

Soybean Injury And Yield Response When Burndown Herbicides Are Applied At Different Intervals After Planting

Purpose:

In no-till or minimum till soybean production systems, ideally any emerged weeds are controlled with a burndown herbicide applied at 14 or more days before planting. However, challenging environmental conditions (rain, high wind speeds) can put a farmer in the position that the crop has been planted and now the burndown herbicide will be applied after. If glyphosate resistant weeds are present in the field, some of the herbicide solutions for such weeds restrict applications being made beyond 3 days after planting. The purpose of this study was to evaluate the impact on soybean injury and yield when applying 3 common burndown herbicides used to control glyphosate resistant weeds at various intervals after planting, including beyond the label restriction, so as to evaluate the level of risk with late applications.

Methods:

The soybean variety P05T24R (glyphosate tolerant) was planted on June 3, 2017 in 15" rows with a Kinze planter at a depth of 3 cm and at a seeding rate of 190,000 seeds/acre. Three herbicides were applied at 4 different timings following planting (Tables 1 and 2). A control plot was included in which no burndown treatment was applied. A blanket application of glyphosate (540 g/L) at 1 L/ac was applied at the 3rd to 4th trifoliolate stage to control any weeds that had emerged after planting. Visual crop injury was taken at 7 and 14 days after planting (DAA), plant populations were taken at 28 days after planting and soybeans were harvested on October 3, 2017.

Table 1. Herbicide, active ingredient and rate of the three burndown herbicides applied after soybean planting.

Herbicide	Active Ingredient	Rate applied
2,4-D Ester 700	2,4-D (660 g ae/L)	0.5 L/acre
Eragon LQ	Saflufenacil (342 g/L)	30 mL/acre
Sencor 75 DF	Metribuzin (75%)	300 g/acre

Table 2. The stage of soybeans observed at four herbicide application timings.

Application Timing	Soybean stage (see Figures 1-3)
Day of planting	Seed imbibed
3 days after planting	1 cm radicle
6 days after planting	15 mm hypocotyl
9 days after planting	40% cotyledon emergence

Table 3. Herbicide brands, their active ingredient(s) and application restrictions of common soybean burndown herbicides.

Brand names	Active Ingredient(s)	Latest Application window
2,4-D Ester 700	2,4-D (660 g ae/L)	7 days prior to planting
Blackhawk	2,4-D (473 g ae/L) Pyraflufen-ethyl (6.1 g/L)	Up to 3 days after planting
Eragon LQ	Saflufenacil (342 g/L)	Up to 3 days after planting
Sencor 75 DF	Metribuzin (75%)	Prior to soybean emergence

Results:

Since approximately 40% of the soybean stand was emerged and at the cotyledon stage when herbicides were applied at 9 days after planting, crop injury was greatest and plant populations were lowest at this application timing. Applications of 2,4-D Ester 700, Eragon LQ or Sencor 75 DF made within 3 days after planting did not appear to affect plant population when compared to the non-burndown control (Table 4). When 2,4-D Ester 700 was applied at 6 and 9 days after planting soybean populations decreased by ~15% and ~40% respectively. With Eragon LQ, plant populations decreased by ~8% when applied at 9 days after planting. Sencor 75 DF did not alter plant populations regardless of application timing.

Table 4. Soybean populations in each herbicide treatment as counted four weeks after planting.

Herbicide	Timing	Soybean Stage	Plant population
No burndown	Not applicable	Not applicable	145,833 plants/ac
2,4-D Ester 700	Day of planting	Seed imbibed	148,750 plants/ac
	3 days after planting	1 cm radicle	145,833 plants/ac
	6 days after planting	15 mm hypocotyl	122,500 plants/ac
	9 days after planting	cotyledon	90,417 plants/ac
Eragon LQ	Day of planting	Seed imbibed	145,833 plants/ac
	3 days after planting	1 cm radicle	145,833 plants/ac
	6 days after planting	15 mm hypocotyl	148,750 plants/ac
	9 days after planting	cotyledon	134,167 plants/ac
Sencor 75 DF	Day of planting	Seed imbibed	145,833 plants/ac
	3 days after planting	1 cm radicle	148,750 plants/ac
	6 days after planting	15 mm hypocotyl	148,750 plants/ac
	9 days after planting	cotyledon	148,750 plants/ac

Not surprisingly, the highest level of crop injury was observed when all three herbicides were applied 9 days after application, when approximately 40% of the stand had emerged and was at the cotyledon stage (Table 5). 2,4-D injury was most pronounced when applications were made at 6 and 9 days after application with 17% (Figure 4) and 37% (Figure 5) visual injury respectively.

Table 5. Visual crop injury observed in each treatment at 7 days after application.

Herbicide	Timing	Soybean Stage	Crop Injury (7 DAA)
No burndown	Not applicable	Not applicable	0
2,4-D Ester 700	Day of planting	Seed imbibed	0
	3 days after planting	1 cm radicle	2
	6 days after planting	15 mm hypocotyl	17
	9 days after planting	cotyledon	37
Eragon LQ	Day of planting	Seed imbibed	0
	3 days after planting	1 cm radicle	0
	6 days after planting	15 mm hypocotyl	0
	9 days after planting	cotyledon	15
Sencor 75 DF	Day of planting	Seed imbibed	0
	3 days after planting	1 cm radicle	0
	6 days after planting	15 mm hypocotyl	8
	9 days after planting	cotyledon	20

When all three burndown herbicides were applied the day of planting and 3 days after planting, soybean yields were 10% to 20% higher than when no burndown was applied (Table 6). With 2,4-D Ester 700, soybean yields were significantly reduced when applied at 9 days after planting, which is not surprising given that there was close to a 40% reduction in plant population. Soybean yields were not affected regardless of application timing with either Eragon LQ or Sencor 75 DF, although plant populations were reduced when Eragon LQ was applied at 9 days after planting.

Summary:

The purpose of this study was to evaluate risk associated with applying a burndown herbicide past the labeled stage so as to control problematic weeds. At this one site, during the 2017 season, applying 2,4-D Ester and Eragon LQ, past the labeled application window, at 6 days after planting resulted in soybean yields that were 12% to 15% higher than when no burndown was applied. Soybean yield was reduced when 2,4-D Ester 700 was applied at 9 days after planting, when 40% of the stand was emerged and at the cotyledon stage. One should not have great confidence that the results observed in this trial will always occur since it is only one trial conducted over one season. It is important to go back to the original question posed by the farmer that prompted this trial. If one has glyphosate resistant Canada fleabane emerged in their field at a moderate population density and soybeans have been planted, the risk of doing nothing to control that population of Canada fleabane (since it can't be controlled once the soybean crop is up) can range from 30%-90% yield loss. In this trial applying products that a farmer would use to control glyphosate resistant Canada fleabane (e.g. Eragon + Sencor + glyphosate) past their labelled application window (up to 3 days after planting) did not result in reduced soybean yields.

Table 6. Soybean yield associated with three burndown herbicides applied at 4 different application timings and compared to a control where no burndown was applied. All treatments received an in-crop application of glyphosate to remove weeds at the 3rd to 4th trifoliolate stage of soybean

Herbicide	Timing	Soybean Stage	Soybean Yield
No burndown	Not applicable	Not applicable	42.1 ^{bcd}
2,4-D Ester 700	Day of planting	Seed imbibed	49.6 ^{abc}
	3 days after planting	1 cm radicle	46.7 ^{abc}
	6 days after planting	15 mm hypocotyl	47.9 ^{abc}
	9 days after planting	cotyledon	38.3 ^d
Eragon LQ	Day of planting	Seed imbibed	53 ^a
	3 days after planting	1 cm radicle	48.4 ^{abc}
	6 days after planting	15 mm hypocotyl	49.6 ^{abc}
	9 days after planting	cotyledon	47.9 ^{ab}
Sencor 75 DF	Day of planting	Seed imbibed	51.2 ^a
	3 days after planting	1 cm radicle	46.9 ^{abc}
	6 days after planting	15 mm hypocotyl	49.6 ^{abc}
	9 days after planting	cotyledon	49.4 ^{abc}

Next Steps:

This trial will be repeated again during the 2018 season.

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Project Contacts:

Mike Cowbrough, OMAFRA, mike.cowbrough@ontario.ca

Location of Project Final Report:

Mike Cowbrough, OMAFRA, mike.cowbrough@ontario.ca



Figure 1. When herbicides were applied at 3 days after planting, the soybean seed had a 1 cm radicle.



Figure 2. When herbicides were applied at 6 days after planting, the soybean seed had a 15 mm hypocotyl



Figure 3. When herbicides were applied at 9 days after planting, approximately 40% of the soybean crop had emerged and were at the cotyledon stage. The soybeans could be “rowed” easily as you walked by the plots.



Figure 4. 2,4-D injury on soybean trifoliate leaves when applied 6 days after planting.



Figure 5. 2,4-D injury on soybean trifoliolate leaves when applied 9 days after planting.



Figure 6. Eragon LQ injury to soybean seedlings, slight distortion of cotyledon leaves, when applied 9 days after planting.



Figure 7. Sencor 75 DF injury to soybean seedlings, yellowing of the unifoliate leaf margins, eventually turning brown and defoliating, when applied 9 days after planting.