Strategic Field Program (SFP)
Project Final Report

Completed reports must be returned by email to Evaluation.Coordinator@gov.sk.ca.

Project Title: Grasshopper control with cultural methods

SFP File Number: SFP #20220381

Principal Investigator

Full Name: James Tansey, james.tansey@gov.sk.ca, 306-787-4669
Lana Shaw, lshaw.serf@gmail.com, 306-452-7253

Organization:

Mailing Address: (James Tansey, 3085 Albert St, Room 125, Regina CA ,S4S 0B1) and (Lana Shaw, PO Box 129, Redvers, SK ,S0C 2H0)

Phone Number: James Tansey, 306-787-4669
Lana Shaw, 306-452-7253

E-mail: James Tansey, james.tansey@gov.sk.ca
Lana Shaw, lshaw.serf@gmail.com

Collaborators *(add additional lines as needed)*

Name	Manager /Director	Phone Number	Email	Branch/Unit	Mailing Address
Bryan Nybo	Research Manager	306-777-4775	wcanybo@sasktel.net	Wheatland Conservation Area	P.O Box 2015, Swift Current, SK, S9H 4M7, CA
Gursahib Singh	Research Manager	306-867-5669	gursahib.singh@irrigationsaskatchewan.com	Irrigation Crop Diversification Corporation	P.O Box 1460, Outlook, SK, S0L 2N0

Abstract *(maximum 500 words)*

Sustainable Canadian Agricultural Partnership
Saskatchewan
Canada

Detail an outline on overall project objectives, methods, key findings and conclusions for use in publications and in the ministry's database. The abstract should address the following (usually 1–2 sentences per topic):

- Key aspects of the literature review
- Problem under investigation
- Clearly stated hypothesis or hypotheses
- Methods used (including brief descriptions of the study design, sample, and sample size)
- Study results
- Conclusions

The effect of wheat varieties along with other crops (Peas, Barley and Lentil) as a cultural control method were tested to see the effect of grasshopper damage in Saskatchewan during 2023 and 2024 season. The experiment was set at three Agri-ARM sites (Outlook, Swift Current and Redvers) in Saskatchewan. Four wheat varieties, including HY320 or a progeny line with three prevalent commercial varieties were seeded, as well as peas and barley at Outlook, while a susceptible pulse crop (lentil) was also planted at Redvers and Swift Current. Trap strips of either peas, oats, or wheat (with and without insecticide) were seeded around subplots to test the effect on grasshopper feeding. During 2023, due to negligible grasshopper pressure at Redvers, the data for grasshopper damage was not noted because there was less than 1% damage assessed. On the other hand, at Swift Current and Outlook, data for yield and damage assessment was recorded. Grasshopper damage rating was assessed at Outlook and Swift Current on 25 plants per plot showed a significant effect of the barrier type, with pea serving as the most effective barrier, substantially reducing grasshopper numbers in the subplots.
Similarly, during 2024, the grasshopper pressure remained below threshold level. For assessment, grasshopper count was done at all locations revealed no grasshopper pressure at Redvers, but Similar like 2023 few numbers of grasshoppers were found at Outlook and Swift Current and a significant effect of barrier type was detected, with peas providing the most effective barrier and significantly reducing grasshopper.

Extension Messages *(3 to 5 bullet point in plain language)*

Provide key outcomes and their importance for producers/processors and the relevant industry sector.

Grasshopper numbers were below economic thresholds (10 m2) at all sites in both years. However, a significant effect of barrier type was detected, with peas providing the most effective barrier and significantly reducing grasshopper numbers in sub plots. Further work is needed to assess the effects of this cultural practice.

Introduction *(maximum 1,500 words)*

Provide a brief project background and rationale.

Cultural control of pest species reduces selective pressures associated with pesticide application and can reduce input costs to field crop production. This work also aligns with the strategies to encourage and support industry to adopt best practices, and advance research, innovation, and knowledge transfer to improve productivity and sector competitiveness for these reasons.

Recent years have seen a significant increase in and application of control products for grasshoppers in crops in Saskatchewan. Although the bulk of these control efforts have been concentrated in southern parts of the province, all regions have experienced significant localized pressure. Densities of the populations of grasshoppers depend in large part on weather conditions. In 2022 Continued warm dry conditions in many parts of the province will contribute to sustained population growth and pest pressures. Of the 85 species of grasshoppers found in the province, only four are typically pests. Feeding preferences of these species differ markedly and regional prevalence of each species varies and is selectively controlled by limiting factors.

Work in the 1980s and 1990s by Owen Olfert and Ross Weiss (AAFC) and students indicated that there are differences in the preferences and therefore damage potential of the four pest grasshopper species also varies. Their studies also indicated a significant difference in susceptibilities among wheat varieties, with HY320 RSW demonstrating apparent mechanical resistance to head clipping by clearwing grasshoppers, a major pest species. This variety was initially bred by Ron DePauw at AFFC Swift Current and there are also commercially available progeny varieties derived from HY320 are present that should be tested.

Work by Olfert and Weiss also indicated resistance in peas and oats to specific grasshopper species and suggestions about the use of these plants as trap and barrier strips to reduce grasshopper impacts Trap strips involve the planting of highly palatable host plants to concentrate pests and limit the area that requires control. Obligate host switching has also been demonstrated in some of the pest grasshopper species in Saskatchewan. Dietary requirements and host plant defenses oblige these grasshopper species to switch hosts. These grasshopper species do not spend their entire lives feeding on one plant species and can switch preferences in relatively short periods of time (days). This means that the proximity of one crop plant to another species of crop plant can interact with this host switching behaviour to attenuate feeding and therefore damage.

Objectives and Progress *(add additional lines as needed)*

Please list the original objectives and/or revised objectives if ministry-approved revisions have been made to original objectives. A justification is needed for any deviation from original objectives.

Objective	**Progress** *(i.e., completed/in progress)*
a) Demonstrate the efficacies of cultural control methods to reduce grasshopper feeding damage	Completed
b) Demonstrate differences among specific crop plants. Prior work has indicated that there are substantial differences among the feeding preferences of the four major pest species of grasshopper in Saskatchewan. Demonstration will include multiple varieties of wheat, and barley, oats, lentil, and peas.	Completed
c) Demonstrate the effectiveness of barrier and trap strips to limit grasshopper feeding. Peas and oats will be used as barrier strips. Trap strips of susceptible wheat with and without insecticide application will also be incorporated.	Completed
d) Make robust recommendation to the agriculture industry regarding non-chemical or augmented chemical grasshopper control.	Progress

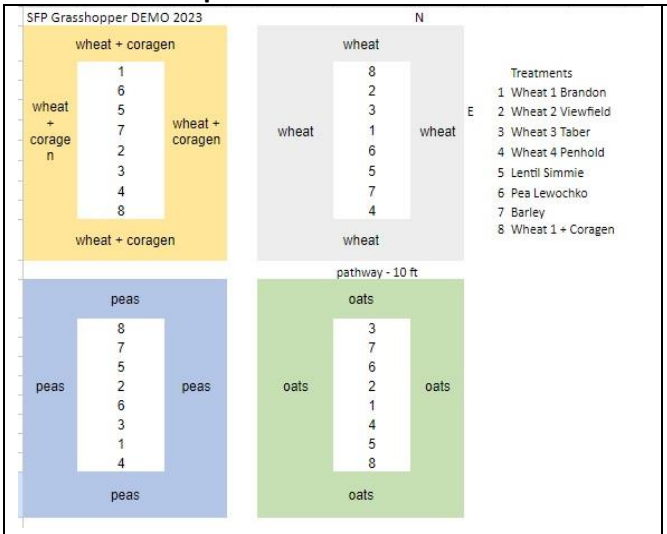
Methodology *(maximum of five pages)*

Specify project activities undertaken during this reporting period. Include approaches, experimental design, tests, materials, sites, etc. Please note that any significant changes from the original work plan will require written approval from the ministry.

The trial was set up eight plots at Redvers and Swift Current and seven plots at Outlook and replicated 4 times. These plots consisted of four wheat varieties (Brandon, Taber, Viewfield and Penhold) during 2023 along with peas and Barley but on the other hand in 2024, taber was replaced by HY320 but other three wheat varieties remained the same. Lentil was included at Redvers and Swift Current. plots were randomized between blocks. Blocks consisted of different seeded borders around the plots, were planted with wheat (with and without coragen), oats and peas.

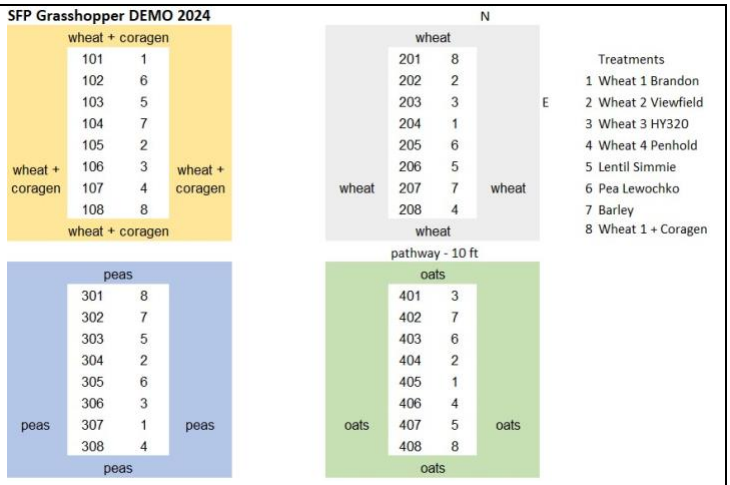
The plot maps for three sites are attached for reference.

Redvers Plot Map



2023 Plot Plan

Note: The treatments are numbered as single digit number from 1 to 8

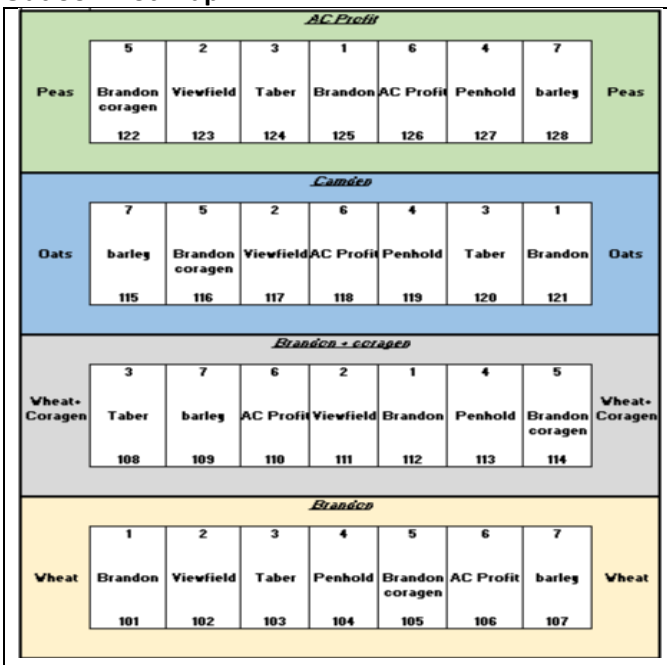


2024 Plot Plan

Note: The treatments are numbered as single digit number from 1 to 8, whereas plot numbers are denoted by three-digit number from 101 to 408.

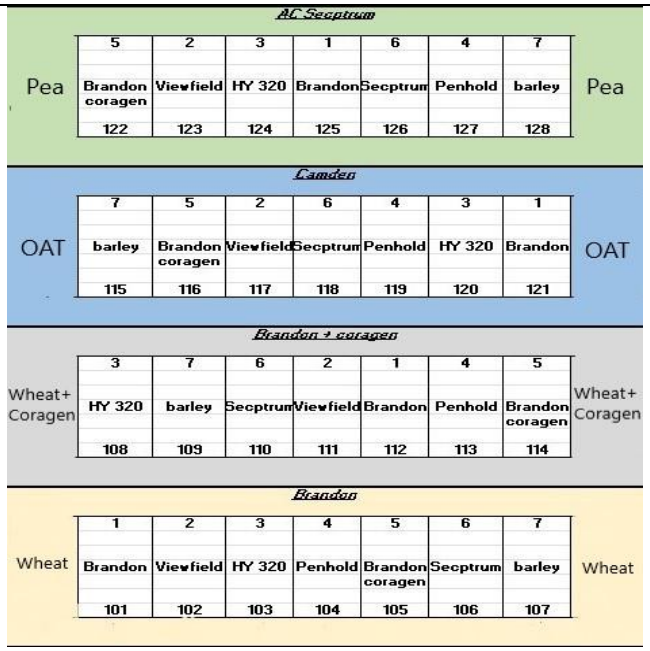
The feeding damage was assessed by counting the number of damaged heads out of a total of 25 heads. Similarly, the percentage of defoliation was evaluated based on 25 plants.

Outlook Plot Map



2023 Plot plan

Note: The blocks/ borders are represented as four different colors around the treatments.



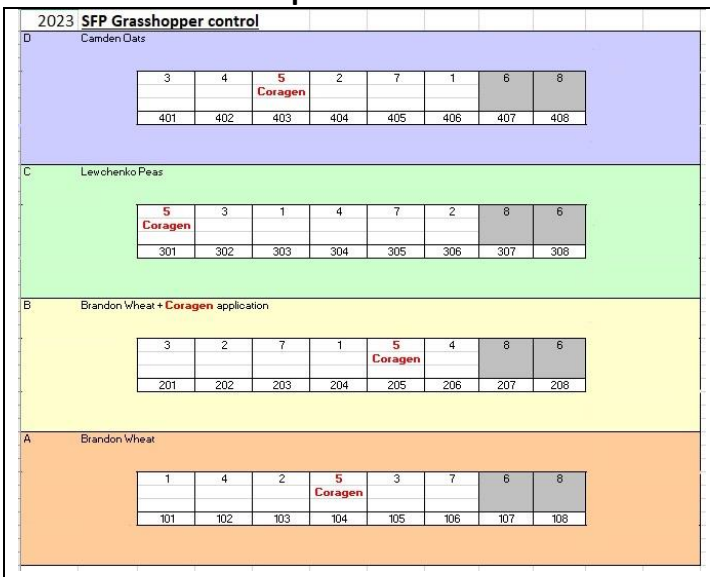
2024 Plot plan

Note: The blocks/ borders are represented as four different colors around the treatments.

The plots are numbered as three-digit numbers from 101 to 128	The plots are numbered as three-digit numbers from 101 to 128

The yield was measured after harvesting the plots using a plot combine, followed by weighing the harvested crop and recording its moisture content. The yield was then adjusted to a standardized moisture level of 14.5% and converted into kilograms per hectare (kg/ha) for accurate comparison.

Swift Current Plot Map



Treatments

1	Brandon Wheat
2	Taber Wheat
3	Viewfield Wheat
4	Penhold Wheat
5	Brandon Wheat + coragen
6	Lewchenko peas
7	barley
8	lentils

2023 Plot Plan

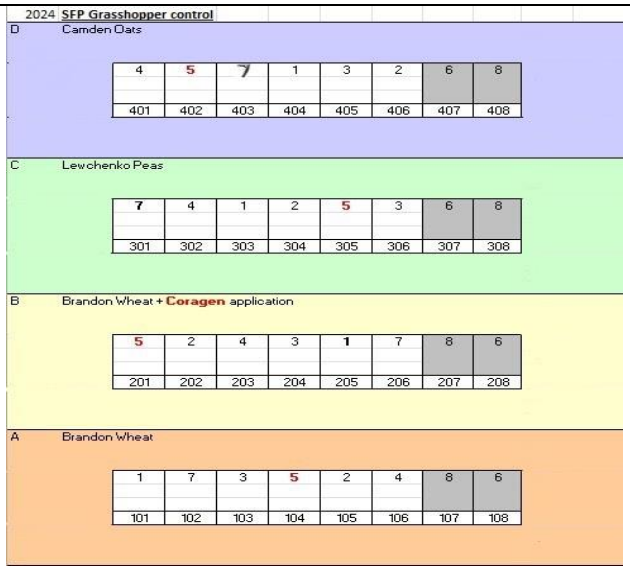
Note: The blocks are represented as four different colors around the treatments.

Block A – Wheat (Brandon)

Block B – Wheat (Brandon) + Coragen (insecticide application)

Block C- Peas (Lewchenko)

Block D- Oats (Camden)



Block	
A	Wheat var 1
B	Wheat var 1 + coragen
C	Lewchenko Peas
D	Camden Oats
reatments	
1	Brandon Wheat
2	HY 320
3	Viewfield Wheat
4	Penhold Wheat
5	Brandon Wheat + corage
6	Lewchenko peas
7	barley
8	lentils

2024 Plot plan

Note: The blocks are represented as four different colors around the treatments.

Block A – Wheat (Brandon)

Block B – Wheat (Brandon) + Coragen (insecticide application)

Block C- Peas (Lewchenko)

Block D- Oats (Camden)

Due to constraints in the experimental design the analysis of variance was not possible for foliar/ feeding damage and yield, but instead descriptive statistics were done at 95% CI, and SE Means are presented for reference.

Results and Discussions *(maximum of 30 pages (not including figures or tables))*

Describe project accomplishments during the reporting period under relevant objectives listed under "Objectives and Progress" section. Please accompany a written description of results with tables, graphs and/or other illustrations. Provide discussion necessary to the full understanding of the results. Where applicable, results should be discussed in the context of existing knowledge and relevant literature. Detail any major concerns or project setbacks.

In 2023, yield and foliar damage were evaluated at Outlook and Swift Current by measuring the percentage of defoliation in 25 randomly selected plants per plot. However, damage assessment was not conducted at Redvers, as cereal and pulse crops showed less than 1% damage.
In 2024, grasshopper damage was minimal across all locations. Despite this, damage assessments were performed at each site, along with yield measurements.

Foliar and Feeding damage:

The data collected at Outlook was based on percent defoliation and represented in table: 1. Grasshopper damage was seen during 2023, while recorded data during 2024 revealed no damage.

Table:1 Grasshopper defoliation (%) 2023

Treatment name	**% defoliation out of 25 plants**			
	Trap Crop (Wheat Brandon)	Trap Crop (Wheat Brandon+ Coragen)	Trap Crop Oats	Trap Crop Peas
Wheat 1	90	20	10	10
Wheat 2	60	0	20	10
Wheat 3	30	10	10	20
Wheat 4	40	40	10	40
Wheat 1+Coragen	40	70	10	10
Pea	10	20	10	20
Barley	10	10	30	10
SE Mean	10.7	8.96	2.97	4.21

Data for percentage defoliation was recorded at Swift current during 2023 was presented in table 2. while no visible defoliation was found in 2024 during data collection. Grasshopper feeding damage was recorded for both 2023 and 2024 and presents in table 3.

Table 2. Data for percentage (%) defoliation at WCA (Swift Current) during 2023

Treatment name	**% defoliation out of 25 plants at dough stage**			
	Trap Cover (Wheat Brandon)	**Trap Cover (Wheat Brandon+ Coragen)**	**Trap Crop Oats**	**Trap Crop Peas**
Wheat-1	15	15	15	10
Wheat-2	15	5	5	10
Wheat-3	10	5	10	10
Wheat-4	10	10	10	10
Wheat 1+ coragen	15	10	10	15
Peas	10	10	10	10
Barley	10	5	5	10
lentils	0	0	0	10
SE Mean	1.75	1.64	1.62	0.63

Table 3. Data for grasshopper feeding damage at WCA (Swift Current) during 2023

Treatment name	**Damaged heads/ flowers (out of 25) at dough stage**			
	Trap Cover (Wheat Brandon)	**Trap Cover (Wheat Brandon+ Coragen)**	**Trap Crop Oats**	**Trap Crop Peas**
Wheat-1	6	5	10	10
Wheat-2	4	6	10	7
Wheat-3	14	10	20	17
Wheat-4	4	4	9	12
Wheat 1+ coragen	10	10	18	25
Peas	*	*	*	*
Barley	12	10	5	2
lentils	4* (flowers at flowering stage)	4*(flowers at flowering stage)	4*(flowers at flowering stage)	12*(flowers at flowering stage)
SE Mean	1.74	1.15	2.35	3.28

* Not used while calculating SE Mean

During 2024, few heads were affected at dough stage and data is presented in the table:4

Table 4. Data for grasshopper feeding damage at WCA (Swift Current) 2024

Treatment name	Damaged heads (out of 25) at dough stage			
	Trap Cover (Wheat Brandon)	Trap Cover (Wheat Brandon+ Coragen)	Trap Crop Oats	Trap Crop Peas
Wheat-1	1	1	5	2
Wheat-2	1	1	13	6
Wheat-3	4	0	2	5
Wheat-4	0	1	7	5
Wheat 1+ coragen	3	1	3	1
Peas	*	*	*	*
Barley	1	1	3	2
lentils	*	*	*	*
SE Mean	0.61	0.17	1.67	0.85

* Not used while calculating SE Mean

No reported defoliation and feeding damage was recorded in Redvers during 2023 as visible damage was less than 1%, while flower damage was assessed for the lentil, but negligible damage was seen during 2024. For cereal crops, percentage defoliation was not assessed as visible damage was below 1% while, the number of damaged heads were counted at the dough stage out of a total of 25 heads. The evaluation revealed that, despite some heads being affected, the extent of the damage on these heads remained minimal, with the affected portion being less than 10%. The data is presented in the table below:

Table: 5 Data for grasshopper feeding damage at Redvers during 2024.

Treatment name	Damaged heads (out of 25) at dough stage			
	Trap Cover (Wheat Brandon)	Trap Cover (Wheat Brandon+ Coragen)	Trap Crop Oats	Trap Crop Peas
Wheat 1	1	0	1	0
Wheat 2	0	1	2	1
Wheat 3	3	2	4	4
Wheat 4	2	0	1	0
Wheat 1 + Coragen	0	0	3	0
Lentil	*	*	*	*
Pea	*	*	*	*

Barley	2	1	4	1
SE Mean	0.49	0.33	0.56	0.61

* Not used while calculating SE Mean

Yield: Yield showed variability according to the site. During 2023, hailstorms caused damage at Swift Current, the extent of damage ranges from 45 % in Wheat to 70 % in lentils. Harvesting was not done at Redvers, while yield data was collected at both Swift Current and Outlook.

During 2024, yield data was collected at all three sites and moisture was standardized to 14.5% across the treatments and sites. The data for 2023 and 2024 are presented in tables: 6 and 7.

Table: 6 Yield (kg/ha) in 2023

Treatment name	**Yield (kg/ha) in 2023**							
	Trap Cover (Wheat Brandon)		**Trap Cover (Wheat Brandon+ Coragen)**		**Trap Crop Oats**		**Trap Crop Peas**	
	Outlook	**Swift Current**	**Outlook**	**Swift Current**	**Outlook**	**Swift Current**	**Outlook**	**Swift Current**
Wheat 1	787	1222	1247	1205	419	1193	1650	1118
Wheat 2	2929	1455	3845	1272	3299	884	4273	982
Wheat 3	3361	1699	4150	1356	2407	1541	5613	1409
Wheat 4	3034	1451	1897	1566	2938	1387	3653	1562
Wheat 1 + Coragen	1711	1409	2019	1261	1755	1553	2495	1031
Pea-	808	867	921	1028	1046	1212	1589	1047
Barley	2085	1048	6291	1300	4572	1057	1203	1530
Lentil	**N/A**	515	**N/A**	431	**N/A**	688	**N/A**	243
SE Mean	399.2	135.2	730.05	119.1	533.8	108.4	619.8	149.3

Table: 7 Yield (kg/ha) in 2024

Treatment	**Yield (kg/ha) 2024**											
	Trap Cover (Wheat Brandon)			**Trap Cover (Wheat Brandon+ Coragen)**			**Trap Crop Oats**			**Trap Crop Peas**		
	Outlook	Swift Current	Redvers	Outlook	Swift Current	Redvers	Outlook	Swift Current	Redvers	Outlook	Swift Current	Redvers
Wheat 1	4460	1359	3637	4095	1442	3019	5233	1374	3824	4713	1757	3455
Wheat 2	4812	1493	3460	3347	1328	2932	4710	1391	3724	4746	1532	4376
Wheat 3	5478	1562	2794	5024	1559	2208	5440	1378	2164	4865	1647	2754
Wheat 4	5201	1560	3473	4871	1419	2807	5986	1421	3455	4762	1388	2691
Wheat 1 - Coragen	4726	1545	3928	5008	1499	3547	4312	1444	3792	3264	1512	4076
Pea	3109	421	527	2200	558	291	2765	828	241	**Lost***	439	208
Barley	5370	1417	4675	5939	1568	3634	5547	1086	4082	7409	1750	4788
Lentil	**N/A***	Damaged*	671	**N/A***	Damaged*	604	**N/A***	Damaged*	733	**N/A***	Damaged*	553
SE Mean	304.6	155.4	534.6	472.5	133.9	450.7	406.1	87.2	601.2	548.6	173.1	537.3

Note- while calculating SE Mean, treatments labelled (*) were not considered

Grasshopper count data and analyses are presented below (Table 8). Treatment effects were evaluated using analysis of variance of the split plot design using the lm statement in the R software package. Pairwise comparisons among treatment groups were made using Šidák correction post hoc test (and visualized using the Compact Letter Display (CLD) command. Grasshoppers were not detected at the SERF site when evaluations were conducted in July. Significant effects of barrier type were found at both the WCA and ICDC sites with peas associated with reduced numbers in subplots. Significant effects of subplot crop type were not detected (p>0.05).

Table 8. Grasshopper counts by site. Different letters represent Sidak groupings: there are no significant differences

among like-lettered groups (α = 0.05).

Site	year	barrier	mean	SE	df	lower.CL	upper.CL	. group
WCA	2023	peas	0.667	0.376	21	-0.357	1.69	a
		oats	2.188	0.376	21	1.164	3.21	b
		Coragen + wheat	2.75	0.376	21	1.727	3.77	b
		wheat	3.042	0.376	21	2.018	4.06	b
	2024	peas	1.4	0.664	21	-0.413	3.2	a
		oats	2.91	0.664	21	1.1	4.72	a
		Coragen +wheat	3.5	0.664	21	1.694	5.31	a
		wheat	3.75	0.664	21	1.941	5.56	a
ICDC	2023	peas	3.14	0.619	18	1.43	4.85	a
		oats	5.57	0.619	18	3.86	7.28	ab
		Coragen +wheat	6	0.619	18	4.29	7.71	b
		wheat	6.14	0.619	18	4.43	7.85	b
	2024	peas	2.14	0.51	18	0.734	3.55	a
		oats	4.71	0.51	18	3.305	6.12	b
		Coragen +wheat	4.71	0.51	18	3.305	6.12	b
		wheat	6.14	0.51	18	4.734	7.55	b

Conclusions and Recommendations *(maximum 500 words)*

Highlight significant conclusions based on the findings of this project, with emphasis on the project objectives specified above. Provide recommendations for the application and adoption of the project findings.

Grasshopper pressure remained relatively low across all locations in both 2023 and 2024. In 2023, grasshopper damage at Redvers was not recorded, as the level of damage assessed was less than 1%, indicating minimal impact. However, damage assessments at Outlook and Swift Current provided valuable insights and revealed some significant effect of using pea as a barrier crop on grass hopper numbers.

A similar trend continued in 2024, with no grasshoppers detected at Redvers and only a few collected at Outlook and Swift Current. However, their numbers remained below the threshold level. Notably, a significant effect of the barrier type was observed, with pea serving as the most effective barrier, substantially reducing grasshopper numbers in the subplots. This suggests that pea may play a crucial role in mitigating grasshopper infestation when used as a barrier crop.

To further validate these findings, additional research is required at a field scale to assess the long-term effectiveness of this cultural practice. Conducting further studies will help determine its potential as a sustainable strategy for grasshopper management and allow for more concrete conclusions to be drawn.

Follow-up Work

Please identify if there is a need to conduct further work. Detail any further projects and/or communication needs arising from this project.

Continued evaluations of barrier crops should be conducted under elevated grasshopper pressures and at near-farm scales.

Patents/ IP generated/ Commercialized Products

List any products developed from this project.

None

Sustainable Canadian Agricultural Partnership (Sustainable CAP) Performance Indicators

a) List of performance indicators

Sustainable CAP Indicator	Total Number
Scientific publications from this project (List the publications under section b)	
• Published	None
• Accepted for publication	None
HQPs trained during this project	
• Master's students	None
• PhD students	None
• Post docs	None
Knowledge transfer products developed based on this project (presentations, brochures, factsheets, flyers, guides, extension articles, podcasts, videos)[1]	This project was presented at the SERF field days with an attendance of over 50 in the presence of Dr James Tansey. At WCA, this project was featured by Amber Wall on "Walk the Plots" Radio Show.

[1] Please only include the number of unique knowledge transfer products.

b) List of scientific journal articles published/accepted for publication from this project.

Title	Author(s)	Journal	Date Published or Accepted for Publication	Link (if available)
N/A	N/A	N/A	N/A	N/A

c) List of knowledge transfer products/activities developed from this project.

Knowledge Transfer Product or Activity	Event/Location Where Knowledge Transfer Was Conducted	Estimated Number of Producers/Processors Participated In Knowledge Transfer	Link (if available)
This project was presented at the SERF field days with an attendance of over 50 in the presence of Dr James Tansey.	Redvers, SK	50	N/A
At WCA, this project was	Country 94.1, Magic 97.1,	Southwest Saskatchewan	

featured by Amber Wall on "Walk the Plots" radio program (July 4, 2023).	CKSW 570		Walk the Plots
Results presented at Alberta agronomy update, 2023	Tansey	1000 online and in-person	N/A
Results presented at Agronomy Research Update, 2023	Tansey	500	N/A

Contributions and Support

List any industry contributions or support received.

Seed received in-kind from AAFC, FP Genetics, SeCan, Richardson Pioneer, Synergy Ag, and LLSeeds. Insecticide as in-kind from FMC

Acknowledgements

Include actions taken to acknowledge support by the Ministry of Agriculture, the Canadian Agriculture Partnership (for projects approved between 2017 and 2023) and the Sustainable Canadian Agriculture Partnership (for projects approved between 2023 and 2028).

Funded by the Government of Canada under the Sustainable Canadian Agricultural Partnership, a federal-provincial-territorial initiative and under Strategic field programs. The funding was acknowledged on field days and other events at all locations.

Appendices

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

Table A1. Mean long-term and 2023 temperature and precipitation over the growing season at the 3 sites.

Location	Year	May	June	July	August	Avg. / Total
		----------Mean Temperature (°C) ----------				
Oulook	**2023**	15.2	19.45	18.6	18.7	17.98
	Long-term	***11.25***	***16.1***	***18.85***	***17.9***	***16***
Redvers	**2023**	14.46	19.73	17.59	17.84	17.40
	Long-term	***11.1***	***16.2***	***18.7***	***18.0***	***16.0***
Swift Current	**2023**	14.8	17.8	18.5	17.8	17.2
	Long-term	***11.5***	***16.3***	***19.0***	***18.6***	***16.4***
		---------- Precipitation (mm) ----------				
Outlook	**2023**	17.5	15.3	15.5	16.6	64.9
	Long-term	***41.5***	***65.3***	***55.8***	***43.9***	***206.5***
Redvers	**2023**	84.06	33.01	10.84	37.6	165.51
	Long-term	***53.2***	***95.2***	***65.5***	***46.6***	***260.5***
Swift Current	**2023**	48.8	33.8	76.7	47.5	207
	Long-term	***43.4***	***60.5***	***56.4***	***40.4***	***200.7***

Table A2. Mean long-term and 2024 temperature and precipitation over the growing season at the 3 sites.

Location	Year	May	June	July	August	Avg. / Total
		----------Mean Temperature (°C) ----------				
Outlook	2024	10.9	14.2	20.4	18.3	15.9
	Long-term	***11.25***	***16.1***	***18.85***	***17.9***	***16***
Redvers	2024					
	Long-term	***11.1***	***16.2***	***18.7***	***18.0***	***16.0***
Swift Current	2024	10.6	14.3	21.3	19.4	16.4
	Long-term	***11.5***	***16.3***	***19.0***	***18.6***	***16.4***
		---------- Precipitation (mm) ----------				
Outlook	2024	62.6	122	19.1	3.8	207.5
	Long-term	***41.5***	***65.3***	***55.8***	***43.9***	***206.5***
Redvers	2024					
	Long-term	***53.2***	***95.2***	***65.5***	***46.6***	***260.5***
Swift Current	2024	73.6	52.1	18.6	18.2	162.5
	Long-term	***43.4***	***60.5***	***56.4***	***40.4***	***200.7***

Table A3. Irrigation application at ICDC (Outlook)

Site	Irrigation (inches)			
Outlook	**June**	**July**	**Aug**	**Total**
2023	4.6	3.4	1.7	9.7
2024	1.5	3	1.25	5.75

Table A4. 2023 Seeding rate and applied fertilizers and their rates at seeding for all sites.

(2023) Seeding/ Fertilizer application rate (lb/ac)			
	ICDC (Outlook)	**SERF (Redvers)**	**WCA (Swift Current)**
Wheat 1 -Brandon	104	96	90
Wheat 2 -Viewfield	102	78	90
Wheat 3 -Taber	141	97	90
Wheat 4 -Penhold	140	121	90
Wheat 1 -Brandon+Coragen	104	97	90
Pea	100* AC Profit	241 * Lewochko	180* Lewochko
Barley	138	81	100
Lentil	Not seeded	32* Simmie	55* Simmie
N	120	64	5.5 in pulses, 80 in cereals
P	27	26	50 in Pulses, 40 in cereals
K	---	5	------
S	---	6	5

*Varieties

Table A5. 2024 Seeding rate and applied fertilizers and their rates at seeding for all sites.

(2024) Seeding/ Fertilizer application rate (lb/ac)			
	ICDC (Outlook)	**SERF (Redvers)**	**WCA (Swift Current)**
Wheat 1 -Brandon	104	96	90
Wheat 2 -Viewfield	102	78	90
Wheat 3 -Taber	141	97	90
Wheat 4 -Penhold	140	121	90
Wheat 1 -Brandon+Coragen	104	97	90
Pea	100* AC Spectrum	241 * Lewochko	180* Lewochko
Barley	138	81	100
Lentil	Not seeded	32* Simmie	55* Simmie
N	134	64	5.5 in pulses, 80 in cereals
P	22	26	50 in Pulses, 40 in cereals
K	---	5	------
S	---	6	5

*Varieties

Table A6. Dates of key operations at all sites for 2023.

Activity	**Operation/date**		
	Outlook	**Redvers**	**Swift Current**
Pre-seed/pre-emergent Herbicide Application	None	Roundup @ 0.7 L/ac on 7-June	Roundup 540 @ 0.67L/ac on 12-May
Seeding	17-May	6-June	16-17 May
Emergence Counts	-----	29 June	----
Damage rating	-----	--------	25 July and 4 Aug (Feeding/Foliar damage rating)
Agrochemical application	17 Jul (Closer)	-----	12 Jun (Liquid Achieve @ 200 ml /ac + Buctril M @ 400ml /ac+ Carrier@0.5 ml/100l, (Pea block- Viper ADV @400 ml/ac+UAN @810ml /ac)
Harvest	14-Sep	-----	15 Aug (pea plots), 17 Aug (lentil plots), 31 Aug (Wheat plots) and 15 Sep (barley plots)

Table A7. Dates of key operations at all sites for 2024.

Activity	**Operation/date**		
	Outlook	**Redvers**	**Swift Current**
Pre-seed/pre-emergent Herbicide Application	None	Roundup 540 @ 0.67L/ac on 12-June	Roundup 540 @ 0.67L/ac on 13-May
Seeding	29- May	11-June	30- May
Emergence Counts	-------	-------	-------
Damage rating		27 Aug	25 July and 4 Aug (Feeding/Foliar damage rating)
Agrochemical application	24 June Centurion	-----	17 Jun (Liquid Achieve @ 200 ml /ac + Buctril M @ 400ml /ac+ Carrier@0.5

	(Peas) 24 June Cirray and Thumper (Cereals)		ml/100l, (Pea block- Viper ADV @400 ml/ac+UAN @810ml /ac), Lentil crop- Solo ADV @ 325 ml/ac Coragen @101ml/ac on T5 Coragen @101ml/ac on Wheat+Coragen Block
Harvest	27 Sep	26 Sep	22 Aug (Lentil plot were too small and patchy, green, did not have good emergence, eaten by deer and rabbits)