Adaptability of dry weight rank method for botanical analysis of natural pasture grown in coconut plantations

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Abstract

The objective of this study was to find out the relationship between dry weight rank method (DWRM) values and hand separation (HS) values in order to determine the accuracy and validity of DWRM to study the botanical composition (BC) of tropical pastures grown under coconut. The species which came first, second and third place in terms of dry weight were recorded in 80 random quadrat ($50 \times 50 cm^2$) samples. If no differences in rank could be seen, first and second places, second and third places or first, second and third places were allocated equally to two or three species. The data were tabulated to give the proportion of quadrats in which each species received first, second and third place. According to the Mannetje and Haydock. (1963) these proportions were multiplied by 70.2, 21.1 and 8.7 respectively, and added to give the dry weight percentage of each species. DWRM was tested five times by comparing the results with those obtained by hand separation method. With each test, actual HS values gradually became more closely related to DWRM values indicating a positive and significant ($p < 0.05$) correlation (0.65). Therefore it was found that accurate data obtained with HS could be predicted using the simple DWRM as an alternative to the HS method in determining botanical composition of tropical pastures.

Keywords: Botanical composition (BC), Dry weight rank method (DWRM), Hand separation (HS)

Introduction

Approximately half the coconut plantations ($\pm$ 200000 ha) in Sri Lanka provide potential grazing lands for ruminant livestock especially cattle and buffaloes. As there are limited cultivated pasture lands available, majority of the cattle & buffaloes are totally depending on natural pastures grown in coconut plantations. On the other hand buffaloes and cattle act as weeders or biological lawn mowers in plantations, saving part of the weedicide cost.

Estimates of herbage yields and composition are important for both plantation and livestock management. The most accurate method of herbage composition and yield estimation is probably the hand separation method. The major drawbacks of this method include necessity of taking large number of samples, requirement of drying facilities and the need of longer time period. Mannetje and Haydock (1963) proposed an alternative to hand separation method called Dry Weight Rank (DWR) method to estimate the botanical composition of a grassland.

The objective of this study was to find out the relationship between dry weight rank method (DWRM) values and more accurate hand separation (HS) values in order to determine the accuracy of DWRM to study the botanical composition of the herbage in coconut plantations.

Materials and Methods

DWRM proposed by Mannetje and Haydock (1963) was used. A quadrat (50×50 cm^2) was randomly thrown on a pasture sward (± 300 m^2) planted with coconut. All species (pasture, legumes and other) present within the quadrat were recorded. In a number of quadrats (80 times) it was estimated which species took first, second and third place in terms of dry weight. If no difference in rank could be seen, first and second places, second and third places or first, second and third places were allocated equally to two or three species. The data were tabulated to give the proportion of quadrats in which each species received first, second and third place. According to Mannetje, L.T. and Haydock, (1963) these 1st, 2nd and 3rd proportions were multiplied by 70.2, 21.1 and 8.7 respectively and added to give the dry weight percentage of each species or group.

As the observer needs to have a good training in carrying out DWRM to obtain a close relationship between the two methods, observations of plant species were taken by two observers and it was tested on five occasions. In each test the exact ranking of species in each quadrat was made from the data of HS method. The botanical composition of each event by the DWRM was calculated from the estimated rankings made by the observers. As the sward was somewhat uniform for HS method the same quadrat was randomly thrown 5 times at different places in the

coconut plantation at five different times. The herbage within each quadrat was cut at ground level, put into a polythene bag, sealed and brought to the laboratory. Later they were hand separated into grass, legumes and others and each component was dried to constant weight at 80°C for 8 hrs. Special care was taken to ensure the uniformity of cutting. Results of DWRM were then compared with the botanical composition calculated from the dry weights of hand separated material.

Results and Discussion

Results of the 5 tests conduced are shown in Table 1.

Table1. Comparison of DWRM with HS method.

Herbage Species	Test 1		Test2		Test3		Test4		Test5		r^2 species wise all test
	DWR	HS	DWR	HS	DWR	HS	DWR	HS	DWR	HS	
Grass	49.14	47.6	51.08	37.5	60.37	50.0	57.1	41.18	63.82	41.67	0.0104
Legumes	2.61	38.18	19.16	25.0	21.85	33.33	27.57	28.26	16.8	16.67	0.1628
Others	28.2	25.27	29.8	22.22	17.78	18.75	15.35	8.77	19.39	25.0	0.4386
r^2 at each test	0.135		0.766		0.850		0.881		0.921		0.653

[1]r^2 of all observations (n=15), p<0.05 and the regression equation was Y=a+bX, a= 16.5, b=0.44 Correlation between DWRM and HS method rose from 0.135 at the first test to 0.921 at the 5th test. In all five tests, the herbage yields of grasses were over estimated by DWR method, compared to HS method. The herbage yields of legumes were always under estimated in DWRM. The dominance of prostate type grass in the coconut lands might have led to underestimate the yield of legumes.

When all five tests are considered there was a significant (P<0.05) and positive correlation (0.653) between DWRM and HS method. In the fifth test r^2 was around 0.921. However, it must be noted that even after four tests, substantial differences were observed between the values obtained by two methods, particularly in relation to pasture and other species. A good experience seems to be the crucial factor for increasing the r^2 value and reducing the discrepancies between the values taken by two methods. Even though the DWRM seems to be less accurate compared to HS method, the former method could be useful when preliminary experiments are conducted or when accuracy of the estimation is not a matter of concern or when financial and time constraints prevent the use of HS method

Conclusion

With each subsequent test, the relationship between the hand separation (HS) method and dry weight rank method (DWRM) became a positive correlation. Therefore DWRM can be suggested as an alternative method specially for preliminary experiments in estimating botanical composition of natural pastures grown in coconut plantations.

References

Mannetje, L.T. and Haydock, K.P. (1963). The dry weight rank method for the botanical analysis of pasture, British Grassland Society, 18(4) pp 13-16.