Cover crop and herbicide combinations for season-long weed control in dry beans

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Herbicides will undoubtedly remain an important weed management tool in dry beans, but even the most ardent supporters of herbicides acknowledge the necessity of reducing reliance on herbicides through integrated weed management practices. Reducing reliance on herbicides is especially important in specialty crops like dry edible beans where effective herbicides are limited. Cover crops are arguably one of the most sustainable and environmentally friendly weed management practices, and they are consistently promoted for other reasons such as erosion control, nutrient stabilization, and other aspects of soil health. In most cases, cover crops cannot provide adequate weed control alone, so combining cover crops with other weed management practices such as herbicides is often required for economical weed control.

The objective of this research is to evaluate combinations of cover crops and herbicides for season-long weed suppression in dry bean production.

Methods:

Field studies were conducted near Powell and Lingle, Wyoming at the Research & Extension Centers. A winter wheat cover crop was established and PRE, POST, or sequential herbicide applications were applied within the cover crop treatments (Table 1). The study was a split-plot arrangement of cover crop treatments and herbicides for a total of 12 treatment combinations. PRE and PPI herbicides were applied within one day of dry bean planting, and POST herbicides were applied when dry beans reached the 2 to 3 trifoliolate stage of growth.

- Cover crops (whole-plot factor):
  - no cover crop (control to evaluate herbicide effects)
  - cover crop planted in March (early)
  - cover crop planted in April (late)
- Herbicide treatments (split-plot factor):
  - no herbicide (control to evaluate cover crop effects)
  - PRE herbicide only (Prowl + Outlook)
  - POST herbicide only (Varisto)
  - sequential PRE + POST herbicides (Prowl + Outlook PRE, Varisto POST)

We collected small grains biomass at the time of bean planting (June 2 to June 8) to quantify cover crop biomass production. Dry bean was planted into the standing cover crop, and terminated with glyphosate within 1 day of bean planting. Weed control was evaluated periodically throughout the growing season. At maturity, beans were harvested to collect yield data.

Table 1: Planting and harvest dates, 2021.

	Powell, WY	Lingle, WY
Early cover crop planting date	March 26	March 9
Late cover crop planting date	April 20	April 23
Dry bean planting	June 2	June 8
	'Max'	'Othello'
PRE herbicide application date	June 3	June 9
POST herbicide application date	June 29	July 8
Dry bean harvest date	September 10	September 14

Results:

Due to cool, dry weather across Wyoming in the spring of 2021, cover crop biomass production was less than expected, especially at Powell (Table 2). Less than 1,000 lbs/A biomass was produced at Powell, compared to just greater than 3,000 lbs/A in the early cover crop planting at Lingle. A meta-analysis of field research by Osipitan et al. (2019) suggests that no effective weed suppression would be expected at Powell, and less than 25% weed suppression would be expected at Lingle, based on this level of cover crop biomass production.

Table 2: Small grains biomass at the time of dry bean planting.

	Powell, WY	Lingle, WY
	small grains biomass (lbs/acre)	
No cover crop	107[a]	936[b]
Late planted cover crop	647	1680
Early planted cover crop	499	3080

[a]Volunteer barley was present from previous crop.

[b]Volunteer spring wheat was present from previous crop.

As expected from the cover crop biomass data, the cover crop appeared to have an impact on weed densities at Lingle (Table 3), where kochia, hairy nightshade, redroot pigweed, and common lambsquarters were all affected by cover crop treatment. At Powell, even though the cover crop biomass was insufficient to have expected weed suppression, the cover crop treatments appeared to have an impact on kochia control. Presence of a cover crop reduced kochia density by >45% at Powell and by 70% at Lingle (Table 4). At Powell, all other weed species were affected by herbicide treatments, with the POST herbicide application of Varisto (bentazon + imazamox) having the greatest impact on weed density (Table 5). At Lingle, weed density was variable, and primarily driven by herbicide treatments (Table 6).

Table 3: Effect of cover crop, PRE, and POST herbicides on weed density 21 days after POST treatment at Powell and Lingle, Wyoming, 2021.

	kochia	hairy nightshade	redroot pigweed	common lambsquarters	Venice mallow	redstem filaree
Lingle, WY						
Cover crop	**	**	**	**		
PRE herbicide		**				
POST herbicide		**	**	**		
Powell, WY						
Cover crop	**					
PRE herbicide			**		**	
POST herbicide		**	**		**	**

Asterisks (**) denote a statistically significant effect on weed control.

Table 4: Kochia density 21 days after POST treatment as affected by cover crop treatment at Powell and Lingle, WY in 2021.

	Powell, WY	**Lingle, WY**
	—— kochia density (plants per m^2) ——	
No cover crop	11.7	1.3
Late planted cover crop	6.4	0.4
Early planted cover crop	5.5	0.3
LSD (0.05)	*4.7*	*0.9*

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

Table 5: Weed density 21 days after POST herbicide treatment at Powell, WY in 2021.

Cover crop	Herbicide	hairy nightshade	redroot pigweed	Venice mallow	redstem filaree
		plants per m^2			
none	no herbicide	2	5	19	4
	PRE only	2	4	11	4
	POST only	0	1	12	1
	PRE + POST	0	0	8	1
late planted	no herbicide	2	5	18	2
	PRE only	1	3	16	2
	POST only	0	1	6	1
	PRE + POST	0	0	4	0
early planted	no herbicide	1	5	16	6
	PRE only	1	3	10	1
	POST only	0	2	11	3
	PRE + POST	0	0	9	1
LSD (0.05)[†]		*2*	*3*	*11*	*4*

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

Table 6: Weed density 21 days after POST herbicide treatment at Lingle, WY in 2021.

Cover crop	Herbicide	hairy nightshade	redroot pigweed	common lambsquarters
		plants per m^2		
none	no herbicide	1	1	35
	PRE only	1	1	21
	POST only	3	0	15
	PRE + POST	0	0	26
late planted	no herbicide	1	7	16
	PRE only	1	1	21
	POST only	0	0	7
	PRE + POST	0	0	26
early planted	no herbicide	4	3	25
	PRE only	1	0	21
	POST only	0	0	16
	PRE + POST	0	0	9
LSD (0.05)[†]		*2*	*3*	*17*

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

Dry bean yield was highest where POST herbicide treatments were applied, and appeared to have a trend for greater yield where the late-planted cover crop was established at both locations (Figure 1).

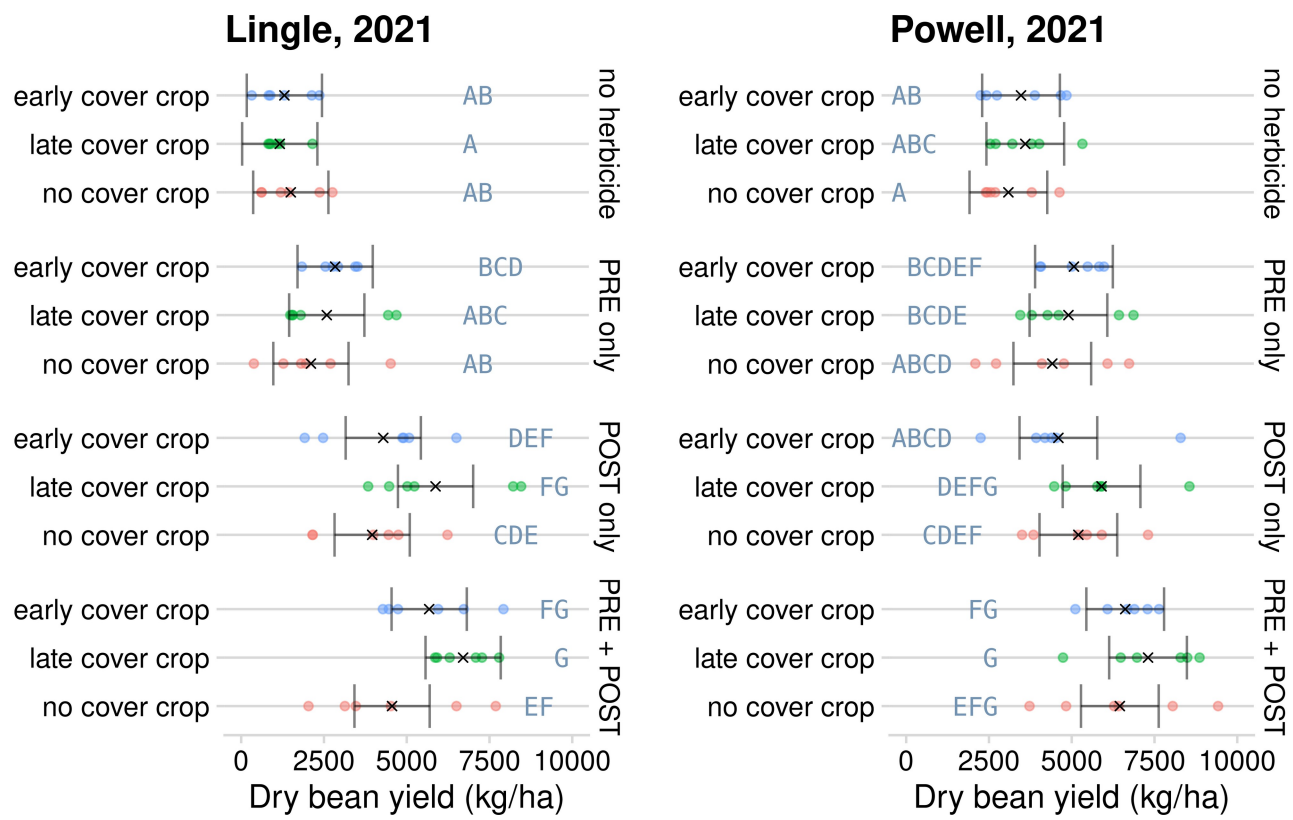

Figure 1: Dry bean yield as affected by cover crop and herbicide treatments at Lingle and Powell, WY in 2021.