

Cattle Preference for Annual Forages

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Summary

Many plant species that are available to use as cover crops also have potential as forage for cattle. With this array of options it can be daunting to decide which plants to establish to meet goals as either a cover crop, forage, or for both. Therefore, the purpose of this study was to identify the annual forages fed to cattle in the fall, winter, or summer that cattle preferred. To summarize, grasses were the most highly preferred forage for cattle regardless of grazing period. Low glucosinolate brassicas such as 'Graza' forage radish was the most highly preferred brassica that was offered. Selection by cattle of legume and broadleaf plant species was variable, and was primarily driven by other less-preferred plants that were offered.

Introduction

Integration of cattle grazing in cropping systems has been promoted as a management practice in certain areas of the country, including the southern Great Plains, western Corn Belt, and middle Plains states. However, adoption of these practices is still somewhat controversial, especially for producers who do not own cattle. Previous methods of integration include cattle grazing corn or sorghum residues or dual-purpose wheat. Cattle can graze wheat during its early growing period, and then the wheat grain is harvested at maturity. More producers have started to implement grazing of annual forages.

Land usage within the United States has been changing. Based on the most recent report from the USDA Economic Research Service (2011), of the nearly 2.3 billion acres of land in the US, 30% is forest-use land, 27% is grassland and range, 18% is used as cropland, 3% as urban land, and 23% for special usage and miscellaneous. Those numbers do not necessarily address the changes that are being seen with land usage. Urban land use, even though a small fraction of total land, has quadrupled from 1945 to 2007 and forest-use land has increased by 20 million acres from 2002 to 2007. The increases in urban and forest land usage has shown a trend for decreased land usage for crops and grasses. Overall, total land used for crops in the United States has not changed; however, regionally there have been large shifts in land usage. For example, nearly 12 million acres in the Corn Belt and northern Plains have been converted to cropland, while in other regions nearly 12 million acres have been removed from the cropland category. The human population is expanding, yet land mass is not, indicating a need to utilize a greater portion of the land to produce calories for human consumption. Integration of cattle in cropping systems is one method to accomplish the mission of producing more

calories per acre, while also enhancing economic revenue to an operation in an implementable management practice.

There are two broad categories of cover crops: monocultures and multi-species cover crops. A monoculture is a single species of plant that is planted for a specific purpose. Multi-species cover crops include a diverse population of plants that have been selected to match producer's objectives. Even though limited data support enhanced cattle performance with multi-species in annual forages that can function as a cover crop, because of theories of improved ecological systems from a soil perspective, producers are planting multi-species cover crops and grazing. Understanding the order and cattle selectivity to these cover crops can help producers make strategic decisions on what plant species to use in integrated systems. Therefore the purpose of this study is to determine cattle preference for fall, winter, and summer cover crops.

Experimental Procedures

Fall Annual Forages

On September 2, 2017, repurposed protein tubs (~452 in.² surface area) were filled with soil and planted with eight different cool season annual forages. The plant species evaluated consisted of Austrian winter pea, 'Graza' forage radish, mustard, winter barley, 'Bayou' kale, 'Trophy' rapeseed, 'Impact' collard, and purple top turnip. On October 11 three ruminally cannulated heifers were individually penned and allowed access to the 8 tubs for 24 hours. Heifers were observed during the first 30 minutes of exposure to the tubs by three staff members of the Southeast Research and Extension Center. These observers recorded behavior such as "sniffing plants and walking away" and "tasting (biting) and walking away". Additionally, each pen had a trail camera that was set to capture video for 60 seconds with a 1 second lapse before recording again. This allowed for nearly a full 24 hours of observation for each heifer. These videos were then watched to determine the order that the plants were consumed. These were ranked as first, second, third, and so on, and then were used to determine cattle selectivity to plants. This was repeated again on October 12.

Summer Annual Forage

The same procedures were completed for the summer annual forages as that described for the fall annual forages. The date of planting was May 17, 2018, in the same repurposed protein tubs. During the summer study, the plants of interest included 3 grass species, 2 legume species, and 3 broadleaf species. The grass species were pearl millet, brown midrib (BMR) forage sorghum, and sorghum-sudan. The legume species were sunn hemp and mung bean. The broadleaf species were okra and black-oil sunflower. The grasses were allowed to grow to a minimum height of 2 feet before the preference test was initiated to minimize prussic acid issues. Therefore, on June 21 and 22, 2018, four ruminally cannulated Holstein heifers were placed on test for preference as previously described.

Winter Annual Forages

The same methods were used for the winter annual forage study, and several of the fall forages were used in this portion of the study. The difference is that we waited to start

the preference study until three weeks after a killing freeze to see if brassica preferences were altered as compared to grazing prior to a freeze. The plant species used in the winter study included 2 grass species, 2 legume species, and 3 brassica species. The grass species were winter barley and winter oat; the legumes were Austrian winter pea and common vetch; and the brassicas were ‘Graza’ forage radish, ‘Trophy’ rapeseed, and purple top turnip. These were planted in the repurposed protein tubs on August 20, 2018, and were used in the preference study November 27 and 28, 2018.

Results and Discussion

Fall Annual Forages

Barley was the most highly preferred fall annual forage of the eight offered. There was a tie for the second favorite of this group: Austrian winter pea and ‘Graza’ forage radish. The heifers showed strong aversion to all the other brassicas offered: mustard, collard, turnip, rapeseed, and kale (Table 1). There did not seem to be much of a difference between these brassicas, with the exception of kale. Two of the three heifers refused to eat the kale on both days. These results were expected, except for the forage radish which was more highly preferred than anticipated. Brassicas in general are unpalatable because of nitrates and glucosinolates. Both of these compounds are fairly bitter, which is the predominant adverse flavor for cattle. Interestingly, the ‘Graza’ forage radish has been reported to have a fairly low level of glucosinolate, which led to its preference more than all the other brassicas. Even though the cattle preferred this more than the other brassica species, this plant had the greatest number of “bites and moving on” of any of the plants. Based on the method of determining preference, these cows consumed forage radish as second favorite, “one bite at a time.” Interestingly, the spring forage pea was one of the top two that had the greatest number of “sniffs and move” indicating something was not desirable in that plant, but once the heifers took a bite of the Austrian winter pea, they stayed at the tub and consumed all the plants growing. This indicates that it is a palatable plant but cattle need to “learn” how to eat this legume.

Summer Annual Forages

Once again in the summer covers, the grass species were the most preferentially selected (Table 2). Even within the grass species, BMR forage sorghum and sorghum-sudan were preferentially selected more than pearl millet. The intermediate selected species consisted of sunflower and sunn hemp. The plants that were not preferred were okra, mung bean, and safflower. Of the broadleaves, sunflower was more preferentially selected as compared to okra and safflower. This could primarily be driven by the fact that the sunflower seeds did not do well in the protein tubs and were nearly 2 weeks younger in maturity than the other broadleaf species. Of the legumes, sunn hemp was more preferentially selected as compared to mung bean.

When trying to understand why pearl millet was less preferred than the other grasses, the first thought was nitrates were higher in pearl millet, as that is typically seen. However, in these samples nitrates were the lowest in pearl millet. When handling the pearl millet, the underside of the leaf was “hairy” in texture, which might have led to an unfavorable eating experience for the heifers. For this study, since okra and mung bean were not preferred, even though their nutritional composition indicates they should be

a quality feed, one possible reason for adverse selection could be associated with plant morphology. Both of these plants have very large broad leaves. The sunn hemp used in this study was fairly immature which might have led to its preference.

Winter Annual Forages

Grass species were the most preferentially selected with no difference in oat or barley. The intermediate selected plants were ‘Graza’ forage radish, common vetch, and Austrian winter pea. The other two brassicas, rapeseed and purple top turnip, were not preferred (Table 3). Even after a hard killing freeze, the level of glucosinolate must have been high enough that it led to aversion to rapeseed and turnip, especially as compared to forage radish. The legumes are reported to not have glucosinolates and the heifers did select them more than the high glucosinolate brassicas. Common vetch was selected as a possible option because other vetch species, such as hairy vetch and crown vetch, have been shown to grow well in Kansas but have toxicity issues for livestock species, cattle in particular.

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Table 1. Fall annual forages preference

Plant	Score ¹
Winter barley	6
Austrian winter pea	17
‘Graza’ forage radish	17
Mustard	34
‘Impact’ collard	35
Purple top turnip	37
‘Trophy’ rapeseed	39
‘Bayou’ kale	43

¹Numerical score: the lower number means more preferentially selected.

Table 2. Summer annual forage preference

Plant	Score ¹
'Silo Pro' brown midrib forage sorghum	13
'Sorgrow 80' sorghum-sudan	15
Pearl millet	25
Black oil sunflower	37
Sunn hemp	41
Okra	51
Mung bean	52
Safflower	55

¹Numerical score: the lower number means more preferentially selected.

Table 3. Winter annual forage preference

Plant	Score ¹
Winter oat	12
Winter barley	16
'Graza' forage radish	25
Common vetch	27
Austrian winter pea	29
'Trophy' rapeseed	36
Purple top turnip	44

¹Numerical score: the lower number means more preferentially selected.



Figure 1. One of the heifers during the fall preference study consuming forages in the repurposed protein tub.