ANALYSIS OF BOTANICAL COMPOSITION DATA

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INTRODUCTION

In experiments in which several variables are measured on each experimental unit, univariate analyses are usually presented for each variable. However, in drawing inferences from the results of univariate analyses, responses of the different variables are combined when ideally the data should not have been separated for individual analyses in the first place.

This paper presents a method for the combined analysis of several variables.

EXPERIMENTAL

A 2^3 factorial experiment with three blocks was conducted over 3 years on a predominantly carpet grass (*Axonopus affinis*)-based pasture. The factors were ammonium nitrate (N), superphosphate (P) and oversown white clover (W) with each factor being present or absent.

The data presented in this paper are the percentage ground cover of five species (carpet grass, paspalum *(Paspalum dilatatum)*, white clover *(Trifolium repens)*, Kikuyu *(Pennisetum clandestinum)* and others) assessed visually for each plot at the end of the experiment.

Univariate analyses of variance were conducted for each species.

A principal component analysis (PCA) was conducted on the 5 x 5 variance-covariance matrix for species. The principal components were analysed using standard univariate analysis.

RESULTS

Univariate analyses indicated that relative to the control treatment, treatments containing P and W reduce carpet grass cover and increase white clover cover, and treatments containing N increase paspalum cover.

PCA indicated that there were two important principal components. The first, accounting for 76% of the total variation, reflected a contrast between carpet grass and white clover cover and was reduced by treatments containing P and W. The second (23%) was dominated by a positive contribution from paspalum and contrasted by approximately equal and negative contributions from carpet grass and white clover. The principal component was increased by treatments with N.

DISCUSSION

The univariate analyses show clearly the treatment effects on the individual species. However it is left to the researcher to combine the results to explain the sward composition changes due to the applied treatments. Because the measured variables are correlated, it is often difficult to combine and interpret univariate analyses.

In this example, PCA overcomes this difficulty by transforming the five measured variables to two principal components. The first component explained the P, W and P*W effects on increasing white clover and decreasing carpet grass cover. The second component explained the independent effect of N treatments increasing paspalum and decreasing both carpet grass and white clover cover. These two components explain 99% of the total variation, and hence summarize all the important results in the data.

PCA has an application in all trials where several variables are measured per plot. It is most effective in data reduction and simplifying the interpretation of the treatment effects on the experimental units.

PCA also has an application in detecting non-random patterns in experiments. For example, a pre-emergence herbicide trial may have an unknown but non-random weed population. In such a case the non-random pattern would be explained by a significant principal component variable which would not be affected by the imposed treatments.

It is suggested that PCA is applicable for data collected on plant communities and is preferable to the currently used univariate techniques.