent with the results for both maturity and yield, the seeds were much heavier with delayed seeding (537 g/1000 seeds) versus early seeding (422 g/1000 seeds).

Site 5: Redvers 2021

Redvers 2021 had close to normal precipitation and there was good establishment on this site; however, residual Group 2 herbicide issues were suspected. This, combined with intermittent heat and drought stress, impeded crop development and greatly reduced yields. Neither seed moisture nor seed weights were measured. Data from this site will likely be excluded from future, combined analyses. Main effect means for Redvers are presented in Table 7 and those for the interactions appear in Tables 26 and 27.

Plant densities were affected by seed rate ($P < 0.001$), but not seeding date ($P = 0.413$) and there was no D x R interaction ($P = 0.120$). Across dates, 42 and 55 plants/m^2 were recorded at the 45 and 65 seeds/m^2 rates, respectively.

Essentially no disease was observed at Redvers either at the time of the fungicide applications or for the final ratings during pod fill. Individual plot ratings were 0.0/9 in nearly all cases and for both timings. Individual treatment means from the final ratings ranged from 0-0.2/9 and no main effects or interactions were

significant (*P* = 0.319-0.736). Plant samples from Redvers 2021 were not submitted to the Saskatchewan Crop Protection Laboratory for disease identification.

Maturity was affected by seeding date (*P* = 0.025) but not seed rate (*P* = 0.127) or fungicide (*P* = 0.486). Like most of the preceding locations, early seeded faba beans took longer to mature (98 days) than the later seeded plots (92 days). The trend for seed rate effects on maturity was as expected with a slight, non-significant hastening of maturity at the higher plant densities. No significant interactions were detected (*P* = 0.172-0.861).

As previously alluded to, yields were extremely low and variable at Redvers 2021. We suspect that this was largely due to residual herbicide injury combined with heat and drought induced stress. The overall average yield was 789 kg/ha, and no main effects or interactions were significant (*P* = 0.184-0.992). Given the high p-values and low yields, there no notable trends for yield at this location.

Site 6: Swift Current 2021

When this project was initiated, Swift Current was recognized as being a relatively poor environment for faba bean production due to frequent drought and heat stress – this was especially the case in 2021. That said, things went well for the trial overall with good establishment and relatively low variability for all response variables. Like many locations, seed moisture content at harvest was not recorded at Swift Current 2021. Main effect means are presented in Table 8 with interactions deferred to Tables 28 and 29, respectively.

Plant densities at Swift Current were affected by seed rate (*P* < 0.001), but not seeding date (*P* = 0.210) and there was no D x R interaction (*P* = 0.317). In general, establishment was fair with an overall average of 37 plants/m^2 at the 45 seeds/m^2 rates and 53 plants/m^2 at 65 seeds/m^2.

As expected, given the conditions, disease was negligible at Swift Current both at the time of fungicide application and for the final ratings. For the final ratings, all values were zero and, as such, this data could not be statistically analyzed. Plant samples were not submitted to the Saskatchewan Crop Protection Laboratory for this location; however, WCA staff did confirm with SPG agronomists that there was no disease at this location.

Maturity came relatively early at Swift Current 2021, not unexpected given the heat, drought, and low yield potential; however, variety may have also influenced maturity. Unlike the other locations where Snowbird was grown, the variety at Swift Current was CDC Snowdrop, which is a relatively small seeded and early maturing, but lower yielding, faba bean variety. Maturity was affected by seeding date (P = 0.019) and fungicide (*P* = 0.040), but not seed rate (*P* 0.470). The D x F effect was also significant (*P* = 0.040); however, no other interactions were (*P* = 0.470-0.884). The seeding date effect was like most other sites whereby days to maturity was longer with early versus (93.4 days) delayed seeding (88.9 days). The fungicide effect showed a slight, 0.9 day, delay in maturity with fungicide which was not necessarily expected given the lack of disease but consistent with what we would expect to see in a fungicide effect on maturity. The D x F interaction showed that this delay in maturity only occurred with the late seeding date (Table 28). A greening effect and subsequent delays in maturity have been observed with fungicide applications for a variety of crops; however, such effects are generally more apparent when disease is present.

Seed yields were affected by seeding date (*P* < 0.001) and fungicide (*P* = 0.013), but not seed rate (*P* = 0.382) or any interactions (*P* = 0.277-0.722). While yields were relatively low for all treatments, this was especially the case with delayed seeding where the overall average yield was 427 kg/ha compared to 1072 kg/ha with early seeding. The fungicide response was small in absolute terms, but substantial when expressed as a percentage of the control. Averaged across seeding dates and seed rates, yields were increased by 93 kg/ha, or 13%, with the application of a foliar fungicide. Inspection of the means and p-values for the interactions showed that this response was quite consistent. While a fungicide response was unexpected under the conditions, it is possible that low levels of disease were missed/mistaken for environmental stress during the ratings, or the fungicide application helped the plants cope with other stresses (i.e., flowering under extreme heat and drought stress).

In general, seed weights at Swift Current were quite low compared to other sites. While partly attributable to drought and heat, this was also a function of variety. CDC Snowdrop is the smallest seeded registered faba

bean, averaging 323 g/1000 seeds compared to 448 g/1000 seeds for Snowbird, according to the 2022 Saskatchewan Seed Guide. Seed weights at this location were affected by seeding date (P = 0.011) and marginally affected by seed rate (P = 0.079), but not fungicide (P = 0.244) or any interactions (P = 0.248-0.948). The seeding date effect on seed size was consistent with the yield response whereby seeds were larger with early seeding (228 g/1000 seeds) than with delayed seeding (219 g/1000 seeds). The trend associated with seed rates was for larger/heavier seeds with lower seed rates.

Site 7: Yorkton 2021

Main effect means for Yorkton 2021 are presented in Table 9 while means for the interactions are in Tables 30 and 31. Yorkton was amongst the driest locations in 2021 and, as such, both disease levels and yields were low; however, establishment was excellent, and the data generally appeared to be of good quality. Yorkton was one of only two locations who measured seed moisture at the time of harvest; however, the plots were also desiccated, and this measurement did not provide particularly meaningful insights into the relative maturity of the various treatments.

Plant densities at Yorkton were affected by both seeding date (P < 0.001) and seed rate (P < 0.001), with a marginally significant interaction (P = 0.082). The seeding date effect revealed an overall average of 50 plants/m^2 with early seeding and 60 plants/m^2 when seeding was delayed. The reason for this difference is not clear – it may have been due to warmer soils, better seed placement, or more timely precipitation with delayed seeding. The seed rate effect was as expected with 46 and 64 plants/m^2 achieved with target seed rates of 45 and 65 seeds/m^2. The marginally significant interaction was not particularly meaningful as seeding date effects were broadly consistent for both rates and vise versa.

Disease levels were negligible for both measurement times and, although occasional treatment effects were detected, they were not important due to the extremely low values. For example, seeding date effects were significant for both the initial and final ratings (P = 0.011-0.051); however, the associated main effect means never exceeded 0.4/9 and individual treatment means for the final ratings ranged from 0.0-0.3/9.

Maturity at Yorkton was affected by seeding date (P = 0.005) and seed rate (P = 0.041) along with marginally significant fungicide (P = 0.095) and D x R effects (P = 0.095). The seeding date effect differed from most locations (except Prince Albert) in that the late seeded plots (100.4 days) took longer to reach maturity than the early seeded plots (96.6 days). This may have been due to the late seeded plots benefiting more from August precipitation than the early seeded plots. The seed rate response was small, but also unusual in that maturity was delayed slightly at higher plant populations; however, with only 0.6 days difference between the two rates, this effect was of little practical importance. The marginally significant fungicide effect was such that the treated plots matured, on average, o.5 days later than the untreated plots.

Seed moisture content at harvest was affected by seeding date (P = 0.007), seed rate (P = 0.006), and fungicide (P= 0.008). Both the D x R and R x F interactions were also significant (P = 0.006-0.012). Importantly, and in contrast to most sites, both seeding dates were desiccated and harvested at the same time for this location. The seeding date effect was as expected with higher moisture content with delayed seeding (12.8%) compared to early seeding (11.9%). Aside from this, significant treatment differences were generally small and often difficult to explain. The seed rate effects were consistent with those reported for maturity, but opposite of what was expected, with slightly higher moisture content observed at higher plant densities. The fungicide effects were also opposite of what was expected and, additionally, inconsistent with the maturity notes. The D x R interaction was due to seed rate effects only appearing with delayed seeding. The R x F interaction was due to fungicide effects only being evident at the higher seed rate. Again, other than seeding date effect, these responses were not particularly meaningful or valuable.

Yields at Yorkton 2021 were well below what we might have anticipated for this location, but not unexpectedly so given the extreme drought and heat. Interestingly and, perhaps surprisingly under the conditions, the only significant treatment effect was for fungicide (P = 0.005). Fungicides application resulted in a yield increase of 233 kg/ha, relatively small in absolute terms, but an increase of 24% when expressed relative to the control. While this response was not expected given the low levels of disease, it was consistent with Swift Current (another severely drought affected location) and appeared to be genuine as the overall

yield variability was relatively low and the response was consistent when means for the interactions were inspected.

Seed weight was quite variable at Yorkton but, like yield, affected by fungicide (P = 0.017) but no other main effects or interactions (P = 0.206-0.639). The fungicide effect on seed weight was opposite of what was observed for yield in that the seeds were lighter (i.e., smaller) with fungicide (406 g/1000 seeds) than without (423 g/1000 seeds). While we do not have the data to confirm this and it is only speculation, it is possible that the fungicide applications helped the plants retain flowers and form pods while flowering under extreme heat and drought stress. As the dry conditions persisted, the pods may have filled better when there were fewer of them per plant or for a given area, ultimately leading to heavier/larger seeds. There were also trends for larger seeds with early seeding (which coincided with fewer plants) and at the lower seed rate; however, with relatively high variability, these trends were not significant. Like yield, the fungicide effects on seed weight were quite consistent across both seeding dates and seed rates.

Table 3. Treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Indian Head in 2021.

Main Effect	Plant Density	Initial Disease	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Seeding Date	--- plants/m^2 ---	-------- 0-9 -------	-------- 0-9 -------	------- days -------	------ kg/ha ------	--------- % ---------	- g/1000 seeds -
Early	52.8 A	1.8 A	2.2	103.2 A	—	1818 A	414.3 B
Delayed	51.7 A	0.5 B	0.9	98.1 B	—	1893 A	449.5 A
S.E.M.	1.02	0.14	0.41	0.12	—	89	2.9
Pr > F (p-value)	0.549	0.001	0.146	<0.001	—	0.536	0.004
Seed Rate							
45 seeds/m^2	42.0 B	1.2 A	1.4 A	101.6 A	—	1835 A	442.6 A
65 seeds/m^2	62.4 A	1.1 A	1.7 A	99.8 B	—	1876 A	421.2 B
S.E.M.	1.16	0.15	0.29	0.16	—	72.9	2.68
Pr > F (p-value)	<0.001	0.407	0.284	<0.001	—	0.295	<0.001
Fungicide							
Control	—	—	1.6 A	100.2 B	—	1824 A	430.8 A
Treated	—	—	1.6 A	101.1 A	—	1887 A	433.0 A
S.E.M.	—	—	0.29	0.16	—	72.9	2.68
Pr > F (p-value)	—	—	0.933	<0.001	—	0.11	0.575

Table 4. Treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Melfort in 2021.

Main Effect	Plant Density	Initial Disease	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Seeding Date	--- plants/m^2 ---	-------- 0-9 -------	-------- 0-9 -------	------- days -------	--------- % ---------	------ kg/ha ------	- g/1000 seeds -
Early	38.8 A	0.7 A	0.1 A	95.0 A	16.9 A	2227 A	379.3 B
Delayed	43.5 A	0.0 B	0.1 A	89.5 B	16.8 A	2244 A	421.6 A
S.E.M.	1.25	0.07	0.03	0.67	0.13	38.8	4.86
Pr > F (p-value)	0.091	0.008	1.000	0.010	0.62	0.822	0.003
Seed Rate							
45 seeds/m^2	36.1 B	0.3 A	0.1 A	91.8 A	16.7 A	2257 A	400.3 A
65 seeds/m^2	46.1 A	0.4 A	0.1 A	92.7 A	17.0 A	2214 A	400.6 A
S.E.M.	1.29	0.06	0.02	0.67	0.17	55.1	4.97
Pr > F (p-value)	<0.001	0.627	1.000	0.367	0.184	0.691	0.945
Fungicide							
Control	—	—	0.1 A	92.7 A	17.1 A	2267 A	398.9 A
Treated	—	—	0.0 A	91.8 A	16.6 A	2204 A	402.0 A
S.E.M.	—	—	0.02	0.67	0.17	55.1	4.97
Pr > F (p-value)	—	—	0.174	0.367	0.062	0.557	0.555

Table 5. Treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Outlook in 2021.

Main Effect	Plant Density	Initial Disease	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Seeding Date	--- plants/m^2 ---	-------- 0-9 -------	-------- 0-9 -------	------- days -------	--------- % ---------	------ kg/ha ------	- g/1000 seeds -
Early	52.9 A	0	0	101.5 A	—	3994 A	461.4 A
Delayed	47.1 A	0	0	96.0 B	—	3429 A	417.9 B
S.E.M.	1.66	—	—	0.46	—	552.5	14.1
Pr > F (p-value)	0.063	—	—	0.003	—	0.187	0.008
Seed Rate							
45 seeds/m^2	41.7 B	0	0	99.2 A	—	3869 A	447.5 A
65 seeds/m^2	58.3 A	0	0	98.3 A	—	3554 A	431.8 A
S.E.M.	1.59	—	—	0.46	—	540.2	14.3
Pr > F (p-value)	<0.001	—	—	0.166	—	0.199	0.088
Fungicide							
Control	—	—	—	98.8 A	—	3903 A	436.6 A
Treated	—	—	—	98.7 A	—	3521 A	442.6 A
S.E.M.	—	—	—	0.46	—	540.2	14.3
Pr > F (p-value)	—	—	—	0.850	—	0.124	0.500

Table 6. Treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Prince Albert in 2021.

Main Effect	Plant Density	Initial Disease	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Seeding Date	--- plants/m^2 ---	-------- 0-9 -------	-------- 0-9 -------	------- days -------	------ kg/ha ------	--------- % ---------	- g/1000 seeds -
Early	42.1 A	0.8 B	2.3 A	97.1 B	—	1991 B	421.5 B
Delayed	43.3 A	2.1 A	1.7 A	111.4 A	—	2785 A	537.4 A
S.E.M.	1.2	0.15	0.39	0.19	—	457.6	10.97
Pr > F (p-value)	0.627	0.022	0.096	<0.001	—	0.016	<0.001
Seed Rate							
45 seeds/m^2	35.6 B	1.5 A	1.8 A	104.3 A	—	2207 B	486.9 A
65 seeds/m^2	49.8 A	1.4 A	2.2 A	104.3 A	—	2569 A	472.1 A
S.E.M.	1.42	0.098	0.43	0.2	—	458.5	11.8
Pr > F (p-value)	<0.001	0.655	0.413	1.000	—	0.048	0.179
Fungicide							
Control	—	—	1.8 A	104.1 A	—	2440 A	477.5 A
Treated	—	—	2.2 A	104.4 A	—	2336 A	481.4 A
S.E.M.	—	—	0.43	0.2	—	458.5	11.8
Pr > F (p-value)	—	—	0.270	0.470	—	0.545	0.715

Table 7. Treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Redvers in 2021.

Main Effect	Plant Density	Initial Disease	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Seeding Date	--- plants/m^2 ---	-------- 0-9 -------	-------- 0-9 -------	------- days -------	------ kg/ha ------	--------- % ---------	- g/1000 seeds -
Early	46.7 A	0.0 A	0.1 A	98.3 A	—	913 A	—
Delayed	50.1 A	0.0 A	0.0 A	92.1 B	—	665 A	—
S.E.M.	2.88	0.02	0.04	1.17	—	103.7	—
Pr > F (p-value)	0.413	0.391	0.391	0.025	—	0.223	—
Seed Rate							
45 seeds/m^2	41.8 B	0.0 A	0.0 A	95.8 A	—	767 A	—
65 seeds/m^2	55.0 A	0.0 A	0.1 A	94.7 A	—	811 A	—
S.E.M.	2.36	0.02	0.04	0.98	—	71.6	—
Pr > F (p-value)	<0.001	0.328	0.331	0.127	—	0.481	—
Fungicide							
Control	—	—	0.1 A	95.0 A	—	747 A	—
Treated	—	—	0.0 A	95.5 A	—	831 A	—
S.E.M.	—	—	0.04	0.98	—	71.6	—
Pr > F (p-value)	—	—	0.331	0.486	—	0.184	—

Table 8. Treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Swift Current in 2021.

Main Effect	Plant Density	Initial Disease	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Seeding Date	--- plants/m^2 ---	-------- 0-9 -------	-------- 0-9 -------	------- days -------	------ kg/ha ------	--------- % ---------	- g/1000 seeds -
Early	46.8 A	0.1 A	0	93.4 A	—	1072 A	227.5 A
Delayed	43.0 A	0.0 B	0	88.9 B	—	427 B	219.3 B
S.E.M.	1.67	0.01	—	0.48	—	32.4	1.78
Pr > F (p-value)	0.21	0.014	—	0.019	—	<0.001	0.011
Seed Rate							
45 seeds/m^2	36.8 B	0.0 A	0	91.0 A	—	764 A	226.5 A
65 seeds/m^2	53.0 A	0.1 A	0	91.3 A	—	734 A	220.3 A
S.E.M.	1.57	0.02	—	0.23	—	27.3	2.31
Pr > F (p-value)	<0.001	0.378	—	0.47	—	0.382	0.079
Fungicide							
Control	—	—	0	90.7 B	—	703 B	221.4 A
Treated	—	—	0	91.6 A	—	796 A	225.4 A
S.E.M.	—	—	—	0.23	—	27.3	2.31
Pr > F (p-value)	—	—	—	0.040	—	0.013	0.244

Table 9. Treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Yorkton in 2021.

Main Effect	Plant Density	Initial Disease	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Seeding Date	--- plants/m^2 ---	-------- 0-9 -------	-------- 0-9 -------	------- days -------	------ kg/ha ------	--------- % ---------	- g/1000 seeds -
Early	50.3 B	0.4 A	0.2 a	96.6 B	11.9 B	1077 A	425.7 A
Delayed	59.8 A	0.0 A	0.0 b	100.4 A	12.8 A	1098 A	403.2 A
S.E.M.	1.62	0.07	0.04	0.63	0.2	71.0	10.73
Pr > F (p-value)	<0.001	0.051	0.011	0.005	0.007	0.888	0.206
Seed Rate							
45 seeds/m^2	46.1 B	0.2 A	0.2 a	98.2 B	12.2 B	1098 A	417.2 A
65 seeds/m^2	64.1 A	0.2 A	0.1 a	98.8 A	12.5 A	1077 A	411.7 A
S.E.M.	1.84	0.06	0.04	0.59	0.2	39.5	8.68
Pr > F (p-value)	<0.001	0.294	0.319	0.041	0.006	0.778	0.379
Fungicide							
Control	—	—	0.2 a	98.3 A	12.5 A	971 B	422.5 A
Treated	—	—	0.1 a	98.8 A	12.2 B	1204 A	406.4 B
S.E.M.	—	—	0.04	0.59	0.2	39.5	8.68
Pr > F (p-value)	—	—	0.319	0.095	0.008	0.005	0.017

9. Economic and Practical Implications For growers – is there any economic implications for growers

At this stage, due to the generally poor growing conditions and the fact that the project is still in progress, our ability to make meaningful recommendations to producers is limited.

The seeding date responses were often unexpected with many sites experiencing dry springs, but a relatively wet August combined with a warm fall with no major frost events prior to faba bean maturity. As such, delayed seeding often performed better than expected. Establishment was either not affected or only slightly affected by seeding date and seeding date had no meaningful effects on disease or response to fungicide. Yields were not affected by seeding date at 5/7 locations, higher with early seeding at 1/7 locations, and higher with delayed seeding at 1/7 locations. Early seeded faba beans usually took more days to reach maturity than with delayed seeding but were still ready to harvest earlier in the fall. Based on past research showing yield advantages to early seeding and potential concerns with maturity under more typical conditions, we continue to recommend seeding faba beans as early as possible. In many cases, this should be the first crop farmers attempt to seed in the spring.

Utilizing higher seed rates obviously consistently increased the number of plants/m^2; however, for the 45 seeds/m^2 and 65 seeds/m^2 rates evaluated, there generally was not much for advantages beyond this. Higher plant densities can help compete with weeds and this is potentially a substantial benefit for faba beans. However, seeding this crop at 45 seeds/m^2 can already be a challenge due to the large seed size and an increase in seed rates this large can substantially increase input costs. Seed rate had no impact on maturity at 4/7 locations, hastened maturity by 1.5-1.8 days at 2/7 locations, and caused a small, unexpected, delay in maturity at 1/7 locations. Seed rates never impacted disease for either the initial or final ratings. Focussing on yield, there were no effects of seed rate for 6/7 locations but a positive response to the higher rates at 1 location. The responsive location was, however, flagged for having high yield variability and potentially unreliable yield results. Based on these results, we would not currently recommend targeting seeding rates above 45 seeds/m^2. While higher rates are unlikely to be detrimental from an agronomic perspective, current and past research shows that they are rarely beneficial. While there can be slight maturity advantages, they are not likely large or consistent enough to provide a meaningful advantage to farmers, and the increased cost and logistic concerns with higher seeding rates may be substantial.

Under the dry conditions, we did not expect to see much benefit to fungicide applications, and this was usually the case. There was no yield advantage to fungicide for 5/7 locations. Unexpectedly, the one site that did have high disease pressure was amongst the non-responsive sites; however, again, this site was flagged for having particularly variable yields. There were 2/7 locations that responded positively to the foliar fungicide application but, ironically, these were two of the driest, lowest yielding locations where essentially no disease was observed. While this response was not expected, the yield data from these responsive sites was quite consistent and we have no reason to suspect that the responses may not have been genuine. If there was truly no disease, we can only speculate that the fungicide applications helped the faba beans cope with environmental stress such as extreme heat and drought during flowering. There was some evidence of this at one site, where the control plots had significantly larger seeds than those treated with a fungicide. Larger seeds were occasionally observed with lower seed rates, and it is possible that, under the drought conditions especially, either fewer plants within a given area or fewer pods per plant could allow the pods to fill better, thus resulting in larger, heavier seeds. At this stage, it is difficult to make broad fungicide recommendations for faba beans as the limited available research to date have found responses to be both relatively rare, small, and difficult to predict. The optimal application timing is still uncertain, however, due to the prolonged flowering period, slow canopy closure, and fact that chocolate spot (*Botrytis spp.*, which appears to be the dominant disease), appears quite late in the season, it is likely at least a week into flowering, perhaps even later. Farmers should choose a product that is registered for control of *Botrytis*; however, such options are limited with Priaxor® (BASF) being discontinued. While we expect the higher rate of Dyax® (BASF) to have some activity on this disease, it is not currently on the label for either control or suppression.

Meaningful interactions between the main effects were relatively rare, variable, and, in many cases, difficult to explain; therefore, will not be discussed in detail at this time. This project is planned to continue for another season and, after the data has been vetted and combined across locations, potentially meaningful interactions will be revisited.

10. **Conclusions & Recommendations –** how do results relate to origination objectives or original research that project is based on; is there a need to refine current recommendation based on the results from this project?

    Overall, environmental conditions were not ideal for faba bean production due to widespread drought and heat stress, albeit to varying degrees depending on the location. Apart from a few sites that were flagged for data quality issues, much of the data is considered valid; however, with low disease pressure, low yields, and unusually early maturity in many cases, our results are not conclusive and our ability to achieve the initially identified objectives was limited. At this stage, we would not change any of the current recommendations for seeding dates, seed rates, or fungicide recommendations.

    While we will recommend excluding data from select locations from future combined analyses (Redvers, Outlook, and Prince Albert), data from these sites will not necessarily go to waste. Except for Redvers, where residual herbicide issues were suspected, even locations where yields were variable can be utilized to help document the overall yield potential of faba beans for a range of geographic locations and, depending on duration of the project and future weather, environmental conditions.

    There are a couple of minor recommended changes to the protocol going into the 2022 growing season. First, since Priaxor® is discontinued, we recommend that all locations plan to use 395 ml/ha Dyax® in 2022. This was kept optional for the first season. Our original protocol specifically called for Priaxor®; however, when the time came to apply these treatments, we realized that this product could no longer be purchased, and several sites had no access to it. At this time, some locations had already applied treatments or were ready to do so; however, we see limited value in using a product which is no longer available, especially if there are other viable options. The second protocol change recommended is to exclude seed moisture content at harvest from the required data collection activities. Most sites missed this measurement in 2021 so we do not have much of a foundation to build on and, depending on harvest dates and the weather preceding harvest, in addition to confounding effects of desiccation, we do not believe this variable is likely to provide useful information. Furthermore, it is a difficult measurement to collect due to time sensitivity combined with limited staff (i.e., seasonal staff are normally gone when faba beans are being harvested) and conflicting field operations (i.e., harvesting other trials, fall fertilizer applications, site flagging, and soil testing) which is why so many locations missed it in 2021.

11. **Future research –** did the project identify need for future research for further work?

    At this stage, since the project is continuing and results to date are inconclusive, we are hesitant to make recommendations for future research. One area of interest, which we recognized prior to developing this project, is the uncertainty surrounding the optimal timing of fungicide application for faba beans; however, wetter conditions and higher disease pressure would be required to generate meaningful information on this subject. Upon conclusion of the current project, this might be something to consider for locations which are well-equipped for such work and can reasonably expect disease to develop.

12. **Technology transfer activities –** include presentations, extension material, field days, articles published

    Extension activities have been limited to date as 2021 was the first year of the work and few results have been available to date. At Indian Head, the plots were not shown during the Crop Management Field Day for logistic reasons but were visited by numerous farmers and industry representatives throughout the season during small, informal tours. At Melfort, a YouTube video highlighting the trial was prepared as part of NARF's virtual field day on July 27 (www.youtube.com/watch?v=TNc8PycX65o) and Brianne McInnes presented preliminary results for their site during the SIA Northeast Branch Ag Update on February 3, 2022 (virtual). At Outlook, the

trial was not highlighted during the 2021 growing season as it was apparent that growth was atypical, and the plots may not be appropriate for viewing. At Prince Albert, the plots were visited by a subset of participants during the CLC Field Day on July 22 and Zoe Galbraith discussed the trial in a YouTube video uploaded August 17, 2021 (www.youtube.com/watch?v=wUpsOA3txzQ). At Redvers, the project was not highlighted during any field tours or other extension activities. At Swift Current, the project was highlighted during a "Walk the Plots" segment on CKSW Radio and during informal site tours. At Yorkton, the project was not highlighted as part of any extension activities during the 2021 growing season. This technical report will be made available on the IHARF website (www.iharf.ca) and interim results may be incorporated into presentations and farm media articles as appropriate opportunities arise.

13. **Funding contributions –** acknowledge partners and contributors to the project

This project is a collaboration between multiple Agri-ARM organizations and the Saskatchewan Pulse Crop Development Board. Financial support for the project was provided exclusively by the Saskatchewan Pulse Crop Development Board. Several of the Agri-ARM organizations also have close working relationships and memorandums of understanding with Agriculture and Agri-Food Canada which should be acknowledged.

14. Appendices: detailed data tables, maps, photos, etc

Table 10. Selected agronomic information and dates of operations from faba bean agronomy demonstrations completed at Indian Head (IH), Melfort (ME), Outlook (OL), Prince Albert (PA), Redvers (RV), Swift Current (SW), and Yorkton (YK) in 2021 (21).

Location-Year	Previous Crop	Variety	kg N-P_2O_5-K_20-S	Seeding Dates	Plant Counts	Days to Flower	Fungicide Apps.	Final Disease Ratings	Harvest Dates
IH-21	Oat	Snowbird	10-45-0-0	May-2 May-28	Jun-18 Jun-25	Dyax Jun-29 (58) Jul-11 (44)	Jul-5 Jul-18	Jul-28 Aug-13	Sep-5 Oct-5
ME-21	Wheat	Snowbird	23-56-0-13	Apr-30 May-19	May-26 Jun-9	Priaxor Jun-22 (53) Jul-5 (47)	Jun-28 Jul-13	Jul-12 Jul-26	Aug-31 Sep-7
OL-21	Wheat	Snowbird	5-25-0-0	Apr-30 May-15	May-31 Jun-7	Priaxor Jun-16 (48) Jun-29 (45)	Jul-5 Jul-16	Jul-22 Aug-4	Sep-23 (all)
PA-21	Oat	Snowbird	12-58-0-0	May-11 May-31	Jun-16 (all)	Priaxor Jun-30 (50) Jul-12 (43)	Jul-9 Jul-23	Jul-29 Aug-10	Sep-14 Oct-13
RV-21	Wheat	Snowbird	7-31-0-0	May-4 May-31	Jun-7 Jun-23	Priaxor Jun-27 (54) Jul-7 (41)	Jul-5 Jul21	Jul-21 Aug-3	Aug-17 Sep-25
SW-21	Barley	CDC Snowdrop	12-56-0-0	May-4 May-28	Jun-7 Jun-14	Dyax Jun-25 (52) Jul-9 (42)	Jul-5 Jul-19	Jul-23 Aug-4	Sep-1 (all)
YK-21	Wheat	Snowbird	3-15-0-0	Apr-30 May-27	May-26 Jun-14	Priaxor Jun-25 (56) Jul-6 (40)	Jul-5 Jul-16	Jul-20 Jul-30	Sep-14 (all)

Table 11. Overall tests of fixed effects for faba bean plant densities for all sites in 2021.

Source	IH21	ME21	OL21	PA21	RV21	SW21	YK21
	p-values						
Seeding Date (D)	0.549	0.091	0.063	0.627	0.413	0.210	<0.001
Seed Rate (R)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
D x R	0.816	0.224	0.815	0.723	0.120	0.317	0.082

Table 12. Overall tests of fixed effects for faba bean plant initial disease ratings for all sites in 2021.

Source	IH21	ME21	OL21 [z]	PA21	RV21	SW21	YK21
	p-values						
Seeding Date (D)	0.001	0.008	—	0.022	0.391	0.014	0.051
Seed Rate (R)	0.407	0.627	—	0.655	0.328	0.378	0.294
D x R	0.218	0.871	—	0.881	0.328	0.368	0.181

[z] All values were zero at OL21

Table 13. Overall tests of fixed effects for faba bean plant final disease ratings for all sites in 2021.

Source	IH21	ME21	OL21 [z]	PA21	RV21	SW21 [z]	YK21
	p-values						
Seeding Date (D)	0.146	1.000	—	0.096	0.391	—	0.011
Seed Rate (R)	0.284	1.000	—	0.413	0.331	—	0.319
Fungicide (F)	0.933	0.174	—	0.270	0.331	—	0.319
D x R	0.124	1.000	—	0.768	0.331	—	0.736
D x F	0.560	0.174	—	0.482	0.331	—	0.319
R x F	0.363	0.174	—	0.768	0.331	—	0.319
D x R x F	0.676	0.174	—	0.295	0.331	—	0.319

[z] All values were zero at OL21 and SW21

Table 14. Overall tests of fixed effects for faba bean maturity for all sites in 2021.

Source	IH21	ME21	OL21	PA21	RV21	SW21	YK21
	p-values						
Seeding Date (D)	<0.001	0.010	0.003	<0.001	0.025	0.019	0.005
Seed Rate (R)	<0.001	0.367	0.166	1.000	0.127	0.470	0.041
Fungicide (F)	<0.001	0.367	0.850	0.470	0.486	0.040	0.095
D x R	0.792	0.367	0.830	0.470	0.172	0.884	0.095
D x F	0.196	0.367	0.326	1.000	0.861	0.040	0.665
R x F	0.792	1.000	0.240	0.470	0.386	0.470	0.203
D x R x F	0.196	1.000	0.989	0.009	0.486	0.470	1.000

Table 15. Overall tests of fixed effects for faba bean seed moisture content at harvest for all sites in 2021.

Source	IH21 [z]	ME21	OL21 [z]	PA21 [z]	RV21 [z]	SW21 [z]	YK21
	p-values						
Seeding Date (D)	—	0.620	—	—	—	—	0.007
Seed Rate (R)	—	0.184	—	—	—	—	0.006
Fungicide (F)	—	0.062	—	—	—	—	0.008
D x R	—	0.615	—	—	—	—	0.012
D x F	—	0.840	—	—	—	—	1.000
R x F	—	0.396	—	—	—	—	0.006
D x R x F	—	0.840	—	—	—	—	0.313

[z] Seed moisture content at harvest was not measured at IH21, OL21, PA21, RV21, or SW21

Table 16. Overall tests of fixed effects for faba bean seed yields for all sites in 2021.

Source	IH21	ME21	OL21	PA21	RV21	SW21	YK21
	p-values						
Seeding Date (D)	0.536	0.822	0.187	0.016	0.223	<0.001	0.888
Seed Rate (R)	0.295	0.691	0.199	0.048	0.481	0.382	0.778
Fungicide (F)	0.110	0.557	0.124	0.545	0.184	0.013	0.005
D x R	0.237	0.511	0.771	0.482	0.349	0.722	0.907
D x F	0.458	0.588	0.812	0.095	0.413	0.317	0.36
R x F	0.565	0.820	0.711	0.885	0.668	0.277	0.342
D x R x F	0.777	0.980	0.722	0.955	0.992	0.389	0.466

Table 17. Overall tests of fixed effects for faba bean seed weight (g/1000 seeds) for all sites in 2021.

Source	IH21	ME21	OL21	PA21	RV21 [z]	SW21	YK21
	p-values						
Seeding Date (D)	0.004	0.003	0.008	<0.001	—	0.011	0.206
Seed Rate (R)	<0.001	0.945	0.088	0.179	—	0.079	0.379
Fungicide (F)	0.575	0.555	0.500	0.715	—	0.244	0.017
D x R	<0.001	0.106	0.166	0.848	—	0.412	0.640
D x F	0.075	0.797	0.918	0.436	—	0.948	0.639
R x F	0.004	0.964	0.255	0.261	—	0.68	0.652
D x R x F	0.673	0.549	0.224	0.741	—	0.248	0.465

[z] Seed weight was not measured at RV21

Table 18. Two-way interaction treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Indian Head in 2021.

2-Way Interaction	Plant Density	Initial Disease	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Date x Rate	--- plants/m^2 ---	-------- 0-9 -------	-------- 0-9 -------	------- days -------	--------- % ---------	------ kg/ha ------	- g/1000 seeds -
Early - 45	42.9 b	1.9 a	1.8 a	104.1 a	—	1774 a	415.3 b
Early - 65	63.2 a	1.7 a	2.6 a	102.3 b	—	1861 a	413.3 b
Delayed - 45	41.7 b	0.5 b	1.0 a	99.0 c	—	1896 a	469.8 a
Delayed - 65	61.6 a	0.6 b	0.9 a	97.3 d	—	1891 a	429.1
S.E.M.	1.71	0.17	0.46	0.21	—	92.8	3.97
Pr > F (p-value)	0.816	0.218	0.124	0.792	—	0.237	<0.001
Date x Fung							
Early - Control	—	—	2.1 a	102.9 a	—	1800 a	409.6 b
Early - Treated	—	—	2.3 a	103.5 a	—	1835 a	419.1 b
Delayed - Control	—	—	1.0 a	97.5 c	—	1848 a	452.0 a
Delayed - Treated	—	—	0.9 a	98.8 b	—	1939 a	446.9 a
S.E.M.	—	—	0.46	0.21	—	92.8	3.97
Pr > F (p-value)	—	—	0.560	0.196	—	0.458	0.075
Rate x Fung							
45 - Control	—	—	1.3 a	101.1 ab	—	1793 a	447.7 a
45 - Treated	—	—	1.6 a	102.0 a	—	1878 a	437.4 ab
65 - Control	—	—	1.9 a	99.3 c	—	1855 a	413.8 c
65 - Treated	—	—	1.6 a	100.3 b	—	1896 a	428.6 bc
S.E.M.	—	—	0.36	0.23	—	77.6	3.82
Pr > F (p-value)	—	—	0.363	0.792	—	0.565	0.004

Table 19. Three-way interaction treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Indian Head in 2021.

3-Way Interaction	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Date x Rate x Fung	-------- 0-9 -------	------- days -------	--------- % ---------	------ kg/ha ------	- g/1000 seeds -
Early - 45 - Control	1.5 a	104.0 a	—	1741 a	416.0 bc
Early - 45 - Treated	2.1 a	104.3 a	—	1808 a	414.6 bc
Early - 65 - Control	2.7 a	101.8 b	—	1860 a	403.1 c
Early - 65 - Treated	2.5 a	102.3 ab	—	1862 a	423.5 bc
Delay - 45 - Control	1.0 a	98.3 cd	—	1845 a	479.5 a
Delay - 45 - Treated	1.0 a	99.8 c	—	1947 a	460.2 a
Delay - 65 - Control	1.0 a	96.8 d	—	1850 a	424.5 bc
Delay - 65 - Treated	0.7 a	97.8 d	—	1931 a	433.7 b
S.E.M.	0.55	0.31	—	100.1	5.53
Pr > F (p-value)	0.676	0.196	—	0.777	0.673

Table 20. Two-way interaction treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Melfort in 2021.

2-Way Interaction	Plant Density	Initial Disease	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Date x Rate	--- plants/m^2 ---	-------- 0-9 -------	-------- 0-9 -------	------- days -------	--------- % ---------	------ kg/ha ------	- g/1000 seeds -
Early - 45	35.1 b	0.7 a	0.0 a	95.0 a	16.8 a	2284 a	383.6 b
Early - 65	42.5 ab	0.7 a	0.1 a	95.0 a	17.0 a	2170 a	375.1 b
Delayed - 45	37.2 b	0.0 b	0.1 a	88.6 b	16.6 a	2230 a	417.0 a
Delayed - 65	49.7 a	0.1 b	0.0 a	90.4 b	17.0 a	2258 a	426.2 a
S.E.M.	1.91	0.09	0.04	0.95	0.22	84.4	6.10
Pr > F (p-value)	0.224	0.871	1.000	0.367	0.615	0.511	0.106
Date x Fung							
Early - Control	—	—	0.1 a	95.0 a	17.1 a	2229 a	377.1 b
Early - Treated	—	—	0.0 a	95.0 a	16.6 a	2224 a	381.6 b
Delayed - Control	—	—	0.1 a	90.4 a	17.0 a	2305 a	420.7 a
Delayed - Treated	—	—	0.0 a	88.6 a	16.6 a	2183 a	422.5 a
S.E.M.	—	—	0.04	0.95	0.22	84.4	6.10
Pr > F (p-value)	—	—	0.174	0.367	0.840	0.588	0.797
Rate x Fung							
45 - Control	—	—	0.1 a	92.3 a	16.8 a	2301 a	398.6 a
45 - Treated	—	—	0.1 a	91.4 a	16.5 a	2213 a	402.0 a
65 - Control	—	—	0.1 a	93.1 a	17.4 a	2233 a	399.2 a
65 - Treated	—	—	0.0 a	92.3 a	16.7 a	2194 a	402.1 a
S.E.M.	—	—	0.03	0.95	0.24	93.1	6.19
Pr > F (p-value)	—	—	0.174	1.000	0.396	0.820	0.964

Table 21. Three-way interaction treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Melfort in 2021.

3-Way Interaction	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Date x Rate x Fung	-------- 0-9 -------	------- days -------	--------- % ---------	------ kg/ha ------	- g/1000 seeds -
Early - 45 - Control	0.0 a	95.0 a	16.9 a	2300 a	382.8 bc
Early - 45 - Treated	0.1 a	95.0 a	16.6 a	2268 a	384.4 bc
Early - 65 - Control	0.2 a	95.0 a	17.4 a	2159 a	371.4 c
Early - 65 - Treated	0.0 a	95.0 a	16.6 a	2181 a	378.8 c
Delay - 45 - Control	0.1 a	89.5 ab	16.7 a	2302 a	414.4 ab
Delay - 45 - Treated	0.1 a	87.8 b	16.4 a	2158 a	419.6 a
Delay - 65 - Control	0.1 a	91.3 ab	17.3 a	2308 a	427.0 a
Delay - 65 - Treated	0.0 a	89.5 ab	16.7 a	2208 a	425.4 a
S.E.M.	0.05 a	1.34	0.33	135.6	8.02
Pr > F (p-value)	0.174	1.000	0.840	0.980	0.549

Table 22. Two-way interaction treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Outlook in 2021.

2-Way Interaction	Plant Density	Initial Disease	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Date x Rate	--- plants/m^2 ---	-------- 0-9 -------	-------- 0-9 -------	------- days -------	--------- % ---------	------ kg/ha ------	- g/1000 seeds -
Early - 45	44.3 b	0	0	102.0 a	—	4117 a	462.9 a
Early - 65	61.4 a	0	0	101.0 a	—	3871 a	459.8 a
Delayed - 45	39.0 b	0	0	96.4 b	—	3622 a	432.1 ab
Delayed - 65	55.3 a	0	0	95.6 b	—	3237 a	403.8 b
S.E.M.	2.06	—	—	0.63	—	577.1	15.36
Pr > F (p-value)	0.815	—	—	0.830	—	0.771	0.166
Date x Fung							
Early - Control	—	—	0	101.9 a	—	4214 a	457.9 a
Early - Treated	—	—	0	101.1 a	—	3774 a	464.8 a
Delayed - Control	—	—	0	95.8 b	—	3592 a	415.4 b
Delayed - Treated	—	—	0	96.3 b	—	3267 a	420.5 b
S.E.M.	—	—	—	0.63	—	577.1	15.36
Pr > F (p-value)	—	—	—	0.326	—	0.812	0.918
Rate x Fung							
45 - Control	—	—	0	99.6 a	—	4105 a	439.4 a
45 - Treated	—	—	0	98.8 a	—	3634 a	455.6 a
65 - Control	—	—	0	98.0 a	—	3701 a	433.9 a
65 - Treated	—	—	0	98.6 a	—	3407 a	429.7 a
S.E.M.	—	—	—	0.63	—	565.4	15.59
Pr > F (p-value)	—	—	—	0.240	—	0.711	0.255

Table 23. Three-way interaction treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Outlook in 2021.

3-Way Interaction	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Date x Rate x Fung	-------- 0-9 -------	------- days -------	--------- % ---------	------ kg/ha ------	- g/1000 seeds -
Early - 45 - Control	0	102.8 a	—	4423 a	459.9 a
Early - 45 - Treated	0	101.3 a	—	3810 a	466.0 a
Early - 65 - Control	0	101.0 a	—	4004 a	456.0 a
Early - 65 - Treated	0	101.0 a	—	3739 a	463.6 a
Delay - 45 - Control	0	96.5 b	—	3787 a	418.9 ab
Delay - 45 - Treated	0	96.3 b	—	3458 a	445.2 ab
Delay - 65 - Control	0	95.0 b	—	3398 a	411.8 ab
Delay - 65 - Treated	0	96.3 b	—	3076 a	395.7 b
S.E.M.	—	0.88	—	623.4	17.64
Pr > F (p-value)	—	0.989	—	0.722	0.224

Table 24. Two-way interaction treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Prince Albert in 2021.

2-Way Interaction	Plant Density	Initial Disease	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Date x Rate	--- plants/m^2 ---	-------- 0-9 -------	-------- 0-9 -------	------- days -------	--------- % ---------	------ kg/ha ------	- g/1000 seeds -
Early - 45	35.4 b	0.9 b	2.2 a	97.2 b	—	1871 c	427.9 b
Early - 65	48.7 a	0.8 b	2.4 a	97.0 b	—	2110 bc	415.1 b
Delayed - 45	35.7 b	2.1 a	1.5 a	111.3 a	—	2544 ab	545.9 a
Delayed - 65	50.9 a	2.0 a	2.0 a	111.5 a	—	3027 a	529.0 a
S.E.M.	2.26	0.19	0.49	0.31	—	473.1	13.29
Pr > F (p-value)	0.723	0.881	0.768	0.470	—	0.482	0.848
Date x Fung							
Early - Control	—	—	2.2 a	97.0 b	—	1893 c	423.8 b
Early - Treated	—	—	2.4 a	97.3 b	—	2088 bc	419.3 b
Delayed - Control	—	—	1.4 a	111.3 a	—	2987 a	531.3 a
Delayed - Treated	—	—	2.1 a	111.5 a	—	2583 ab	543.6 a
S.E.M.	—	—	0.49	0.31	—	473.1	13.29
Pr > F (p-value)	—	—	0.482	1.000	—	0.095	0.436
Rate x Fung							
45 - Control	—	—	1.7 a	104.0 a	—	2272 a	478.8 a
45 - Treated	—	—	2.0 a	104.5 a	—	2143 a	495.0 a
65 - Control	—	—	1.9 a	104.3 a	—	2609 a	476.3 a
65 - Treated	—	—	2.5 a	104.3 a	—	2529 a	467.9 a
S.E.M.	—	—	0.52	0.31	—	474.0	13.98
Pr > F (p-value)	—	—	0.768	0.470	—	0.885	0.261

Table 25. Three-way interaction treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Prince Albert in 2021.

3-Way Interaction	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Date x Rate x Fung	------- 0-9 ------	------- days -------	--------- % ---------	------ kg/ha ------	- g/1000 seeds -
Early - 45 - Control	1.9 a	96.5 b	—	1791 b	425.8 b
Early - 45 - Treated	2.4 a	98.0 b	—	1951 b	430.0 b
Early - 65 - Control	2.5 a	97.5 b	—	1996 b	421.8 b
Early - 65 - Treated	2.3 a	96.5 b	—	2225 ab	408.5 b
Delay - 45 - Control	1.4 a	111.5 a	—	2753 ab	531.8 a
Delay - 45 - Treated	1.6 a	111.0 a	—	2334 ab	560.0 a
Delay - 65 - Control	1.3 a	111.0 a	—	3222 a	530.8 a
Delay - 65 - Treated	2.7 a	112.0 a	—	2832 ab	527.3 a
S.E.M.	0.65	0.56	—	502.7	17.00
Pr > F (p-value)	0.295	0.009	—	0.955	0.741

Table 26. Two-way interaction treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Redvers in 2021.

2-Way Interaction	Plant Density	Initial Disease	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Date x Rate	--- plants/m^2 ---	-------- 0-9 -------	-------- 0-9 -------	------- days -------	--------- % ---------	------ kg/ha ------	- g/1000 seeds -
Early - 45	41.3 c	0.0 a	0.0 a	98.4 a	—	861 a	—
Early - 65	52.0 ab	0.0 a	0.1 a	98.3 a	—	964 a	—
Delayed - 45	42.2 bc	0.1 a	0.0 a	93.3 b	—	672 a	—
Delayed - 65	58.0 a	0.0 a	0.0 a	91.1 b	—	657 a	—
S.E.M.	3.09	0.03	0.05	1.27	—	112.3	—
Pr > F (p-value)	0.120	0.328	0.331	0.172	—	0.349	—
Date x Fung							
Early - Control	—	—	0.1 a	98.1 a	—	845 a	—
Early - Treated	—	—	0.0 a	98.5 a	—	981 a	—
Delayed - Control	—	—	0.0 a	91.9 b	—	648 a	—
Delayed - Treated	—	—	0.0 a	92.5 b	—	681 a	—
S.E.M.	—	—	0.05	1.27	—	112.3	—
Pr > F (p-value)	—	—	0.331	0.861	—	0.413	—
Rate x Fung							
45 - Control	—	—	0.0 a	95.9 a	—	711 a	—
45 - Treated	—	—	0.0 a	95.8 a	—	822 a	—
65 - Control	—	—	0.1 a	94.1 a	—	782 a	—
65 - Treated	—	—	0.0 a	95.3 a	—	840 a	—
S.E.M.	—	—	0.05	1.10	—	83.6	—
Pr > F (p-value)	—	—	0.331	0.386	—	0.668	—

Table 27. Three-way interaction treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Redvers in 2021.

3-Way Interaction	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Date x Rate x Fung	-------- 0-9 -------	------- days -------	--------- % ---------	------ kg/ha ------	- g/1000 seeds -
Early - 45 - Control	0.0 a	98.3 a	—	780 a	—
Early - 45 - Treated	0.0 a	98.5 a	—	943 a	—
Early - 65 - Control	0.2 a	98.0 a	—	910 a	—
Early - 65 - Treated	0.0 a	98.5 a	—	1018 a	—
Delay - 45 - Control	0.0 a	93.5 ab	—	642 a	—
Delay - 45 - Treated	0.0 a	93.0 ab	—	702 a	—
Delay - 65 - Control	0.0 a	90.3 b	—	654 a	—
Delay - 65 - Treated	0.0 a	92.0 ab	—	661 a	—
S.E.M.	0.07	1.45	—	127.8	—
Pr > F (p-value)	0.331	0.486	—	0.992	—

Table 28. Two-way interaction treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Swift Current in 2021.

2-Way Interaction	Plant Density	Initial Disease	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Date x Rate	--- plants/m^2 ---	-------- 0-9 -------	-------- 0-9 -------	------- days -------	--------- % ---------	------ kg/ha ------	- g/1000 seeds -
Early - 45	39.7 B	0.1 ab	0	93.3 a	—	1093 a	229.2 a
Early - 65	53.8 A	0.1 a	0	93.5 a	—	1051 a	225.8 a
Delayed - 45	33.8 B	0.0 b	0	88.8 b	—	435 b	223.7 ab
Delayed - 65	52.2 A	0.0 b	0	89.1 b	—	418 b	214.8 b
S.E.M.	2.21	0.02	—	0.57	—	40.1	2.93
Pr > F (p-value)	0.317	0.368	—	0.884	—	0.722	0.412
Date x Fung							
Early - Control	—	—	0	93.4 a	—	1009 a	225.4 ab
Early - Treated	—	—	0	93.4 a	—	1136 a	229.6 a
Delayed - Control	—	—	0	88.0 c	—	398 b	217.4 b
Delayed - Treated	—	—	0	89.9 b	—	455 b	221.1 ab
S.E.M.	—	—	—	0.57	—	40.1	2.93
Pr > F (p-value)	—	—	—	0.040	—	0.317	0.948
Rate x Fung							
45 - Control	—	—	0	90.4 a	—	699 a	223.8 a
45 - Treated	—	—	0	91.6 a	—	829 a	229.1 a
65 - Control	—	—	0	91.0 a	—	707 a	219.0 a
65 - Treated	—	—	0	91.6 a	—	762 a	221.6 a
S.E.M.	—	—	—	0.38	—	36.1	3.28
Pr > F (p-value)	—	—	—	0.470	—	0.277	0.680

Table 29. Three-way interaction treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Swift Current in 2021.

3-Way Interaction	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Date x Rate x Fung	-------- 0-9 -------	------- days -------	--------- % ---------	------ kg/ha ------	- g/1000 seeds -
Early - 45 - Control	0	93.3 a	—	996 a	224.5 ab
Early - 45 - Treated	0	93.3 a	—	1190 a	234.0 a
Early - 65 - Control	0	93.5 a	—	1021 a	226.4 ab
Early - 65 - Treated	0	93.5 a	—	1081 a	225.3 ab
Delay - 45 - Control	0	87.5 b	—	403 b	223.1 ab
Delay - 45 - Treated	0	90.0 ab	—	468 b	224.3 ab
Delay - 65 - Control	0	88.5 b	—	393 b	211.7 b
Delay - 65 - Treated	0	89.8 ab	—	443 b	218.0 ab
S.E.M.	—	0.71	—	52.2	4.41
Pr > F (p-value)	—	0.470	—	0.389	0.248

Table 30. Two-way interaction treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Yorkton in 2021.

2-Way Interaction	Plant Density	Initial Disease	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Date x Rate	--- plants/m^2 ---	-------- 0-9 -------	-------- 0-9 -------	------- days -------	--------- % ---------	------ kg/ha ------	- g/1000 seeds -
Early - 45	43.1 d	0.5 a	0.3 a	96.5 a	11.9 c	1091 a	427.1 a
Early - 65	57.6 b	0.3 ab	0.2 a	96.6 b	11.9 c	1062 a	424.4 a
Delayed - 45	49.1 c	0.0 b	0.1 b	99.9 a	12.5 b	1104 a	407.4 a
Delayed - 65	70.5 a	0.0 b	0.0 b	101.0 a	13.0 a	1092 a	398.9 a
S.E.M.	2.1	0.09	0.05	0.66	0.21	87.5	11.58 a
Pr > F (p-value)	0.082	0.181	0.736	0.095	0.012	0.907	0.640
Date x Fung							
Early - Control	—	—	0.3 a	96.4 b	12.0 b	994 ab	432.4 a
Early - Treated	—	—	0.2 a	96.8 b	11.8 b	1159 ab	419.1 a
Delayed - Control	—	—	0.0 b	100.1 a	12.9 a	948 b	412.7 a
Delayed - Treated	—	—	0.0 b	100.8 a	12.6 a	1248 a	393.6 a
S.E.M.	—	—	0.05	0.66	0.21	87.5	11.58
Pr > F (p-value)	—	—	0.319	0.665	1.000	0.360	0.639
Rate x Fung							
45 - Control	—	—	0.2 a	98.1 a	12.2 b	1017 ab	426.7 a
45 - Treated	—	—	0.2 a	98.3 a	12.2 b	1179 ab	407.7 a
65 - Control	—	—	0.2 a	98.4 a	12.7 a	925 b	418.4 a
65 - Treated	—	—	0.1 a	99.3 a	12.2 b	1229 a	405.0 a
S.E.M.	—	—	0.05	0.62	0.21	64.6	9.71
Pr > F (p-value)	—	—	0.319	0.203	0.006	0.342	0.652

Table 31. Three-way interaction treatment means and overall F-test results for faba bean seeding date, seed rate, and foliar fungicide effects on selected response variables at Yorkton in 2021.

3-Way Interaction	Final Disease	Maturity	Seed Moisture	Yield	Seed Weight
Date x Rate x Fung	-------- 0-9 -------	------- days -------	--------- % ---------	------ kg/ha ------	- g/1000 seeds -
Early - 45 - Control	0.3 ab	96.5 b	11.9 cde	1017 a	432.8 a
Early - 45 - Treated	0.3 ab	96.5 b	11.9 de	1166 a	421.3 a
Early - 65 - Control	0.3 a	96.3 b	12.1 bcde	971 a	431.9 a
Early - 65 - Treated	0.2 ab	97.0 b	11.7 e	1153 a	416.9 a
Delay - 45 - Control	0.1 ab	99.8 a	12.5 bcd	1016 a	420.7 a
Delay - 45 - Treated	0.1 ab	100.0 a	12.6 bc	1192 a	394.2 a
Delay - 65 - Control	0.0 b	100.5 a	13.3 a	879 a	404.8 a
Delay - 65 - Treated	0.0 b	101.5 a	12.7 b	1305 a	393.1 a
S.E.M.	0.06	0.72	0.23	113.5	13.12
Pr > F (p-value)	0.319	1.000	0.313	0.466	0.465

Government of Saskatchewan

Crops and Irrigation Branch
Crop Protection Laboratory

Ministry of Agriculture
1610 Park St.
Regina, SK S4N 2G1

General Inquiries: 306-787-8130
Billing Inquiries: 306-787-7191
Email: cpl@gov.sk.ca

August 9, 2021

Lab ID: PD-297

Test Requested: Plant Disease

IHARF
Chris Holzapfel
Box 1568
INDIAN HEAD, SK, S0G 2K0
cholzapfel@iharf.ca

Field ID: 21-2513
Land Location: ----

Results:
Common Name: Chocolate spot
Scientific Name: *Botrytis spp. (cinerea and / or Fabae)*

Chocolate spot identified. No Ascochyta identified.

For more information on crop protection please visit www.saskatchewan.ca, or contact the Agriculture Knowledge Centre at 1-866-457-2377, your Regional Crop Specialist, or a Crops and Irrigation Branch Provincial Specialist.

Sincerely,

Scott Hartley, P. Ag
Manager, Crop Protection Lab
Crops and Irrigation Branch

Figure 1. Saskatchewan Crop Protection Laboratory Report for Indian Head, 2021.

Government of Saskatchewan

Crops and Irrigation Branch
Crop Protection Laboratory

Ministry of Agriculture
1610 Park St.
Regina, SK S4N 2G1

General Inquiries: 306-787-8130
Billing Inquiries: 306-787-7191
Email: cpl@gov.sk.ca

August 23, 2021

Lab ID: PD-306

Test Requested: Plant Disease

ICDC
Garry Hnatowich
Box 1460, 901 McKenzie Street South
OUTLOOK, SK, S0L 2N0
garry.icdc@sasktel.net

Field ID: Field 8 - CSIDC
Land Location: SE-16-29-8-W3

Results:
Common Name: Chocolate Spot
Scientific Name: *Botrytis spp. (cinerea and / or Fabae)*

Chocolate Spot was observed, plate and isolated with a mild severity.

For more information on crop protection please visit www.saskatchewan.ca, or contact the Agriculture Knowledge Centre at 1-866-457-2377, your Regional Crop Specialist, or a Crops and Irrigation Branch Provincial Specialist.

Sincerely,

Scott Hartley, P. Ag
Manager, Crop Protection Lab
Crops and Irrigation Branch

Figure 2. Saskatchewan Crop Protection Laboratory Report for Outlook, 2021.

Government of Saskatchewan

Crops and Irrigation Branch
Crop Protection Laboratory

Ministry of Agriculture
1610 Park St.
Regina, SK S4N 2G1

General Inquiries: 306-787-8130
Billing Inquiries: 306-787-7191
Email: cpl@gov.sk.ca

July 20, 2021

Lab ID: PD-269

Test Requested: Plant Disease

Saskatchewan Conservation Learning Centre
Brooke Howat
PO BOX 1903 STN MAIN
PRINCE ALBERT, SK, S6V 6J9
info@conservationlearningcentre.com

Field ID:
Land Location: SW-20-46-26-W2

Results:
Common Name: Chocolate spot
Scientific Name: *Botrytis spp. and Alternaria*

Heavy presence of Botrytis and Alternaria on moist chamber leaves suggest a leaf spot complex, including chocolate spot disease.

For more information on crop protection please visit www.saskatchewan.ca, or contact the Agriculture Knowledge Centre at 1-866-457-2377, your Regional Crop Specialist, or a Crops and Irrigation Branch Provincial Specialist.

Sincerely,

Scott Hartley, P. Ag
Manager, Crop Protection Lab
Crops and Irrigation Branch

Figure 3. Saskatchewan Crop Protection Laboratory Report for Prince Albert, 2021.

15. Reference papers or articles – as applicable

There are no reference papers or articles to report currently.