Introducing Grazeable Cover Crop to Wheat Systems in Oklahoma

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Introduction

In Oklahoma, winter wheat (*Triticum aestivum)* is grown from Fall to Spring, then left fallow. Consequently, these fields prone to erosion, weeds, and water losses during summer months. Planting summer cover crops may be a strategy to reduce soil erosion, reduce herbicide use, increase soil health, and potentially provide summer forage for livestock. However, the use of cover crops in Oklahoma is a relatively new practice where its adaptation and integration to forage-livestock systems is essential for success. Therefore, the objectives of this study are:

1. **To determine cover crops potential as cattle feedstock.**
2. **To quantify biomass residue produced for each cover crop.**
3. **To assess the effect of cover crop residue on wheat yield.**

Material and Methods

Locations

This ongoing study was initiated in 2016 in two locations: OSU South Central Research Station Chickasha, OK, and OSU Cimarron Valley Research Station, Perkins, OK.

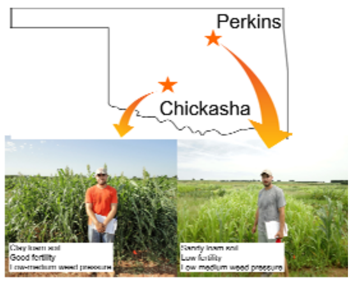

Figure 1: Experimental fields

Treatments and Experimental Design

Eight summer cover crops and mechanical fallow (main plots) were evaluated under different simulated grazing regimes (sub-plots) in a split-plot design with four blocks. Data were analyzed using PROC MIXED – SAS. Block and all its interaction were considered random effects. Cover crop, grazing and their interaction (cover crop x grazing) were considered fixed effects. Locations were analyzed separately. Presented data are from first season (2016-2017). Treatments and their interactions were considered statistically significantly different at p<0.05.

Table1: Evaluated summer cover crops (Main plots)

-----Legumes-----	-----Grasses-----	Mixes
Forage Soybean (FS) *Glycine max (L.) Merr*	Pearl Millet (PM) *Pennisetum glaucum (L.) R. Br.*	PM+MB
Cowpeas (CW) *Vigna Unguiculato (L.) Walp*	Sorghum Sudan *Sorghum x Drummondi (Steud.) Millsp. & Chas*	TTSS+CW
Mung Beans (MB) *Vigna radiata (L.) R. Wilczeck*	Triple treat SS (TTSS) *Sorghum x Drummondi (Steud.) Millsp. & Chas*	

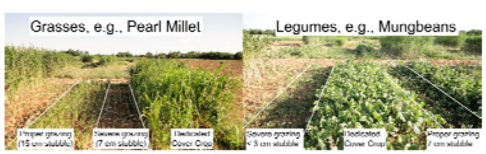

Figure 2: Evaluated simulated grazing regimes (sub-plots)

Cultural Practices and Data Collection:

Cover crops were seeded in late June 2016. Six weeks after planting (WAP), each subplot was cut according to its assigned stubble height, and cover crops regrowth was chemically terminated at 14 WAP. Three weeks after termination, wheat (cv. Gallager) was no-till seeded (78 kg ha^{-1}) in both experimental fields and managed according to OSU Extension recommendations. Finally, wheat was separately harvested from each subplot early June 2017.

Timeline:

Figure 3: Major field practices in Perkins and Chickasha

Cover crop samples (three 0.5-m^2 quadrats per subplot) were collected before simulated grazing and at termination for assessing species compositions (grass : legume : weeds). At 6 WAP, each subplot was cut according to its assigned stubble height, and total fresh weight was recorded. Samples from each subplot were taken, ground and dried at 55ºC to estimate dry forage biomass production. The samples were processed, and Near-Infrared Spectrometry procedures were used for determining forage quality estimators such as TDN, NDF, ADF and IVDM. A subsample was used to determine DM (AOAC, 1999) and total N was detemined using a combustion analyzer (Elementar Americas, Inc., Mt. Laurel, NJ); expressed as %CP calculated as %Total N x 6.25. Wheat was harvested and the grain yield in each subplot was determined. In addition, the final cover crop dry residue was determined using the quadrat samples.

Results and Discussion

Forage Production

High soil fertility in Chickasha resulted in 38% higher dry forage biomass production than in Perkins (ρ<0.01). The TTSS supplied the highest amount of forage in both locations when severely grazed; however it was not significantly different from SS and PM at Chickasha. Nevertheless, there were no differences among TTSS and other grasses when proper grazed in both locations. As expected, all legumes produced less forage than grasses. However, legumes produced similar total forage biomass at both locations. The reason is the high incidence of weeds in Perkins' legumes plots inflated total forage yield to values close to those at Chickasha. This statement was supported by forage quality analysis. Legumes at Perkins were 5% lower in CP (data not shown). Furthermore, proper grazing significantly decreased forage availability by 28% when compared to severe grazed plots in both locations (ρ<0.01).

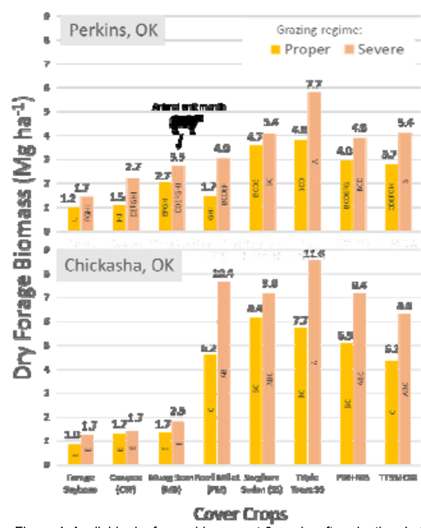

Figure 4: Available dry forage biomass at 6 weeks after planting. Letters only denote significant differences within same location (α=0.05)

Cover Crop Residue

Contrary to our hypothesis, the dedicated cover crop subplots did not produce higher residue than the grazed ones. A total rainfall amount of 140 mm in both locations supplied enough water for all cover crops to regrow accordingly to soil fertility conditions (Mesonet, 2017). Therefore, grazed subplots regrew vigorously for eight weeks. At the same time, the dedicated cover crops were senescing, shattering leaves and losing aboveground biomass. Furthermore, grasses and mixes (grass+legumes) had higher regrowth than legumes in both locations resulting in a more effective weed suppression.

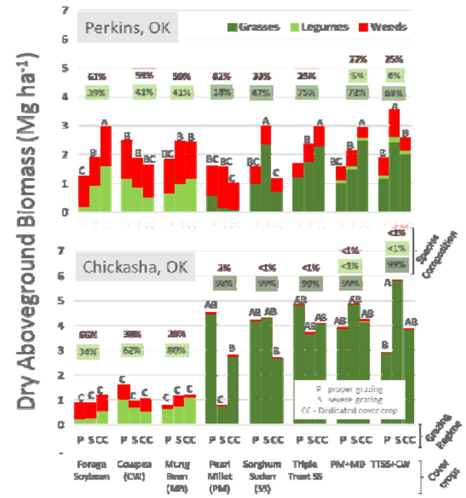

Figure 5: Cover crop residue species composition at 14 WAP (before chemical termination). Letters denote significant differences within same location (α=0.05)

Wheat Grain Production

Cover crop residue (ρ<0.01) and wheat grain production (ρ<0.01) were 35% and 25% higher, respectively in Chickasha thanks to higher soil fertility. In Perkins, neither wheat grain nor cover crop residue were significantly affected by cover crop (ρ_{grain}=0.54, $\rho_{residue}$=0.18) and cut effects (ρ_{grain}=0.36, $\rho_{residue}$=0.22). Nevertheless, in Chickasha, dedicated cover crop subplots and fallow (check plots) had significantly higher wheat production than proper and severely grazed plots (ρ=0.04). The authors speculate cover crop residue amounts higher than 2.5 Mg ha^{-1}, which was only achieved in Chickasha, might negatively affect wheat grain production. A more comprehensive data analysis using linear regression will be performed to explain a possible correlation between wheat grain and cover crop residue.

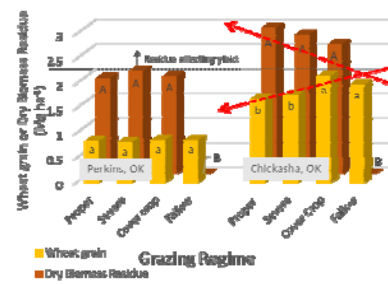

Figure 6: Forage quality indicators. Letters denote significant differences within same location (α=0.05)

Conclusions

- TTSS was the highest forage yielding cover crop which had similar forage quality to all other grasses, legumes and mixes (data not shown).
- Data suggest that by decreasing stocking rate in 28% for all evaluated graze covers, proper grazing can be achieved, and, consequently, at least 70% soil cover is maintained during all summer.
- Grass cover crops are more effective in weed suppression when compared to legume cover crops.
- Cover crop residue amounts higher than 2.5 Mg ha^{-1} might negatively affect wheat grain production.

References

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