EFFECTS OF SEASONAL CUTTING REGIMES ON THE DM YIELD OF TEMPERATE PASTURES. I. RESPONSE OF A SECOND-YEAR SOWN PASTURE

E.A. Moliterno[1], R.A. Zanoniani[1] and C. Tafernaberry[2]
[1]Pasturas, Facultad de Agronomía-EEMAC, CP60000 Paysandú, Uruguay
[2] Ing.Agr. , Edificio Paytorre 33 Orientales 937, CP 60000 Paysandú, Uruguay

ABSTRACT

The effects of combined frequencies and intensities of defoliation were assessed through different sward heights at cutting time and residual stubble heights on a second-year temperate pasture composed of tall fescue (*Festuca arundinacea* Schreb.), white clover (*Trifolium repens* L.) and birdsfoot trefoil (*Lotus corniculatus*). Frequencies of defoliation could only be evaluated in autumn and winter since soil water deficit became especially critical in spring and summer. Main differences in yield within seasons were due to a combination of the intensity of defoliation at which the particular treatment was managed and that of the previous season. Extreme weather conditions characterized by early frosts in autumn and soil water deficit throughout the entire experimental period proved as relevant as management in determining DM yields.

KEYWORDS

Defoliation frequency, intensity, sward height, cutting horizon, temperate species, seasonal production

INTRODUCTION

Sown pastures are regarded as the best alternative to the inherently low DM production and forage quality of native grassland in Uruguay. Despite availability of Uruguayan cultivars for most of the temperate grasses and legumes commonly sown, problems of persistence of some key species remain unsolved. An International Technical Meeting (IICA-DiálogoV 1983) held in Uruguay to discuss this topic highlighted grazing management as one of the main factors to be assessed, together with ecological adaptation of C_3 species to a mostly subtropical environment. Whether by animal or mechanical means, defoliation must be evaluated through its components: frequency, intensity and timing (Harris, 1978). Seasonal effects of defoliation regimes on the output of pasture are the response to interactions between the defoliation components and climate parameters which regulate herbage growth. For cool season sown pastures such as those predominant in Uruguayan intensive farming systems, one of these interactions is posed by inappropiate defoliation management during the normally hot and dry summers. This situation has been experimentally assessed on pure swards of *Festuca arundinacea* Schreb. (García *et al*., 1981), resulting in a marked decrease of subsequent autumn/winter production. Considering the importance of legumes in grazing systems, the early and progressive loss of these components due to ambient stress and selective grazing has been mentioned (García *et al*., 1981; Carambula, 1987) as an important limiting feature of cultivated pastures in Uruguay. This paper describes an experiment in which a mixture of widespread use was evaluated under different combinations of frequency and intensity during its second year, typically the most productive for temperate cultivated pastures in Uruguay.

METHODS

A mixture of *Festuca arundinacea* cv. Tacuabé; *Trifolium repens* cv. Zapican and *Lotus corniculatus* cv. Ganador sown at the Mario A. Cassinoni Experimental Station (EEMAC; 32ºS) was managed under different defoliation regimes during its second year. Defoliation regimes were defined as: *normal defoliation* (ND), when cutting was applied to experimental units reaching height swards between 15 cm and 20 cm, and *intense defoliation* (ID), when cutting was applied to experimental units reaching height swards between 10 cm and 14 cm. Residual sward heights were 6-8 cm and 3-4 cm for ND and ID treatments, respectively. To study any possible interactions between defoliation regime and seasonal weather conditions, both defoliation managements were combined so as to have experimental units assessed under one defoliation regime during a particular season, which changed to the other cutting treatment through the next season (Table 1). Experimental units were arranged in complete randomized blocks with four replicates of 4x5 m. Results are related to the yield of the *"cutting horizon"* (CH) (ie. the difference between height at cutting time and residual sward height). Analysis of variance were employed to compare the accumulated yield within each season (with variable # of treatments = 2; 4; 8 and 10 for autumn, winter, spring and summer, respectively) as well as for total yield per treatment.

RESULTS AND DISCUSSION

The main results (Table 2) highlighted the relevance of weather conditions (ie. soil water stress and frosts) over defoliation management. Autumn and winter were the only seasons where differences in yield were partly explained by frequency of defoliation. Extreme rainfall shortage during spring and summer did not allow sward heights previously defined to act as frequency determinants. Within autumn, significant differences in herbage yields between defoliation managements occurred under severe soil water deficit conditions and early and frequent frosts. The latter started after the first cut to ID treatments, determining a considerable reduction in the growth rate of both treatments from mid autumn onwards. The lower depth of the total CH throughout the season resulted in a higher DM yield through a denser sward, emphasizing the efficiency and timing of harvest. This was particularly relevant when analyzing the components of the total seasonal yield: while the ND treatment had more grass than clover and a dead material content of more than 20%, the greater part of which corresponded to senescent tall fescue laminae, the ID treatment had half this percentage value of dead material and a clover fraction that contributed to more than 50% of accumulated seasonal yield. During winter higher rainfall and a lower frost frequency accounted for an average increase of 216% in DM production for this season relative to that of autumn. White clover accounted for 60% of winter yield, mean of all treatments, while fescue accounted for 32%, dead material being irrelevant, irrespective of treatment. Yield differences recorded in spring (ID = 43% increase over ND DM production) reflected a combination of ambient conditions with changes in sward composition. Lotus became the dominant component with a contribution of 59% of total seasonal DM, while tall fescue followed with 23%. White clover practically disappeared as soil water deficit increased from mid-spring onwards together with the increase in mean daily temperature. Summer herbage yield (2% of total annual yield), was the result of dramatic drought conditions combined with higher-than-average temperatures. Under such extreme environmental conditions the differences in the absolute values of seasonal DM yield were due to ID treatments harvesting deeper into the sward profile. Though not significant, the 24% more production of the intense management mainatined the trend observed in previous seasons. Main contributing fractions for this season were birdsfoot trefoil, tall fescue and dead material (32%; 27% and 17%, respectively; mean of all treatments). Like during autumn, dead material of pasture reached high levels, this time aggravated by previous spring conditions which did not allow plants of sown species to prepare for the extreme ambient to come. For all seasons the accumulated yield represented the average of all experimental units under the same defoliation management. From winter onwards the accumulated yield was due to the particular treatment being applied plus an eventual interaction (Table 3) with the treatment applied to the same experimental unit the previous season. A common trend arises from these results: in any of three seasons and defoliation managements, higher DM yields of the CH were obtained in treatments which were under ND managements the previous season. The higher residual height of these treatments at the end of the season resulted in a larger leaf area which allowed a faster regrowth at the begining of the following season. As proposed by Parsons et al. (1988), leniently defoliated swards will have their maximum rate of photosynthesis restored sooner compared to severely defoliated ones under equal environmental conditions. For the ID treatments this is thought to be responsible for the increased yield of the CH of the first cut in each season, together with an intensity of defoliation which harvested almost 3 cm of DM produced wihin the previous season. The influence of the latter was such that it made up for the differences in the accumulated yield of ID treatments in winter, spring and summer, respectively. Of special importance was the result of this feature in winter, when ID treatments were not only more frequently defoliated but yielded 31% more DM (Table 3) when previously managed under ND.

REFERENCES

Carambula, M. 1987. Producción de pasturas en Uruguay. Pages 95-112 *in* C.J. Molestina, ed. DIALOGO XIX Reunión sobre. Producción y Utilización de Pasturas para Engorde y Producción de Leche. Convenio IICA/BID/PROCISUR, Montevideo, Uruguay.

García, J.A. , F.A. Formoso, D.F. Risso, C.G. Arrospide and P. Ott. 1981. Factores que afectan la productividad y estabilidad de praderas. Miscelánea 29, CIAAB-La Estanzuela, Colonia, Uruguay.

Harris, W. 1978. Defoliation as a determinant of the growth, persistence and composition of pastures. Pages 67-85 *in* J.R. Wilson, ed. Plant Relations in Pastures. CSIRO, Melbourne, Australia.

IICA-DIALOGO V. 1983. Reunión Técnica sobre Persistencia de Pasturas Mejoradas. J. García, ed. Convenio IICA-Cono Sur/BID. La Estanzuela, Colonia, Uruguay.

Parsons, A.J., I.R. Johnson and A. Harvey. 1988. Use of a model to optimize the interaction between frequency and severity of intermittent defoliation and to provide a fundamental comparison of the continuous and intermittent defoliation of grass. Grass and Forage Science **43**: 49-59.

Table 1
Combination of defoliation managements and season in the treatments

Season	TREATMENTS 1	2	3	4	5	6	7	8	9	10
AUTUMN	ND	ID	ND	ND	ND	ID	ND	ID	ID	ID
WINTER	ND	ND	ID	ND	ND	ID	ID	ND	ID	ID
SPRING	ND	ND	ND	ID	ND	ID	ID	ID	ND	ID
SUMMER	ND	ND	ND	ND	ID	ID	ID	ID	ID	ND

Table 3
Interaction between defoliation management in two successive seasons on herbage DM yield

(ND - ID)
↓ Defoliation management of the previous season
↓ Defoliation management of the season under evaluation

WINTER
← ND-ND vs ID-ND = +13% ND-ND (P<0.07)
← ND-ID vs ID-ID = +31% ND-ID (P<0.001)

SPRING
← ND-ND vs ID-ND = +4% ND-ND ns
← ND-ID vs ID-ID =+30% ND-ID (P<0.03)

SUMMER
← ND-ND vs ID-ND = +42% ND-ND (P<0.09)
← ND-ID vs ID-ID =+70% ND-ID (P<0.01)

Table 2
Herbage yield of the cutting horizon (CH) through seasons and accumulated under different defoliation managements

Seasons		Nº cuts	Sward height —(cm) —	Residual height	Total CH depth (cm)	Yield CH (kg.ha^{-1} DM)	***Accumulated Yield*** Treatment	kg.ha^{-1} DM
	ND	1	17.2	6.5	10.7	1313	1	6305
Autumn[1]						(P<0.01)	2	6410
	ID	2	8.1	3.8	8.7	1753	3	7373
							4	8180
	ND	2	16.0	6.5	19.0	3177	5	7115
Winter						NS	6	7252
	ID	3	10.4	3.8	19.8	3457	7	7714
							8	7961
	ND	2	16.7	7.6	18.2	1827	9	6994
Spring						(P<0.01)	10	6996
	ID	2	14.1	3.8	20.6	2618	s.e.d.[2] = 439 (26 d.f.)	
	ND	1	4.5	7.6	?	138		
Summer							NS	
	ID	1	3.7	3.8	?	171		

[1] Figures within seasons are mean of all treatments managed under ID or ND, respectively.