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Cereal rye to extend the grazing season

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Abstract

Eleven cereal rye (*Secale* cereale) cultivars, one triticale ***(Triticum secale)*** and one winter wheat ***(Triticum aestivum)*** cultivar were evaluated in 2 studies for their ability to extend the grazing season into the autumn and winter in southern Ohio. The cultivars, 5 in 1993 and 9 in 1994, were randomly assigned to replicated plots and planted in late summer. Plots were harvested ***in late*** autumn to determine dry matter (DM) yield and forage quality. Results from the two years indicate significant differences (P=0.05) between cultivars for DM yield, crude protein(CP) and NDF levels. DM yields ranged from 1389 to 2470 kg/ha (1993) and 1018 to 2 124 kg/ha (1994). Crude protein levels ranged from 25.2 to 27.9% (1993) and 28.8 to 33.7% (1994). A second harvest of the 1994 plots was made in early spring 1995 for continued evaluation. Statistically significant differences again existed between the stockpiled cultivars. DM yields ranged from 1979 to 2980 kg/ha while crude protein levels ranged between 21.5 and 27.0% of DM. Results support the conclusion that selected cereal rye cultivars can produce excellent yields of high quality forage for late autumn and winter grazing in the Ohio climate.

Keywords: cereal rye, extended grazing season, *Secale* ***cereale,*** triticale, wheat

Introduction

Livestock farms in midwest United States are generally characterised as having excessive amounts offorages to graze for 3 months of the year, moderate amounts for another 4 months and a reliance on stored feeds for the remaining 5 months. As feed costs comprise the largest share of the livestock enterprise expense, a reduction in feed costs should improve the profitability of the enterprise.

Extensive efforts were initiated in 1990 to identify practices which could extend the animal grazing season into the late autumn and winter months in southern Ohio. Trials of brassica cultivars have shown promise and the practice of stockpiling fescue has been successfully adopted by many producers.

In 1993, we began investigating cereal rye (Secale ***cereale)*** as a possible forage for winter and early spring grazing. Successful grazing of small-grain vegetation is common in many temperate areas of the US; however, its productivity in a colder winter environment was in question. Recently, numerous cultivars of *Secale cereale* have been developed for greater production of forage mass rather than for grain production. The 1993-94 study involved four forage type cultivars and one unstated variety. The 1994-95 study included five selected cultivars, one unstated cultivar, one triticale *(Triticum secale)* cultivar and one winter wheat *(Triticum aestivum)* cultivar.

The objectives of this study were to evaluate cereal rye cultivars for their production of vegetative material in our climate and to determine their value for grazing during the winter months.

Materials and methods

The 1993-94 study was conducted on the farm of a producer 24 km east of Jackson, Ohio. The specific site of the trial was a portion of a 3.2 ha field which has a slope of 4.5" and a southern exposure. The soils are Wellston and Rarden-Wharton silt loams which are deep and moderately well to well drained. In the spring of 1993, the field was ploughed and prepared for burley tobacco production. Fertiliser applications in mid-spring totalled 448 kg/ha of nitrogen, 202 kg/ha of P_2O_5 and 605 kg/ha of K_2O. Precipitation for late spring through mid-summer totalled 149 mm, 148 mm less than normal. Following tobacco harvest in late summer, the ground was deep-disced to prepare for the cover crop seeding.

Five cereal rye cultivars, Aroostock, Pastar, Prima, Dacold and an unstated variety, were randomly assigned to 3 replications in a complete block design of 2.44 m by 15.24 m and planted late summer (20 September) 1993. The seeding was done with a no-till drill at a seeding rate equivalent to 100.84 kg/ha. No additional fertiliser was applied. Rainfall for late summer through early autumn (September, October and November) was near normal.

Subplots of each replication, measuring 0.61 m by 1.83 m, were hand-harvested in late autumn (9 December) 1993 to determine DM yield and forage quality. Measurements were also taken to evaluate canopy height. Standard procedures were used to

determine DM yield and samples were submitted to the Ohio Agricultural Research and Development Center's (OARDC) analytical lab at Wooster, Ohio for analysis of forage quality.

The 1994-95 study involved 2 locations. Site I was located at the Jackson Branch of the OARDC at Jackson, Ohio. The trial was placed on a well drained portion of a 16 ha field which has a 9" slope with a south-eastern exposure. The field had been managed for pasture with fescue and bluegrass being the predominant forage species.

Seven cereal rye cultivars, Aroostock, Winter King, Wheeler, Maton, Oklon, Elbon, an unstated variety and a tritcale variety, Trical, were randomly assigned to 3 replicated plots of 2.8 m by 40.5 m and were no-till drilled into existing sod in late summer (6 September) 1994. The equivalent of 56 kg N/ha, in the form of ammonium nitrate, was applied after plant emergence. One half of the plots were to be harvested in early winter and one half stockpiled until early spring. However, extremely dry conditions in early fall resulted in a nearly total loss of stand and no harvest could be made.

Site 2 was located 22 km east of Jackson, Ohio on the farm of a producer. The plots were located in a portion of a 2.43 ha field which has a slope of about 2°, on Rarden-Wharton silt loams. As in the previous year's study, the field was prepared for tobacco production. Fertiliser applications in mid-spring included 168.06 kg ofnitrogen, 268.89 kg of P_2O_5 and 336.12 kg of K_2O per ha. Precipitation for late spring through mid-summer totalled 272.5 mm, 24.5 mm less than normal. The soil was disced after tobacco harvest.

Cultivars selected for this trial were the same as at Jackson, with the addition of a commonly grown winter wheat cultivar, Caldwell. Each was randomly assigned to three replicated plots of 0.91 m by 15.24 m and planted with a grain drill at the rate of 100.84 kg/ha in early autumn (23 September) 1994. No additional fertiliser was applied since the fertiliser levels applied the preceding spring were much greater than crop uptake levels and carryover of nutrients was expected. Precipitation amounts during the late summer through mid-autumn months (September through November) resulted in a total of 116.6 mm less than normal.

Subplots of each replication at site 2 were hand harvested in late autumn (14 December) 1994, in the same manner as the previous year's study. Standard procedures were used to determine DM yields and quality analysis was made at the same laboratory. A second harvest of each replication at site 2 was completed in early spring (31 March) 1995. The same procedures were followed as before. Analysis of variance were performed on all measurements using SAS procedure GLM for unbalanced data. Paired group means were compared using LSDs at the 0.05 probability level.

Results and discussion

Analysis of the 1993-94 study data indicated statistically significant differences among the measures of canopy height, DM yields and NDF levels (Table 1).

Canopy height measurements across all replications ranged from a low of 5.1 cm to a high of 20.3 cm, while DM yields ranged from 1389 to 2470 kg/ha. The forage-type cereal rye cultivars Aroostock and Pastar were significantly taller and had higher DM yields than the grain type ryes.

Laboratory analysis of the forage samples indicates that there were minor differences among cultivars in crude protein (CP), acid detergent fibre (ADF), and neutral detergent fibre (NDF). The CP levels ranged from 25.2% to 27.9%, ADF from 17.3% to 20.7%, and NDF from 3 1.5% to 36.7%. Significant differences were found only in the NDF variable at the P=0.05 level.

Table 1 Canopy height, DM yield, CP, ADF and NDF of five cereal rye cultivars (I 993).

Cultivar	Canopy Height (cm)	Dry Matter Yield (kg/ha)	Crude Protein (%)	ADF (%)	NDF (%)
Aroostock	18.6 a ♦	2470 a	26.5	20.7	36.7 a
Pastar	15.7 a	2120a	27.7	19.6	33.1 ab
Dacold	6.3 b	1390 b	27.9	17.9	31.5 b
Prima	7.4 b	1466 b	26.5	17.3	32.8 ab
Unstated	7.6 b	1500 b	25.2	18.1	32.0 b

♦ Groupings within columns followed by the same letter are not significantly different at the 0.05 level

The 1994-95 study, which was established at site 2 in early autumn (23 September), produced two harvests of usable data from the trial. Table 2 provides the results of the measurements and analysis of the plots harvested in late autumn (14 December). Statistically significant differences were found (P=0.05) in canopy height, DM yield, CP and NDF. Of the 9 cultivars, Wheeler and Elbon had significantly greater canopy heights and Trical was significantly lower than all other groups.

DM yields ranged from 1018 to 2 124 kg/ha, Wheeler having the highest yield and Trical and Caldwell being significantly lower than all other groups. CP levels ranged from 28.8 (Caldwell) to 33.7 (Winter King), and NDF levels ranged from the unstated cultivar's low of 27.9 to Maton's high of 3 1.6%.

Table 2 Canopy height, DM yield, CP, and NDF of seven cereal rye, one triticale, and one winter wheat cultivar (Dec. 1994) at site 2.

Cultivar	Canopy Height (cm)	Dry Matter Yield (kg/ha)	Crude Protein (%)	NDF (%)
Winter King	20.3 ab ♦	1988 abc	33.7 a	31.0 ab
Wheeler	22.9 a	2124 a	30.7 bcd	29.5 bc
Maton	17.8 b	1576 cd	32.5 ab	31.6 a
Oklon	19.5 ab	2016 ab	32.9 ab	30.9 ab
Aroostock	16.9 bc	1662 bcd	32.1 ab	30.4 ab
Trical	7.6 d	1091 e	31.3 abcd	29.3 bc
Elbon	22.0 a	1566 d	31.4 abc	30.5 ab
Unstated	14.0 c	1321 de	29.4 cd	27.9 c
Caldwell	14.0 c	1016 e	28.8 d	30.1 ab

♦ Groupings in columns followed by the same letter are not significantly different at the 0.05 level

Table 3 illustrates the results of the early spring (3 1 March) harvest at site 2. Again, statistically significant differences, at the P=0.05 level, were found between cultivars and the variables canopy height, DM yield, CP and NDF. Winter King, Maton, and Oklon had significantly greater canopy heights and Trical, unstated and Caldwell were significantly lower.

Elbon's DM yield of 2981 kg/ha was significantly greater than that of Caldwell's 1980 kg/ha yield. CP levels ranged from 21.5% (Maton) to 27.0% (Oklon). Wheeler had the lowest NDF level of all cultivars (42.5%) and Oklon and Elbon had the highest levels at 47.5 and 47.2% respectively.

Table 3 Canopy height, DM yield, CP and NDF for nine cultivars (March 1995) at site 2.

Cultivar	Canopy Height (cm)	Dry Matter Yield (kg/ha)	Crude Protein (%)	NDF (%)
Winter King	29.3 a ♦	2616 ab	22.8 ab	46.9 ab
Wheeler	19.5 bc	2482 ab	25.7 ab	42.5 d
Maton	26.2 a	2536 ab	21.5 b	45.9 abc
Oklon	26.0 a	2622 ab	27.0 a	47.5 a
Aroostock	25.1 ab	2659 ab	24.5 ab	46.4 abc
Trical	17.8 c	2304 ab	21.8 b	43.9 cd
Elbon	24.3 ab	2981 a	25.3 ab	47.2 a
Unstated	16.6 c	2404 ab	23.2 ab	45.6 abc
Caldwell	14.1 c	1980 b	21.8 b	44.5 bcd

♦ Groupings in columns followed by the same letter are not significantly different at the 0.05 level

Laboratory analysis ofmineral content of all cultivars was conducted. Although statistically significant differences were found between cultivars for some variables, all levels were within acceptable nutritional ranges and are, therefore, not reported here.

Dry matter yield comparisons between the 1993-94 trial and December 1994 results are quite similar with the exception of the poor performance of the Tricticale and Caldwell wheat. The results also indicate that canopy heights and CP levels were higher in late autumn 1994 and the NDF levels were generally at a more desirable level (30% or lower) in 1994 than in 1993.

Although there are no comparative results for the early spring 1995 analysis, DM yields of the stockpiled forage are impressive with a total mean of 2509 kg/ha. CP levels remain relatively high with a total mean of 23.7 % and, as expected, NDF levels rose to a mean of 45.6%.

Animal performance results were not available with either of these trials; however, a demonstration conducted at the Southern Branch, OARDC yielded relevant results. In that demonstration, 25 beef steers, averaging 328 kg, rotationally grazed 4 ha of stockpiled cereal rye/fescue pasture for 46 days in early spring commencing 22 March 1995. The calves had spent the previous 40 days on field-stockpiled tall fescue supplemented with 2.72 kg of grain/hd/day and gained an average of 0.57 kg/day. The calves were weighed on 17 and 18 May to account for variation in fill levels and then removed. The average daily gain for all calves was 1.1 kg with a range of 0.63 to I .58 kg/day. The average exit weight of all calves was 389.6 kg with a range of 332.0 to 440.9 kg/head.

Growth rates of cereal rye are very rapid, beginning in late March and continuing through early May. The use of cereal rye would seem to be most appropriate for finishing calves, dairy cows and ewe hoggets. Annual crops, while much more costly than perennial crops, may have some use in specialised operations.

Conclusion

Trials conducted in 1993-94 and 1994-95 indicated that there are significant differences among cereal rye (*Secale cereale)* cultivars in performance in southern Ohio. The results support the conclusion that rye can provide as much as 2400 kg/ha of DM for grazing in late autumn and that the CP level will be at least 25%. The growth characteristics of Trical *(Triticum secale)* and Caldwell wheat *(Triticum aestivum)* indicate these two varieties would not be expected to perform well if early winter grazing is a goal. DM yields of stockpiled rye harvested in late-winter, indicate that several cultivars would be expected to produce at least 2300 kg of forage at a CP level of 21% or greater. Caldwell wheat would be expected to produce less dry matter and with lower CP.

Crude protein and NDF levels must be taken into consideration when determining classes of animals to graze rye pastures. Animals having high nutritional requirements should be the first choice. Supplementing

rye pastures with forages having higher fibre content may be desirable for late autumn and early winter grazing to slow rate of passage through the gut and improve nitrogen utilisation by the animal.

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