BOTANICAL CHANGES FOLLOWING APPLICATION OF FERTILIZER AND SEED TO RUN-DOWN PASPALUM, KIKUYU AND MAT GRASS PASTURES ON A SCRUB SOIL AT MALENY, SOUTH-EAST QUEENSLAND

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SUMMARY

Marked botanical changes occurred when the required nutrients and white clover seed were applied to grass dominant pastures on a scrub soil at Maleny, South-East Queensland. After 14 months there was a considerable increase in white clover; about half of this was attributable to overseeding and half to fertilizer. There was much more white clover in the more open paspalum sward and establishment was quicker than in the dense Kikuyu one. Most of the increase in white clover was at the expense of paspalum. The content of mat grass (*Axonopus affinis*), the main weed in paspalum, was also reduced, but to a smaller extent.

INTRODUCTION

An attempt was made to renovate run-down pastures of paspalum (*Paspalum dilatatum*) and Kikuyu (*Pennisetum clandestinum*) on a scrub (*krasnozem*) soil at Maleny. Seed of white clover (*Trifolium repens*) was oversown on a factorial fertilizer trial with phosphorus, calcium, sulphur, molydenum and potassium treatments but which did not include nitrogen since the main aim was to study the establishment of the white clover. White (1967), who gave details of this field experiment, has discussed the effects of different nutrients in terms of dry matter yield and in one case on white clover content. This paper presents more detailed information on the botanical changes that occurred.

MATERIALS AND METHODS

There were two swards in the trial, one dominated by Kikuyu and one by paspalum. The site had little or no white clover and was one of the least fertilized areas of the farm. On such an area the effects of oversowing and fertilizing could best be studied. No cultural treatments were applied; fertilizers and 5lb/acre of white clover seed were broadcast on April 4th, 1963.

Between November 7th, 1963 and May 4th, 1964 the two-acre area was grazed in common for one day every 14 days by approximately 50 cows, giving 325 short grazing days an acre over the period of 175 days.

Ground cover (area) estimates (Brown, 1954) were made on a whole plot basis at the beginning of the experiment on April 4th, 1963 and again on June 9th, 1964. In addition, on September 13th, 1963, November 5th, 1963 and June 9th, 1964, estimates were made of the percentage ground cover of white clover on a ranking of 0 to 10 and an estimate of clover vigour on a ranking of 1 to 5, 5 being the most vigorous. The two ranks were multiplied together to give an estimate of bulk.

In this paper the comparisons presented are between control plots (unfertilized) and well fertilized ones. For unfertilized plots, the sulphur and potassium treatments, which had no significant effect on the estimates at the times of botanical sampling, were combined with no phosphorus, no calcium and no molybdenum to give eight plots for each grass, and for the well fertilized ones the sulphur and potassium treatments were combined with calcium, molybdenum and phosphorus (6 and 10 cwt/acre) treatments to give 16 plots of each grass.

RESULTS

The most noteworthy changes were the sharp increase in white clover, the marked decline in paspalum and the relative constancy of Kikuyu.

Table 1 separates the effects of seeding and of fertilizing between the date of seeding and fertilizing on April 4th, 1963 and June 9th, 1964. The effect of seeding

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is shown in the comparison of the unfertilized plots within each grass. The significant increase in white clover was achieved in each case at the expense of a significant decrease in paspalum. The amount of Kikuyu was fairly constant in each case.

The additional effect of fertilizer is shown by the significantly greater amount of white clover in fertilized plots as compared with unfertilized plots. The two effects were approximately equal.

Changes in percentage ground cover before and after addition of seed and fertilizer.

TABLE 1.

SPECIES	Paspalum	Kikuyu	Grass Mat	Weeds Miscellaneous	Ground Bare	Clover White
PASPALUM PLOTS	%	%	%	%	%	%
Unfertilized (1)						
4-4-63	45.0	36.25	16.25	1.25	1.25	
9-6-64	23.1	40.0	9.4	5.0	0	22.5
Least significant difference	17.8*	N.S.	N.S.	3.6*	1.0*	5.4**
Fertilized (2)						
4-4-63	40.0	41.9	11.9	4.4	1.9	0
9-6-64	15.2	34.4	7.1	2.5	0	40.8
L.S.D.	16.7*	N.S.	N.S.	0.3**	0.9**	3.8**
L.S.D. between means for 9-6-64 (1) vs. (2)	N.S.	N.S.	N.S.	0.3**	—	6.7**
KIKUYU PLOTS						
Unfertilized (1)						
4-4-63	20.0	80.0	0	0	0	0
9-6-64	4.4	78.8	0.6	3.1	0	13.1
L.S.D.	14.7*	N.S.	N.S.	N.S.	—	5.5**
Fertilized (2)						
4-4-63	12.5	85.6	1.3	0.6	0	0
9-6-64	1.9	67.5	0.3	0.6	0	29.7
L.S.D.	10.4*	14.4*	0.3**	—	—	3.9**
L.S.D. between means for 9-6-64 (1) vs. (2)	N.S.	N.S.	N.S.	N.S.	—	6.8**

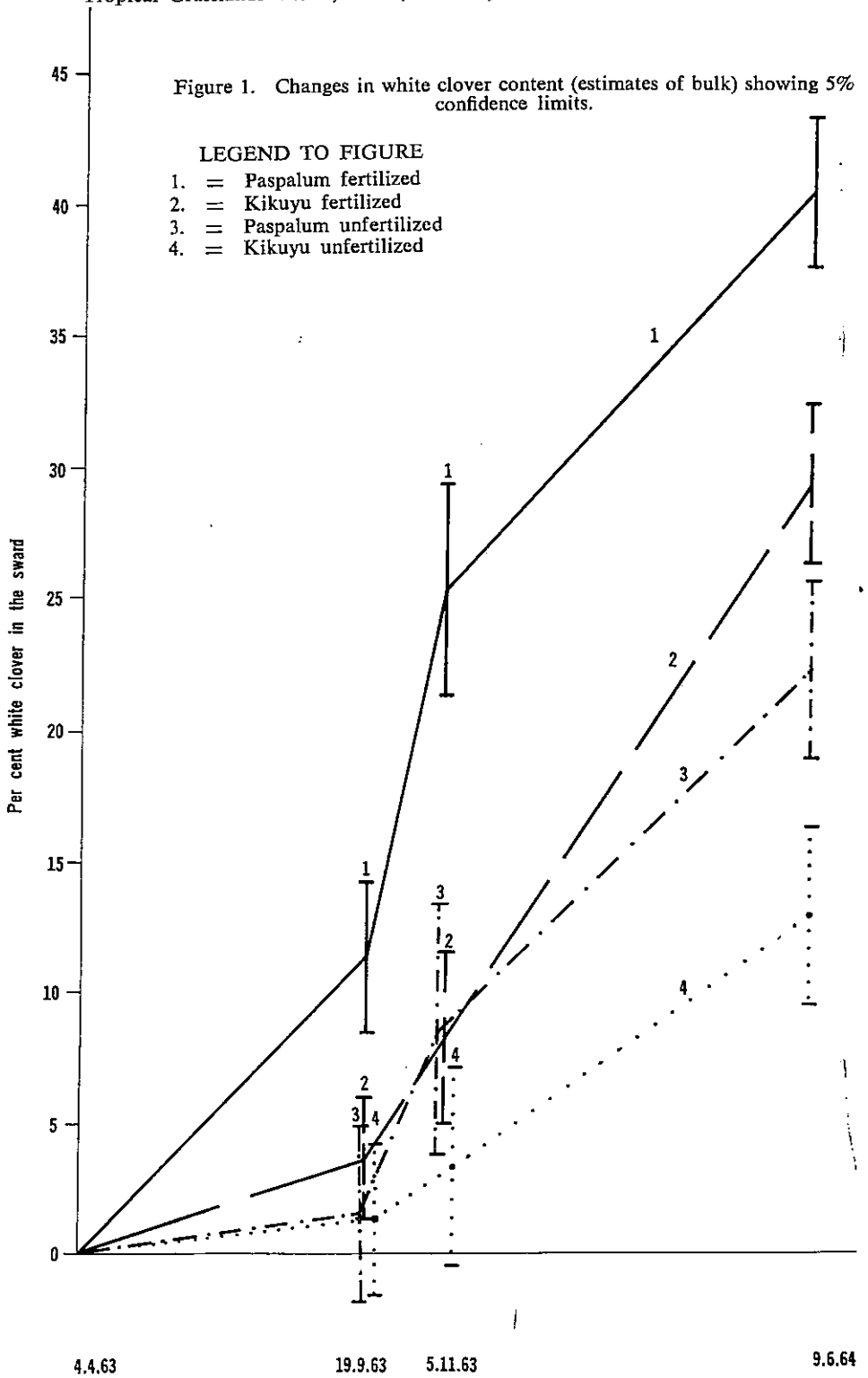
(1) Mean of 8 plots (2) Mean of 16 plots
* Significant at 5% level ** Significant at 1% level

Table 1 shows that neither sward was pure. Indeed, in the so-called paspalum sward there was initially as much Kikuyu as paspalum. When this sward was oversown with white clover and fertilized, the amount of Kikuyu was unchanged, and the marked increase in white clover was achieved largely at the expense of the paspalum, and to a small extent by a reduction in mat grass. In the case of the Kikuyu sward the ingress of white clover resulted from a reduction in the paspalum content and a small reduction in the percentage of Kikuyu grass.

Mat grass (*Axonopus affinis*) was the main weed in the paspalum plots but was almost absent from the dense Kikuyu sward. Although the reduction in the amount of mat grass (approximately 40 per cent.) was considerable, in terms of total ground cover the reduction was only five to seven per cent. and this was not statistically significant.

Figure 1 shows the trend of change in white clover content. For both grass swards there was a steady increase in white clover in both unfertilized and fertilized plots. The amount was far greater in fertilized plots and more in paspalum than in Kikuyu.

Figure 1. Changes in white clover content (estimates of bulk) showing 5% confidence limits.



DISCUSSION

The renovation of run-down pastures can be approached in a number of ways, but basically it involves the restoration of fertility and the provision and establishment of more useful and persistent pasture plants to take advantage of the increased fertility. There must be an integrated approach. When nutrient deficiencies are overcome, there must be sufficient legume plants to take advantage of the improved fertility and to provide a supply of nitrogen for the associate grass — hence the possible need to oversow with legumes for quick response. At this point the maintenance of balance will depend on management.

In this experiment the addition of white clover seed provided about half the improvement and fertilizer the other half. It seems clear that the response to oversowing white clover was due to the depletion of white clover seed reserves in the soil which was brought about by decreasing soil fertility over years of grazing leading to an almost total absence of white clover plants at the time the experiment was begun. The increase in white clover in unfertilized plots would be attributable largely to oversowing and only to a minor extent to nutrient transfer under grazing. The greater amount of clover in paspalum than in Kikuyu was due initially to the more open nature of the paspalum sward, aided later by much heavier grazing on this grass because of the higher clover content and the greater palatability of the grass.

Ryan (1956 and personal communication) has shown that it is possible to establish and maintain good stands of subterranean clover in Kikuyu grass in Western Australia by periodic drastic renovation or by very heavy stocking. Had such management been adopted here, much better establishment of white clover might have resulted.

The behaviour of mat grass was in keeping with the findings of Cassidy (1963) in so far as an improvement in fertility and, therefore, an increase in the competitiveness of the better species, (in this case white clover), resulted in a decline in mat grass. The decline was, however, small in comparison with the decline in paspalum. Where a highly competitive species already existed, such as Kikuyu, there was little or no mat grass at any time.

The botanical changes recorded here occurred within the short space of fourteen months. The speed, nature and extent of the changes show how powerful are the factors concerned, viz. balanced nutrition, oversowing and management, especially when combined.

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