NON-DESTRUCTIVE METHODS FOR THE ESTIMATION OF SWARD PRODUCTION

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ABSTRACT

Two non- destructive methods of grass production were compared: grassmeter and sward stick, in order to find an equation for transforming one into the other in dairy rotational systems. Linear, logarithmic and quadratic equations were fitted to the data. Linear equation was preferred by simplicity. General equations which included all the year periods showed no differences between sward stick and grassmeter. A detailed study of the different phenology states showed lower heights with grassmeter than with the sward stick method, which should take into account grazing management height recommendations.

KEYWORDS

Height, sward stick, Grassmeter

INTRODUCTION

Non-destructive methods should meet several criteria as described by Tucker (1980). They should be accurate, fast, light, easy to carry, reliable and inexpensive. Farmers should be able to utilise this technique in order to manage adequately their own grazing systems. Dry matter and height relationship changes with the season because of the kind of animal on the farm, grass use and management and densities as well as botanical composition of the sward. On the other hand, there are several methods for height estimation like the sward stick and the grassmeter. Target height depends on height estimation method. For this reason, target height recommendation changes depending on method. Lowman (1984) recommended a target height of 8-10 cm for cows movement in rotational systems at the start of the spring with the sward stick, however a target height of 5 cm should be achieved for the same period with grassmeter (Newberry et al., 1983). Therefore, the method should be described when a recommended height is made and for this reason it is very useful to describe an equation for transforming heights between the two methods as we attempt in the present work.

MATERIALS AND METHODS

The present work was developed in Galicia (north-west of Spain) and it was part of an experiment on stocking rate effect on pasture and animal production in a dairy rotational system (Mosquera, 1993).

Two methods were used for determining height: Grassmeter and Sward stick. Grassmeter consisted of a light, horizontal, metal plate of 0.3 x 0.3 m which can slide up or down a central, vertical and graduated stem (Frame, 1981). This plate weighed 430 grs and pressed slightly on the sward. Sward stick consisted of a clear 2 x 1 cm window which is lowered vertically toward the sward, when its base first touches the vegetation the window is halted and the above-ground height of the contact recorded in 0.5 cm bands. Grassmeter height was determined on 5 square samples of 0.3 x 0.3 m which determined the mean height of 0.3 ha plots. Sward stick height was made on six points of 0.1 x 6 m samples which were recorded on 6 points in 0.3 ha plots. These measurements were made before grazing on 108 plots during the springs of 1990 and 1991 following a dairy rotation. Mean per plot was calculated for each method and a regression model applied to these data. Three periods were studied: before and after flowering (being date of flowering 15 of May) and autumn, as height relationships probably varied with the sward phenology state.

RESULTS AND DISCUSSION

Height relationship between the two methods described for the three periods studied are presented in Table 1. Density means were in the interval of 10000 and 24000 tillers per square meter. Both linear and quadratic regression fit well to the data, however the logarithmic model had a lower correlation coefficient. Linear equation is preferred for the simplicity. Height relationship depended on seasonal period. The slope was always lower than one unit in the linear regression which probably means that every centimetre change of sward stick originated a lower change on height estimated with grassmeter. Sward stick tended to give us higher height than grassmeter. A height of 10 and 20 cm with sward-stick represented 7.5, 9.1 and 8.9 and 16.01, 18.27 and 17.21 cm for the periods before flowering, after flowering and autumn, respectively. This could be explained because the grassmeter makes a slight pressure over the pasture which compressed the sward and makes the height reading lower with the grassmeter than with the sward stick (Mosquera, 1993). Measurements between methods in the studied interval were more similar during the summer probably due to the flowering tillers which resisted this pressure and originated less pressure over vegetative tillers.

The equation which determines height relationship for all periods had a slope of 0.99 and the value of independent term was almost zero. This equation meant very lower differences for both methods, for example 10 and 20 cm measured with sward stick meant 9.89 and 19.79 with the grassmeter following this equationTarget height recommended by different authors are usually lower at the start of the season than at the end in order to avoid flowering development and this height is usually lower with grassmeter than with sward stick. The target recommended height at the start of the season is around 2 cm lower with grassmeter, (6-8 cm by Mayne et al. (1984)) than with sward stick (8-10 by Lowman (1984)) in accordance with our results.

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Table 1

Grassmeter and sward stick relationships for the total and the three year period studied.

Period	Equation	r
Before flowering	HGM = 0.75hs +1.01	0.80
	HGM = 4.96log(hs)-2.83	0.71
	HGM = $0.01hs^2$ + 0.47 hs + 2.19	0.80
After flowering	HGM = 0.92hs -0.13	0.87
	HGM = 7 log(hs) -6.45	0.79
	HGM = 0.006 hs^2 + 0.80 hs + 0.43	0.87
Autumn	HGM = 0.99hs -0.59	0.77
	HGM = 6.68 log (hs) -6.32	0.73
	HGM = $0.07hs^2$ - 0.17 hs + 3.62	0.80
Total	HGM = 0.99hs -0.0098	0.85
	HGM = 6.57 log (hs) -5.83	0.76
	HGM = $0.009hs^2$ + 0.71 hs + 0.84	0.85