

## **Final Report:**

### **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.

In this research, we evaluated the use of a spring-seeded cover crop alone or in combination with PRE and POST herbicides for season-long weed suppression in dry bean production. We hypothesized that the combined weed suppression from cover crops and PRE or POST herbicides would be greater than either practice used alone, and that the combination will allow for cost-effective control of problematic weeds like kochia, common lambsquarters, hairy nightshade, and Venice mallow.

## **METHODS:**

Field studies were conducted near Powell and Lingle, Wyoming during the 2021 and 2022 field seasons. at the Research & Extension Centers. Winter wheat was seeded as the cover crop at all sites. Two cover crop planting dates ('early' and 'late') and a no cover crop control treatment were established at all sites (Table 1). The cover crop was terminated with glyphosate on the day of dry bean planting in all years. PRE herbicide treatments (Prowl + Outlook) were applied within 48 hours of dry bean planting, and POST herbicide (Varisto) was applied when the beans reached the 3<sup>rd</sup> trifoliolate stage of growth.

Cover crop biomass was collected near bean planting to estimate total cover crop biomass production for each planting date. Dry bean stand counts were collected within 3 weeks of dry bean emergence. Weed density was evaluated at the time of dry bean planting, at the time of POST herbicide application, and 3 weeks after the POST application. All plots were harvested for yield in September at bean maturity by pulling 20 feet of row per plot, drying, and threshing.

**Table 1. Trial establishment information for four field sites.**

	Powell, 2021	Lingle, 2021	Powell, 2022	Lingle, 2022
Cover crop cultivar	‘Willow Creek’	‘WB4303’	‘Willow Creek’	‘WB4303’
Cover crop seeding rate	200 lbs/A	100 lbs/A	200 lbs/A	100 lbs/A
‘Early’ cover crop planting date	26-Mar-2021	3-Mar-2021	8-Apr-2022	25-Mar-2022
‘Late’ cover crop planting date	28-Apr-2021	23-Apr-2021	28-Apr-2022	21-Apr-2022
Dry bean cultivar	‘Maxx’	‘Othello’	‘Maxx’	‘Othello’
Dry bean planting date	2-Jun-2021	8-Jun-2021	14-Jun-2022	8-Jun-2022
Dry bean seeding rate	80,000/A	80,000/A	80,000/A	80,000/A
Dry bean row spacing	22-inches	30-inches	22-inches	30-inches
PRE herbicide application date				
POST herbicide application date				
Dry bean harvest date	10-Sep-2021	14-Sep-2021	20-Sep-2022	31-Aug-2022

**RESULTS:**

Cover crop biomass exceeded 1.5 tons per acre for the early planting at Lingle in 2021, but was less than 670 lbs/acre at all other sites and planting dates (Table 2). The differences between cover crop biomass production between years at Lingle was most likely a function of precipitation. During the March through May period at Lingle, soil temperatures and growing degree days were lower in 2021 compared to 2022 or the previous 10 year average. Conversely, there was substantially more precipitation in March in 2021, and this early precipitation likely improved establishment and early growth of the cover crop and increased biomass production.

**Table 2. Small grains biomass at dry bean planting time as influenced by the cover crop planting time, Powell and Lingle, Wyoming, 2021 and 2022.**

Cover crop establishment timing	Powell		Lingle	
	2021	2022	2021	2022
	lbs/acre			
Early	500	298	3081	132
Late	670	297	1681	83
None	108*	0	936*	0

\*Biomass collected where no cover crop was planted included volunteer small grains from previous year barley (Powell) or wheat (Lingle) crop.

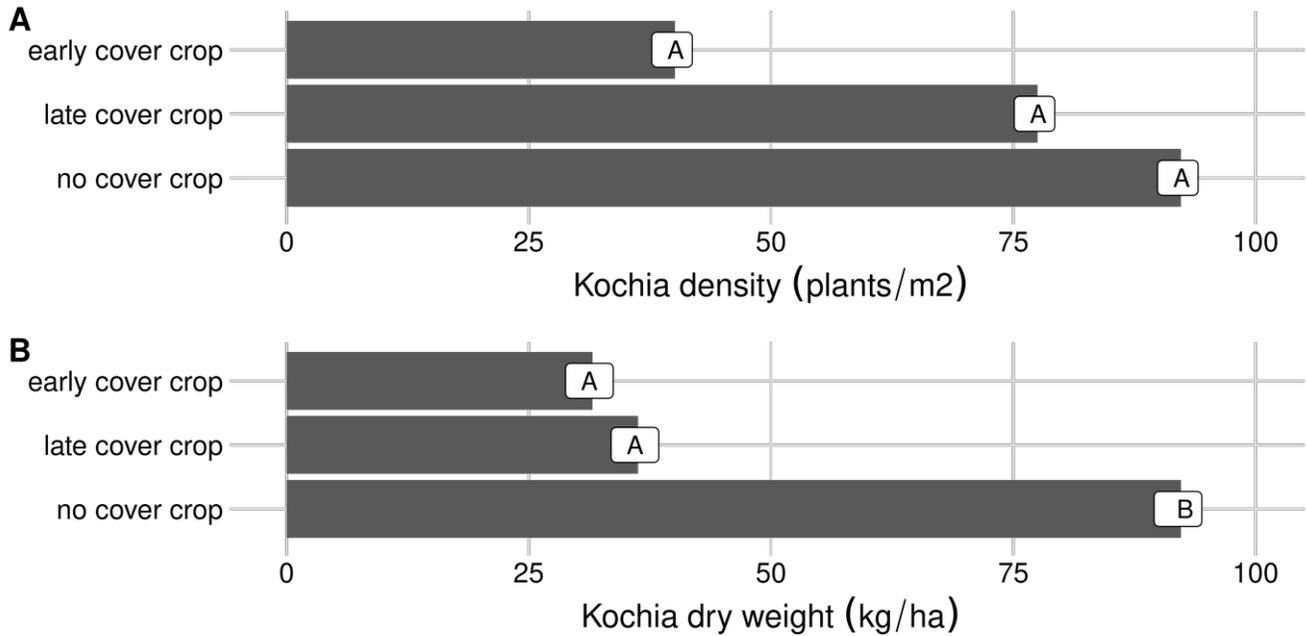
At the time of bean planting kochia and common lambsquarters were the most prevalent emerged weeds. Cover crops did not have a consistent effect on the density of either of these weed species at bean planting, but biomass of both weeds was reduced by the presence of a cover crop (Figures 1 & 2).

Kochia at the lingle site was resistant to imazamox and glyphosate, and therefore, kochia plants that had emerged before the PRE herbicide treatment was applied were not controlled by the cover crop termination treatment of glyphosate or the POST application of Varisto. When evaluated 3 weeks after the POST treatment, the PRE and POST herbicides did not significantly impact kochia density. However, the impact of the cover crop was evident at this evaluation timing, reducing kochia density 39 to 54% compared to the no cover crop treatment (Figure 3).

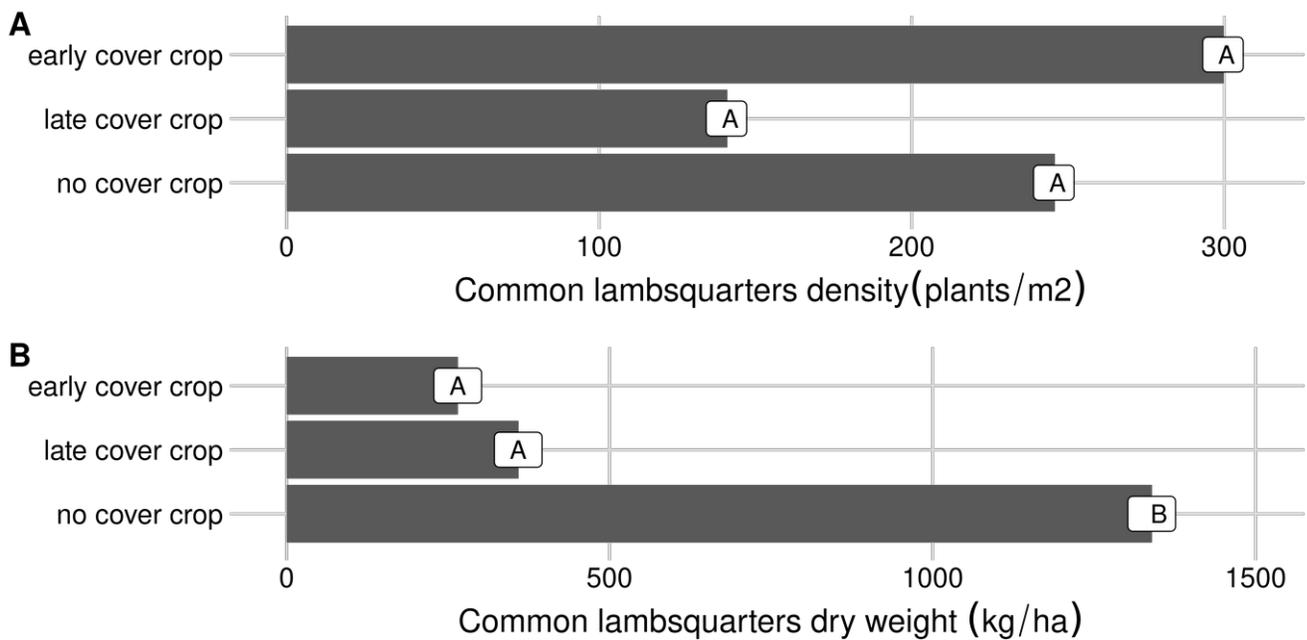
Common lambsquarters density 3 weeks after the POST treatment was reduced by the cover crop treatments 24 to 49% compared to the no cover crop treatment, but not significantly affected by the PRE herbicide treatment (Figure 4). The POST herbicide reduced common lambsquarters density by 45%.

Hairy nightshade, the latest emerging weed evaluated in this study, was not affected by the cover crop treatments (Figure 5). The PRE and POST herbicide treatments reduced hairy nightshade by 48 and 53%, respectively.

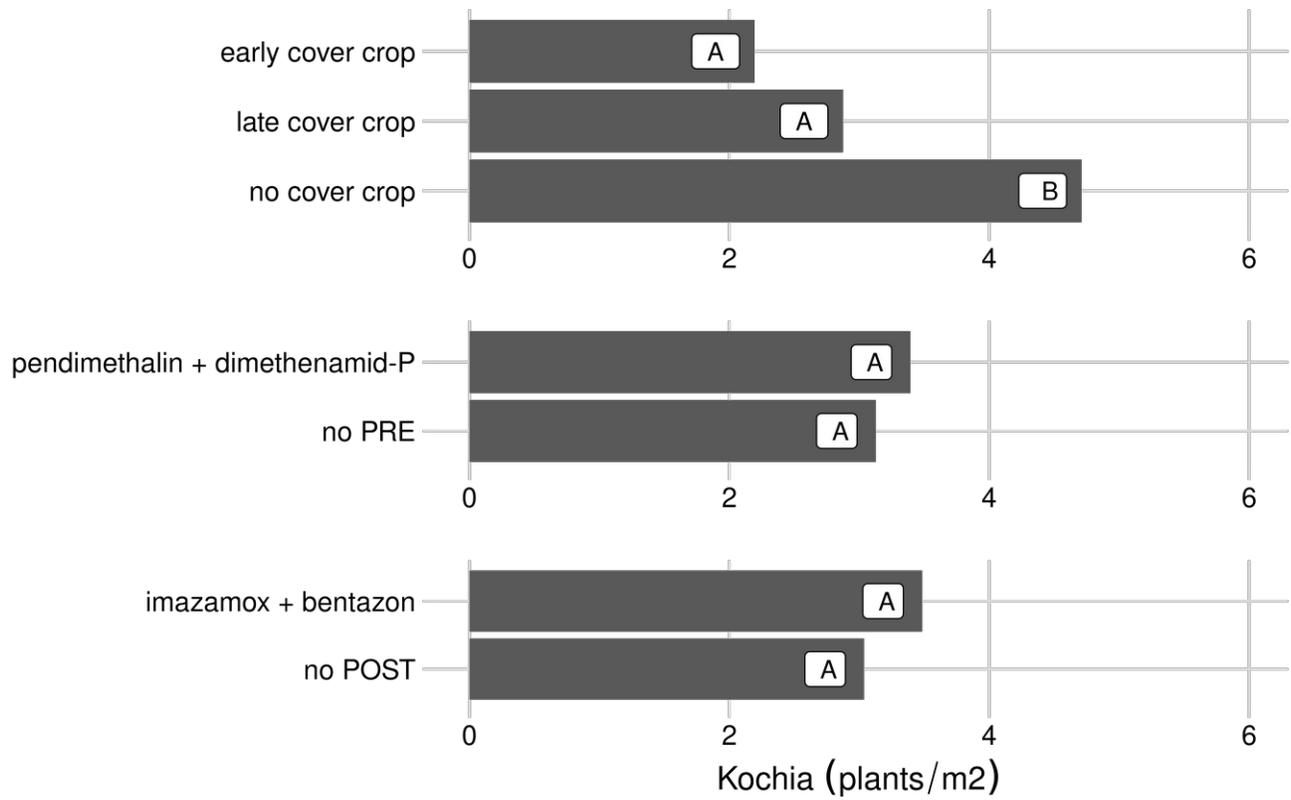
Cover crops, PRE herbicide, and POST herbicide impacted dry bean yield in an additive manner; that is, the presence of a cover crop did not impact the efficacy (or need for) a PRE or POST herbicide treatment. Yield was greater in the presence of a cover crop, possibly because of the weed suppression it provided, but that is not the only potential explanation. Herbicide treatments had a greater impact on protecting dry bean yield compared with cover crops (Figure 6). Cover crops increased bean yield between 4 to 12% compared to the no cover crop treatment. PRE herbicide increased dry bean yield by 23% compared to no PRE, and POST herbicide increased dry bean yield by 29% compared to no POST.



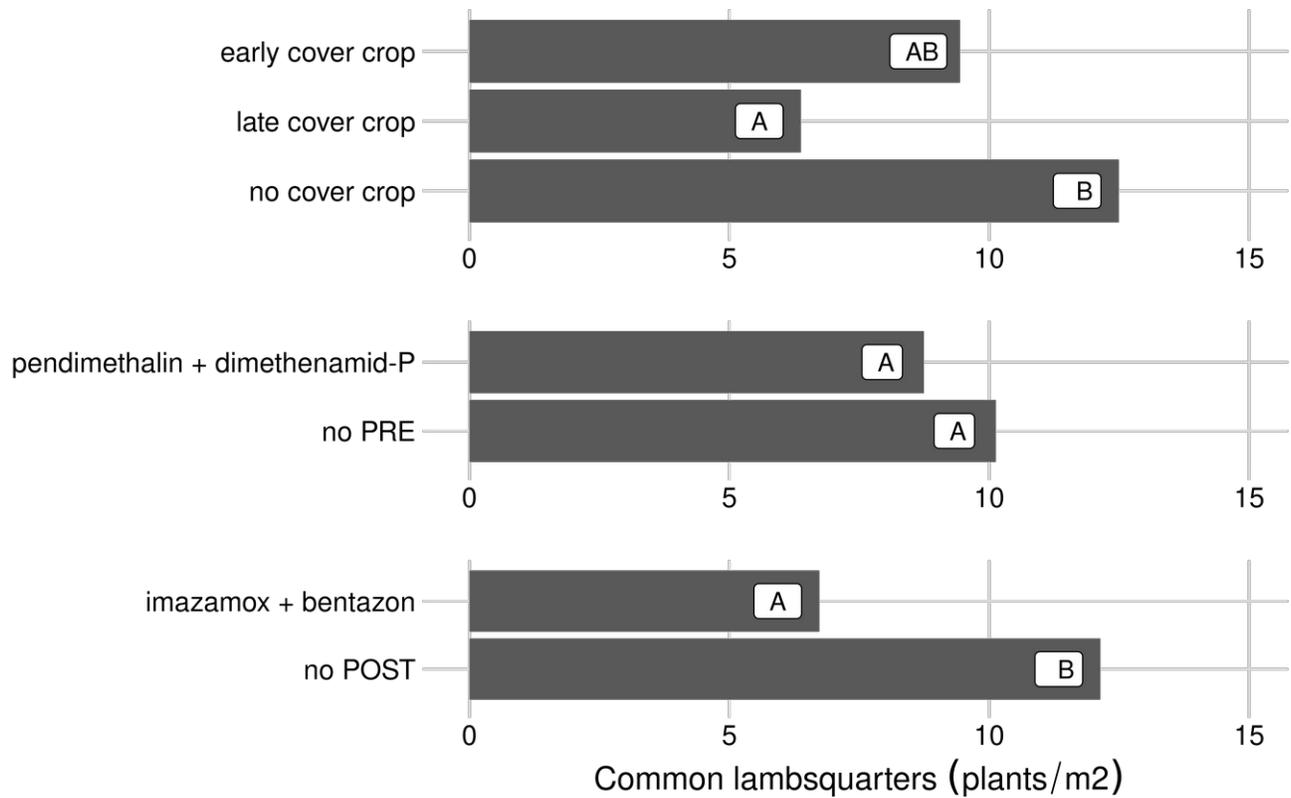
**Figure 1. Kochia density (A) and biomass (B) at dry bean planting as affected by cover crop treatment, averaged over four sites.**



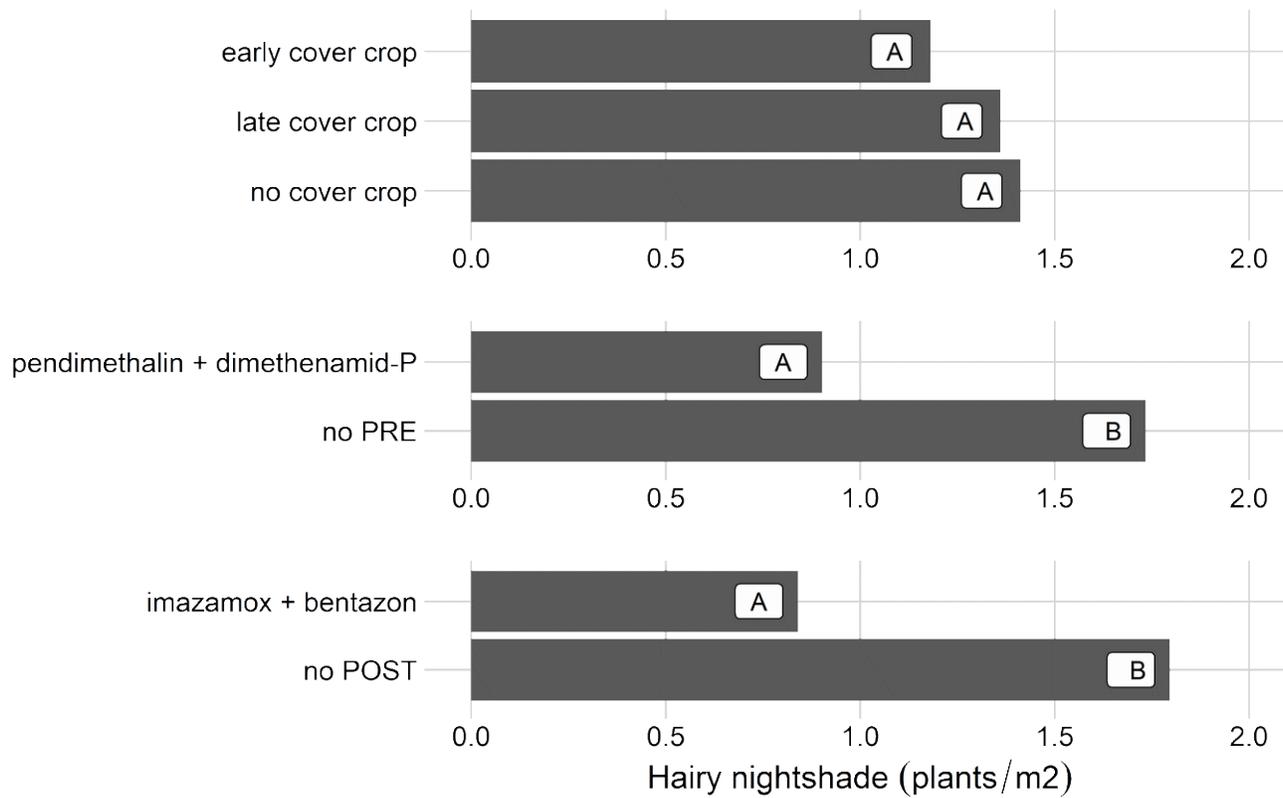
**Figure 2. Common lambsquarters density (A) and biomass (B) at dry bean planting as affected by cover crop treatment, averaged over four sites.**



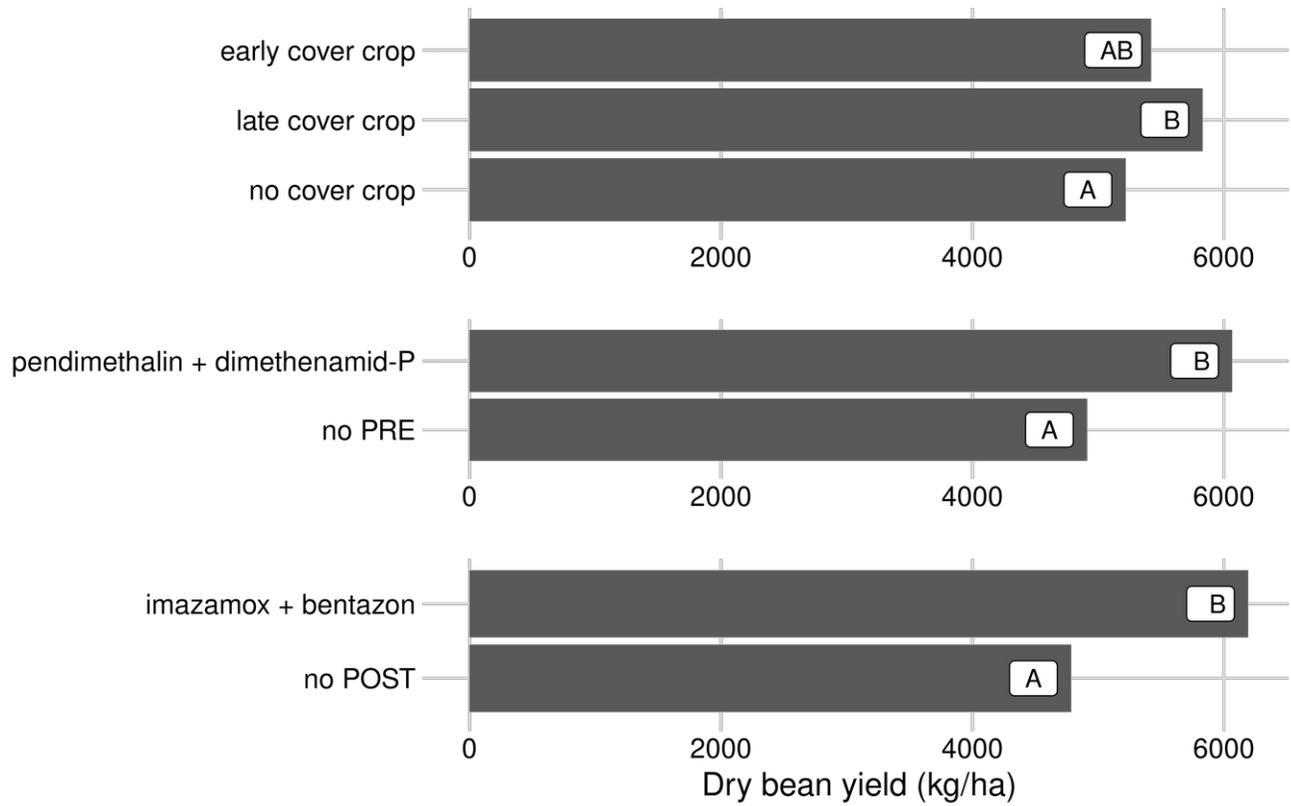
**Figure 3. Kochia density 3 weeks after the POST herbicide treatment as affected by cover crop, PRE, and POST herbicide treatments averaged over three sites.**



**Figure 4. Common lambsquarters density 3 weeks after the POST herbicide treatment as affected by cover crop, PRE, and POST herbicide treatments averaged over three sites.**



**Figure 5. Hairy nightshade density 3 weeks after the POST herbicide treatment as affected by cover crop, PRE, and POST herbicide treatments averaged over three sites.**



**Figure 6. Dry bean yield as affected by cover crop, PRE, and POST herbicide treatments averaged over three sites.**