BRASSICA COVER CROP VARIETY TRIAL – SPRING UPDATE

Christy Tanner, Malheur County Extension Service, Oregon State University, Ontario, OR

Introduction

Cover crops can directly benefit farmers by improving soil health and water holding capacity; suppressing weeds, pests, and diseases; preventing erosion and nutrient losses; fixing nitrogen; and providing additional forage for livestock. In Malheur County, Oregon, there is growing interest in cover crops, but little work has been done to identify which cover crops are best suited to this area. This trial evaluated the performance of brassica cover crop species and varieties planted in August 2019 following wheat harvest. Varieties were evaluated for biomass production, weed suppression, and forage quality. This report includes data collected the following spring.

Materials and Methods

Brassica cover crops were grown on an Owyhee silt loam soil in the fall of 2019 following wheat harvest. Wheat stubble was shredded, and the field was disked and irrigated. A soil analysis showed a pH of 8.1, 2.94% organic matter, 3 ppm nitrate-nitrogen (N), 3 ppm ammonium-N, 31 ppm phosphorus (P), 331 ppm potassium (K), 29 ppm sulfate-sulfur (S), 3,577 ppm calcium (Ca), 345 ppm magnesium (Mg), 99 ppm sodium (Na), 7.9 ppm zinc (Zn), 1.7 ppm copper (Cu), 2 ppm manganese (Mn), 14 ppm iron (Fe), and 0.04 ppm boron (B). Based on this soil analysis, fertilizers were broadcast applied at rates of 120 lb N/acre, 200 lb elemental sulfur/acre, 6 lb Mn/acre, and 1 lb B/acre. The field was then disked, rototilled, and beds formed at 30-inch spacing.

The experiment followed a randomized complete block design with four replicates. Plots were 15 ft wide (6 beds) by 40 ft long. A total of 11 varieties of 6 brassica species were seeded on August 28, 2019. Seeding rates were determined based on dealer recommendations (Table 1). Three of the tested varieties are marketed for pest control (biofumigation and nematode control), while the other eight varieties are forage types. A 7-row small plot planter with 7.5-inch row spacing was used for planting. The middle row of the planter was plugged to avoid planting in the furrow, resulting in three rows per bed. Seeds were planted at ½-inch depth, and drag chains were used to ensure good seed-to-soil contact. The trial was furrow irrigated for 24 hours the day after planting. No additional irrigation was applied, and no herbicides or pesticides were used. By not controlling volunteer wheat and weeds, we were able to evaluate weed suppression.

After yield measurements were made in the fall of 2019 (7 weeks after planting), the plots were left undisturbed over the winter in order to evaluate winter survival and continued weed suppression. Biomass samples were collected on April 24, 2020. A quadrat measuring 10 ft^2 was sampled by cutting all biomass at soil level from a 48-inch-long section of a single bed (30-inch width) within each plot. To measure weed biomass when no cover crop was present, this sampling protocol was also used to collect four quadrats from the area surrounding the study.

The fresh weights of the samples were recorded. Samples were divided into live cover crop biomass, dead cover crop biomass, and weeds. All samples were dried to a constant weight and the weights recorded.

Differences between varieties were evaluated using analysis of variance (ANOVA), and means separation were determined using Tukey's honestly significant difference with a family-wise error rate of $P < 0.05$.

Additional details about the experiment as well as biomass production and weed suppression data collected in the fall of 2019 were included in the 2019 Malheur Experiment Station annual report: "Brassica Cover Crop Variety Trial."

Results and Discussion

The only variety that fully winter killed was 'Master mustard'. Varieties 'Bayou kale', 'Caliente 199', 'Shield mustard', and 'Winfred forage brassica' all had 1–2 ton/acre of live biomass present at the spring harvest date (Table 2). All other varieties suffered winter damage, and had low biomass yields, but did not fully winter kill. The winter of 2019–2020 was relatively mild, but an early cold spell with temperatures of 9°F occurred in October 2019.

Weed biomass was significantly higher in the weedy check than in the cover crop plots. Among varieties, there was a wide range of weed suppression, with 'Caliente 199' and 'Bayou kale' having 10-fold less weed biomass than the weedy check. Other varieties had closer to 50% the weed biomass compared to the weedy check (Figure 1).

Conclusions

These results demonstrate that brassica cover crops can significantly contribute to weed suppression in the Treasure Valley. When growing varieties other than 'Master mustard', producers should plan for how to terminate the cover crop as they are unlikely to fully winterkill each year.

Acknowledgements

A special thanks to Saddle Butte Ag, PGG, Allied Seed, and Simplot Grower Solutions for donating seeds used in this project. This work was supported by Oregon State University, the Malheur County Education Service District, and Formula Grant nos. 2020-31100-06041 and 2020-31200-06041 from the USDA National Institute of Food and Agriculture.

Table 1. Brassica varieties included in the cover crop trial and seeding rates used, Malheur Experiment Station, Oregon State University, Ontario, OR, 2020. Seeding rates were chosen based on recommendations indicated on suppliers' websites or verbal recommendations from suppliers.

Variety	Seed donor	Seeding rate (lb/acre)
Forage		
Winfred forage brassica	PGG	2
Purpletop rutabaga	Allied Seed	2
Ethiopian cabbage	PGG	4
African cabbage	Saddle Butte Ag	4
Graza radish	PGG	6
Enricher radish	Saddle Butte Ag	6
Shield mustard	Saddle Butte Ag	6
Bayou kale	Saddle Butte Ag	6
Pest control		
Master mustard	Allied Seed	20
Caliente 199	Simplot	20
Control radish	Allied Seed	25

Table 2. Spring 2020 biomass of weeds and live and dead cover crop for 11 brassica cover crop varieties planted at the Malheur Experiment Station, Oregon State University, Ontario, OR, in August 2019. Values are mean ± standard deviation (n = 4). Within each column, values with the same letter did not differ significantly according to Tukey's honestly significant difference.

Variety	Live cover crop biomass (ton/acre)				Weed biomass (ton/acre)				Dead cover crop biomass (ton/acre)			
African cabbage	0.47	±	0.21	b	1.90	±	0.43	be	0.45	±	0.17	b
Bayou kale	2.11	±	0.49	bd	0.60	±	0.49	e	0.19	±	0.10	bd
Caliente 199	1.59	±	0.36	a	0.31	±	0.25	e	0.74	±	0.12	a
Control radish	0.77	±	0.11	bc	1.10	±	0.35	cde	0.36	±	0.22	bc
Enricher radish	0.07	±	0.04	cd	2.75	±	0.56	bc	0.10	±	0.05	cd
Ethiopian cabbage	0.60	±	0.57	bd	2.54	±	1.28	bd	0.24	±	0.11	bd
Graza radish	0.37	±	0.23	d	3.51	±	1.46	b	0.06	±	0.04	d
Master mustard	0.00	±	0.00	a	0.77	±	0.40	de	0.84	±	0.13	a
Purpletop rutabaga	0.67	±	0.24	cd	3.04	±	0.85	b	0.14	±	0.06	cd
Shield mustard	1.78	±	0.35	bd	0.91	±	0.66	de	0.19	±	0.06	bd
Winfred forage brassica	1.51	±	0.35	bd	1.83	±	0.35	be	0.17	±	0.03	bd
Weedy check					6.20	±	0.60	a				

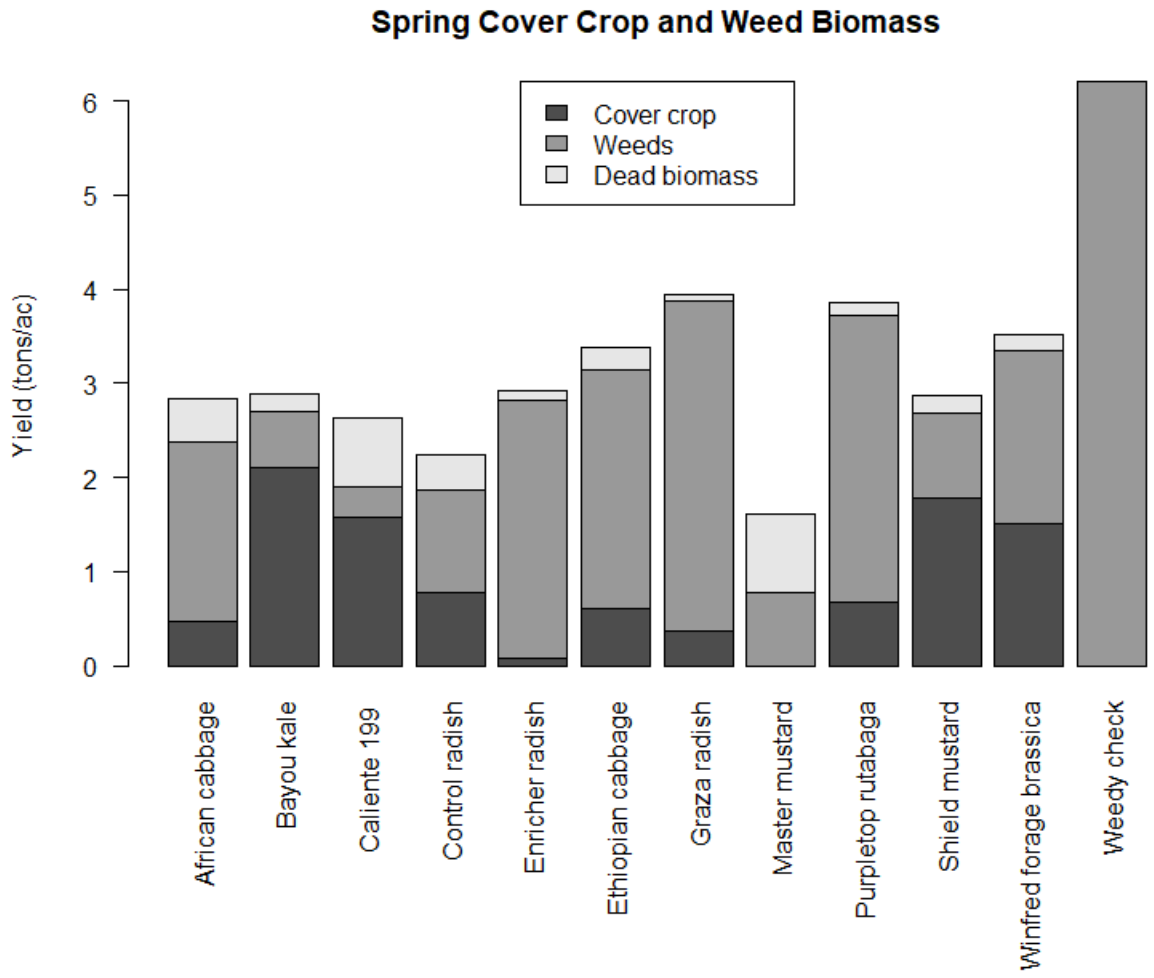

Figure 1. Live cover crop, weed, and dead cover crop biomass in the spring of 2020 for cover crops planted in fall 2019 at the Malheur Experiment Station, Oregon State University, Ontario, OR.