Progress Report

Hemp Seeding Date Demonstration for Grain Production

Project # 20200455 SFP

Principal Investigators
Sara Ingell

Progress Report

1. **Project title, SFP file number and reporting period.**

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Project # 20200455 SFP

Reporting Period: May 2022 – October 2022

2. **Name of the Principal Investigator and contact information.**

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3. **Name of the collaborators and contact information.**

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4. **Abstract**.

The main objective of this project is to determine the ideal seeding date of conventional hemp in Saskatchewan. Three Hemp seed varieties, X59, Katani & Picola, were seeded at three different seeding dates, late May, mid-June, and early July. The four participating sites were ICDC (Outlook), WARC (Scott), NARF (Melfort) and IHARF (Indianhead). At all sites, plots were seeded to attain a plant population of 100-125 plants/m2. Of the four trial sites, three were established under natural rainfed conditions (dryland), while one trial was irrigated. All sites experienced dry soil conditions early in the season, but IHARF and NARF received adequate rainfall toward the end of the season. Yield was affected at WARC due to limited precipitation. In year two of this project, seeding date significantly affected yield, height, and days to maturity. Yield was higher when plots were seeded in late May and hemp variety Katani yielded higher than Picola and X59. Hemp plants were also taller when seeded in late May, with X59 taller than the other varieties at all locations. Hemp variety X59 took longer to mature at all sites.

5. **Introduction:**

The project demonstrates different seeding dates for three varieties of conventional hemp to show producers the ideal time for seeding in various Saskatchewan locations. This demonstration will provide producers with data for different hemp varieties in a wide range of seeding dates in Saskatchewan. Hemp is a newer crop in Saskatchewan and is a high value crop ($0.75 - $0.90/lb) and has good potential yields in Saskatchewan (average 660-1,070 lbs/acre and up to 2000 lbs/ acre under irrigation). Discovering optimum seeding dates for this higher value crop will encourage local growth in the conventional hemp industry and help ensure new growers have access information that will contribute to their success. Having regional seeding data and variety recommendations would increase acres of this crop in Saskatchewan would provide economic benefits to producers. With increased pathogens associated with major crops currently grown (fusarium in wheat and clubroot in canola), increasing economic crops in rotations are becoming more important. Demonstrating the high potential return of this crop and how the currently registered varieties perform will help producers decide if they want to include this crop into their rotation.

Demonstrating the wide seeding date window of this crop will also show producers how growing hemp can help with time management in spring.

6. Objectives and the *progress towards meeting each objective*

The following table contains completed objectives from year one and year two of this project.

Objectives (*Please list the original objectives and/or revised objectives if Ministry-approved revisions have been made to original objective. A justification is needed for any deviation from original objectives)*	**Progress (e.g. completed/in progress)**
a) Seeding date 1; Yield, Height & Maturity	Yield and Height completed as scheduled.
b) Seeding date 2; Yield, Height, & Maturity	Yield and Height completed as scheduled.
c) Seeding date 3; Yield, Height & Maturity	Yield and Height completed as scheduled.

Please add additional lines as required.

7. Changes in the work plan, or budget:

No change in work plan.

8. Methodology:

This project was seeded in a randomized, replicated small plot design including three hemp varieties. Outlook was the only irrigated sites, whereas Melfort, Scott, and Indian Head were non-irrigated. The three seeding dates were end of May, middle of June and beginning of July.

The three varieties (Finola, Picolo and X59) selected were high yielding, dwarfs that are suitable for Saskatchewan conditions.

Plot size and row spacing varied at the four participating sites depending on the equipment, but the target population was set at 100-125 plants/m^2.

Fertilizer was applied in a sideband to reduce the risk of seed injury, and rates were dependent on soil test results.

Plant vigor was visually assessed for each treatment 2-3 weeks after planting. Plant heights were measured prior to harvest, and days to maturity were evaluated for each variety and seeding date. At all sites, plots were harvested when the crop reached physiological maturity (lower grains were hard, and the seed bract didn't hold the seeds started to shatter, but the plants were still green). Plots were directly combined depending upon the maturity of each variety and seeding dates. Yields were determined from cleaned harvest grain samples and corrected to the required moisture content.

9. Results and discussion:

Emergence at all four locations was improved in 2022 when compared to 2021. At Outlook, the irrigation amount was 8 inches (table 2). Indian Head and Melfort received normal precipitation. In Scott, the majority of the precipitation in June occurred in the middle of the month with 21.2mm of rainfall. In July, there was a total of 53.2 mm of rainfall which is 25% higher than the long-term average. July and August produced poor growing conditions as the daily temperature was above average, with very little available soil moisture.

Table 1. Mean monthly temperatures and long-term (1992-2021) normal for the 2022 growing seasons at 4 sites in Saskatchewan.

Location	**Year**	**May**	**June**	**July**	**August**	**Avg.**
		----------*Mean Temperature (°C)* ----------				
Indian Head	2022	10.9	16.1	18.1	18.3	15.8
	Long-term	**10.8**	**15.8**	**18.2**	**17.4**	**15.6**
Melfort	2022	9.9	15.2	18.2	18.7	15.5
	Long-term	***10.7***	***15.9***	***17.5***	***16.8***	***15.2***
Outlook	2022	11.8	16.3	19.8	20.6	17.1
	Long-term	***11.5***	***16.1***	***18.9***	***18***	***16.1***
Scott	2022	10	15	18.3	18.9	15.6
	Long-term	***10.8***	***14.8***	***17.3***	***16.3***	***14.8***

Table 2. Precipitation amounts along with long-term ((1992-2021)) normal for the 2022 growing seasons at 4 sites in Saskatchewan and irrigation amount at Outlook.

		---------- *Precipitation (mm)* ----------				
Location	**Year**	**May**	**June**	**July**	**August**	**Total**
Indian Head	2022	97.7	27.5	114.5	45.9	285.6
	Long-term	***51.7***	***77.4***	***63.8***	***51.2***	***244.1***
Melfort	2022	90.8	78.1	34.9	36.5	240.3
	Long-term	***42.9***	***54.3***	***76.7***	***52.4***	***226.3***
Outlook	2022	30.4	69.4	51.4	8	159.2
	Long-term	***43.2***	***69.3***	***57.6***	***44.2***	***214.3***
Scott	2022	11	57.1	86.5	32.1	186.7
	Long-term	***38.9***	***69.7***	***69.4***	***48.7***	***226.7***
		---------- *Irrigation (mm)* ----------				
		June	**July**	**August**	**September**	**Total**
Outlook		35.6	55.9	63.5	48.3	**203.3**

Data collection for year-two of the trials consisted of yield, height, and maturity (Tables 1 to 6). Seeding dates (late May vs. mid June vs. early July) had a significant effect on hemp yield at two (Scott and Indian Head) of the four sites. Hemp yield was higher when seeded in late May at both Scott and Indian Head (Table 1 and 2). Seeding date effect on hemp yield was not significant at both Outlook and Melfort. Of the four test sites Indian Head had the highest yield (grand mean = 1162 kg/ha).

Yield did not vary with hemp varieties except at Indian Head, where Katani yielded higher than Picola and X59. The interaction between seeding timing and hemp variety was not significant at all four locations (Table 1).

Table 1: Analysis of variance (P-values) for seeding dates and varieties effect on yield at four sites in Saskatchewan in 2022.

	Melfort	***Outlook***	***Scott***	***Indian Head***
Date	NS	NS	<0.005	0.001
Variety	NS	NS	NS	<0.005
*Date*Variety*	NS	NS	NS	NS
Grand Mean	598	864.4	917.6	1162.1
CV	28.8	-	11.4	3.6

NS = Not Significant

Table 2: Seeding dates and varieties effect on mean yield (Kg/ha) measured at four sites. Different letters indicated significant differences between treatments (ANOVA, $P \leq 0.05$).

Seeding dates				
	Melfort	***Outlook***	***Scott***	***Indian Head***
Late (early-July)	584 a	1240 a	637 c	1093 b
Mid (Mid-June)	497 a	640 a	890 b	1037 b
Early (Late-May)	715 a	714 a	1226 a	1356 a
Varieties				
Katani	585 a	1108 a	941 a	1207 a
Picola	595 a	539 a	911 a	1156 b
X59	616 a	947 a	900 a	1123 b

NS = Interaction is Not Significant

Seeding date significantly affected hemp height at all sites (Table 3). At Outlook, Melfort and Indian Head early seeded (late May) hemp plants had a greater height, due to the longer growing season as compared to the other two seeding dates. At Scott, the hemp height increased as the seeding date was delayed as the late seeding coincided with the precipitation in July.
Of the three hemp varieties, X59 was taller than Katani and Picola at Outlook, Scott and Indian Head. Seeding date and hemp varieties interaction were again non-significant for plant height.

Table 3: Analysis of variance (P-values) for seeding dates and varieties effect on plant height at four sites in Saskatchewan in 2021

	Melfort	***Outlook***	***Scott***	***Indian Head***
Date	<0.01	0.031	<0.01	<0.01
Variety	NS	0.007	<0.01	<0.01
*Date*Variety*	NS	NS	NS	NS
Grand Mean	87.1	128.5	115	123.6
CV	13.8	11.3	2.8	2.5

NS = Not Significant

Table 4: Seeding dates and varieties effect on plant height at four sites. Different letters indicated significant differences between treatments (ANOVA, $P \leq 0.05$).

Seeding dates

	Melfort	***Outlook***	***Scott***	***Indian Head***
Late (early-July)	75 c	119 b	124 a	106 b
Mid (Mid-June)	86 b	132 a	114 b	132 a
Early (Late-May)	101 a	134 a	108 c	132 a
Varieties				
Katani	89 a	122 b	111 b	123 b
Picola	85 a	122 b	118 a	121 b
X59	88 a	141 a	118 a	127 a

Days to maturity were collected at all sites other than Outlook (at seeding dates and varieties were harvested simultaneously; Table 5 and Table 6). At IHARF, poor seeding conditions (lack of moisture) at first seeding affected seed emergence, which eventually affect crop maturity. Seeding dates effect on maturity was significant at all three sites, with early seeding date hemp plants taking longer to mature than mid and late seeding. All hemp varieties maturated at the same time at Melfort, whereas at both Scott and Indian Head, Hemp variety X59 took longer to mature than Katani and Picola.
At Scott, plant maturity differed among hemp varieties at the three seeding dates, with variety X59 taking more days to mature at all three seeding dates.

Table 5: Analysis of variance (P-values) for seeding dates and varieties effect on days to maturity (DAT) at four sites in Saskatchewan in 2021

	Melfort	***Outlook***	***Scott***	***Indian Head***
Date	<0.01	NC	<0.01	<0.01
Variety	NS	NC	<0.01	<0.01
*Date*Variety*	NS	NC	0.02	NS
Grand Mean	95	-	91	105
CV	2.4	-	0.75	0.29

NS = Not Significant
NC = Observation Not Captured

Table 6: Seeding dates and varieties effect on hemp days to maturity (DAT) at four sites. Different letters indicated significant differences between treatments (ANOVA, P ≤ 0.05).

Seeding dates				
	Melfort	***Outlook***	***Scott***	***Indian Head***
Late (early-July)	84 c	NC	86 c	106 b
Mid (Mid-June)	96 b	NC	88 b	132 a
Early (Late-May)	106 a	NC	101 a	132 a
Varieties				
Katani	95 b	NC	89 b	123 b
Picola	95 ab	NC	90 b	121 b
X59	97 a	NC	95 a	127 a
Seeding dates* Varieties				
Late*Katani	-	-	84 e	-
Late*Picolo	-	-	84 e	-

Late*X59	-	-	90 c	-
Mid*Katani	-	-	87 d	-
Mid*Picolo	-	-	85 e	-
Mid*X59	-	-	91 c	-
Early*Picolo	-	-	100 b	-
Early*Katani	-	-	100 b	-
Early*X59	-	-	104 a	-

10. **Interim conclusions (*Maximum of 500 words)*.**

In general, growing conditions of 2022 improved slightly from 2021 but were still relatively hot and dry. In year-two of this project, seeding date significantly affected yield, height, and days to maturity. Yield was higher when plots were seeded in late May and hemp variety Katani yielded higher than Picola and X59. Hemp plants were also taller when seeded in late May, with X59 taller than the other varieties at all locations. Hemp variety X59 took longer to mature at all sites.

11. **List any technology transfer/demonstration activities undertaken in relation to this project:**

In 2022 this project was discussed both at the virtual CSIDC field day and at the in person ICDC field day. The project was also talked about at Irrigation Saskatchewan's 2022 Conference. *Will be talked about at North Battleford Conference March 2*

12. **Identify any changes expected to industry contributions, in-kind support, collaborations, or other resources.**

There are no changes to record.

13. **Appendices:**

IHARF location expressed difficulty with harvesting as the stems of the hemp plant would wrap around inside the combine and create issues of plugging. The pictures below are of a research technician at one of the site's unplugging the combine and a pile of what was pulled out of the combine once it was unplugged. ICDC had mentioned that their harvest went smooth this year as they took time to stop and unplug the combine before it become an issue. ICDC also noted that they had issues with birds at maturity and likely lost yield due to this.