Calibration of the rising plate meter for pasture yield determination in kikuyu (*Pennisetum clandestinum*) over-sown with ryegrass (*Lolium* spp.)

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Keywords: Kikuyu-ryegrass pasture, seasonal regressions, botanical composition.

Introduction

Accurate feed budgeting and management of forage in grazing systems requires frequent assessment of forage mass and growth of pastures (Gabriëls and Van den Berg 1993; Sanderson *et al.* 2001). The rising plate meter (RPM) developed by Earle and McGowan (1979) has been used widely by researchers and farmers to estimate pasture dry matter (DM) production. The advantages associated with using the RPM for the estimation of pasture DM yield include its low sensitivity to environmental conditions, stability of calibration equations across years and seasons (if pasture composition remains similar), and the fact that its robustness and ease of use makes it operator friendly, allowing a large number of readings to be taken in a short period of time (Earle and McGowan 1979; Michell 1982; Fulkerson and Slack 1993, Douglas and Crawford 1994, Martin *et al.* 2005). There is limited data available for the calibration of the RPM for kikuyu (*Pennisetum clandestinum*) pastures over-sown with ryegrass (*Lolium spp.*) and grazed by dairy cows in the Western Cape Province, South Africa. The aim of this study was to evaluate the calibration equations developed using the RPM for irrigated and grazed kikuyu pastures over-sown with ryegrass.

Methods

The study was carried out over a two-year period on the Outeniqua Research Farm, Western Cape Province, South Africa on a kikuyu pasture over-sown with annual Italian ryegrass (*Lolium multiflorum* var. *italicum*), annual Westerwolds ryegrass (*Lolium multiflorum* var. *westerwoldicum*) or perennial ryegrass (*Lolium perenne*). Calibration of meter readings to DM yield per unit area was undertaken by recording the height and DM yield of a number of quadrats of pasture cut to a height of 30 mm and correlating one with the other (Bransby and Tainton 1977; Fulkerson and Slack 1993; Botha 2003). Dry matter yield (kg/ha) was then related to meter height by the linear model (Earle and McGowan 1979):

$$Y = mH + b$$

where: m = gradient; H = mean rising plate meter height; and b = intercept value.

Separate calibrations were developed pre- and post-grazing. Over the study period, the RPM was calibrated approximately every 10 days. Three samples each were cut at locations where pasture height was judged by the operator to be low, medium and high, resulting in 18 sampling points per treatment per sampling (Bransby *et al.* 1977; Earle and McGowan 1979; Trollope and Potgieter 1986).

Results and Discussion

The seasonal pre- and post-grazing regressions for kikuyu-ryegrass pastures are shown in Table 1. The gradient of pre-grazing regressions decreased from winter to spring, probably due to the thinning of swards as ryegrass changes from a vegetative to a reproductive state before senescing. These results are similar to those of Michell (1982), who reported that as ryegrass becomes more erect at about ear emergence (seed set) during spring, the gradient of the regression equation decreased slightly, after which it increased again during summer. Both the gradient and intercept value increased from spring to summer, and the intercept value increased from summer to autumn. This trend has previously been attributed to the build-up of a

Table 1. The number of samples, gradient value, intercept value, standard error of estimate and coefficient of estimation of seasonal pre- and post-grazing regressions developed for kikuyu over-sown with ryegrass

Regression	Season	n	m	b	SE_y	R^2
Pre-grazing	Winter	1041	76.5	-510	485	0.77
	Spring	861	62.9	-277	603	0.68
	Summer	917	72.2	-242	786	0.62
	Autumn	270	59.4	+72	766	0.55
	Annual	3089	70.1	-338	662	0.69
Post-grazing	Winter	877	76.4	-464	355	0.66
	Spring	805	81.3	-517	394	0.70
	Summer	871	95.6	-562	525	0.70
	Autumn	413	103.7	-597	538	0.69
	All data	2966	89.8	-556	464	0.68

n= number of samples, m=gradient, b=intercept, SE_Y=standard error of estimate, R^2=coefficient of variation dead stoloniferous mat as the growing season of kikuyu progresses (Fulkerson and Slack 1993), while the development of a kikuyu mat has also been found to reduce the gradient and intercept value of regressions (Reeves *et al.* 1996). The increase in the gradient value of post grazing regressions from winter to autumn was also likely attributable to these factors.

The R^2 value of pre-grazing regressions decreased from winter to summer. This is in agreement with previous findings by Fulkerson and Slack (1993) that the error associated with pasture yield determination can be twice as high in pastures based on sub-tropical species compared to those based on temperate species.

Conclusions

In this study the gradient and intercept values of the pre-grazing regressions developed for the kikuyu-ryegrass pasture varied between seasons. The change in gradient and intercept values was associated with the change from a winter ryegrass dominant sward to a summer kikuyu dominant sward and the concomitant change in sward structure. The high pasture yields and progressive build-up of stem material associated with kikuyu pastures over the summer-autumn period led to a decrease in the accuracy of the regression equations over that period. The regressions developed in this study could be of value to assist Western Cape producers in their feed budgeting provided similar pasture management is implemented.

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