Evaluation of Imazamox for Weed Control in White Bean and Crop Tolerance across four Dry Bean Market Classes



UNIVERSITY OF GUELPH | Ridgetown Campus

Natalie Medland[1], Eric Page[2], Francois Tardif[3], Peter Sikkema[1], Isabelle Aicklen[1]

[1] Department of Plant Agriculture, University of Guelph, Ridgetown Campus, ON [2] Agriculture and Agri-Food Canada, Harrow, ON

[3] Department of Plant Agriculture, University of Guelph, ON

Introduction

Significant weed interference can cause substantial yield losses, making timely weed control important. Herbicide options are becoming increasingly limited due to the evolution of herbicide-resistant weeds, creating additional challenges for dry bean producers. Imazamox, is an acetolactate synthase (ALS)-inhibiting herbicide that was recently registered for postemergence (POST) applications in Ontario dry bean production.

This study evaluated POST applications of imazamox for weed efficacy in white beans and crop tolerance across four dry bean market classes.

Objective

- Assess weed control efficacy with imazamox in white bean.
- Evaluate the tolerance of dry bean market classes to imazamox applied at different rates.



Methods

Study 1: Weed Efficacy

Four field experiments were conducted in 2025 and 2026 in Ridgetown and Exeter, Ontario. Each experiment was established as a randomized complete block design with four replications, and nine herbicide treatments. Herbicides were applied as a single POST application or in a two-pass program with a PPI (preplant incorporated) application, followed by a POST application (Table 1).

Herbicide applications were made when dry beans (*Phaseolus vulgaris L.)* were V1-V3 (first to third trifoliate), and weeds at approximately 4-leaf stage. Applications were made using a CO_2-pressurized backpack sprayer calibrated to deliver 200 L ha^{-1}.

Visible crop injury and weed control were evaluated (0-100% scale). Weed species density and biomass were recorded. Dry bean yield was harvested at maturity.

Study 2: Market Class Tolerance

Two field experiments were conducted in 2025 and 2026 in Ridgetown, Ontario. Each experiment was established as a factorial split-plot design with 12 POST herbicide treatments. There were 4 replications in 2025 and 3 replications in 2026.

The following dry bean market classes were assessed; adzuki, kidney, pinto and white. Imazamox was applied at 0, 20, and 40 g ai ha^{-1}. Herbicide applications were made when dry beans were V1-V3. Applications were made using a CO_2-pressurized backpack sprayer calibrated to deliver 200 L ha^{-1}.

Visible crop injury assessments were evaluated (0-100% scale). Crop density and biomass were recorded, as well as average heights. Dry bean yield was harvested at maturity.

Data were analyzed using generalized linear mixed models (GLIMMIX, SAS v9.4), and treatment means were compared using Tukey-Kramer means separation at $P < 0.05$.

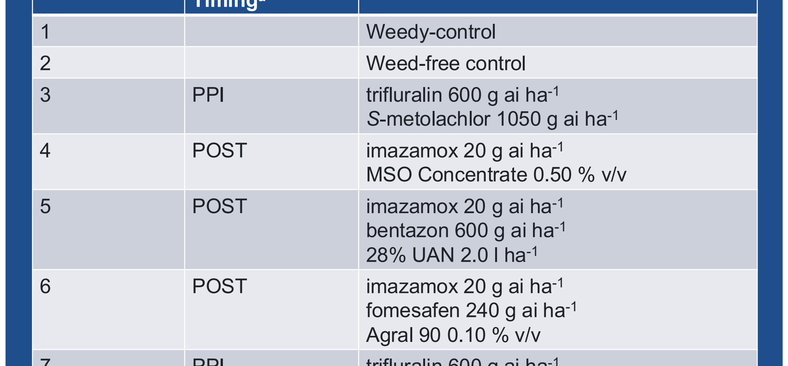
Preliminary Results and Discussion

Table 1. Imazamox Weed Efficacy Study Treatments

Treatment	Application Timing[a]	Product
1		Weedy-control
2		Weed-free control
3	PPI	trifluralin 600 g ai ha^{-1} *S*-metolachlor 1050 g ai ha^{-1}
4	POST	imazamox 20 g ai ha^{-1} MSO Concentrate 0.50 % v/v
5	POST	imazamox 20 g ai ha^{-1} bentazon 600 g ai ha^{-1} 28% UAN 2.0 l ha^{-1}
6	POST	imazamox 20 g ai ha^{-1} fomesafen 240 g ai ha^{-1} Agral 90 0.10 % v/v
7	PPI POST	trifluralin 600 g ai ha^{-1} S-metolachlor 1050 g ai ha^{-1} imazamox 20 g ai ha^{-1} MSO Concentrate 0.50 % v/v
8	PPI POST	trifluralin 600 g ai ha^{-1} S-metolachlor 1050 g ai ha^{-1} imazamox 20 g ai ha^{-1} bentazon 600 g ai ha^{-1} 28% UAN 2.0 l ha^{-1}
9	PPI POST	trifluralin 600 g ai ha^{-1} S-metolachlor 1050 g ai ha^{-1} imazamox 20 g ai ha^{-1} fomesafen 240 g ai ha^{-1} Agral 90 0.10 % v/v

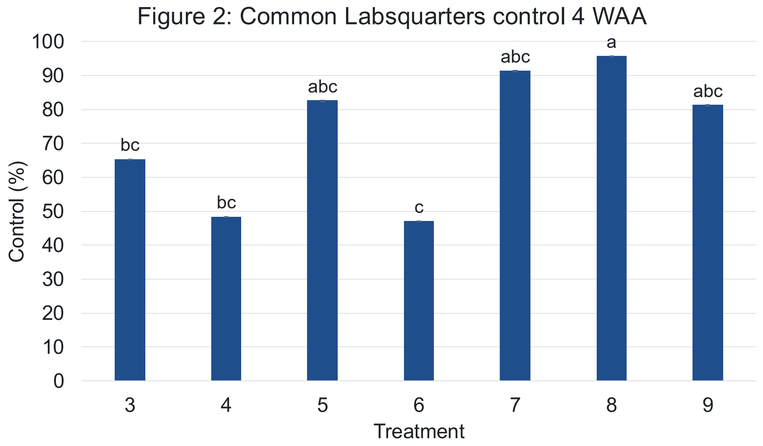
[a] Abbreviations: POST; post emergence, PPI; preplant incorporated

Figure 1: Green Foxtail Control 4 WAA



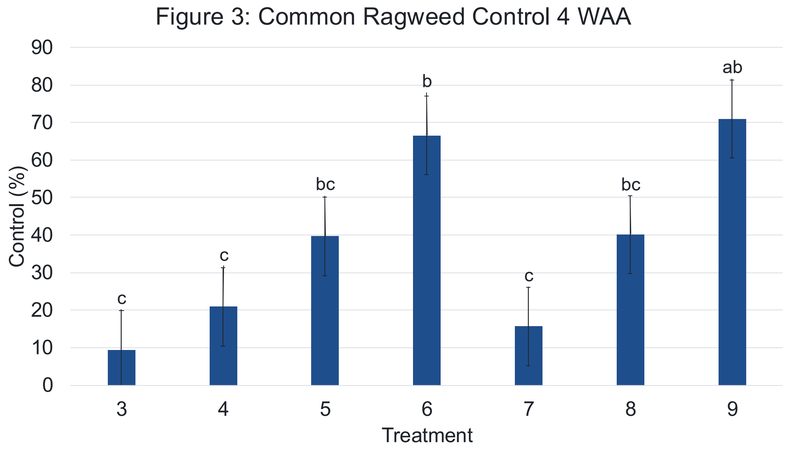
a indicates the control is similar to that of the weed-free control (treatment 2)

Figure 2: Common Labsquarters control 4 WAA



a indicates the control is similar to that of the weed-free control (treatment 2)

Figure 3: Common Ragweed Control 4 WAA



a indicates the control is similar to that of the weed-free control (treatment 2)

Weed Efficacy Discussion

Weed control ratings at 4 weeks after application (WAA) were 78, 46, and 20% for green foxtail *(Setaria viridis),* common lambsquarters *(Chenopodium album),* and common ragweed (*Ambrosia artemisiifolia)* when imazamox was applied alone POST. Green foxtail control increased to 89% when sprayed with a two-pass program of trifluralin + *S*-metolachlor preplant incorporated (PPI), followed by imazamox alone POST. Common lambsquarters control was 95% with a two-pass program of trifluralin + *S*-metolachlor PPI, followed by imazamox + bentazon POST. Control of common ragweed was <70% with all treatments. (Figures 1, 2 & 3).

Yield was highest in the weed-free control (1.79 T/Ha). The treatments that were statistically similar to the weed free control were imazamox + bentazon (1.25 T/Ha) POST, imazamox + fomesafen POST (1.25 (T/Ha), triflurain + S-metolachlor applied PPI followed by imazamox + bentazon POST (1.34 T/Ha), and triflurain + S-metolachlor applied PPI followed by imazamox + fomesafen (1.60 T/Ha).



Acknowledgments

Thank you to Ontario Bean Growers and Agri-Food Innovation Alliance for their financial support.

Table 2. Crop tolerance at 1 and 2 WAA, dry weight per plant (g plant^{-1}) at 2 WAA, height (cm) at 5 WAA, and yield (T/ha) following POST applications of imazamox [a,b]

Herbicide Treatment	Injury (%) 1 WAA	Injury (%) 2 WAA	DW PP (g plant^{-1}) 2 WAA	Height (cm) 5 WAA	Yield (T/ha)
Control 0 g ai ha^{-1}	0	0	5.6 a	65 a	2.65 a
Imazamox 20 g ai ha^{-1} + MSO 0.50 % v/v	3 b	9 b	5.3 a	61 b	2.62 a
Imazamox 40 g ai ha^{-1} + MSO 0.50 % v/v	10 a	15 a	4.8 a	60 b	2.57 a

Table 3. Market class tolerance at 1 and 2 WAA following POST applications of imazamox[a,b]

Market Class	Injury 1 WAA (%)	Injury 2 WAA (%)
Adzuki	11 a	17 a
Kidney	9 a	15 a
Pinto	3 a	7 b
White	4 a	9 b

[a] Abbreviations: WAA; weeks after application.
[b] Means followed by the same letter within a column are not significantly different according to Tukey-Kramer multiple range test ($P > 0.05$).

Market Class Tolerance Discussion

Crop injury varied among dry bean market class, with adzuki (11% at 1 WAA; 17% at 2 WAA) and kidney beans (9%; 15%) showing greater sensitivity to imazamox than pinto (3%; 7%) and white beans (4%; 9%). Injury at 1 WAA was greater at the 40 g ai ha^{-1} rate, but no significant rate differences were observed at 2 WAA. Overall visual injury included stunting, chlorosis and minor leaf deformation. Dry weight collected from one plant per plot at 2 WAA did not differ significantly among herbicide rates, while plant height at 5 WAA was reduced at the higher rate. Yield did not differ significantly among herbicide rates, suggesting that early crop injury and reduced height did not translate to measurable yield losses. (Tables 2 & 3).

Takeaway Message

1. Imazamox provided variable weed control depending on weed species and location.
2. Trifluralin + S-metolachlor applied PPI with Imazamox + Fomesafen POST had the best control among treatments, with an average of 70 – 85% control.
3. Adzuki and kidney beans showed greater sensitivity to imazamox, but early transient injury did not result in significant yield reductions.
4. Studies will be repeated in the 2027 growing season for further evaluation.