Project Identification

1. **Project Title:** Demonstrating the Seed Terminator to reduce weed seed return to the seedbank
2. **Project Number:** 20180403
3. **Producer Group Sponsoring the Project:** Saskatchewan Conservation Learning Centre
4. **Project Location(s):** Farm owned and operated by cooperating producer Josh Lade, east of Rosthern and Duck Lake off of highway 683, RM #403
5. **Project start and end dates (month & year):** Fall 2018 to February 2022
6. **Project contact person & contact details:**

Primary Contact: Robin Lokken (General Manager)
Phone: 1-306-960-1834
Email: info@conservationlearningcentre.com

Secondary Contact: Ryan Scragg (BOD Chair)
Phone: 1-306-961-2240
Email: ryan_scragg@hotmail.com

Objectives and Rationale

7. **Project objectives:**

This project was intended to demonstrate the ability of the Seed Terminator to prevent weed seed return to the seed bank. This project also promoted harvest weed seed control, raised awareness about herbicide-resistant weeds, and provided an option to producers who are concerned about herbicide-resistant weeds on their farms.

8. **Project Rationale:**

The number of herbicide-resistant weed species and their spread continues to grow on the Canadian Prairies (Beckie et al., 2020). With a limited number of registered herbicide groups and a lack of new chemistries being registered, different methods and practices of weed management are needed. These different strategies help to develop better-integrated management plans, reduce further herbicide resistance, and help protect the chemicals we have from becoming obsolete.

Harvest weed seed control (HWSC) includes a variety of different methods and practices for limiting the spread of weed seeds during harvest. Herbicide resistance has become a large problem in countries such as Australia, where HWSC is more commonly utilized. A 2017 study indicated 43% of Australian farmers were utilizing some method of HWSC in their operations. The most commonly used method was narrow-windrow burning. With the attachment of a chute, chaff is directionally contained to a narrow windrow. After harvest producers are able to burn the chaff rows. This method of HWSC has shown to be most effective with canola and pulse crops, as the chaff burns hotter and slower than cereal chaff, destroying more weed seeds. Chaff tramlining, chaff carts and the bale-direct system was used by 10% of producers. Tramlining is one of the most affordable HWSC options for producers. Farmers are able to direct chaff and

weed seeds into single tramlines with modified chute attachments. The chaff is placed on soil that is usually compacted and driven over multiple times a year. As the chaff is placed in a narrow row, some weed seeds rot before germinating, and others have difficulty establishing through the thick chaff layers. With chaff carts, chaff is directionally fed into the cart that is pulled behind the combine during harvest. The chaff is then dumped in piles that can then be grazed by livestock, burned by producers, or both. The bale direct system of HWSC allows farmers to utilize chaff for livestock feed. A large square baler is directly attached to the combine. As chaff and weed seeds are collected, they are compacted into bales and kicked out in the field. Finally, less than 1% of surveyed producers claimed to use the Harrington Seed Destructor (HSD), a type of integrated impact mill. The HSD was a tow behind milling unit. Inside the mill, three rows of bars rotate in opposite directions grinding the chaff down, effectively destroying weed seeds. The HSD allows for chaff to be spread over the field without the high presence of weed seeds. Despite low use of the HSD, almost one-third of producers stated that they would prefer to use the system. When asked what method (s) of HWSC they would like to use in five years' time, 29% of growers said they would like to implement the HSD (Walsh et al., 2017).

In 2017, the Seed Terminator technology was announced by Dr Nick Berry. Dr Berry brought over the first unit to Saskatchewan in 2018. The Conservation Learning Centre was approached to be involved with demonstrating how the technology works under Canadian conditions by collaborating with local producer Josh Lade. The Seed Terminator was developed in Australia and works similar to the Seed Destructor, except it uses a multi-stage hammer mill for pulverizing weed seeds during combining. Initially, the Harrington Seed Destructor was a tow-behind unit, but it is now integrated with the combine like the Seed Terminator.

Australian producers were initially reluctant to adopt the HSD due to perceived high costs (55% of producers surveyed), and unproven technology (24% of producers surveyed) (Walsh et al., 2017). Previously, it was anticipated that the cost to operate the Seed Terminator would be over $10/ac (Hein, 2020). In 2021, Josh Lade shared the cost breakdown for operating his Seed Terminator based on four years of operation. When 2000ac were managed with the seed terminator, the price of the equipment came out to $8.47/ac. When 3000ac were managed, the price dropped to $6.86/ac. With 4000ac in operation, the price of the seed terminator was $6.16/ac (Lade, 2021). Interest in using the equipment is growing as the equipment can now be more easily integrated into combines and increased industry competition may be driving the initial equipment costs down. There are currently 4 integrated impact mills on the market. In addition to the newly integrated HSD v.12, and the Seed Terminator, there is the WeedHOG and Canadian-made Redekop Seed Control Unit (Tidemann et al., 2020).

The Seed Terminator has been proven to successfully remove at least 93% of weed seeds when operating at 2250 RPM, and up to 96% successful when operating at 2400 RPM. High levels of HWSC in the 2017 Australian study clearly signifies that these approaches to weed control are now accepted and routine methods of weed control in Australian cropping systems (Walsh et al. 2017). Rather than waiting for herbicide resistance, HWSC can be used as a pre-emptive tactic for herbicide conservation. With the Seed Terminator, producers may also have another option to manage herbicide-resistant weeds that pop up on their operations. The Seed Terminator allows producers to reduce weed seed inputs to the seed bank. Weeds that survive multiple herbicide applications throughout the growing season are the toughest to control. The Seed

Terminator allows producers to pulverize and minimize the redistribution of weed seeds back into the seed bank and spread across the field. This technology may also be of interest to organic producers who do not have access to herbicides and rely heavily on tillage. Harvest weed seed control could help organic producers reduce tillage use. The data collected during this trial will showcase the functionality of the Seed Terminator used under Canadian conditions and in managing Canadian weeds.

References:

Beckie, H., Shirriff, S., Leeson, J., Hall, L., Harker, K., Dokken-Bouchard, F., & Brenzil, C. (2020). Herbicide-resistant weeds in the Canadian prairies: 2012 to 2017. Weed Technology, 34(3), 461-474. doi:10.1017/wet.2019.128

Hein, Treena. "The Pros, Cons and Costs of Owning a Weed Seed Smasher." *Grainews*, Grainews, 16 Apr. 2020, https://www.grainews.ca/news/the-pros-cons-and-costs-of-owning-a-weed-seed-smasher/?__cf_chl_tk=r4CucKeFGO8BsxF5ZuziUDjopsyLSma9lHz4leFe.1w-1637768463-0-gaNycGzNCKU.

Lade, Josh. "4 Years in with the Seed Terminator- What Have We Learned?" *Government of Saskatchewan*, Saskatchewan Agriculture Knowledge Centre, 2 Dec. 2021, https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/agribusiness-farmers-and-ranchers/sask-ag-now/webinars-for-agribusiness-farmers-and-ranchers.

Tidemann B.D., Kubota, H., Reid, P., and J. Zuidhof. Initial testing of a cage mill with an incorporated blade system on volunteer canola. Canadian Journal of Plant Science. 100(5): 592-596. https://doi.org/10.1139/cjps-2020-0010

Walsh, Michael, et al. "High Levels of Adoption Indicate That Harvest Weed Seed Control Is Now an Established Weed Control Practice in Australian Cropping." *Weed Technology*, no. 3, Cambridge University Press (CUP), May 2017, pp. 341–47. *Crossref*, doi:10.1017/wet.2017.9.

Methodology and Results

9. Methodology:

Field Study

This four-year demonstration began in the fall of 2018. The field demonstration is located east of Rosthern and Duck Lake, off of Highway 683. To examine the efficacy of the Seed Terminator, two treatments were used in the trial. Each treatment was replicated twice. The in-field plots/strips were a combine header width wide of 10m and 100m in length. Treatments are summarized in Table 1. Other than the use of the Seed Terminator during harvest, the treatments received the same inputs such as seeding rate, fertility and crop protection. No herbicides were applied to the trial site since the 2018 growing season, where Rival herbicide was applied. The producer's crop rotation has included wheat (2018), canola (2019), barley (2020), and peas (2021). Select photos of the field site can be found in the appendix. Weed surveys occurred in

the fall of 2018, August 14, 2019, June 12, 2020, September 10, 2020, June 10, 2021, and August 19, 2021. Weeds were surveyed in 10 x 0.25 m^2 quadrats per plot selected in a W pattern approximately every 10 m. Both weed species present and quantity was recorded for each quadrat.

Table 1. Treatments used in "Demonstrating the Seed Terminator to reduce weed seed return to the seed bank".

Treatment #	Treatment Type
1	No Seed Terminator (Control)
2	Seed Terminator

Pot Study

In 2018, chaff was collected from two locations per plot. The samples were collected from the back of the combine during harvest using sweep nets. For regular combined plots without the Seed Terminator, all the material was collected as 1 sample of material. For the plots that were combined with the Seed Terminator, two types of material were collected. The two types of materials consisted of the chaff that travelled through and came directly out of the Seed Terminator and chaff that bypassed the Seed Terminator. The three types of chaff were planted into small, sterilized soil medium in the winter of 2019 and grown under grow lights indoors at the Ministry of Agriculture Office in Prince Albert (Figure 1). Prior to planting the chaff, the material was passed through a sieve to remove the largest chaff material, as material that had not passed through the Seed Terminator was quite large (Figures 2 and 3). This indoor small pot method was not the best as weed identification was difficult due to seedling death prior to a positive weed ID and germinated weed seeds would often die quickly due to unideal growing conditions, making total weed counts a challenge.

Figure 1. In lab pot experiment set up of planted chaff collected during harvest time with and without the use of a Seed Terminator.

Figure 2. Chaff that passed through the Seed Terminator that was mounted onto the back of a combine.

Figure 3. Chaff collected from combine without the Seed Terminator.

The pot study was repeated again in the summers of 2019 and 2020 using the same material collected fall of 2018. Again, the chaff was passed through a sieve prior to planting. The chaff was planted into potting soil in large pots outdoors at the Conservation Learning Centre. The outdoor pot study was a success as weed seeds had better growing conditions that were more similar to typical field conditions (same light and temperature). For this pot study, two controls were used; potting soil with nothing seeded, and potting soil with wheat/oats seeded. The experiment was repeated again in 2020 to collect photos for extension purposes and to present at the annual Field Day. Biomass was also measured in 2020.

10. Results

Weather Conditions

Although this Seed Terminator project does not take place at the CLC, the CLC is the closest climate station. Since the start of this trial, conditions have been relatively dry compared to the long-term average (Table 2). 2021 has been the driest year with total precipitation in the 2021 growing season being almost 100 mm lower than the long-term average. 2020 and 2019 have been cooler, but 2021 was very hot with mean temperature for the entire growing season nearly 1˚C warmer than the long-term average. Poor crop growing conditions and the poor competitiveness of the field peas likely contributed to high weed pressure in 2021.

Table 2. Weather conditions in the 2021 growing season at the Conservation Learning Centre from the onsite SRC weather station.

	May	June	July	August	September	October	Average/Total
				--- Mean Temperature (°C) ---			
2021	10.1	18.3	20.3	17.0	13.5	4.9	14.0
2020	9.2	13.4	17.6	16.1	10.9	1.0	11.4
2019	9.5	15.8	17.4	15.1	11.6	1.0	11.7
2012-2018	11.8	16.1	18.5	17.3	11.6	3.5	13.1
				--- Precipitation (mm) ---			
2021	29.8	84.0	9.6	57.0	9.5	13.9	202.3
2020	68.4	91.4	32.2	33.2	31.6	10.1	266.9
2019	30.0	54.4	57.4	16.8	59.6	11.6	229.8
2012-2018	36.4	80.6	96.1	48.0	25.8	26.0	310.5

Field Study

In the fall of 2018, before harvest and the use of the seed terminator, a preliminary weed survey was completed to determine the type and quantity of weeds present on site (Figure 1A). Results are summarized in table 3 and 4, and indicate that weed pressure was similar across treatments prior to the initiation of harvest weed seed control. The weed species present include barnyard grass, horsetail, kochia, perennial sow thistle, volunteer canola, wild oats, shepherds' purse, wild buckwheat, knotweed and lamb's quarter. The first control (plot 1) had the lowest weeds, and the second control (plot #3) had the highest weeds out of all four plots.

Table 3. Total weeds counted during weed surveys of a field using the Seed Terminator as harvest weed seed control vs no control. Harvest weed seed control was initiated Fall of 2018. No spring survey was conducted in 2019 due to minimal weed pressure.

Treatment	Plot #	Total Weeds					
		Fall Surveys				Spring Surveys	
		2018	2019	2020	2021	2020	2021
Control	1	53	170	79	413	109	712
Seed Terminator	2	85	128	73	160	332	325
Control	3	120	94	111	396	610	847
Seed Terminator	4	71	47	48	132	382	243

Table 4. Total species of weeds identified during weed surveys of a field using the Seed Terminator as harvest weed seed control vs no control. Harvest weed seed control was initiated Fall of 2018. No spring survey was conducted in 2019 due to minimal weed pressure.

Treatment	Plot #	Total Species					
		Fall Surveys				Spring Surveys	
		2018	2019	2020	2021	2020	2021
Control	1	6	15	5	10	11	11
Seed Terminator	2	5	10	4	12	9	12
Control	3	6	11	6	9	9	12
Seed Terminator	4	3	8	6	7	12	12

No spring weed survey was completed in 2019 because there was minimal to no weed pressure across all plots. The second weed survey in 2019 was conducted in the fall after 1 year of harvest weed seed control use. The 2019 survey showed a higher number of total weeds and total species than 2018 for all plots, except for plot #4 (Table 3). The weed species included American vetch, barnyard grass, cleavers, green foxtail, horsetail, lamb's quarter, perennial sow thistle, round leaved mallow, shepherd's purse, spiny annual sow thistle, volunteer canola, wild buckwheat, kochia, and volunteer wheat. Plot #4 (Seed Terminator treatment) had a lower number of total weeds in 2019 when compared to 2018 but had a higher number of total species in 2019. The higher number of total weeds and weed species in year 2 (2019) was likely due to management, since herbicides were used in 2018 and no herbicides were used in 2019.

Spring surveys completed in 2020 and 2021 show huge increases in weed density across all treatments (table 3). In 2020, there was a high presence of volunteer canola from the 2018 canola crop. The values presented in spring 2020 are the weed totals without volunteer canola. Some canola likely shattered during swathing or prior to combining. Weed populations decreased throughout the growing season, despite the fact that no herbicides were used likely due to competition from the seeded crop or competition between weeds. Some weeds would also complete their lifecycle prior to harvest. While counts are high in the spring, there are often 1 or 2 sampling points within a treatment that had a large quantity of the same weed species present. For example, the control plot 3 in spring 2020 had 262 lamb's quarters present within a single ¼ m^2 sampling location. In spring 2021, the total number of weeds per plot was highest in both control treatments, with 712 and 847 weeds recorded in plots 1 and 3, respectively (table 3). The Seed Terminator treatments both had the lowest quantity of weeds, with 325 weeds observed in plot 2 and 243 weeds observed in plot 4. The total number of weed species found was relatively consistent in all plots. The most common weed species found include lamb's quarter, sow thistle, kochia and shepherd's purse.

In the fall of 2020 (Figure 2A), the control plots had higher total weed quantity than the Seed Terminator plots. The most common weeds found when surveying in the fall of 2020 include volunteer canola, kochia, sow thistle, buckwheat and Canada thistle. The final pre-harvest fall

weed survey was conducted on August 19, 2021. This was the weediest survey that occurred in the driest year with peas as the seeded crop (Figure 3A). Once again, the total number of weeds observed per plot was highest in the control treatments, with 413 identified in plot 1 and 396 identified in plot 3 (Table 3). The Seed Terminator plots had the fewest number of total weeds, with 160 and 132 weeds observed in plots 2 and 4, respectively. Total weed species found was highest in plot 2 (Seed Terminator) at 12 species, and lowest in plot 4 (Seed Terminator) at 7 species. Most common weed species identified include kochia, sow thistle, Canada thistle, foxtail barley, lamb's quarter and spear saltbush.

A summary of weed density changes in the Seed Terminator plots relative to the control plots for 2018-2021 can be found in Table 5 and Figure 3. Prior to the use of the Seed Terminator in the fall of 2018, the Seed Terminator plots had 9.8% fewer weeds than the control plots. This would indicate that there were some slight differences in weed populations in the different treatment plots before the start of the trial. Throughout the course of the study, there have been consistently fewer weeds in the Seed Terminator treatments than the control treatments. By the fall of 2019, after just one use of the Seed Terminator, the Seed Terminator plots had a 33.7% lower weed density than the control plots. This difference continued to increase year after year, with a 36.3% difference by the fall of 2020 and a 63.9% difference by the fall of 2021. Spring weed density was similar in both treatments in 2020, and 63.6% lower in the Seed Terminator treatment in the spring of 2021.

Table 5. Weed density observed in each treatment. % Difference represents the decrease in weed density in the Seed Terminator treatment compared to the control, where a positive value indicates a lower density of weeds with the use of the Seed Terminator compared to the control.

Treatment	Weed Density (# of weeds/m^2)					
	Fall Surveys				Spring Surveys	
	2018	2019	2020	2021	2020	2021
Control	35	53	38	162	144	312
Seed Terminator	31	35	24	58	143	114
Difference (Control-Terminator)	3	18	14	103	1	198
% Difference (Difference/Control*100)	9.8	33.7	36.3	63.9	0.7	63.6

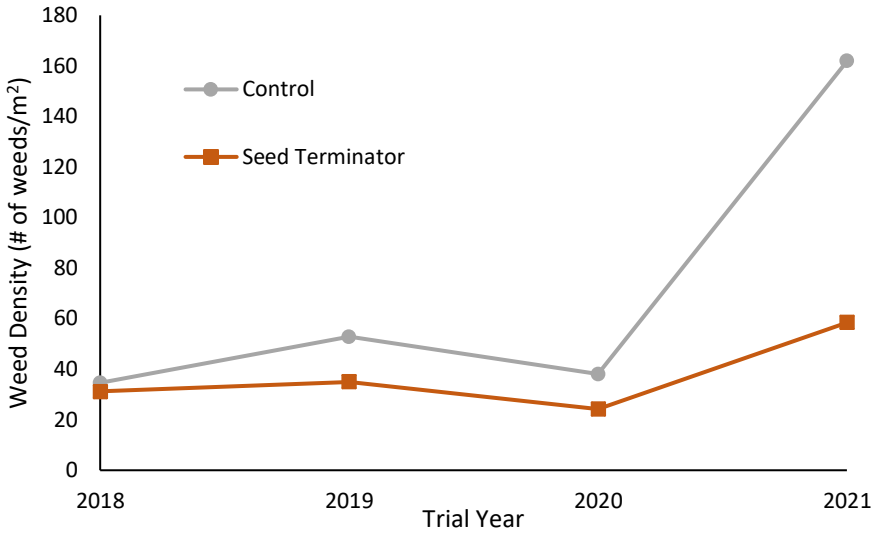

Figure 3. Chart depicting changes in fall weed density between 2018-2021 in the Control and Seed Terminator treatments. The fall 2018 weed survey was conducted prior to the first use of the Seed Terminator.

All plots saw an increase in total weeds and total species between the fall of 2018 and the fall of 2021 (Figure 3). This increase in overall weed quantity and species can likely be attributed to the fact that 1) no herbicides have been applied to the field since the 2018 growing season, and 2) peas were grown in 2021 and are relatively poor competitors to weeds compared to many other common conventional crops. The increase in total weeds was the largest in the control treatments (Table 6) increasing between 230-679% since 2018 compared to an increase of just 86-88% in the control plots since 2018. Despite the overall increase in weeds throughout the trial, the Seed Terminator treatment displayed a much lower increase than the control plots.

Table 6. Percentage decrease in total weeds and total species between the fall of 2018 and the fall of 2021. A negative number indicates a percentage increase.

Treatment	Strip/Plot #	Total Weeds (%)
Control	1	-679
Seed Terminator	2	-88
Control	3	-230
Seed Terminator	4	-86

Pot Study

The number of weeds that germinated from the no terminator chaff in the outdoor pots in 2019 and 2020 was higher than pots with terminator and terminator bypassed chaff (Table 7 and 8). The chaff that bypassed the terminator had a slightly higher weed count than the chaff that passed through the terminator in 2019.

Table 7. Average weed count (4 reps – 2 plots x 2 locations) from chaff that was collected in the harvest of 2018 and then planted in pots during the summer of 2019 and 2020.

Treatment	Description	Weed count	
		2019	2020
No terminator	Chaff	12.25	5.5
Terminator	Bypassed chaff	3	0.5
Terminator	Terminator chaff	1.25	0.5

Table 8. Average biomass (4 reps - 2 plots x 2 locations) from chaff that was collected in the harvest of 2018 and planted in pots during the summer of 2020. Biomass for the control treatments refers to actual biomass, as there was only one pot each of the controls.

Treatments	Description	Mean/Actual Biomass (g)
No terminator	chaff	114.1
Terminator	bypassed chaff	0
Terminator	Terminator chaff	4.2
Control	soil	0
Control	wheat/oats	120.5

Mean weed biomass in 2020 was highest in the no terminator chaff treatment at 114.1 g (Table 8 and Figure 2). The bypassed chaff and the soil control both had a mean weed biomass of 0 g. Weed biomass in the terminator chaff was slightly higher but low, at 4.2 g. The wheat and oat control treatment had the highest biomass, at 120.5 g. Control B (Figure 2) shows some weed seeds were present in the potting soil used. These weeds were not included in counts or biomass measurements. Figure 2 provides a great visual showing better weed control achieved when chaff passes through the Seed Terminator.

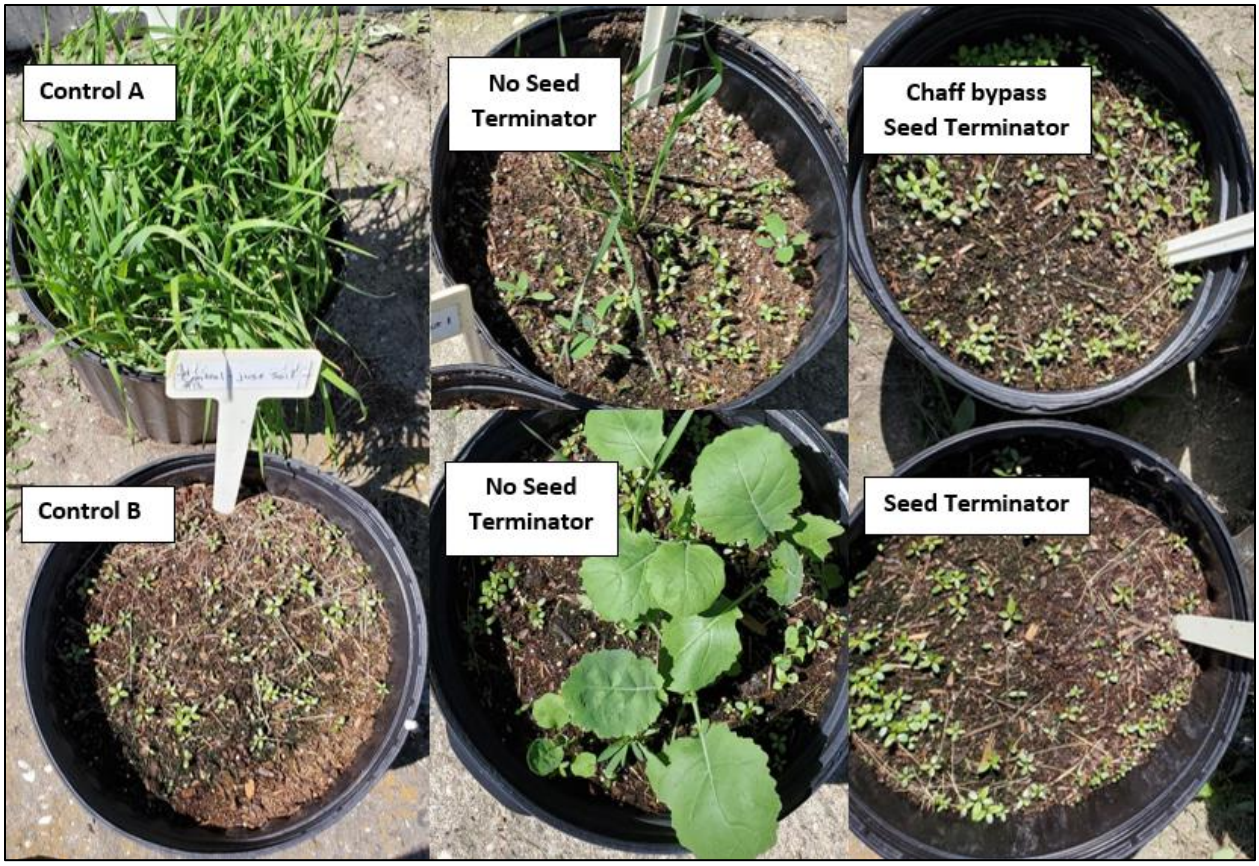

Figure 2. Outdoor pot experiment completed in summer of 2020. Chaff was collected during harvest 2018 from the back of a combine using sweep nets. Samples were collected from a combine fitted with and without a Seed Terminator. Control A was seeded with wheat and oats. Control B was potting soil only with nothing planted.

11. Conclusions and Recommendations

The 2019 and 2020 large pot experiments demonstrated that the Seed Terminator successfully reduces the amount of weed seeds that return to the seedbank. In both years, chaff collected from the Seed Terminator resulted in fewer weeds when planted compared to chaff collected when the Seed Terminator was turned off.

The effect of harvest weed seed control (HWSC) was more difficult to distinguish on a field scale due to environmental factors, differences in ability of the crop to compete with weeds, and the survivability of weed seeds in the seedbank. Despite these challenges, the impact of HWSC on weed populations was evident when comparing the percentage difference in weed density between the control and Seed Terminator treatments in each year of the trial. In 2019, the HWSC treatments had 33.7% fewer weeds than the control plots. By 2020, this number had increased to 36.3%. By 2021, three years after the last in field herbicide application and the first use of the Seed Terminator, plots where HWSC was used exhibited 63.9% fewer weeds than the plots where there was no HWSC. While this data is extremely promising, continued use of the Seed Terminator on this site would help to strengthen these results by

demonstrating the impacts of HWSC in a field with an increasingly diminishing weed seedbank. The decision was made at the beginning of this trial to not use herbicides in order to see the full effect of the Seed Terminator and there was concern that herbicide use would be too effective at controlling weeds and there would be no weed seeds come harvest time. If monitoring were to continue at this site, it would be valuable to see if HWSC in conjunction with herbicide control would reduce weed populations over time compared to the control without HWSC. While it is evident that the impact mill technology successfully reduces weed seeds from entering the seed bank during harvest, it is one tool that should be used in an integrated approach to weed management. The Seed Terminator can only destroy weed seeds that enter the combine. For example, weeds that shatter prior to harvest, are too low to the ground or perennial weeds are able to escape HWSC.

An additional factor for a producer to consider when looking at purchasing the Seed Terminator is the costs associated with using the equipment. The collaborating producer for this project, Josh Lade, provided a cost breakdown based on his experience with the Seed Terminator. This cost breakdown is available in Figure 2 in the Appendix. Lade estimates the costs of using the Seed Terminator average as low as $6.16/ac (assuming a farm size of 4000 ac). The cost to operate the Seed Terminator was initially anticipated to be $10/ac. The lower operating cost may increase interest in adoption by growers in Saskatchewan.

Supporting Information

12. Acknowledgements

The Conservation Learning Centre graciously acknowledged the Ministry's support through signage directly in field with the project, verbally during the Field Day and on the Field Day agenda handed out to all visitors. The pot study was available for producers to see in person in 2019 and 2020. Many thanks to Josh Lade for allowing us to conduct this demonstration on his land, carrying out the treatments with field scale equipment, and his knowledge on harvest weed seed control and the Seed Terminator.

13. Appendices

Table A1. Cost breakdown of using the Seed Terminator provided by cooperating producer Josh Lade during Day 4 of the 2021 Agronomy Research Update on December 2, 2021. Available at: https://www.saskatchewan.ca/business/agriculture-natural-resources-and-industry/

Terminator Cost Break-down	**Year**		*1*	*2*	*3*	*4*	*5*	*6*	*7*
	Acres Farmed		4000	4000	4000	4000	4000	4000	4000
	Yearly Payment	***Purchase Price--$120,000***	43 600	43 600	43 600	n/a	n/a	n/a	n/a
		3% Yearly Interest							
	Yearly Fuel Costs		4000	4000	4000	4000	4000	4000	4000
	Repairs/Maintenance Cost	***Mill belts***	1125	0	1125	0	1125	0	1125
		Drive belts	400	1050	400	1050	400	1050	400
		Bearings and Pully Rebuild	0	0	7000	0	0	0	7000
		Rotors and Screens	0	0	15 000	0	0	0	15 000
	Yearly Total Cost		49 125	48 650	71 125	5050	5525	5050	27 525
	Total Price/Acre		12.28	12.16	17.18	1.26	1.38	1.26	6.88
	Average Price/Acre		6.16						
Terminator Cost Breakdown with Different Acres Farmed					**Acres Farmed**	2000	3000	3500	4000
					Average Price/Acre	8.47	6.86	6.54	6.16

Figure 1A. 2018 Site year prior to harvest of wheat crop. Some kochia patches present. Orange flags indicate the boundaries of the plots.

Figure 2A. 2020 Site year prior to harvest of barley crop. Flags indicate the boundaries of the plots.

Figure 3A. 2021 site year prior to harvest of field peas. High weed density in 4th year due to poor competitive nature of peas compounded by dry conditions. Flags indicate the boundaries of the plots.

Abstract

14. Abstract/Summary

Herbicide resistant weed species are becoming an increasing challenge for farms across Saskatchewan. Between 2018-2021, a field scale demonstration was established between Rosthern and Duck Lake, SK by the Conservation Learning Centre and cooperating producer Josh Lade. The purpose of this project was to demonstrate the ability of an integrated impact mill (Seed Terminator) as a method of harvest weed seed control (HWSC), to reduce weed seed

return to the seed bank. The trial was set up with alternating strips/plots (10m x 100m) that were harvested with and without the Seed Terminator. Herbicide was not applied following harvest of 2018. Weed surveys were conducted in the spring and fall throughout the duration of the study. In 2018, chaff was collected from the 2 treatments and planted into pots during summer of 2019 and 2020. The pot experiments demonstrated that the Seed Terminator successfully reduces the amount of weed seeds that return to the seedbank. In both years, fewer weeds germinated from chaff collected from the Seed Terminator compared to chaff collected when the Seed Terminator was turned off. Reductions in weed density were also apparent in the field surveys. In 2019, one year after the first use of the Seed Terminator, the HWSC treatments had 33.7% fewer weeds than the control plots. By 2020, after two seasons of HWSC, this number had increased to 36.3%. Additionally, in 2020 the Seed Terminator plots demonstrated a 14-32% decrease in total weeds since 2018. In comparison, the control plots in 2020 demonstrated between an 8% decrease to a 50% increase in total weeds since 2018. In 2021, three years after the last in field herbicide application and the first use of the Seed Terminator, all plots saw an increase in total weeds relative to 2018, likely due to the non-competitive nature of field peas and drought conditions. The control plots saw an increase in total weeds of 230-670% compared to 2018, much higher than the HWSC plots that saw an increase of only 86-88%. Also in 2021, plots where HWSC was used exhibited 63.9% fewer weeds than the plots where there was no HWSC. The total number of weeds surveyed in each plot increased or decreased each year for many reasons such as environmental factors, differences in crop weed competition ability, and the survivability of weed seeds in the seedbank. However, in any given trial year, the Seed Terminator plots had consistently lower weed density than the control plots. While this data is promising, continued use of the Seed Terminator on this site would help to strengthen these results by demonstrating the impacts of HWSC in a field with an increasingly diminishing weed seedbank. While it is evident that the impact mill technology successfully reduces weed seeds from entering the seed bank during harvest, it is one tool that should be used in an integrated approach to weed management.