Late Summer Planted Oat-Brassica Forage Quality Changes during Winter Grazing

Mary E. Lenz
Jordan L. Cox
Kristen E. Hales
Hannah C. Wilson
Mary E. Drewnoski

Summary with Implications

Oat, radish, and turnip samples were taken on pivots being grazed from November through January in Clay Center, Nebraska. The objective was to determine how the quality changed throughout the winter. The forage was observed to be high-quality (highly digestibility with moderate CP content). Digestibility did decline over this period but minimal changes in CP content were observed. From early November to early January, the digestibility of oats appeared to decline more (10% unit decline) than turnip and radish leaves (5% unit decrease). However, digestibility (67% IVOMD) and CP content (15%) of oats in early January were still as high as a good quality grass hay. Brassica (radish and turnip) leaves were more similar to a concentrate (81–83% IVOMD and 23–26% CP) even in January. Thus, even though the forage changed color from green to brown after hard freezes, the forage still had good feed value in January.

Introduction

Cover crops are frequently grown for agronomic and conservation benefits, but there is also potential for cattle producers to utilize this forage resource. Late summer planted cover crops are available to graze in the winter, but the quality of these cover crops as a feed, and how the quality of this feed changes after cold temperatures causes growth to cease, has not been well established. Therefore, the objective of this study was to 1) quantify and better understand the quality of oats and brassicas as a forage resource in the winter; and 2) to evaluate how the quality of this forage resource changes throughout the winter.

Table 1. Year 2 Nutrient Composition Averages

	Oats	Radish Leaf	Turnip Leaf	Radish Root	Turnip Root	SEM	P-value
OM % (DM Basis)	89[a]	81[c]	81[c]	86[b]	90[a]	1.1	<0.01
IVOMD % (OM Basis)	69[d]	86[c]	88[c]	92[b]	95[a]	1.6	<0.01
NDF % (DM Basis)	58[a]	35[b]	29[c]	22[d]	16[e]	1.2	<0.01
TES % (DM Basis)	13[c]	8[d]	14[c]	32[b]	50[a]	2.5	<0.01
CP % (DM Basis)	10[d]	24[a]	20[b]	17[c]	14[c]	1.4	<0.01
Sulfur % (DM Basis)	0.30[e]	0.95[b]	0.82[c]	1.04[a]	0.69[d]	0.035	<0.01

[a-e] Values within row without the same superscript differ.

Procedure

This experiment took place at the Meat Animal Research Center near Clay Center, Nebraska. An oats, turnip, and radish cover crop mix was planted on irrigated pivots. In 2014–2015, (year 1) these crops were planted September 8th. In 2015–2016, (year 2) these cover crops were planted August 25th. Oats, turnip tops, and radish tops were collected on November 6, December 9, and January 13, in year 1, and October 22, December 10, and January 14, in year 2. In both years, the first frost occurred on October 29th. In year 1, turnip and radish root samples were not collected, but root samples were successfully collected in year 2. After collection, samples were immediately put on ice and frozen for a minimum of 24 hours before drying. The samples were freeze dried and subsequently ground to a 1 mm particle size through a Wiley mill. Nutrient analyses were conducted to evaluate crude protein (CP), total ethanol soluble carbohydrates (TES), neutral detergent fiber (NDF), organic matter (OM), in-vitro organic matter digestibility (IVOMD), and sulfur.

Results

The digestibility of the cover crop mix was high throughout the winter for all species. In each month, the turnip and radish leaves did not differ ($P \geq 0.09$) in digestibility, ranging from 81 to 90% IVOMD and were more ($P < 0.01$) digestible than oats which ranged from 67 to 79% IVOMD (Figure 1). Within species, the digestibility in November and December did not differ ($P \geq 0.17$) but decreased from December to January ($P < 0.01$). The digestibility of oats appeared to decline more (10% unit decline) than turnip and radish leaves (5% unit decrease) however, the digestibility of oats in January was still high (67 % IVOMD). As a reference, good quality bromegrass hay is typically about 55 to 60% digestible.

There was also a year by species interaction for IVOMD. The digestibility of oats was significantly less in year 2 than year 1 (69% vs 80% IVOMD, respectively) when the forage was planted 18 days earlier but digestibility of turnip and radish leaf (85–87% IVOMD) did not differ ($P \geq 0.25$) among year within species.

There was a tendency for a plant species by month interaction ($P = 0.07$) for NDF content (Figure 1). Over the winter, oats were consistently greater ($P < 0.01$), ranging from 48–66% NDF, than both radish leaf and turnip leaf which ranged from 21 to 44 % NDF. The NDF content of the brassicas leaves (radish and turnip) in November and December were quite low (21 to 26 % NDF), being more similar to a concentrate than a forage. For instance, mid-bloom bromegrass hay typically has around 58% NDF and corn grain has about 10% NDF. The NDF content of all species increased (*P*

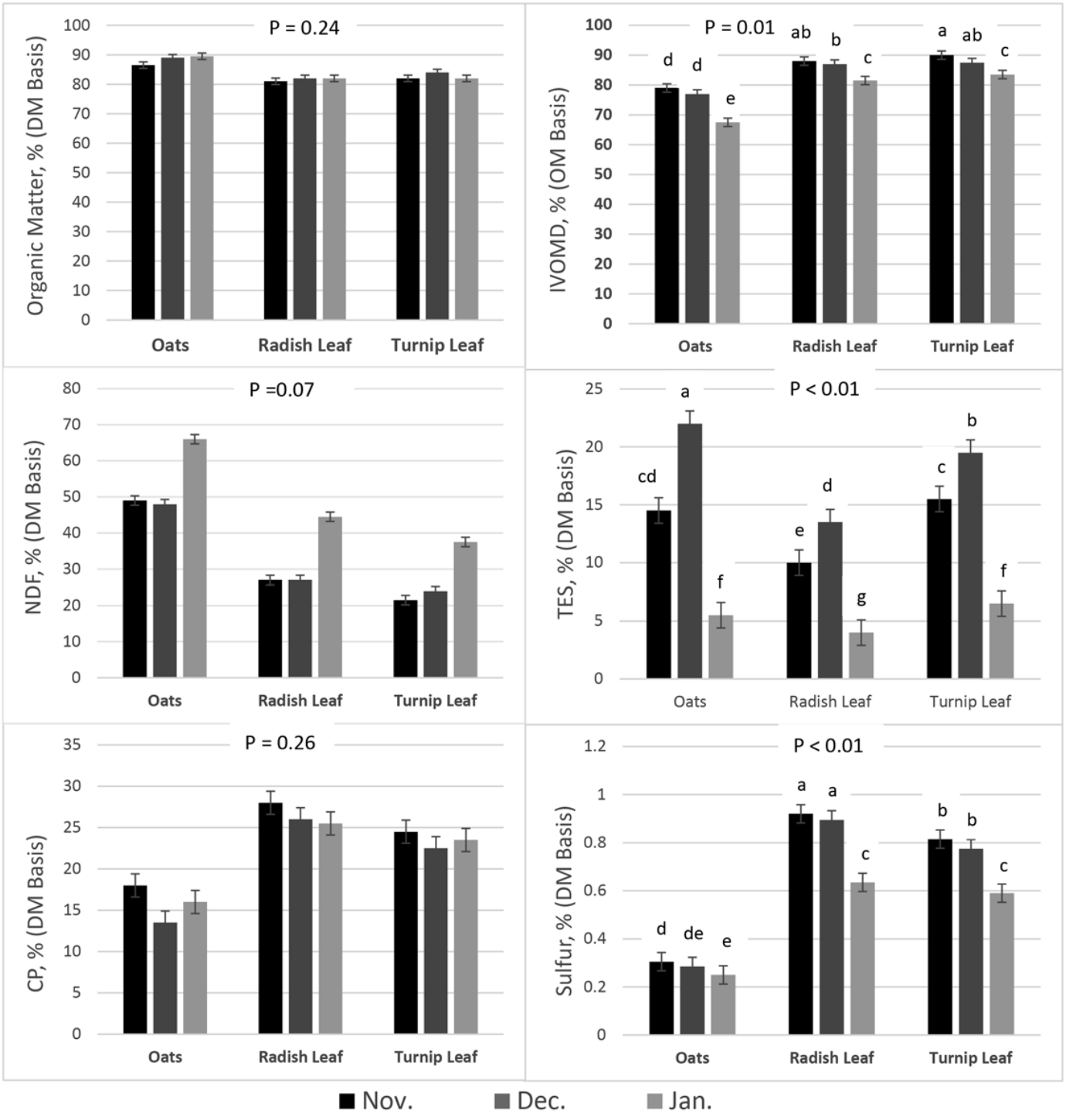

Figure 1. Nutrient Composition Averages for Year 1 and Year 2 [a-g] Within each graph, bars lacking a common letter differ (P<0.05)

< 0.01) in January by 14 to 17% units. There was also a species by year interaction (P < 0.01) for NDF. The NDF content of all species was greater in year 2, due to the earlier planting date, than in year 1 but turnip had less of an increase (2.3% units) than oats (6% units) and radish (5% units).

Total ethanol soluble carbohydrates (TES) had a significant (P < 0.01) plant species by month by year interaction. Soluble carbohydrates for all species peaked, ranging from 17–22% TES in December in year 1 (P < 0.01), and dramatically decreased (P < 0.01) to 5–6% in January. In year two, this trend was the same for oats and turnip leaves (P < 0.01), but radish leaves did not differ (P = 0.78) in TES from November (9.1%) to December (10.6 %) although there was a numerical increase. Like year 1, the TES content of all species decreased (P < 0.01) dramatically from December to January in year 2. These data suggest that following initial frost, photosynthesis continued and soluble carbohydrates continued to increase through the month of November. Then, weathering in December caused much of the soluble carbohydrates to be lost. The TES content of forage is an indicator of sugar content, which is 100% digestible and is digested rapidly in the rumen. The relatively low NDF and high soluble carbohydrate content of these forages explain the high digestibility observed.

There was no date by species interaction (P = 0.26) for CP but there was a significant year by species (P < 0.01) interaction. However, all species had lesser CP content (P < 0.01) in year 2 when the forage was planted earlier (Aug. 25th) than in year 1 (Sept 8th). There was a date by year (P < 0.01) interaction with CP content of all species decreasing from November to December in both years (5% units in year 1 and 2% units in year 2). However, from December to January CP content increased in year 1 (5% units) and continued to decrease in year 2 (2% units). The increase in November in year 2 is likely due to the mild weather and continued plant uptake of N.

There was a significant species by date interaction in S content (P < 0.01). However, across all dates the S content of oats was less than radish and turnip, which were extremely high. Although there was a substantial decrease in S, the brassicas in January still contained extremely high levels of S. The maximum tolerable level of S is suggested to be 0.5%, indicating intake of only brassicas could potentially cause S toxicity. Given the much lower concentrations of S in the grass (oats) and the higher NDF (greater levels of NDF in the diet have been shown to decrease risk of toxicity) mixing a grass in with brassicas for grazing would be recommended.

When comparing the root and leaf of brassicas in year 2, the roots were more digestible and were lower in NDF and CP than the leaves (Table 1).

Conclusion

Digestibility and CP content of brassica leaves is greater than oats, although oats were quite digestible and contained moderate CP content. The digestibility of all species decreased over the winter with the largest decrease during December. However, all forages were still highly digestible in January. Minimal change in CP content was observed over the winter. Therefore, even though the forage changes color from green to brown over the winter, the forage continues to have good feed value. Turnip and radish leaves and roots are more comparable to a concentrate than roughage as they were highly digestible and low in fiber and when coupled with the high S content, it is recommended that they are mixed with a grass.

M. E. Lenz, graduate student

J. L. Cox, graduate student

Kristen E. Hales, Meat Animal Research Center, Clay Center, Neb.

Hannah C. Wilson, research technician

Mary E. Drewnoski, assistant professor, University of Nebraska–Lincoln, Department of Animal Science