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# Interseeding Annual Cover Crops into Perennial Pasture

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## ABSTRACT

Cool season pastures in the Intermountain and Rocky Mountain Regions often suffer from a "Summer Slump", a decrease in production resulting from hot temperatures. The introduction of warm season annuals which are more productive at higher temperatures has been viewed as a potential means to maximize production. Aberdeen PMC conducted two trials comparing establishment and biomass production of four warm season cover crops (oats, sorghum/sudangrass, rapeseed, and cowpea) and a mixture of the four, interseeded into established cool season perennial pastures. Results of the initial trial (2018) showed promise but was not analyzed for significance. The second trial (2019) was designed with more replications to allow statistical analysis. We also compared three seeding techniques in the second trial: no-till drill, broadcast, and broadcast followed by a packer/roller to simulate hoof action. We saw no to little establishment of annual crops from either of the broadcast seeded treatments. Biomass differences in the 2019 trial were not found to be statistically significant. Even during the peak of the summer slump period, cool season pasture production was not increased with the interseeding of warm season annual forage species. Based on these results, the labor and expense of interseeding annual forage crops resulted in a net loss. The most important factor for forage production in the Intermountain West, therefore, would appear to be managing for appropriate soil fertility to ensure the highest production of the cool-season species.

## INTRODUCTION

Livestock producers in the Intermountain West have expressed interest in Interseeding warm season annual forage species into cool season perennial pasture with a goal of producing additional feed as the growth of the cool season pasture species slows with rising summer temperatures (Harmoney and Guretzky, 2018; Mousel, 2014). This practice can also help to stimulate perennial pastures by introducing a diversity of plants within the soil community. If successful this could help to bridge the forage gap that occurs in a cool season pasture as growth slows during the warm summer months when cool season grass species are less efficient at performing photosynthesis (Gierish, 2017; Strickler, 2017).

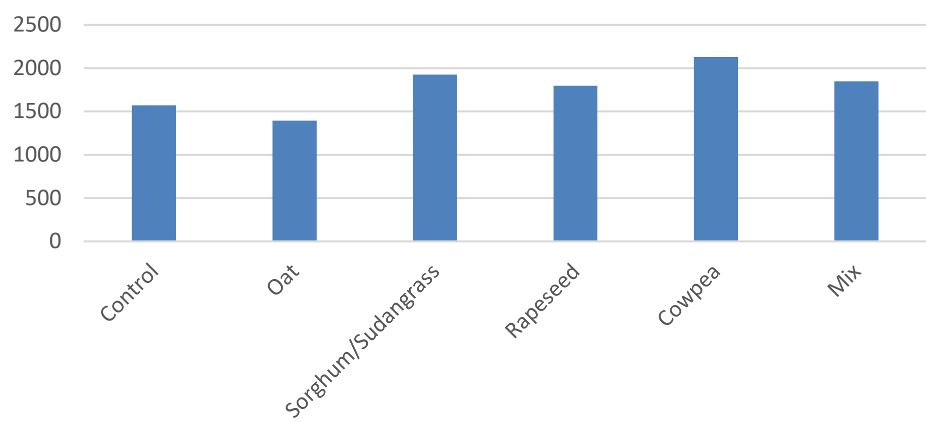
There has been a tremendous surge in the use of annual forages being used for grazing over the last several years, partially driven by the increased use of annual cover crops in mixed farming-livestock production systems. This has led to increased interest in sowing warm season annuals into established perennial pasture systems. Gierish (2017) estimates there has been more interest in this practice in the past two to three years than in at least the two to three decades prior. As farms decrease in size and diversify, the need to produce season long forage with less machinery is increasingly important. Unless a producer has stored feed or another parcel of ground to graze animals, it may be necessary to reduce animal numbers or eliminate an enterprise as a result of decreased feed during the warmer summer months.

Maintaining and increasing soil health is also an important goal for producers. All five NRCS soil health principles: minimizing disturbance, maintaining cover, keeping a living root in the soil, diversifying plants species and integrating livestock are maintained under this system.

## MATERIALS AND METHODS

To investigate the potential of this practice we conducted a small initial trial (with only 2 replications) in 2018. Five treatments of warm season annual forages (oats, sorghum/sudangrass, rapeseed, cowpea and a mixture) were interseeded into a long-established (>10 yr) perennial pasture comprised of 35% tall fescue, 35% meadow brome, 15% orchardgrass, 10% clover and 5% alfalfa that had been flash grazed to approximately 1-2 inches just prior to seeding. Based on evaluations from 2 replications done in 2018, we saw greater biomass production in all treatments except oats when compared to the control plots; however, we were not able to analyze for statistical significance due to the limited number of replications (Figure 1). The greatest biomass was produced by the seeding of cowpea into the pasture which had 1.3 times the amount of biomass than the non-treated control.

Figure 1. Average biomass production from interseeding annual cover crops into non-fertilized perennial pasture, 2018. Data are based on 2 replications.




Though these results were promising, we felt that much of the observed increase in yield might have been the result of poor background soil fertility, as the pasture had not been fertilized in over 10 years. To better ascertain the benefits from interseeding annuals we conducted a larger trial with 4 replications in a newly established perennial pasture with recommended fertility levels.

Perennial pasture was established in the spring of 2018 using a seed mixture of 'Regar' meadow brome, 'Fawn' tall fescue, 'Paiute' orchardgrass and a common Dutch white clover. Grass seed was planted at a target rate of 25 seeds per foot and clover at 15 seeds per foot. The pasture was planted using a Great Plains no till drill (Great Plains Ag. Salina, KS) into a seedbed that had been chemically prepared with Glyphosphate at a rate of 2 quarts per acre. Soils on site are described as a Declo loam with 2 percent slopes. Soil tests were taken spring of 2019 and sent to Stukenholtz Laboratory, Inc. Twin Falls, Idaho. Sorghum sudangrass was used as the desired crop on the report with the intent that it was the most limiting crop in the trial. Test report recommendations called for 210 lbs of Nitrogen and 140 lbs of phosphorous and fertilizer was applied in the spring.

We compared 6 species treatments in a randomized complete block design. Treatments included: 1) a non-interseeded control, 2) Dwarf Essex rape, 3) Goliath oats, 4) Tridan sorghum sudan hybrid, 5) cowpeas, and 6) a mixture comprised of a 25% rate of each of the seeded species. Seeding rates are shown in Table 1. We also compared 3 seeding techniques: 1) no-till drill, 2) broadcast, and 3) broadcast followed by a packer/roller to simulate hoof action. Each seeding followed a simulation of severe grazing using mowing. The field was mowed to 6 inches on June 11, 2019 and mowed again to 3 inches on June 19. Two days after the last mowing we harrowed the field lightly to remove residue and expose the soil. We seeded the plots using an Almaco® cone seeder with double disk openers on June 24. The drill treatments were seeded at an average depth of 0.75 inches. For the broadcast treatments we lifted the cone seeder to where the disk openers were just above the soil and residue, and we allowed the press wheels to push the seed into the soil for the broadcast + packed treatments. The field was irrigated for the remainder of the season for optimum production.

Table 1. Species and seeding rates of annual cover crops interseeded into perennial pasture, 2019.

| Species | Seeding Rate (lb/ac) |
|---|---|
| Dwarf Essex Rape | 6 |
| Tridan Sorghum/Sudan | 30 |
| VNS Cowpea | 90 |
| Goliath Oat | 144 |
| Mix | 68 |

The trial was originally developed as a split-plot design with seeding treatment as the main effect and species as the sub effect. However, due to very poor establishment from the 2 broadcast seeding treatments, we decided to only evaluate the drill seeding as a randomized complete block design. Establishment ratings were done on a 1 to 5 scale where: 1 = 0-20% establishment, 2 = 21-40%, 3 = 41-60%, 4 = 61-80%, 5= 81-100% where plot with highest cover/est of plants was rated as 100 and lowest 0%. Biomass samples of $1m^2$ were harvested to a height of 4 inches, and grab samples of each plot were taken to determine plant moisture. All evaluations occurred on August 16, 2019 estimated to be peak yield.

Statistical analysis was done using Statistix 10 (Analytical Software, Tallahassee, FL). Establishment was analyzed using a Kruskal-Wallis one-way nonparametric analysis of variance at a P = 0.05 level of significance. There were significant differences in ranks between cultivars according to Kruskal-Wallis one-way analysis of variance, but no separation of the ranks was achieved with Dunn's all pairwise comparison test. Biomass data were analyzed with a randomized complete block ANOVA at a P = 0.05 level of significance.

## RESULTS AND DISCUSSION

We saw no to little establishment of annual crops from either of the broadcast seeded treatments. The existing cover and paucity of bare soil limited seed-soil contact and facilitated seed desiccation and likely predation on the soil surface. Likewise, the species evaluated have relatively large seed, which makes it harder to work through any residue and into the soil. The seed was left exposed, sitting on the surface with no protection.

Figure 2. Broadcast and packed cow pea seeds sit, unincorporated on top of the heavy grass residue.

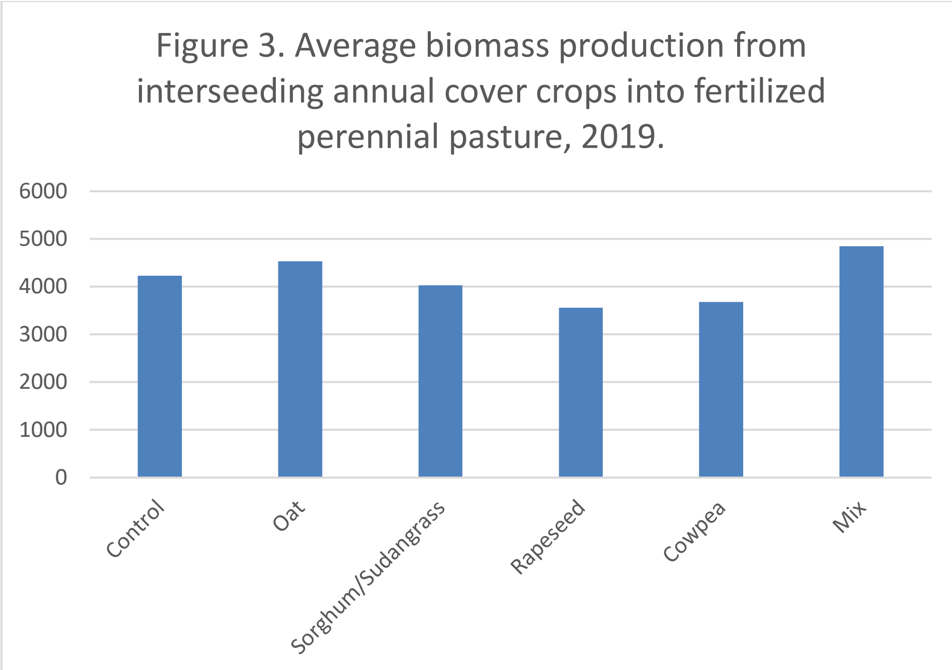
In the drill seeded plots we observed very little establishment of rapeseed and sorghum/sudangrass with both receiving a score of 1.0 (Table 2). Establishment of the other species varied, with the highest average score of 3.3 from the oat treatment. The cowpea treatment established with a score of 2.8, and the mix had a score of 2.5. Despite significant differences detected by the Kruskal-Wallis one-way analysis of variance (p=0.0005), the Dunn's test was unable to separate means.

Table 2. Percent establishment and dry biomass at peak growth (August 16, 2019).

| Species | % establishment[1/] | Lb/ac (dry) |
|---|---|---|
| Control | N/A | 4230[3/] |
| Rapeseed | 1.0 [2/] | 3560 |
| Cowpea | 2.8 | 3680 |
| Sorghum/Sudan | 1.0 | 4030 |
| Oat | 3.3 | 4530 |
| Mix | 2.5 | 4850 |
| Mean | 2.1 | 4150 |
| Std. dev. [4/] | 1.3 | 920 |

[1/]1 = 0-20% establishment, 2 = 21-40%, 3 = 41-60%, 4 = 61-80%, 5= 81-100%.
[2/]There were significant differences in ranks between cultivars according to Kruskal-Wallis one-way analysis of variance, but no separation of the ranks was achieved with Dunn's all pairwise comparison test.
[3/] No significant differences detected
[4/]Standard deviation.

Biomass differences in the 2019 trial (Figure 3) were not found to be statistically significant (p=0.06). The highest biomass production came from the multi-species mix which produced an average 4850 lbs/ac, but that was not statistically significant from the non-seeded control which produced 4230 lbs/ac.




## CONCLUSION

The biomass of the established perennial pasture at the original 2017 trial was low due to low soil fertility. This made the gains seen by adding annual crops much more pronounced than what we saw in the larger 2018/2019 study. With amended soils in the second trial we saw much higher background biomass from the perennial pasture which negated any gains from the added annuals. Even during the peak of the summer slump period, cool season pasture production was not increased with the interseeding of warm season annual forage species. Based on these results, the labor and expense of interseeding annual forage crops resulted in a net loss. The most important factor for forage production in the Intermountain West therefore would appear to be managing for appropriate soil fertility to ensure the highest production of the cool-season species.

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