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Indiana Herbicide Trials

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MIRC Report – Indiana – 2023 Herbicide Trials in Peppermint

Dormant Trial

Site: Commercial field, third year peppermint near Fair Oaks, IN (41°01'37.7"N 87°17'29.3"W).

Soil: Morocco and Brems loamy sands, 2.8% organic matter, pH 7.2.

Application information: Plots of 10 ft wide by 15 ft long were established for each treatment and replicated four times in a randomized complete block design. Treatments (Table 1) were applied to dormant mint on April 7, 2023, using a CO₂-pressurized backpack sprayer calibrated to deliver 20 gallons per acre (187 L/ha).

Table 1. List of treatments applied to dormant peppermint at Fair Oaks, IN, 2023.

Treatment	Abbreviation	Rate	Rate	Adjuvants	Active ingredient
		-- per acre --	-- ai / ha --	-- v/v --	
Nontreated	--	--	--	--	--
Reviton	T50	2 fl oz	50 g	0.25% (NIS)	tiafenacil
	T100	4 fl oz	100 g		
Sinbar	SB	1.25 lb	1,120 g	1% MSO + 2% AMS	terbacil

ai: active ingredient, AMS: ammonium sulfate, ha: hectare, NIS: nonionic surfactant; MSO: methylated seed oil.

Data collection:

Visual crop injury and weed control ratings, crop height, and weed counts were recorded every two weeks after treatment (WAT). Injury and weed control ratings were on a scale of 0% (no crop injury / no weed control) to 100% (crop death/complete weed control). At 18 WAT (August 10, 2023) a 6 ft wide strip of mint was cut at the soil surface from the center of each plot, resulting in a harvested area of 6 ft by 15 ft (90 ft²) (Fig. 1A). On August 12, 2023, hay weight was recorded, and mint hay from each plot was steam distilled to determine oil yield (Fig. 1B). Data were analyzed by descriptive and inferential statistics using JMP 16 PRO software.



Figure 1. Harvesting (A) and distilling (B) equipment at 18 WAT.

Results

Crop injury. At 2 WAT, visual injury of the Sinbar grower standard was 14% (Table 2). Injury from Reviton at 2 fl oz (95%) and 4 fl oz (97%) did not differ from one another, and both Reviton treatments resulted in greater crop injury than the Sinbar standard. Injury presented initially as foliar necrosis followed by stunting in the form of reduced mint height and reduced lateral spread (Fig. 2 and 3). This trend was similar through 10 WAT. Crop injury and percent height reduction data for Reviton were fit to three-parameter exponential decay models to determine crop response over time (Figure 4). The models indicate that injury from Reviton began to decline by 8 WAT, and after 12 WAT mint had fully recovered.

Table 2. Peppermint injury following dormant herbicide applications at Fair Oaks, IN in 2023.

Treatment	Rate	Mint injury (WAT)						
		2	4	6	8	10	12	18
	- per acre -				---- % ----			
Reviton	2 fl oz	95 a	88 a	80 a	68 ab	19 a	3	0
	4 fl oz	97 a	90 a	85 a	76 a	21 a	10	0
Sinbar	1.25 lb	14 b	11 b	31 b	36 b	0 b	4	0

Different letters within a column indicate significant differences ($p \leq 0.05$).

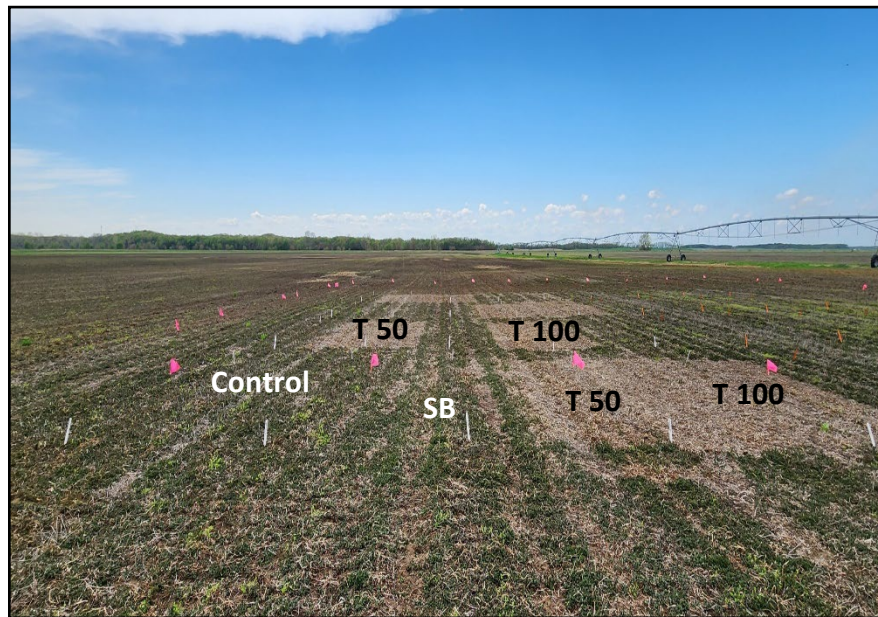


Figure 2. Peppermint plots 2 WAT, Fair Oaks, IN, 2023. SB = sinbar at 1.25 lb/a; T50 and T100 = Reviton at 2 fl oz/a (50 g ai/ha) and 4 fl oz/a (100 g ai/ha), respectively.



Figure 3. Peppermint injury 2 WAT at Fair Oaks, IN, 2023.

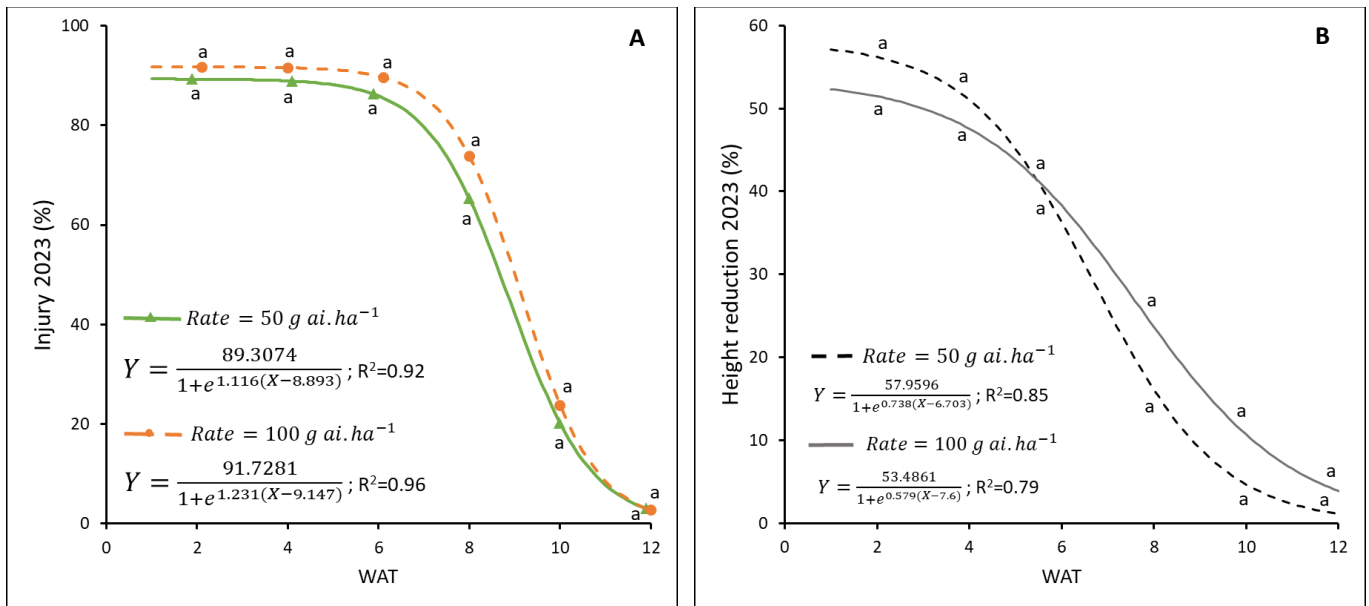


Figure 4. Peppermint injury (A) and height reduction (B) 2 to 12 WAT with Reviton at 2 and 4 fl oz/a, Fair Oaks, IN, 2023.

Weed control. Predominant weed species were common chickweed (*Stellaria media* L.) and marestail (*Erigeron canadensis* L.) (Fig. 5). Throughout the course of the study, the Sinbar standard provided numerically better weed control than the Reviton treatments, however, few statistically significant differences occurred among herbicide treatments (Table 3). Weed density of the nontreated control was 19 weeds per plot at 2 WAT and decreased between 4 WAT (19 weeds/plot) to 18 WAT (1 weed/plot) (Table 4). Sinbar resulted in lower weed density compared to the control, however Reviton treatments did not differ from the control. At 6 and 8 WAT Sinbar provided superior weed control (96% and 98%, respectively) compared to Reviton at 4 fl oz/a (66% and 74%, respectively). This was evident as there were no weeds in Sinbar plots, but 14 and 4 weeds/plot in Reviton 4 fl oz/a plots at 6 and 8 WAT, respectively.

Table 3. Peppermint weed control throughout the time after application of treatments.

Treatment	Rate	Weed control (WAT)					
		2	4	6	8	10	12
	-per acre-			---- % ----			
Reviton	2 fl oz	86	78	79 ab	88 ab	91	99
	4 fl oz	87	59	66 b	74 b	60	70
Sinbar	1.25 lb	92	86	96 a	98 a	100	100

Different letters within a column indicate significant differences ($p \leq 0.05$).

Table 4. Weed count in peppermint crop throughout the time after application of treatments.

Treatment	Rate	Weed count (WAT)						
		2	4	6	8	10	12	18
	- per acre-	---- per 150 ft ² ----						
Nontreated	--	19 a	19 a	11 a	2 ab	3 ab	1 ab	1 ab
Reviton	2 fl oz	8 ab	11 ab	8 ab	3 ab	2 ab	1 ab	1 ab
	4 fl oz	12 ab	15 ab	14 a	4 a	5 a	4 a	3 a
Sinbar	1.25 lb	4 b	3 b	0 b	0 b	0 b	0 b	0 b

Different letters within a column indicate significant differences ($p \leq 0.05$).

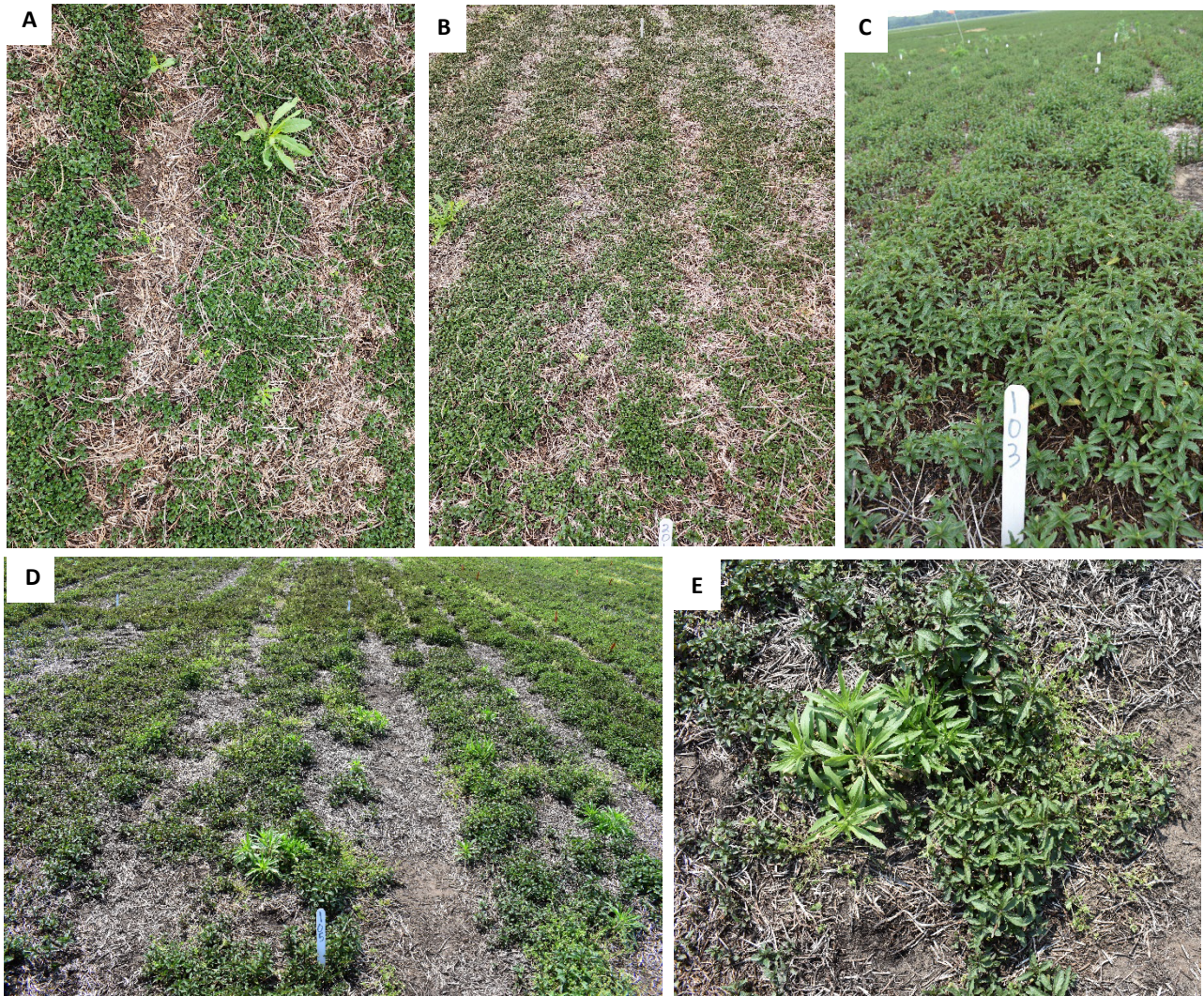


Figure 5. Weeds present in the nontreated 2 WAT (A) and in Sinbar plots 2 WAT (B) and 10 WAT. Weeds present in Reviton 4 fl oz/a at 6 WAT (D), including marestalk and common chickweed (E).

Yield. No significant differences in hay or oil yield were observed among the treatments (Fig. 6). The average oil mint yield was 9.2 liters per hectare across all treatments, while the average mint hay yield was 2.7 megagrams per hectare.

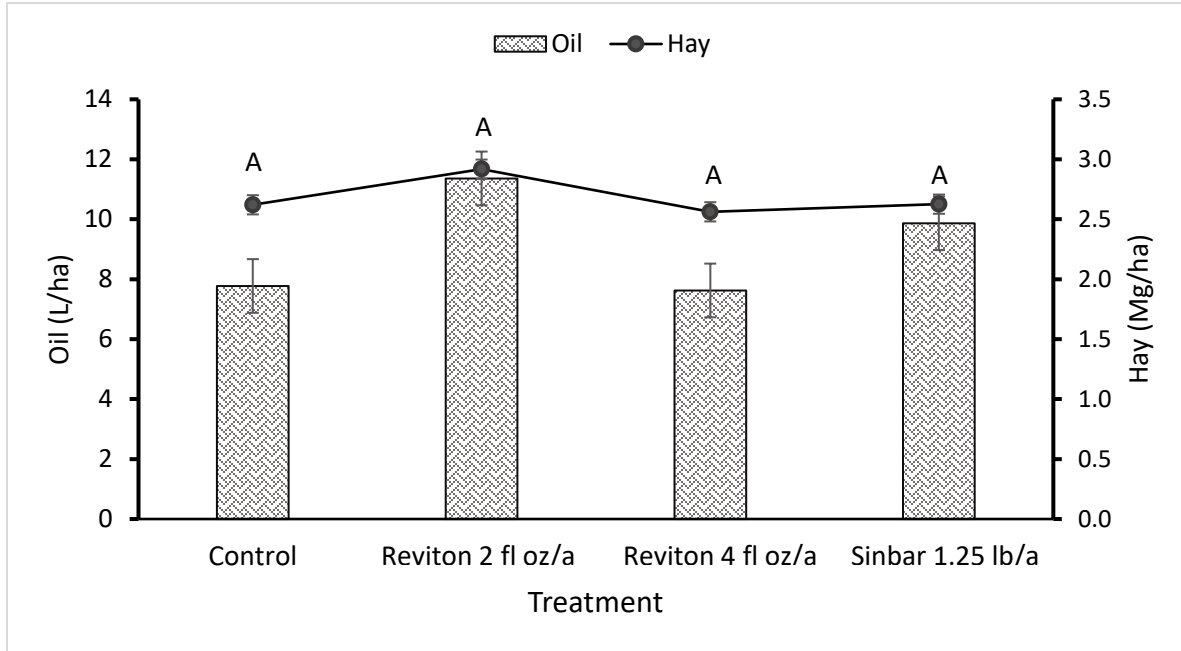


Figure 6. Peppermint hay and oil yield at 18 WAT at Fair Oaks, IN, 2023.

Conclusions

Reviton at 2 or 4 fl oz/a resulted in delayed peppermint green up and delayed early season growth following a dormant application. Weed control from Reviton varied during the growing season, but in general it was less than the Sinbar standard. Weed counts in Reviton treatments were similar to the nontreated control, suggesting that although weeds may have been injured by its application, Reviton was not completely lethal to the predominant weed species at this location. Despite early season crop injury, peppermint did recover after 12 WAT and peppermint hay and oil yield did not differ from the nontreated control nor the Sinbar standard.

Post-Harvest Trial

Site: Commercial field, third year peppermint near Fair Oaks, IN (41°01'37.7"N 87°17'29.3"W).

Soil: Morocco and Brems loamy sands, 2.8% organic matter, pH 7.2.

Application information: Plots used in the dormant peppermint trial were divided in half, resulting in subplots of 5 ft wide by 15 ft long. One subplot received no post-harvest herbicide application and the other subplot received 2 fl oz/a or 4 fl oz/a of Reviton, resulting in eight treatments (Table 5). Post-harvest treatments were applied with a CO₂-pressurized backpack sprayer calibrated to deliver 20 gallons per acre (187 L/ha) on August 28, 2023, 1 week after the entire field was cut by the commercial mint grower. As with the dormant trial, all treatments were replicated four times in a randomized complete block design.

Table 5. List of post-harvest herbicide applications made to peppermint at Fair Oaks, IN, 2023.

Treatment abbreviation	Dormant application^a	Post-harvest application
C-C	None	None
SB-C	Sinbar	None
T50-C	Reviton 2 fl oz/a	None
T100-C	Reviton 4 fl oz/a	None
C-T50	None	Reviton 2 fl oz/a
C-T100	None	Reviton 4 fl oz/a
T50-50	Reviton 2 fl oz/a	Reviton 2 fl oz/a
T100-100	Reviton 4 fl oz/a	Reviton 4 fl oz/a

^aReviton treatments contained 0.25% nonionic surfactant and 2% ammonium sulfate (v/v).

Data collection:

Visual crop injury and weed control ratings, crop height, and weed counts were recorded 1, 2, 4, 6, and 8 WAT. Injury and weed control ratings were on a scale of 0% (no crop injury / no weed control) to 100% (crop death/complete weed control). In addition, crop biomass was recorded after harvest. Data were analyzed by descriptive and inferential statistics using JMP 16 PRO software.

Results

Crop injury. Peppermint that received a dormant herbicide application, but no post-harvest application did not display injury symptoms and did not differ from the nontreated control. Injury was observed in treatments receiving a post-harvest application of Reviton (Fig. 7, Table 6). With one exception, injury did not differ by Reviton rate, and the impact of the post-harvest Reviton application was not influenced by the previous dormant application. As with applications to dormant mint, crop injury presented as foliar necrosis followed by stunted growth. Mean plant height of the nontreated control was 8, 12, and 11 cm at 4, 6, and 8 WAT, respectively (Table 7). Through 8 WAT, mean peppermint plant height was reduced by all treatments containing Reviton at 2 or 4 fl oz/a applied post-harvest in addition to Reviton applied at 4 fl oz/a at dormancy without a sequential post-harvest Reviton application.

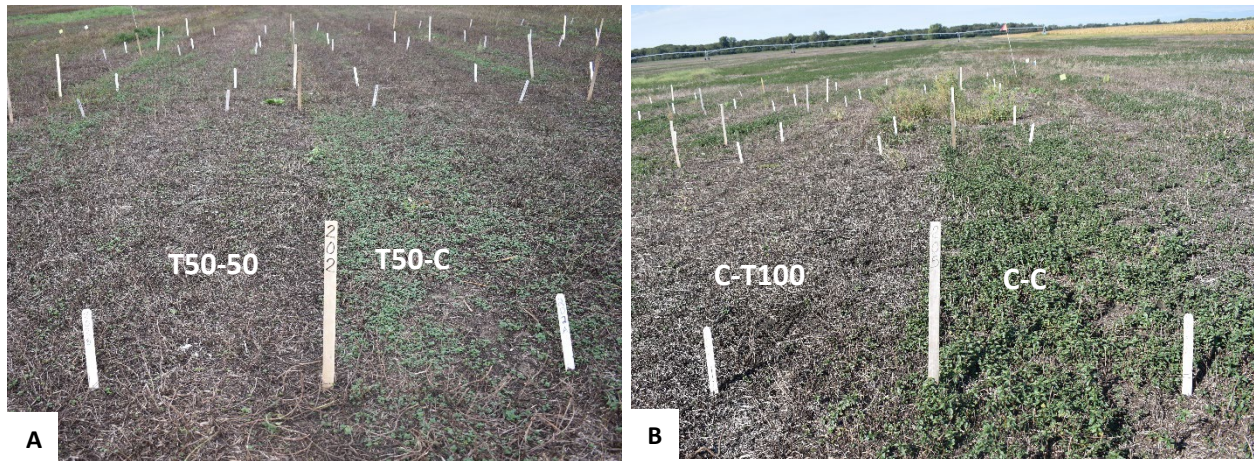


Figure 7. Peppermint injury 1 (A) and 6 WAT (B) with post-harvest Reviton at Fair Oaks, IN, 2023. See Table 5 for treatment codes.

Weed control. Visual weed control did not differ among post-harvest treatments (Table 6). Weed control ranged from 71 to 85% at 1 WAT, 75 to 95% at 2 WAT, 61 to 95% at 4 WAT, and 55 to 81% at 6 WAT. However, weed control declined between 6 and 8 WAT. This decrease in weed control corresponds to an increase in weed density (Table 8). At 6 WAT, there were ≤ 11 weeds per plot (75 ft²), however, by 8 WAT the nontreated control contained 21 weeds per ft². Only the Sinbar at dormancy treatment with no post-harvest herbicide application had a weed density less than the nontreated check (3 weeds ft²). All other treatments contained 10 to 37 weeds per ft² and were statistically similar to the nontreated check.

Table 6. Peppermint crop injury and weed control throughout the time after application of post-harvest treatments at Fair Oaks, IN, 2023

Treatment	Mint injury (WAT)					Weed control (WAT)				
	1	2	4	6	8	1	2	4	6	8
		---- % ----					---- % ----			
C-T50	68	51 b	54	53	69 a	78	78	95	75	8
C-T100	74	69 ab	61	71	63 a	85	95	85	81	20
T50-50	78	91 a	63	58	64 b	85	91	83	55	37
T100-100	86	70 ab	78	86	75 a	71	75	61	55	14

Table 7. Peppermint plant height following post-harvest herbicide applications at Fair Oaks, IN, 2023.

Treatment	Height (WAT)		
	4	6	8
	---- average 5 plants (cm) ----		
C-C	8 b	12 a	11 ab
SB-C	--	12 a	14 a
T50-C	6 bc	9 ab	10 bc
T100-C	10 a	7 bc	8 cd
C-T50	4 c	6 bcd	7 cde
C-T100	4 c	5 bcd	5 de
T50-50	6 bc	4 cd	4 e
T100-100	4 c	3 d	4 e

Table 8. Weed counts throughout the time after application of post-harvest treatments at Fair Oaks, IN, 2023.

Treatment	Weed count (WAT)				
	1	2	4	6	8
	----- per 75 ft ² -----				per 1 ft ²
C-C	0	1 b	2	1	21 b
SB-C	0	1 b	1	0	3 c
T50-C	1	3 ab	2	4	11 bc
T100-C	2	8 a	10	8	11 bc
C-T50	2	3 ab	0	3	37 a
C-T100	0	0 b	0	0	27 a,b
T50-50	1	1 b	1	2	10 bc
T100-100	4	3 ab	8	11	21 ab

Biomass. Sinbar at dormancy treatment with no post-harvest herbicide application had the highest mint biomass production (129 g/m²), followed by the treatments without Reviton post-harvest application (C-C: 92 g/m²; T50-C: 71 g/m²; T100-C: 62 g/m²). The treatments that were untreated at dormancy but had Reviton applied postharvest, as well as the one with Reviton at 50 g ai/ha had similar results in biomass (33-36 g/m²). The treatment with Reviton at 100 g ai/ha in dormancy and post-harvest had the lowest biomass production (18 g/m²) (Figure 8).

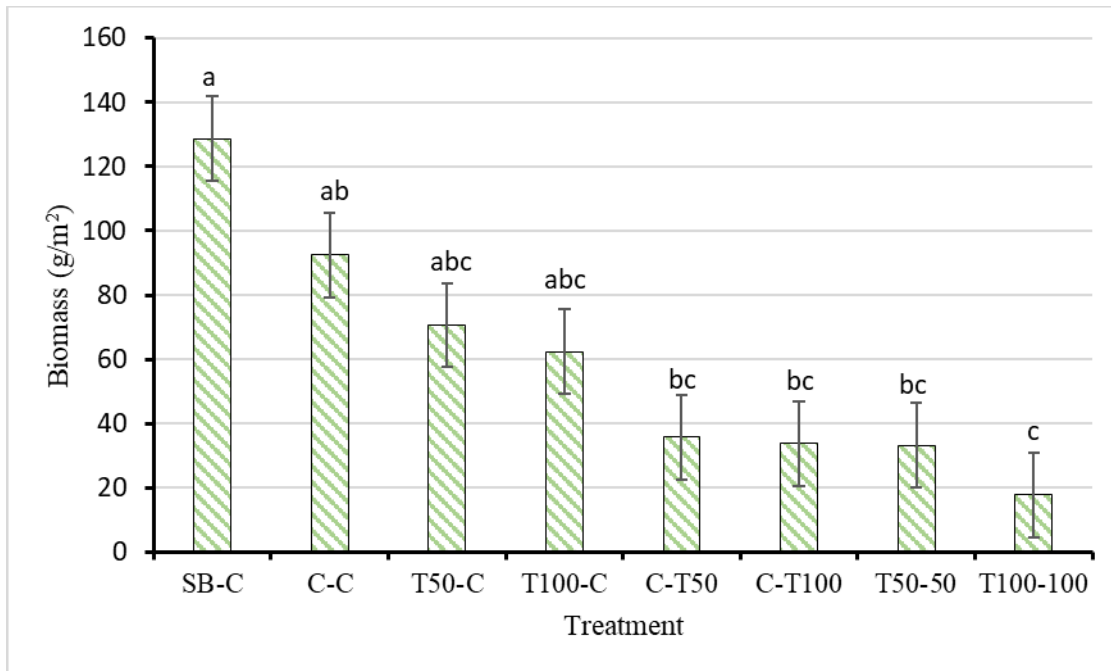


Figure 6. Peppermint biomass (11 WAT) at Oaks, IN, 2023. Bars with standard error are the means of four plots. Different letters represent significant differences among the treatments based on Tukey's HSD $p \leq 0.05$.

Conclusions

All post-harvest Reviton treatments resulted in significant crop injury through 8 WAT. Weed control from post-harvest Reviton applications was variable, from 61 to 95% in the first 4 WAT, but declined to only 8 to 37% by 8 WAT, with no difference among treatments. Plant heights and biomass were reduced in all Reviton-treated plots. Furthermore, these results show the impact of the post-harvest application of Reviton at the rates of 50 g ai/ha and 100 g ai/ha.