EFFECTS OF SEASONAL CUTTING REGIMES ON THE DM YIELD OF TEMPERATE PASTURES. II. RESPONSE TO FREQUENCY OF DEFOLIATION OF A FIVE-YEAR OLD SOWN PASTURE

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ABSTRACT

The effects of three frequencies (15; 30 and 45 days) of defoliation were assessed on a five-year-old temperate pasture composed of tall fescue (*Festuca arundinacea* Schreb.), white clover (*Trifolium repens* L.) and birdsfoot trefoil (*Lotus corniculatus*). Total annual DM yield showed a significant lower production for the most frequent defoliation management, 30 and 45 days frequency treatments averaging 32% more forage production with no statistical difference between them. Spring was the only season in which the more lenient defoliation significantly outyielded the 15- day interval treatment, which made up for the annual difference recorded. Through the rest of the seasons evaluated, the difference between extreme frequencies was non-significant, highlighting the efficiency under which each management produced harvestable material.

KEYWORDS

Defoliation frequency, sward height, cutting horizon, *Paspalum dilatatum, Festuca arundinacea,* seasonal production

INTRODUCTION

The general process of evolution of DM production and species contribution of temperate sown pastures in Uruguay has been described as reaching a peak in the spring of its second year from where the loss of legumes, in particular white clover, becomes the dominant process (García *et al*., 1981). The substitution or filling of niches left by disappearing legumes is dependent on factors such as summer mean temperature and drought occurrence, soil fertility, soil seed bank and type of native species dominant within the ecosystem, among others. Where land cultivation has been proper and soil fertility maintained, legume loss is delayed and normally followed by the appearance of native grasses such as summer growing dallisgrass (*Paspalum dilatatum* Poir) or the cool season *Stipa setigera* Presl. Where soil degradation has occurred and there is a large weed seed bank, bermudagrass (*Cynodon dactylon* L.) dominates early in the life of sown pastures. Its importance has grown considerably in the last decades to the point of being the single most important weed affecting crop-pasture rotations, regardless of their soil condition (Ríos y Giménez, 1991). Once legume loss has become irreversible, one sensible agronomic approach to check bermudagrass domination is to favor the remaining sown species as well as those of native grasses of grazing value mentioned above. Within the range of cultivated perennial grasses available in Uruguay, tall fescue cv. Tacuabé is considered to be the best alternative in terms of total yield and persistence (García y Millot, 1978). Its longevity is one of the main factors controlling bermudagrass invasion. As for *P.dilatatum*, Moliterno et al. (1988) have observed when comparing various sown mixtures that ground cover by contributing species at the end of the second year showed a dominance (51%) of this native grass compared to the cultivated species. The importance of this warm season grass relies not only on its summer forage production but on its ability to counter *Cynodon dactylon*. This paper describes an experiment in which an ageing temperate cultivated pasture with low legume population and tall fescue and dallisgrass as major contributors was managed under three frequencies of defoliation to study the effects on seasonal and annual DM output.

METHODS

The trial was established as a continuation of a previous experiment reported in a precedent paper (Moliterno *et al*., 1997). At the beginning of the fifth year the botanical composition of all experimental units was determined and the entire area managed by successive mowing through the autumn to maintain an average sward height of 6-9 cm. Three frequencies of defoliation were defined: 15; 30 and 45 days between cuts (F15; F30 and F45), respectively, leaving stubble height constant for all frequencies at 3.5-4.5 cm. Contrary to the arrangement of the previous experiment, in which two defoliation managements overlapped on the same experimental unit in different seasons, the treatments defined for this experiment considered the same frequency for the entire experimental period, winter, spring and summer of the fifth year, and autumn of the sixth year, respectively. Treatments were randomly assigned to each of the four blocks of the previous experiment and due to the excess availability of experimental units (40 for the former experiment; 12 needed for the present one), three replicates per treatment per block were finally established. The experiment commenced in early July ending by late June the next year. DM yields were determined by cutting $4m^2$ of each plot (total experimental unit area = $20m^2$), previously recording total sward canopy height (14 readings/plot). When botanical composition was estimated, samples were hand-clipped at the same stubble height, to refer composition to that of the *cutting horizon* (CH; ie. the difference between sward canopy height at specified frequency of defoliation and stubble height), and hand-separated to be finally oven-dried. Data comparing total DM production within seasons and annual accumulated yield were examined by analysis of variance and regression analysis, using the SAS package.

RESULTS AND DISCUSSION

At the beginning of the experimental period tall fescue was the dominant species (59%, mean of all experimental plots), while legumes averaged 6% and dallisgrass -as a spontaneous contributor- 17%. Weeds (bermudagrass and dycotildoneous such as *Ammi majus* and thistles) accounted for the remaining 18% of the available DM. Table 1 summarizes the main results within seasons and total annual yield. In winter and spring the difference between 15 and 30 days interval came close to the statistical threshold (MSD), and it is relevant to note that within winter, no increase in the output of DM arose from extending regrowth beyond the intermediate frequency of defoliation. During spring F45 allowed important internode elongation and flowering of tall fescue and dallisgrass which accounted for the highest DM yields recorded for this treatment in this season. This explained why spring was the only season in which the regression between frequency of defoliation and DM yield (Fig.1) fitted a straight line, whereas for the rest of the experimental period negative quadratic coefficients fitted curved lines for frequency intervals beyond 30 days. At this time, the seasonal DM distribution (mean of all treatments) showed a different pattern to that of the previous experiment (Moliterno *et al.* 1997). Spring and summer accounted for almost 70% of annual DM yield, reflecting the changes in botanical composition and climate parameters. Dallisgrass made up for most of the summer yield in all treatments and by the end of the experimental period had increased its contribution to 29%. Tall fescue continued to be the major contributor of the sown species (45% of total DM) while legumes barely accounted for 2%. In general terms the pasture evolved by the patterns depicted for temperate sown pastures in Uruguay (García *et al*., 1981): lower annual yield than at younger stages and almost total loss of legumes. Yield distribution concentrated in spring (51%, mean of all treatments), another feature of ageing temperate pastures, and this distribution proved similar to all three frequencies, thus emphasizing the effect of managements on forage production but not on its distribution. Autumn averaged the lowest yield of all seasons, producing 9% of total DM. No significant differences were detected for this period which implied that all treatments responded more to climate conditions (and residual from the summer), than to management itself. However, the previously observed trend prevailed: lenient defoliation frequency (F45) outyielded F15, this time by 18%. Results for total DM production (Table 1) showed that F45 outyielded F15 by 32% (P<0.05), but didn´t differ from F30. Considering the difference in the number of cuts involved, the latter yielded the same DM production through 50% more defoliations reflecting a higher efficiency as a result of younger material being produced and harvested at a more appropiate interval. These results agree with those reported earlier (Moliterno et al., 1997) in that the highest total yields were not achieved by treatments managed at large sward canopy heights, but rather for those maintained within intermediate ranges which for this experiment fell within the 7-13 cm range.

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Table 1
Herbage yield of the cutting horizon (CH) through seasons of a pasture managed under different defoliation frequencies

Seasons	Frequency of defoliation (days)	Nº cuts	Sward height -(cm)-	Residual height	Total CH depth (cm)	Yield CH (kg.ha^{-1} DM)	MSD[1]
	15	6	4.7	3.8	5.4	887	
Winter	30	3	7.4	3.8	10.8	1451	561
	45	2	8.1	3.8	8.6	1399	
	15	6	7.0	3.8	19.2	2341	
Spring	30	3	12.0	3.8	24.6	2915	583
	45	2	18.0	3.8	28.4	3164	
	15	6	7.0	3.8	19.2	915	
Summer	30	3	2.6	3.8	26.4	1151	150
	45	2	14.5	3.8	21.4	978	
	15	6	5.1	3.8	7.8	408	
Autumn	30	3	7.2	3.8	10.2	533	134
	45	2	10.0	3.8	12.4	480	
	15	24	5.9	3.8	51.6	4552	
TOTAL[2]	30	12	9.8	3.8	72.0	6050	1139
	45	8	12.6	3.8	70.8	6020	

[1] Minimum Significant Difference (P<0.05) for Tuckey's Studentized Range (HSD)
[2] Figures for Sward and Residual Heights are average of whole year

Figure 1
Fitted regression lines for DM production under three frequencies of defoliation. (a) Seasonal production (b) Total annual yield