An Evaluation of 11 Summer Cover Crops for Suitability to Southwest British Columbia

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INTRODUCTION

- Soil degradation is an important agricultural and ecological issue globally and locally. Farms in the Fraser River delta region in Southwest British Columbia have seen declines in soil organic matter over the last 30 years due to the shift from integrated farming to cultivated vegetable production.
- Cover crops can reduce fertilizer and herbicide use and costs, improve yields, prevent erosion, conserve moisture, protect water quality, and reduce exposure to agrichemicals.
- Biomass accumulation and canopy cover development are important characteristics for cover crops in terms of their ability to benefit soil structure, scavenge nutrients, and outcompete weeds.
- Summer cover crops must grow fast enough to be used between early-planted and late-planted cash crops, often for a window of 3-8 weeks. Summer cover crops in Southwest BC would need to be drought tolerant due to low summer precipitation (Figure 1).
- Sorghum sudangrass and buckwheat are two commonly recommended species for summer cover.

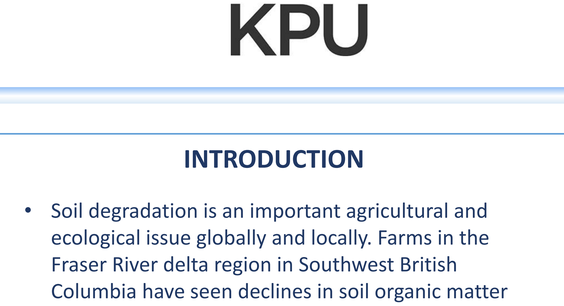

Figure 1. Daily temperature and precipitation readings in Richmond, BC from July 1 to August 31, 2018.

OBJECTIVES

- To compare aboveground biomass accumulation and fractional green canopy canopy coverage of 11 different cover crop species.

MATERIALS AND METHODS

Location: KPU Research Farm, Garden City Lands, Richmond BC

Experimental design: Single factor randomized complete block design with three replicates. 12' x 12' plot.

Treatment factor: Cover crop species. 11 levels:

- Barley (*Hordeum vulgare*)
- Buckwheat (*Fagopyrum esculentum*)
- Oats (*Avena sativa*)
- Sorghum sudangrass (*Sorghum × drummondii*)
- Crimson clover (*Trifolium incarnatum*)
- Sweetclover (*Melilotus officinalis*)
- Alfalfa (*Medicago sativa*)
- Cowpeas (*Vigna unguiculata*)
- White mustard (*Sinapis alba*)
- Brown mustard (*Brassica juncea*)
- Yellow mustard (*Guillenia flavescens*)

Planting: Plots were amended with compost and lightly cultivated before planting. Seeds were planted on July 5, 2018 using Solo 421 chest-mounted spreader. Plots were watered with overhead irrigation twice.

Data collection:

- Fractional green canopy coverage was measured once a week for four weeks starting on July 18 using the Canopeo app with an iPhone held 5 feet above the top of the canopy.
- Aboveground biomass was measured by hand clipping cover crop in 1' x 1' quadrats (3 quadrats per plot). Mustard samples were collected on Aug 15 and 22 as they reached seed set earlier. All other samples were collected on Aug 29 and 30. Fresh weights were collected in the field. Dry weights were collected by oven-drying samples at 70°C until constant weight was reached.

Data analysis:

- All data analysis was conducted in R 3.5.1. Data were tested for normality and transformed using square root (fresh weights and dry weights), arcsine square root (maximum canopy coverage) and logit (canopy coverage over time).
- Maximum canopy coverage and aboveground biomass data were analyzed using one way ANOVA. Tukey's HSD test was used as post-hoc analysis.
- Effect of time and species on canopy coverage were analyzed using repeated measures ANOVA in EZR.

Figure 2. Experimental plots on July 25th (left), August 1st (centre), and August 8th (right).

RESULTS

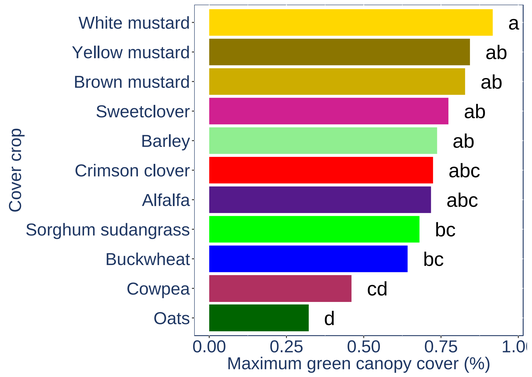

Figure 3. Maximum fractional green canopy coverage of each cover crop species. Means labeled with the same letters are not significantly different (Tukey's HSD, α=0.05).

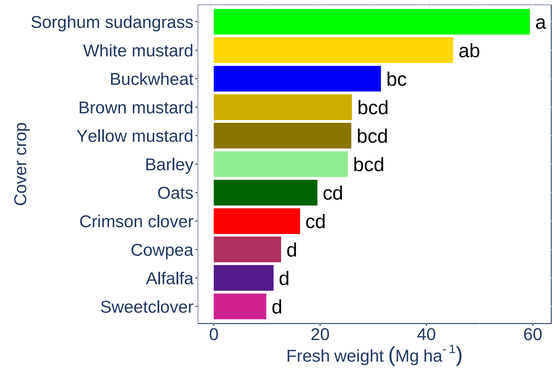

Figure 4. Above ground fresh biomass of each cover crop species. Means labeled with the same letters are not significantly different (Tukey's HSD, α=0.05).

Effect	SSn	d.f.	Error SS	d.f.	F value	P value
Species	622.29	10	151.550	66	27.1006	$<2.2e^{-16}$
Time	703.59	3	31.518	198	1473.3319	$<2.2e^{-16}$
Block	247.01	2	151.550	66	53.7859	$1.387e^{-14}$
Species x Time	41.55	30	31.518	198	8.7012	$<2.2e^{-16}$
Species x Block	54.20	20	151.550	66	1.1801	0.2991
Time x Block	9.46	6	31.518	198	9.9075	$1.483e^{-9}$
Species x Time x Block	21.10	60	31.518	198	2.2091	$2.308e^{-5}$

Mauchly Tests for Sphericity p value for all tests: 0.00044448

Table 1. Results for Type III repeated measures ANOVA regarding the effects of cover crop species, time, block, and interactions on canopy coverage.

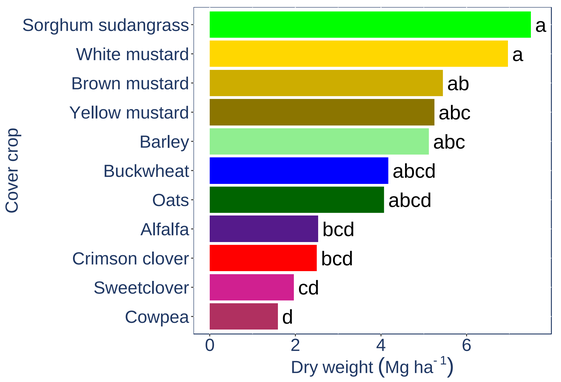

Figure 5. Above ground dry biomass of each cover crop species. Means labeled with the same letters are not significantly different (Tukey's HSD, α=0.05).

CONCLUSION

Canopy coverage:

- Species had a significant effect on maximum canopy coverage. Results of Tukey's HSD test showed significant differences between means at the high end and low end of the data, but not for means in the middle range. There was a significant blocking effect for max canopy coverage, but no interaction between species and block.
- Species, time, blocking, and their interactions were shown to have a significant effect on overall canopy coverage, except for the interaction between species and block.

Aboveground biomass accumulation:

- Species and block had significant effects on dry and fresh weight, but no significant interaction was observed.

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