AN EXAMINATION OF DRY WEIGHT RANK AND COMPARATIVE YIELD TECHNIQUES FOR GRASSLANDS PRODUCTION ESTIMATION

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ABSTRACT
Currently used method of dry matter yield estimation was tested compared with yield estimation from cover measurement using clipped data as an index. The dry weight rank (DWR) method was able to show variations within and between sites in different seasonal conditions. However it was less accurate than other techniques and possibly subject to personal bias.

KEYWORDS
Yield, canopy cover, foliage cover, double sampling, clipping

INTRODUCTION
Selecting an appropriate procedure is important for biomass measurement. The selected method can overestimate yield that would cause land degradation by overgrazing or underestimate yield that may cause wasting of forage by under grazing. Therefore there is an obvious need for a quick and accurate method of biomass estimation and also a need to evaluate methods under local conditions. A combination of modified DWR and comparative yield (CY) methods hereby called DWR is currently used for measuring pasture composition, species frequency and dry matter yield estimation in the Western Division of NSW by the SCS of the Department of Conservation and Land Management (Green 1992). The objective of this experiment was to examine DWR for estimating rangeland production in the Western Division, and the double sampling method of estimating rangeland production (DSMERP) by cover measurement suggested by Arzani and King (1994). They were tested in terms of their accuracy in comparison with actual values. The clipping and weighing method, accepted as a most accurate method was used as a index for this test.

MATERIAL AND METHODS
Four trials were run to compare the DWR and the DSMERP methods with the clipping and weighing method as a scale. Estimates of the yield of 3 groups of species and total yield were made using a range of methods of the two main techniques. They were examined at three different locations and four different land systems across the Western Division of N.S.W. Four types of the DSMERP were tested namely: foliage cover (FC) measurements and 8 clipped quadrats, canopy cover (CC) measurement and 8 clipped quadrats, FC measurement and 12 clipped quadrats, and CC measurement and 12 clipped quadrats. In testing the DWR technique using both sets of multipliers, the original set produced by 't Mannetje and Haydock (1963) and new constants as suggested by Jones and Hargreaves (1979) were involved. The plant production measurement by the clipping and weighing method was taken as the actual yield and was used as a scale for comparison of the techniques. During measurements, minor species were grouped into annual forbs, perennial forbs and annual grasses. For data analysis, groups of species were also considered instead of individual species. This is because most species (except the dominant species) made up only a small amount of the yield and were present in a few randomly placed quadrats. Therefore, using the DWR method, the minor species might not be ranked during measurement, and for the DSMERP, minor species might not be present in enough quadrats for calculating estimators for each individual species. Such a problem has been previously reported 't Mannetje and Haydock (1963) and Tothill *et al.* (1978).

The comparisons of techniques were made by t-test. SPSS version 5.01 was used for these analyses. At the times when all techniques were used in the same quadrats eg, January 1992 at Canonbar and January 1992 and January 1993 at Manuka, the paired-samples test was used. At other times of data collection the paired t-test was used for comparison of the DSMERP method with the clipping method as they were applied in the same quadrats. The independent-samples test was used for comparison of the DWR and the clipping techniques since they were used in different quadrats along the same transects.

RESULTS AND DISCUSSION
The results of the first experiment showed that all techniques were able to show the variations of forage production of different groups of species within and between sites. The results of the second experiment showed that seasonal conditions had no serious effects on the ability of methods for estimating dry matter yield. Application of both the DSMERP and DWR techniques had some limitations over time.

The DSMERP based on 12 clipped quadrats performed better than 8 clipped samples over time, across the semi-arid and arid areas, but selecting 8 or 12 clipped quadrats for calculating an equation as estimator of yield from cover measurements for each group or individual species depends on the objective of the study, available time and expected accuracy. Uniformity, percent cover and sparsity of vegetation should be considered when making such a decision. In general, to achieve the same level of accuracy the number of samples in arid areas should be more than the number of samples in semi-arid areas due to the sparsity of vegetation.

Although it was found that the DWR method was 2 or 2.4 times faster than the DSMERP method based on 8 or 12 clipped quadrats respectively, its low level of accuracy cannot be ignored. The results showed that there are significant differences between actual values and estimates obtained from the DWR method and if the objective of measurement is using data for stocking rate determination, then using other techniques is recommended. Personal biases involved with the DWR procedures may be occurring in three stages: 1- selecting the reference quadrats, different operators may choose different quadrats with different amounts of dry matter for the same rate, 2- ranking the species relative to dry weight inside the quadrat and 3- rating the quadrat in terms of total dry matter yield compared to reference quadrats. The advantage of the method is that it is fast and can be used to show variations between and within sites as illustrated by figures 1 and 2.

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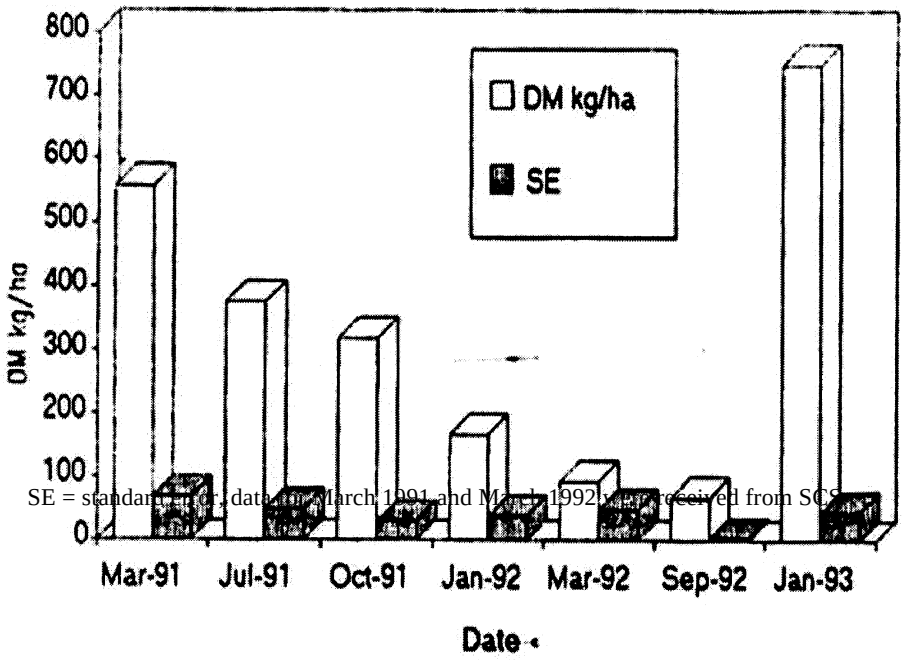
Figure 1
Variation of dry matter yield estimated by the DWR method at Manuka.



SE = standard error; data for March 1991 and March 1992 were received from SCS.

Figure 2
Averages of pasture layer yield estimated by the DWR method at different sites in semi-arid and arid areas of the Western Division (kg/ha).