Italian ryegrass control in spring canola using multiple herbicide modes of action

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Herbicide strategies combining different modes of action were compared for controlling Italian ryegrass in spring canola. Italian ryegrass herbicide control strategies that incorporate herbicides with modes of action different from glyphosate will reduce dependence on glyphosate and thus prolong the time before Italian ryegrass becomes resistant to glyphosate. Italian ryegrass in this region has already developed resistance to many Group 1 and Group 2 herbicides, but glyphosate (Group 9) resistance, if present, is not yet widespread; therefore, Roundup Ready® canola is still an effective tool for Italian ryegrass control. Non-glyphosate options are limited but soil-active Group 3 herbicides, such as trifluralin (Treflan®) and ethalfluralin (Sonalan®), can be effective if adequately incorporated and activated in the soil by tillage and/or rainfall prior to ryegrass emergence. Also, glufosinate (Liberty®), a Group 10 herbicide, can be applied in LibertyLink®

Figure 1. Spring canola in different stages of flowering following herbicide applications for Italian ryegrass control.

canola but is less effective on grass weeds compared with glyphosate, particularly if the grass weeds are tillered and well developed. Glufosinate is primarily a contact herbicide with only limited translocation in the plant. Pronamide (Kerb®) is a Group 3 herbicide that has activity on Italian ryegrass control, but currently is not labelled in canola and may pose plantback injury risks for the winter wheat that follows canola. Currently, no other herbicide options, other than the ones mentioned above, are available for selective Italian ryegrass in spring canola.

A study area on the WSU Cook Agronomy Farm with an abundance of Italian ryegrass was selected for the trial. The field was in chickpeas in 2021 and the residue was left in place. On March 31, 2022, dry fertilizer, 140-25-25-31 N-P-K-S lb/A, was drop-spread over the plot area and then incorporated approximately 2 inches deep with a light-duty cultivator and attached 5-bar harrow. Then on April 8, the plot area was tine-harrowed to further spread the existing crop residue to facilitate better soil contact for the soil-applied herbicides. Treflan HFP was applied on April 25 at 24 fl oz/A and cultivated/harrowed twice in opposite directions. The remaining plot area was cultivated to eliminate potential bias. Following Treflan incorporation, Kerb SC was applied at 20 fl oz/A, but not incorporated. Spring canola InVigor LR344PC was planted on April 29 with a Monosem precision planter with double-disc openers on 10-inch spacing. Seeds were placed 0.75 to 1 inch deep in 10-inch rows at a distribution of 10 seeds per ft^2. By May 13, two weeks after seeding, the canola had emerged. Early postemergence (EPOST) applications of Roundup PowerMax® at 22 and 44 fl oz/A and Liberty at 22 oz/A were applied on June 2 when the canola had 3-4 leaves and the Italian ryegrass had 2-4 leaves. Late postemergence (LPOST) treatments of PowerMax and Liberty, both at 22 fl oz/A, were applied on June 15 when the canola had 6 leaves and was beginning to bolt, and the Italian ryegrass plants ranged from 2 leaves to several tillers. All herbicides were applied with a 10-ft hand-held spray boom with six TeeJet® AIXR110015 nozzles on 20-inch spacing and pressurized with a CO_2 backpack. Spray output was 15 gpa at 40 psi with a ground speed of 3 mph. All PowerMax and Liberty applications included NH_4SO_4 at 17 lb/100 gallons of spray mix.

Treatments were rated visually as percent control compared with the nontreated check plots. Flowering was assessed on July 25 as the percent of plants with flowers. Canola was harvested with a Wintersteiger plot combine. Bagged samples were cleaned and weighed to calculate plot yield. Italian ryegrass control was at or near 100% at harvest for all treatments containing PowerMax (Table 1). Applications of PowerMax were so effective in controlling Italian ryegrass that it was difficult to determine if Treflan added control in the multiple-mode treatments. Treflan by itself averaged 83% control and was not different from Treflan followed by Liberty in the crop, or early plus late postemergence applications of Liberty. One benefit of including a preemergence herbicide like Treflan in a Roundup Ready canola systems is that it reduces the number of plants exposed to the postemergence glyphosate treatment, which reduces the chance for selecting a plant that is resistant to glyphosate. Kerb, at the rate used in this study, was moderately active on Italian ryegrass early but not effective by harvest. All LPOST PowerMax applications resulted in 100% control of Italian ryegrass by harvest, but delayed flowering and may have reduced yield compared with other treatments. The early PowerMax application of 44 oz/A yielded 2590 lb/A and was one of the top-yielding treatments but was not statistically different from Treflan followed by PowerMax at 44 oz/A or Treflan alone. PowerMax applied only LPOST resulted in lower yields than when applied only EPOST, which may have resulted from a combination of early competition from Italian ryegrass as well as delayed maturity. Italian ryegrass competition in the nontreated check treatment reduced crop yield to 1500 lb/A, over 1000 lb/A less than the highest-yielding treatment. In a separate set of plots adjacent to the main trial, Treflan followed by EPOST and LPOST Liberty resulted in 96% Italian ryegrass control by harvest (Table 1) and a canola yield of 3200 lb/A (Table 2); however, this treatment was not part of the main trial and not comparable statistically, but it does correspond with the yield of a neighboring field planted with the same cultivar. Treflan plus

Liberty is a possible non-glyphosate multiple-mode option for Italian ryegrass control. Also, it appears that a late application of glyphosate may result in yield drag. It is not known if other Roundup Ready canola cultivars experience this yield drag.

Table 1. Italian ryegrass control in 2022 spring canola with multiple modes of action.

	04/25	04/25	04/29	06/02	06/15	06/02	06/15	7/01	09/02
				----Canola stages----		-------Italian ryegrass control ratings[1]-------			
Trt	PPI[2]	PRE[3]	Canola Planted[4]	3-4 leaves EPOST[5]	6 leaves-bolting LPOST[6]	39 DAT PPI, PRE	14 DAT EPOST	17 DAT LPOST	Final rating at harvest
				--herbicide (oz/A)--		---------% of nontreated check[7]---------			
1	-	-		PM (44)	-	-	99 a	99 a	100 a
2	Treflan	-		PM (44)	-	90 ab	98 a	95 ab	97 a
3	Treflan	-		-	-	94 a	84 b	83 bc	83 b
4		-		-	PM (22)	-	-	92 ab	100 a
5	Treflan	-		-	PM (22)	94 a	82 b	97 ab	100 a
6	-	-		PM (22)	PM (22)	-	95 a	99 a	100 a
7	Treflan	-		PM (22)	PM (22)	92 a	97 a	99 a	100 a
8	-	-		Liberty	Liberty	-	11 d	47 de	73 bc
9	-	Kerb		Liberty	-	84 c	59 c	34 ef	49 cd
10	Treflan	-		Liberty	-	93 a	80 b	64 cd	79 b
11	-	Kerb		-	-	85 bc	50 c	19 f	24 d
12	Nontreated check			-	-	-	-	-	-
13[8]	Treflan	-		Liberty	Liberty	91	76	91	96

[1]DAT = days after treatment, PPI = preplant incorporated, PRE = preemergence, EPOST = early postemergence, LPOST = late postemergence.
[2]Treflan (trifluralin) was applied at 24 fl oz/A PPI and incorporated twice with a cultivated at 180°.
[3]Kerb was applied at 20 fl oz/A PRE to both the canola and the Italian ryegrass.
[4]InVigor LR344 PC is resistant to both Roundup PowerMax (PM) (glyphosate) and Liberty (glufosinate) herbicides and was planted at 10 seeds/ft^2 with a Monosem drill on 10-inch row spacing.
[5]EPOST PowerMax was applied at 44 and 22 fl oz/A, and Liberty was applied at 22 fl oz/A. All PowerMax and Liberty applications included NH_4 SO_4 at 17 lb/100 gal.
[6]LPOST Liberty and PowerMax were applied at 22 oz/A.
[7]Numbers followed by the same letter in each column are not statistically different ($P \leq 0.05$).
[8]Treatment 13 was in a separate trial adjacent to the main trial, therefore, is not comparable statistically.

Table 2. Effect of herbicide treatments and Italian ryegrass on 2022 spring canola flowering and yield.[1]

	04/25	04/25	04/29	06/02	06/15	07/25	09/02
				-------Canola growth stages-------			
Trt[1]	PPI	PRE	Canola Seeded	3-4 leaves EPOST	6 leaves-bolting LPOST	Plants with flowers[2]	Canola yield
				-----herbicide (oz/A)-----		%[3]	lb/A[3]
1	-	-		PM (44)	-	10 b	2590 a
2	Treflan	-		PM (44)	-	10 b	2160 ab
3	Treflan	-		-	-	9 b	2020 abc
4		-		-	PM (22)	63 a	1540 cd
5	Treflan	-		-	PM (22)	69 a	1400 d
6	-	-		PM (22)	PM (22)	69 a	1730 bcd
7	Treflan	-		PM (22)	PM (22)	69 a	1910 bcd
8	-	-		Liberty	Liberty	10 b	1930 bcd
9	-	Kerb		Liberty	-	10 b	1870 bcd
10	Treflan	-		Liberty	-	10 b	1810 bcd
11	-	Kerb		-	-	10 b	1960 bc
12	Nontreated check			-	-	9 b	1500 cd
13[4]	Treflan	-		Liberty	Liberty	10	3200±250

[1]See Table 1 for application details. PM=Roundup PowerMax herbicide.
[2]Visual rating of plants still with flowers as a measure of delayed flowering in response to herbicide treatments.
[3]Numbers followed by the same letter in each column are not statistically different ($P \leq 0.05$).
[4]Treatment 13 was in a separate trial adjacent to the main trial, therefore, not comparable statistically.

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