EXECUTIVE SUMMARY

Field Assessment of Symbiotic Potential and N_2 fixation in Selected pasture legumes from the Winter rainfall Region of the Southern Cape: - F.D. Dakora

Developping a viable and sustainable livestock industry requires a nutritional source based on readily available low-cost, high-protein feed. Nitrogen-fixing legumes constitute one such source of high quality protein that can be cheaply exploited for increased livestock and poultry production. In this study, medic and clover plants were examined for their potential as pasture legumes from measurements of symbiotic N_2 fixation. The experiments conducted include I) testing the efficacy of introduced rhizobial strains to fix N_2, II) determining the effects of lucerne population density on plant growth and N_2 fixation in that species, and III) assessing the N_2-fixing potential of 27 clover cultivars nodulated with native rhizobia. Standard methodologies were used to measure N_2 fixation in experimental medic and clover plants; these include the ^{15}N natural abundance technique and the N difference method.

These studies were carried out at three locations, namely Elsenberg, Langgewens and Tygerhoek. Experiment I was conducted at Elsenberg and Langgewens, while Experiments II and III were done at only Elsenberg and Tygerhoek, respectively. Two harvests were performed on the experiments at Elsenberg, and one on each experiment at Tygerhoek and Langgewens. At each harvest, plants dug out from the field were washed free of soil and separated into nodules, roots and shoots. These component parts were oven-dried at 65 C, weighed for determination of plant dry matter. Non-leguminous plants were included at each harvest as reference plants for measuring soil N uptake by legume.

In all, about 1692 medic and clover plant samples (nodules, roots and shoots) were produced from 4850 plants harvested between September and November 1994 for measurement of nodulation and N_2 fixation. However, except the enormous workload caused by plant harvests, which all occurred in the spring, there were no setbacks in this research project. Data on nodule mass and plant biomass were successfully collected from all three experiments, but have not been statistically analyzed for presentation here due to priority being given for the processing of the 1692 samples for $^{14}N/^{15}N$ isotope analysis, especially that competition for use of the mass spectrometer at UCT can be intense. Consequently, there are no results included in this report; however I am happy to update it with analyzed data any time prior to the final write-up of the project.

A new technique, involving the use of 100% O_2 to destroy nitrogenase, was also employed to develop isogenic lucerne plants for use as reference material for estimating soil N uptake by symbiotic medics. Visual observation showed that the technique was successful since the O_2-stressed plants were relatively chlorotic, N-starved, and low in chlorophyll due to dependence on only soil N for their N nutrition. This technique is being tested again with lucerne, cowpea and bambara groundnut at UCT using soil in glasshouse studies.

Although this project is still incomplete, there is no doubt that the data generated will be important to agriculturists, farmers, and the livestock industry in terms of identifying greater N_2-fixing, high protein pasture legumes for sustainable animal production. Once N_2 fixation levels have been established for these legumes, future research should concentrate on estimating the benefit of the biologically-fixed N to following, non-fixing, cereal crops. Such studies will provide useful information for farmers to decide whether, or not, to apply chemical N fertilizers after a leguminous pasture crop.

The results of this study should yield a couple of research papers publishable in internationally recognized scientific journals. User groups such as farmers and extension staff will benefit from research summaries published in popular information bulletins.