The Seed Head
Fact sheet # 14

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A three year comparative study of desiccant use on red clover seed crops in the Peace River region

Effects of the desiccant Reglone® on red clover seed crop, 2013

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Introduction

Pre-harvest desiccants, including herbicides with the ability to act as desiccants, are used to aid in crop dry down and to reduce the negative impact that variable maturity can have on plant production and harvest efficiencies (Zhang *et al* 2014 and Zhang 2015). While little information was found specific to red clover harvest and desiccant use, other studies of legume crops point to the importance of type (or combination of types) of desiccant/herbicide used and timing of application, all of which may impact seed yield and quality (May *et al* 1996; Zhang 2015). Desiccants should not be applied until the majority of the legume crop has reached physiological maturity as applying too early can lead to lower seed yields (Moyer *et al* 1996; Zhang *et al* 2014). Furthermore, depending on timing of application, the impact of certain treatments may also affect seed quality and stand vigour (the spring after application) (Moyer *et al* 1996). Dual-purpose pre-harvest herbicide and desiccant application may be a more efficient way to treat red clover seed fields, however more information is needed regarding effects on forage moisture content, seed yield and seed quality.

Trials were conducted in 2013, 2014 and 2015 in partnership with the Smoky Applied Research and Demonstration Association (SARDA) and Agriculture and Agri-Food Canada to explore the impacts of five different desiccant treatments on first year red clover seed fields. The five treatments included stand-alone application or combinations of Heat®, Roundup Transorb® and Reglone® Ion. While Reglone® has already been registered for use on red clover, this study aimed to examine the potential for the use of Heat® and Roundup® treatment combinations as alternative desiccants for pre-harvest use on red clover. Roundup® helps to control perennial weeds such as Canada thistle and, in combination with Heat®, it was hoped that both effective dry down and weed control could be attained. An additional research goal was to determine the effect, if any, of pre-harvest Roundup application on seed germination. For the purpose of this study post-application percent germination is a key indicator of seed quality.

Table 1. Red clover trial desiccant treatment composition, formulation and rates

Treatment	Active ingredient	Formulation	Active ingredient rate (kg/ha)	Product rate (L or g/acre)
Heat+Merge	saflufenacil+Merge	70% WG	0.050	28 g+0.5 L
Heat+Roundup+Merge 1x	saflufenacil+ glyphosate+Merge	70% WG+ 540 g/l	0.025 +0.895	14 g+0.670 L +0.5 L
Heat+Roundup+Merge 2x	saflufenacil+ glyphosate+Merge	70% WG+ 540 g/l	0.050 +0.895	28 g+0.670 L +0.5 L
Roundup	glyphosate	540 g/l	0.895	0.670 L
Reglone Ion	diquat	200 g/l	0.653	1 L
Check				

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Table 2. Applications dates and stages for desiccants on red clover seed crop

Site and Year	Application Date	Stage	Harvest Date
Girouxville 2013	September 3rd	80% brown pods	October 13th
Girouxville 2014	August 12th	100% brown pods	August 22nd
Girouxville 2015	September 9th	100% brown pods	September 29th

Methods

Trials were conducted on very uniform red clover seed fields. The treatments were arranged in a randomized complete block design with four replicates. Plot size was 2m x 20 m. Each trial consisted of five treatments. Table 1 shows detailed information on each treatment. Treatments were applied with a handheld small plot sprayer. Water volume was 200L/ha. Application occurred when the majority of heads were brown. Detailed dates and harvest information are shown in Table 2. Red clover was straight combined with a Winter Steiger combine (combine setting error noted in 2014). Area harvested was $30m^2$. Data collected included forage moisture, seed yields, germination (year of application and following year) and 1000 seed weights.

Growing season precipitation information was sourced from local weather stations and is shown in Table 3. Extremely dry conditions during the 2nd and 3rd years of the study are noted.

Treatment application with handheld sprayer on red clover seed crop, 2014

Table 3. Growing season precipitation for red clover trial (inches)

	Girouxville 2013		Girouxville 2014		Girouxville 2015	
	2013	**LTA***	**2014**	**LTA**	**2015**	**LTA**
May	1.0	1.7	0.3	1.7	0.6	1.7
June	4.1	3.0	1.4	3.0	1.0	3.0
July	2.3	2.7	0.9	2.7	1.2	2.7
August	2.3	1.9	0.2	1.9	2.2	1.9
Total	9.7	9.3	2.8	9.3	5.0	9.3

**Long Term Average*

Results

Trials in all three years showed no significant difference in seed yield, germination or seed weight as a result of the five different desiccant treatments when compared among the treatments or to the untreated check (Tables 4-6). Similar results were found in a study on alfalfa seed crop in which no significant impact on seed germination was found as a result of pre-harvest glyphosate treatment (May *et al* 1996). There was a slight trend for increased seed weights with the majority of treatments in all years.

In 2013 and 2015 forage moisture percentages of red clover treated with Reglone® were significantly lower than the check 8 D-A-A (2013) and 9, 12 and 15 D-A-A (2015). Both combination treatments of Heat®+Roundup® as well as the Roundup® alone in 2015 significantly lowered forage moisture percentages when compared to the check 12 D-A-A.

Optimum timing (days after application) to obtain lowest forage moisture percentages varied among treatments. Studies have shown that environmental factors (precipitation events, humidity, temperature, wind) have an impact on crop dry down and may affect the efficacy of any pre-harvest treatments.

In all years Reglone® appeared to have the greatest effect on decreasing forage moisture percentages. Effective, rapid desiccation with diquat has been noted in other studies (Moyer *et al* 1996).

Table 4. Effect of desiccants on red clover seed crop—Girouxville 2013

Treatment	Forage Moisture 8 D-A-A (%)	Seed Yield (kg/ha)	Germination 2013 (%)	Seed Weight (g/1000)	Germination 2014 (%)
Heat+Merge	30.7 ab	798	93.6	1.956	98.6
Heat+Roundup+Merge 1x	35.3 a	877	96.9	1.954	97.5
Heat+Roundup+Merge 2x	27.0 bc	871	94.5	1.926	95.6
Roundup	28.0 abc	801	95.5	1.954	96.1
Reglone Ion	22.3 c	844	94.8	1.958	95.4
Check	30.7 ab	885	95.5	1.937	96.3
CV%	5.5	7.7	2.9	0.08	2.2
LSD (p=0.05)	4.4	NSD	NSD	NSD	NSD

D-A-A - days after application; CV - coefficient of variance; LSD - least significant difference; NSD - not significantly different
a, b, c - results followed by the same letter do not significantly differ (p=0.05, Student-Newman-Keuls)

Results (cont'd)

Plant stand assessments the year after treatments were applied were not done in this study. The application of pre-harvest Roundup® did reduce the plant stand of alsike clover in a similar study. Heat® and Reglone® did not have an effect on plant stand the year after application. Previous studies on alfalfa seed crop have shown that following-year stand reduction after pre-harvest glyphosate treatment can be significant (May *et al* 1996).

Table 5. Effect of desiccants on red clover seed crop—Girouxville 2014

Treatment	Forage Moisture 3 D-A-A (%)	Forage Moisture 6 D-A-A (%)	Forage Moisture 9 D-A-A (%)	Seed Yield (kg/ha)*	Germination 2014 (%)	Seed Weight (g/1000)	Germination 2015 (%)
Heat+Merge	40.7	39.5	41.8	47	97.8	1.427	96.8
Heat+Roundup+Merge 1x	46.8	40.8	40.5	54	97.8	1.453	95.0
Heat+Roundup+Merge 2x	39.5	45.0	44.0	45	96.3	1.449	97.5
Roundup	41.7	40.3	41.5	48	98.3	1.437	98.3
Reglone Ion	46.8	37.3	38.8	60	98.0	1.431	97.0
Check	44.5	40.3	43.0	54	96.3	1.422	97.8
CV%	11.9	14.7	8.7	19.4	1.9	2.1	2.1
LSD (p=0.05)	NSD	NSD	NSD	NSD	NSD	NSD	NSD

** combine not set properly*
D-A-A - days after application; CV - coefficient of variance; LSD - least significant difference; NSD - not significantly different

Table 6. Effect of desiccants on red clover seed crop—Girouxville 2015

Treatment	Forage Moisture 2 D-A-A (%)	Forage Moisture 9 D-A-A (%)	Forage Moisture 12 D-A-A (%)	Forage Moisture 15 D-A-A (%)	Seed Yield (kg/ha)*	Germination 2015 (%)	Seed Weight (g/1000)	Germination 2016 (%)
Heat+Merge	37.8	27.4 a	34.0 a	28.2 a	181	100.0	1.474	92.0
Heat+Roundup +Merge 1x	38.0	23.8 ab	27.3 b	19.2 ab	188	99.3	1.486	93.5
Heat+Roundup +Merge 2x	36.0	21.5 ab	24.9 b	18.0 ab	187	99.3	1.476	94.3
Roundup	35.5	28.3 a	23.1 b	18.1 ab	171	99.8	1.479	92.5
Reglone Ion	32.1	13.4 b	14.7 c	9.3 b	181	99.0	1.493	90.8
Check	37.3	35.8 a	39.0 a	26.0 a	181	100.0	1.477	93.8
CV%	8.9	6.7	12.8	34.1	9.7	5.2	2.4	3.7
LSD (p=0.05)	NSD	10.1	5.2	10.2	NSD	NSD	NSD	NSD

D-A-A - days after application; CV - coefficient of variance; LSD - least significant difference; NSD - not significantly different
a, b, c - results followed by the same letter do not significantly differ (p=0.05, Student-Newman-Keuls)

Summary

- Forage moisture percentages of red clover treated with Reglone® were significantly lower than the check in 2013 and 2015. 2014 was an extremely dry year.
- Forage moisture percentages of red clover treated with Heat®+Roundup® (1x and 2x) as well as the stand-alone Roundup® treatment were significantly lower than the check 12 D-A-A in 2015
- Reglone® treatment appeared to have the greatest effect on decreasing forage moisture percentages in all study years
- Heat® alone did not reduce forage moisture content when compared to the check
- No significant difference in seed yield, germination or seed weight as a result of the five different desiccant treatments in all study years

Effects of a desiccant on red clover seed crop, 2014

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