

## **Split-Residual Herbicide Treatments for Late-Season Weed Control**

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### **Introduction:**

Late-season weeds in dry edible bean production present harvest challenges and also increase seed-cleaning costs after harvest. Late-season weeds are a problem in the dry bean crop because the residual activity of standard preemergence (PRE) herbicides dissipates too early in the season, and while postemergence (POST) herbicides control emerged weeds, they typically do not provide soil residual activity for weeds that emerge after the POST application. The objective of this research was to test multiple PRE and POST herbicide combinations to determine whether efficacy of soil residual herbicides could be increased by splitting the herbicide treatment into PRE plus POST applications.

### **Methods:**

A field study was conducted in 2021 near Powell, Wyoming. The study was a randomized complete block design with four replications of 13 treatments. Preplant incorporated (PPI) herbicide treatments were applied and dry beans (variety 'Max') were planted immediately afterwards on June 8. PRE herbicide treatments were applied on June 9, and the POST herbicide treatment was applied on June 29 when dry beans had reached the 2 to 3 trifoliolate growth stage. The herbicide treatments (Table 1) included:

- Standard comparison treatments of Eptam + Sonalan PPI with and without Varisto POST (treatments 1 & 2), and Prowl PRE with and without Varisto POST (treatments 3 & 4)
- A series of Permit treatments with Permit applied all PRE (treatments 5 & 6) compared to Permit applied in a split-residual pattern of PRE and POST (treatments 7 & 8)
- A series of Outlook treatments with Outlook applied all PRE (treatments 9 & 10) compared to Outlook applied in a split-residual pattern of PRE and POST (treatments 11 & 12)
- A nontreated control where no herbicide was applied (treatment 13)

Weed control was evaluated on August 29 (59 days after the POST herbicide treatment). Beans were harvested for yield on September 27.

**Table 1:** Herbicide treatment structure, Powell, WY, 2021.

	<b>PRE herbicide</b>	<b>POST herbicide (2-3 trifoliolate stage)</b>
1	Eptam (3pt) + Sonalan (2pt) [PPI]	
2	Eptam (3pt) + Sonalan (2pt) [PPI]	Varisto (21 oz)
3	Prowl (2pt)	
4	Prowl (2pt)	Varisto (21 oz)
5	Prowl (2pt) + Permit (0.66 oz)	
6	Prowl (2pt) + Permit (0.66 oz)	Varisto (21 oz)
7	Prowl (2pt) + Permit (0.5 oz)	Permit (0.5 oz)
8	Prowl (2pt) + Permit (0.5 oz)	Varisto (21 oz) + Permit (0.5 oz)
9	Prowl (2pt) + Outlook (21 oz)	
10	Prowl (2pt) + Outlook (21 oz)	Varisto (21 oz)
11	Prowl (2pt) + Outlook (10 oz)	Outlook (11 oz)
12	Prowl (2pt) + Outlook (10 oz)	Varisto (21 oz) + Outlook (11 oz)
13	nontreated control	

**Results:**

The split residual herbicide concept improved redroot pigweed control with Permit (Table 2). Redroot pigweed control was greatest when Permit was applied POST (92 to 93% control) compared to all other treatments ( $\leq 78\%$  control). Permit does have some postemergence efficacy (unlike many other residual herbicides), so this may provide at least a partial explanation. However, Varisto (bentazon + imazamox) also provides good control of emerged pigweed, and in this study, POST Varisto treatments without Permit ranged from 50 to 78% pigweed control, suggesting the residual activity of Permit improved control of this weed.

Common lambsquarters, which tends to be an earlier emerging weed, was best controlled by the standard treatment of Eptam + Sonalan PPI followed by Varisto POST (97% control; Table 2). The split-residual treatments with Permit and Outlook both improved common lambsquarters control compared to similar treatments without the split-residual; however, even the best split residual treatment (Outlook applied PRE + POST) only provided 75% common lambsquarters control, substantially less than the commercial standard treatment.

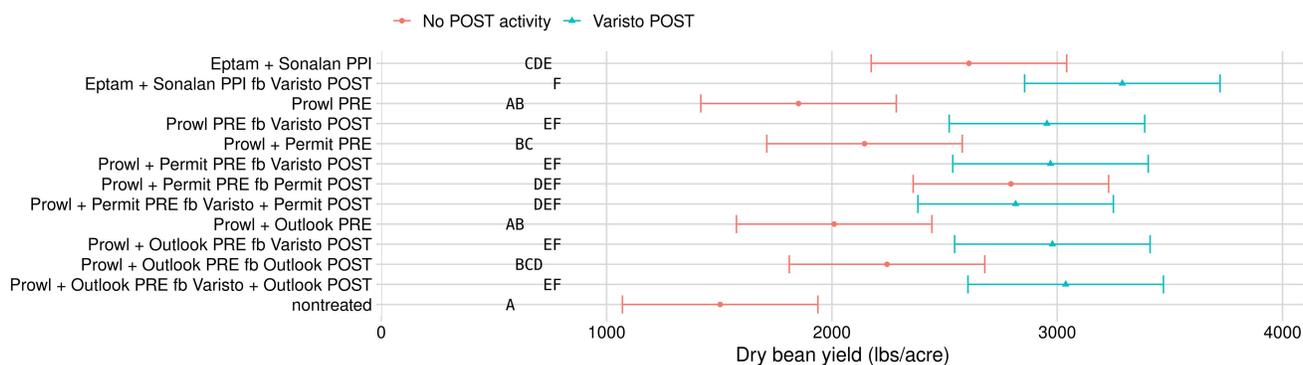
Hairy nightshade, arguably one of the most problematic late-season weeds in dry beans (and one of the driving motivations for this study), was not controlled better by any of the split-residual treatments (Table 2). Treatments containing Varisto POST provided the greatest control of hairy nightshade, and were not improved by adding Permit or Outlook POST.

Dry bean yield benefited most from the application of Varisto POST, since that treatment provided the greatest pigweed and nightshade control, the two weeds present at the highest density at the study site (Figure 1). The only herbicide treatment without Varisto that resulted in competitive bean yields was the treatment including Permit POST, likely due to the substantially improved pigweed control. The split-residual application concept shows some promise for certain weeds, but more research is needed.

**Table 2:** Weed control from herbicide treatments near Powell, Wyoming in 2021.

Herbicide treatment	redroot pigweed (7.5 plants/m <sup>2</sup> )	common lambsquarters (3 plants/m <sup>2</sup> )	hairy nightshade (6 plants/m <sup>2</sup> )
	% control		
Eptam + Sonalan PPI	37	64	42
Eptam + Sonalan PPI fb Varisto POST	50	97	76
Prowl PRE	0	36	0
Prowl PRE fb Varisto POST	60	41	67
Prowl + Permit PRE	17	25	17
Prowl + Permit PRE fb Varisto POST	78	41	77
Prowl + Permit PRE fb Permit POST	93	60	45
Prowl + Permit PRE fb Varisto + Permit POST	92	60	57
Prowl + Outlook PRE	17	20	0
Prowl + Outlook PRE fb Varisto POST	78	46	72
Prowl + Outlook PRE fb Outlook POST	15	40	22
Prowl + Outlook PRE fb Varisto + Outlook POST	70	75	69
<i>LSD (0.05)</i> <sup>†</sup>	32	43	34

<sup>†</sup>Differences between means within a column less than the least significant difference (LSD) value are not statistically meaningful at the 5% level.



**Figure 1:** Dry bean yield as affected by herbicide treatment near Powell, Wyoming in 2021.