

Which residual corn herbicides allow cover crops to be inter-seeded?

With a narrow window to establish cover crops after corn harvest, some farmers have experimented with inter-seeding cover crops when corn is at the 6-8 leaf stage. However, the sensitivity of different cover crops to residual corn herbicides is unknown and could negatively affect their establishment. A multi-year study looked at the sensitivity of six different cover crop species to common corn herbicides used in Ontario.

The simple answer

Cereal cover crops (oats, rye, triticale) and oilseed radish were, in general, more tolerant to residual corn herbicides, and easier to establish than white and red clover. Integrity herbicide caused the least amount of injury across all cover crops. Acceptable levels of injury to cover crops existed with other herbicides but were species-specific. Converge Flexx, Primextra II Magnum, Acuron and AAtrex 480 caused the highest level of injury to all cover crops.

A little more information

Four experiments were conducted over two growing seasons. Eleven commonly used pre-emergence herbicides were applied to field corn. Six cover crop species were seeded with a drill that was modified to sow seed between the 30" corn rows at the 6-leaf stage of growth. Visible crop injury was evaluated at 28 and 56 days after cover crop planting. Biomass was collected the spring after application (data not shown). Oats and tillage radish did not overwinter. Biomass of surviving cover crops was closely associated with the level of crop injury observed. Table 1 shows the average visible injury observed by each cover crop species across all herbicides.



Figure 1. Cover crops species were inter-seeded into standing corn at the V6 stage of growth using a modified seed drill that sows seed in between the 30" corn rows.

Table 1. Average visible injury to each cover crop species caused by all herbicides applied over two growing seasons and four experiments.

Species	Average injury
Oats (<i>Avena sativa</i>)	15%
Triticale (<i>Triticosecale rimpau</i>)	23%
Cereal rye (<i>Secale cereale</i>)	33%
Oilseed radish (<i>Raphanus sativus</i>)	33%
Red clover (<i>Trifolium repens</i>)	70%
White clover (<i>Trifolium alba</i>)	78%



Figure 2. Tillage radish that has emerged in corn after inter-seeding.



Figure 3. Triticale biomass the following spring (April) after establishment.

The full story

The amount of visible crop injury observed was specific to the cover crop species and herbicide. There was significant variability in the amount of crop injury observed by each species across years and locations. This is not uncommon with soil applied herbicides since soil texture, chemical properties (e.g. pH) and rainfall after application will affect the amount of active ingredient taken up by germinating plant species. In general, visible injury ratings of 10% or less are considered acceptable, although individual growers may tolerate a higher level of injury if the cover crop is able to establish.

Table 2 provides specific details about the herbicides applied, active ingredient(s), rate applied per acre and the amount of atrazine applied per acre (if applicable). Table 3 provides an overview of the average visible injury observed to each cover crop species along with the range in visible injury from the least to greatest amount of injury observed across all four trials.

Table 2. Herbicide trade name, active ingredient(s), rate per acre and amount of atrazine applied per acre to field corn prior to its emergence and roughly 4-6 weeks prior to inter-seeding.

Trade name	Active ingredient(s)	Rate/acre	Atrazine rate/acre
AAtrex 480	atrazine	1.24 L	595 g
Acuron	bicyclopyrone, meotrione, s-metolachlor, atrazine	1.96 L	235 g
Callisto	mesotrione	120 mL	
Converge Flexx	isoxaflutole	176 mL	
Dual II Magnum	s-metolachlor	700 mL	
Engenia	dicamba	400 mL	
Frontier Max	dimethenamid-P	385 mL	
Integrity	saflufenacil, dimethenamid-P	440 mL	
Marksman	dicamba, atrazine	1.8 L	470 g
Primextra II Magnum	s-metolachlor, atrazine	1.6 L	512 g
Rimsulfuron 25% WDG	rimsulfuron	24 g	

Table 3. Average visible injury (%) along with the least and greatest amount of visible injury observed to each cover crop species after inter-seeding into field corn at the V6 stage where 11 corn herbicides were applied prior to planting.

Herbicide	Average visible injury (% out of 100)* (range in visible injury – low and high)					
	Oats	Triticale	Rye	Oilseed radish	Red clover	White clover
Integrity	5 (1-11)	2 (0-4)	5 (0-11)	5 (0-16)	30 (0-97)	48 (15-100)
Engenia	15 (0-58)	3 (0-13)	11 (0-29)	4 (0-13)	33 (0-66)	48 (8-77)
Frontier Max	8 (0-15)	17 (8-27)	29 (13-65)	13 (0-45)	36 (4-100)	57 (24-98)
Callisto	4 (0-10)	5 (0-11)	7 (0-13)	16 (0-38)	82 (45-100)	53 (20-90)
Dual II Magnum	9 (0-25)	38 (1-68)	46 (6-88)	6 (0-15)	33 (10-93)	78 (58-100)
Marksman	7 (0-18)	13 (1-30)	14 (0-28)	23 (10-40)	74 (29-100)	88 (73-100)
Rimsulfuron 25% WDG	10 (0-18)	15 (8-27)	37 (26-53)	19 (0-38)	69 (29-100)	85 (63-98)
AAtrex 480	22 (10-46)	31 (11-49)	37 (20-46)	61 (20-93)	88 (68-100)	89 (65-100)
Acuron	15 (0-25)	33 (5-69)	47 (2-98)	60 (11-99)	99 (98-100)	99 (98-100)
Primextra II Magnum	25 (8-38)	45 (8-88)	57 (10-97)	54 (20-86)	93 (73-100)	95 (83-100)
Converge Flexx	33 (8-65)	42 (17-55)	43 (10-75)	75 (24-98)	99 (96-100)	99 (98-100)

*0% injury = no observed injury, 100% injury = complete plant death

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