Evaluating Multispecies Cover Crops for Forage Production

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Summary

Cover crops offer potential benefits for improving soil health, but establishment and management costs can be expensive. One way for farmers to recover these costs is to graze the forage, which benefits producers by integrating crop and animal production. More information is needed on the potential forage quantity and quality for grazing livestock of cover crops and mixed species of cover crops. Researchers have suggested that different plant species complement each other, but additional work is needed to determine how best to balance forage production and how competitive the various species are when added to a mix. Sixteen treatments were drill-seeded at the Southeast Kansas Research Station near Columbus, KS, in August 2014. Each treatment consisted of a three-way mix representing popular cover crops from the plant families Brassicaceae (brassicas), Poaceae (grasses), and Fabaceae (legumes). Eight species were planted, including forage radish (*Raphanus sativus*), purple-top turnip (*Brassica rapa*), oat (*Avena sativa*), rye (*Secale cereale*), barley (*Hordeum vulgare*), wheat (*Triticum aestivium*), Austrian winter pea (*Pisum sativum* subsp. *arvense*), and berseem clover (*Trifolium alexandrinum*). Small areas of each plot were clipped at 30-, 60-, and 90-day intervals. The clipped biomass was then weighed, sorted, and dried to determine biomass as well as species composition. Preliminary results indicate that average biomass produced at 30, 60 and 90 days was 1,250, 3,290, and 3,050 lb/a, respectively. These range from 470 to 1,940 lb/a 30 days after planting to 1,790 to 4,440 lb/a at 90 days after planting, depending on the cover crop mix.

Introduction

Interest in the potential for a multispecies cover crop blend to also provide benefits as forage to supplement fall livestock grazing has been growing among farmers. Although the idea of cover crops is certainly not new, the concept of a cover crop cocktail mix is an area where more research is needed. Information on the quantity of forage produced by a mixture of species, specifically with respect to individual species contribution to total biomass, is minimal. Legumes increase forage value through nitrogen (N) fixation and add nutrition to forage in the form of protein. Animals need a balanced diet with fiber, which can be obtained through grass, and annual cereal grasses provide a fibrous root system and high biomass production. Brassicas have a dense root structure for creating macro pores and are excellent N scavengers. Both brassicas and grasses such as cereal rye have been shown to take up soil N as they grow and then release it back to the soil as they decompose. Farmers can use mixtures of multiple species to gain both grazing and soil health benefits.

Experimental Procedures

A randomized complete block design with 16 treatments in triplicate was laid out in approximately 120-ft × 10-ft plots. The 16 treatments each consisted of a three-way mix with combinations of popular cover crops from each of the three plant families (Brassicaceae, Poaceae, and Fabaceae), as illustrated in Table 1. The plots were planted August 12, 2014, with a 10-ft Great Plains (Salina, KS) no-till drill with two seed boxes. Seeds of similar size were mixed and planted using one seed box; the other seed was placed in the second box. For example, in treatment 1, the berseem clover and turnip seeds were placed in the small box and the wheat was placed in the larger box. The plots were clipped on September 26, 2014; October 25, 2014; and November 11, 2014, at approximately 30, 60, and 90 days after planting, respectively. The area clipped was 1.15 ft^2. The forage samples were then placed in plastic bags and transported to the lab in Manhattan, KS, where they were analyzed for species composition, total biomass, and dry matter. Nutritional components such as acid detergent fiber (ADF), neutral detergent fiber (NDF), crude protein (CP), and nitrates are currently being evaluated and will be reported as the procedures are completed.

Results and Discussion

The total biomass produced by the 16 treatments and the pounds that each species contributed to the total are illustrated in Figure 1. The 60-day clipping in a majority (11 of 16) of the treatments yielded the highest dry matter biomass production. In some treatments, including treatment 1 (wheat, clover, turnip), treatment 4 (oat, clover, turnip), treatment 7 (barley, pea, turnip), treatment 10 (rye, clover, radish), and treatment 16 (oat, pea, radish), the 90-day clipping yielded the highest biomass (DM basis). It is important to note that by the 90-day clipping, a killing freeze occurred that resulted in wilting of the brassicas. This might have led to the reduction in biomass yield for a majority of the cocktail mixes, especially if the aboveground portion of the cocktail was predominantly composed of brassicas. Preliminary data indicated that the optimal time to turn cattle out onto these cocktails might be sometime between days 30 and 60 so the cattle graze during the maximal biomass production period and have sufficient forage to meet requirements.

The cocktail mixes used in this experiment were established successfully, but certain species did not emerge with this planting method and/or cocktail combination. In the first 30 days, the brassicas in all mixes contributed more than 50% of the total dry matter biomass. At the 60-day clipping, turnips were still the predominant species in the cocktail, except for the combinations that included barley and oats (treatments 3, 4, 7, and 8), and this trend continued at the 90-day clipping. This was not observed with the radish mix, where radishes contributed more than 50% of the total biomass at the 60-day clipping for all cocktail mixes. Radishes were also the predominant species at the 90-day clipping, except in treatments 11 and 16 (radish mix with barley and oats, respectively).

The legumes (berseem clover and Austrian winter pea) were a very small component of the mixture, if they even emerged. Austrian winter pea was a better legume in these mixes than berseem clover. No clover was found in the clipped samples. The lack of a substantial biomass contribution from legumes might have been caused by issues with planting depth. Although the planter box had separate seed boxes, the drill would only plant at one depth. The entire cocktail was therefore drilled at 0.5 in., which is deeper than the recommended planting depth for legumes. In addition, poor emergence of the legumes could have been caused by rapid growth of the brassicas within the first 30 days after planting. The brassicas appeared to outcompete and "choke out" the legumes in these cocktail mixtures. This might be a great benefit for fall weed control, but it limits cover crop mixes.

Depending on forage quality results, cocktail mixes can generate a significant amount of dry matter to meet cattle requirements. More information is still needed to determine cattle preference for these forages and the appropriate amount of "cover" to leave in the field to maximize soil and crop potential.

Table 1. Cocktail treatments and seeding rates

	Poaceae[1]		Fabaceae[2]		Brassicaceae[3]	
Treatment number	Species planted[4]	Seeding rate, lb/a	Species planted[4]	Seeding rate, lb/a	Species planted[4]	Seeding rate, lb/a
1	Wheat	30	Clover	3.7	Turnip	2.3
2	Rye	30	Clover	3.7	Turnip	2.3
3	Barley	30	Clover	3.7	Turnip	2.3
4	Oat	37.5	Clover	3.7	Turnip	2.3
5	Wheat	30	Pea	19	Turnip	2.3
6	Rye	30	Pea	19	Turnip	2.3
7	Barley	30	Pea	19	Turnip	2.3
8	Oat	37.5	Pea	19	Turnip	2.3
9	Wheat	30	Clover	3.7	Radish	3
10	Rye	30	Clover	3.7	Radish	3
11	Barley	30	Clover	3.7	Radish	3
12	Oat	37.5	Clover	3.7	Radish	3
13	Wheat	30	Pea	19	Radish	3
14	Rye	30	Pea	19	Radish	3
15	Barley	30	Pea	19	Radish	3
16	Oat	37.5	Pea	19	Radish	3

[1] Poaceae is the grass component in these cocktails.
[2] Fabacea is the legume component of the cocktail.
[3] Brassicacea is commonly known as brassicas.
[4] Common names of the species planted in the cocktail are used in the table. Scientific names are: brassicaceae: forage radish (*Raphanus sativus*) or purple-top turnip (*Brassica rapa*); poaceae: oat (*Avena sativa*), rye (*Secale cereale*), barley (*Hordeum vulgare*), or wheat (*Triticum aestivium*); fabaceae: Austrian winter pea (*Pisum sativum* subsp. *arvense*) or berseem clover (*Trifolium alexandrinum*).

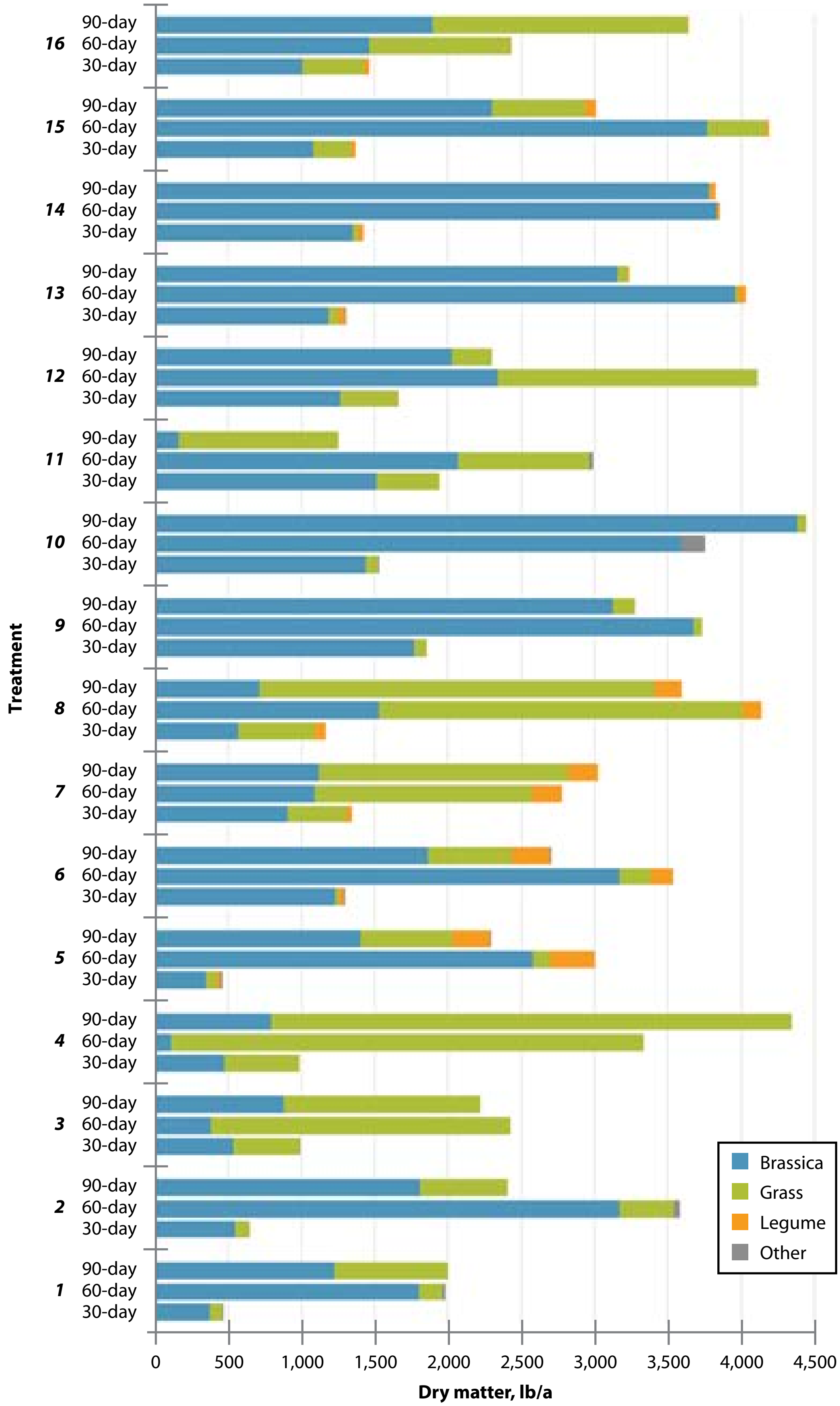

Figure 1. Total biomass yield (dry matter basis) by clipping date and species composition. Reported values are averages. Refer to Table 1 for cocktail composition of each treatment (1–16).