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STOCKPILING SYSTEMS: EVALUATION OF MANAGEMENT STRATEGIES UNDER CLIPPING AND SHEEP GRAZING

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Abstract

Two studies were carried out to examine the role of initiation date, utilization date, grass species, and nitrogen application on the yield and quality of stockpiled pasture. Experiment 1 involved 5 grass species managed under two pre-stockpiling harvest systems in replicated small plots harvested at each of three dates in autumn. Experiment 2 involved two summer initiation dates and two rates of N application on mixed swards grazed by sheep. Both experiments showed that stockpiled forage yields decreased by 52% to 75% as stockpile initiation date was delayed from early July to mid-August. Forage crude protein content increased by 1.7% to 6.5% and acid detergent fibre decreased by 3.6% to 4.4% as stockpile initiation was delayed. Forage quality declined as stockpile utilization date was delayed from September 01 to November 01. Tall fescue (*Festuca arundinacea* Shreb.) had lower ADF levels at the time of stockpile utilization than any other grass species tested. Under grazing conditions, nitrogen fertilizer applied at 50 kgN/ha did not have a significant impact on yield, but forage quality was improved. It should be possible to develop stockpiling recommendations to achieve a certain level of forage quality or to provide a specific carrying capacity.

Keywords: stockpile, deferred grazing, forage grass, sheep, grazing systems

Introduction

The Forage and Grazing Terminology Committee (1992) defines the term "stockpiling forage" as follows: "to allow forage to accumulate for grazing at a later period". Stockpiling usually involves allowing forage to accumulate in summer and/or autumn for use during late autumn and winter when growth has stopped. Stockpile grazing has also been called deferment or deferred grazing. Much of the research data on stockpiling has involved tall fescue (*Festuca arundinacea* Schreb.) management with regards to stockpile initiation date, stockpile utilization date, and nitrogen application (ie; Collins and Balasko, 1981; Fribourg and Bell, 1984; Gerrish et al., 1994). In general, initiating the stockpile earlier in summer results in higher forage yields but lower forage quality as compared to initiating the stockpile later in summer (Fribourg and Bell, 1984; Gerrish et al., 1992). Forage yield and quality tend to decline once the stockpiled forage is subjected to severe frosts (Ocumpaugh and Matches, 1977; Collins and Balasko, 1981). Nitrogen application generally increases the yield of stockpiled forage, but economic rates of nitrogen have been estimated at only 45 to 67 kg/ha of actual N (Gerrish et al., 1992).

Materials and Methods

Two experiments were undertaken to examine stockpile management techniques under the cool temperate climate of Ontario. Experiment 1 consisted of a 2x5x3 factorial in a split-split plot arrangement laid out in randomized complete blocks where stockpiling systems were the main plots, fall harvest dates were sub-plots, and grass species were sub-sub plots. The stockpiling systems consisted of either a hay cut in early July followed by stockpiling (1 cut system) or simulated pasture cuts in June and late July followed by stockpiling (2 cut system). Reed canarygrass (*Phalaris arundinacea* L.), smooth bromegrass (*Bromus inermis* Leyss.), orchardgrass (*Dactylis glomerata* L.), tall fescue, and meadow bromegrass (*Bromus riparius* Rehm.) were evaluated for stockpiled forage yield and quality on September 01, October 01, November 01 in 1994 and 1995. Forage plots were harvested with a flail-type harvester (Carter Manufacturing, Brookston. Indiana, USA). Forage quality was estimated using standard wet chemistry procedures (Goering and Van Soest, 1970).

In experiment 2, complex grass-legume mixtures were stockpiled according to a 2x2 factorial laid out in a completely randomized design. Silage was harvested from the entire experimental area in mid-June. Paddocks were then grazed for 5 to 7 days in early July (Early system) or early August (Late system) by sheep after which the forage was allowed to stockpile. Following the summer grazing, either 0 or 50 kg/ha of actual N was applied to the experimental area. Strip grazing of stockpiled forage by weaned lambs (starting weight=35 kg) began on September 26, 1995 and continued until mid-November. Forage samples were hand-clipped from every second strip prior to grazing on all paddocks. Forage yield and quality was determined from these samples.

Results and Discussion

Experiment 1. Stockpiling management system interacted with both grass species and fall harvest date in most instances, thus data is presented separately for the 1-cut and 2-cut systems (Table 1). In both years, the yield of stockpiled forage was greater and forage quality poorer under the 1-cut as compared to the 2-cut system (see means-Table 1). Differences between systems were much greater in 1995 due to dry conditions during August and September. Yield did not vary greatly among grass species under the 1-cut system in either year, but under the 2-cut system tall fescue and meadow brome had higher stockpiled yields. Tall fescue had consistently lower ADF values over both years and management systems, although differences in crude protein were .less consistent. Under the 1-cut system in 1994, forage yield declined after October 01, but under the 2-cut system, yield increased from September 01 to October 01 and then remained relatively constant. In 1995, forage yield declined in October and increased in November for both management systems. The reason for this yield increase in November is not known. Forage crude protein content decreased and ADF content increased as stockpile harvest was delayed from September 01 to November 01.

Experiment 2. Initiating the stockpiling process in early July resulted in a doubling of forage yield as compared to an early August initiation, while forage quality was higher under the early August initiation (Table 2). Nitrogen did not have a significant effect of the yield of stockpiled forage, but it did increase forage quality. The lack of a significant yield response to nitrogen is likely related to exceptionally dry conditions during August and September. Average daily gain of lambs was not consistently improved by any stockpiling treatment, but total liveweight gain per hectare and lamb grazing days per hectare were both higher on the Early initiated stockpile (data not shown).

To date, this research has shown a consistent relationship between stockpile initiation date and forage yield and quality in the autumn. Forage yields during autumn seem inconsistent, but quality generally declined slowly. Nitrogen fertilizer did not appear to give an economic response in 1995, although different results might be expected in a year of higher rainfall.

These data suggest that the production of stockpiled forage can be greatly manipulated by management strategy. The type of forage required from the stockpiling system will largely depend on the species of livestock raised and the stage of the production cycle during autumn and early winter. For example, spring-calving beef cows would thrive on a large volume of medium quality forage following weaning in October while spring lambing ewes would need a high quality pasture to prepare them for breeding in October or November. Thus, it seems likely that specific recommendations can be developed to manage the stockpiling process based on the type of livestock and stage of the production cycle targeted.

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Table 1. Stockpiled forage yield (kg/ha) and quality (%crude protein and % acid detergent fibre) as affected by management system, and interactions of management system with grass species and stockpile utilization date.

	1994 Data			1995 Data		
	Yield	CP	ADF	Yield	CP	ADF
Mean						
1 Cut	5870	10.7	38.9	4138	11.7	35.2
2 Cut	2004	12.4	34.9	1038	18.2	30.8
1 Cut						
R.Canary	6038	10.2	39.4	5427	10.5	36.1
S.Brome	5912	10.9	38.7	3745	11.3	34.7
Orchard	5307	10.8	40.5	-[z]	-	-
T.Fescue	6226	11.0	34.2	3654	13.0	32.7
M.Brome	5867	10.7	41.6	3727	11.8	37.2
2 Cut						
R.Canary	1067	15.2	33.6	1049	20.0	30.3
S.Brome	1230	13.6	34.9	410	-[y]	-
Orchard	1761	11.6	35.3	-	-	-
T.Fescue	3041	10.8	32.7	1356	17.2	29.7
M.Brome	2930	10.7	37.8	1335	17.2	32.5
1 Cut						
Sept.01	6053	13.2	37.6	4318	13.4	32.1
Oct.01	6196	10.0	37.4	3641	12.8	35.1
Nov.01	5361	9.0	41.7	4456	8.8	38.3
2 Cut						
Sept.01	1597	15.2	34.4	1241	20.1	29.5
Oct.01	2270	11.8	33.3	855	20.3	32.0
Nov.01	2144	10.3	36.9	1017	14.1	30.9
C.V.(%)[x]	12.7	6.4	5.1	23.3	8.3	5.8

[z] orchardgrass winterkilled following the 1994 harvest
[y] regrowth stunted due to drought, not enough samples to analyze quality
[x] coefficient of variation for complete analysis of variance

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Table 2. Stockpiled forage yield (kg/ha) and quality (% crude protein and % acid detergent fibre and calculated % total digestible nutrients) as affected by stockpile initiation date and nitrogen application.

Factor	DM Yield	Crude Protein	ADF	TDN
A) Early	5062	9.7	38.4	58.4
Late	2420	14.8	34.8	62.2
Significance	**	***	**	**
B) 0 Nitrogen	3424	11.2	38.1	58.7
50 Nitrogen	4057	13.3	35.1	61.9
Significance	NS	**	*	*
Interaction AxB	NS	NS	NS	NS
Mean	3741	12.3	36.6	60.3
C.V.[z]	24.8%	6.3	4.9	3.1%

[z] Co-efficient of variation

*,**,*** significant at the 0.05, 0.01 and 0.001 levels, respectively