

1985 at Toowoomba, Paros produced 390 kg/ha clean, dehulled seed compared with 540 kg/ha from Madeira. In 1985 at Stanthorpe, Paros produced 2.72 t/ha podded seed compared with 2.86 t/ha from Madeira.

Paros is particularly hardseeded and laboratory tests show it to have a very slow rate of softening. This contrasts to Pitman which has a substantially lower hardseed content (Bolland 1987).

Regeneration of Paros in the second year has often been lower than Madeira, probably due to a slower rate of hardseed softening. This may be due in part to the non-segmented pod morphology of Paros, which results in less pod/soil contact than occurs with the segmented pods of Madeira. Dry matter production is often lower during early winter although differences are not as great in spring. Regeneration after cereal cropping has however been particularly good, being superior to Pitman and Eneabba at Merredin (W.A.) and to Tauro at South Stirlings, Dinninup and Arthur River (W.A.), in 1986.

Paros is tolerant of high aluminium concentrations, in contrast to Madeira which is particularly sensitive (Drew 1987).

Paros may be useful in mixtures with Madeira on sandy soils in low rainfall areas of Western Australia (300–375 mm annual average). Its high level of hardseed should improve long term persistence of serradella, particularly in situations where the pasture is cropped. Its tolerance of high aluminium levels should give it an advantage over Madeira on strongly acid soils. It could also fill similar niches in central and northern New South Wales (R.D. Freebairn, pers. comm.). Paros will also be used in mixtures of serradella cultivars

(particularly Madeira, Eneabba and Jebala) for sowing on sandy soils in hotter, drier areas of southern inland Queensland (D.L. Lloyd, pers. comm.).

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### References

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## Book review

### Persistence of Forage Legumes

G.C. Martin, A.G. Matches, R.F. Barnes, R.W. Brougham, R.J. Clements and G.W. Sheath (Eds). American Society of Agronomy Inc., Madison, Wisconsin, USA. 1989. 572 pp.

Available from the Tropical Grassland Society. A\$27 plus postage.

This book is the proceedings of a workshop held in Hawaii in July 1988 between pasture scientists from Australia, New Zealand and the USA and also from CIAT in Colombia. The

stated objectives were to document problems of forage legume persistence, review known restraints to persistence, and to resolve what were the gaps in knowledge that would allow modelling of forage persistence. The 33 individual papers have been presented under the sections — Overview of Problems, Development and Growth Characteristics, Edaphic and Climatic Constraints, Cultural Practices and Plant Competition, Plant-Animal Interface, Major Pests and Diseases, Genetics and

**Breeding and Areas for Collaborative Work.**

The book is stimulating to read but exhausting to assimilate because of the wide coverage given to the topic and the descriptive nature of much of the content and overlap between papers. The individual chapters are of mixed quality with many giving little insight into the processes responsible for persistence. On the other hand, the book is an excellent review of all aspects of legume management. Tropical and temperate research has been covered. A bonus is the inclusion of the discussions of individual papers and the general discussions of the different sections.

Though the book has been organised in subject areas, the best way to appreciate it is to skim through all papers and discussions so as to obtain an overall impression and assess what is of most value for oneself. For instance, it is not until p 148 that one comes across an acceptable definition for persistence, namely, 'where legume populations are at a stable density that achieves the expectations of a specific ecosystem'!

It is obvious that there was some difficulty in achieving consensus with respect to a basis (or model) for persistence. It was agreed that the major factors to be considered in relation to persistence are the climate, edaphic considerations, pests and diseases, and management and that the management components amenable to manipulation are competition between plants, severity and intensity of grazing and fertilizer management. However, it was also pointed out (p 13) that 'perceptions on the important attributes of plants required for persistence may be imperfect; for example, survival mechanisms of naturalised medics in Australia are enigmatic in that flowering may be from early to mid-season, drought tolerance is quite variable and species differ markedly in hardseededness'. The outcome is a series of very general statements (p 173-5), namely, 'the requirement for persistence is to match the needs for a particular site with the characteristics of the plant. Greater flexibility will be required the greater the variation in any of the factors mentioned above. And this flexibility can be achieved by phenotypic plasticity in individual species or by genetic variability using a mixture of species or cultivars'.

The book includes excellent reviews on plant competition and the importance of edaphic

factors on legume persistence and on the physiology of the growth of white clover. In these areas, where there is a greater understanding of the processes involved, good progress has been made in the development of mechanistic models. On the other hand, while the effects of grazing on persistence have been well documented, the processes involved at the plant-animal interface are not well understood. Hence, biologically appropriate models cannot be developed at present. This is obviously a key area for increasing the understanding of persistence.

The papers on diseases and pests are quite comprehensive and provide a useful reference source for both students and researchers. One point that caught my attention was that greater loss of production may be caused from chronic occurrence rather than from damaging outbursts of disease or insect attack. It is also likely that chronic attack has often been the 'final straw' in the lack of persistence. However, it is doubtful whether this has been quantitatively measured in many cases. Likewise, the chapters on plant breeding provide a historic record of the endeavour in this area in the three countries. It is readily comprehensible that the success of many programs is limited by a lack of knowledge of the plant attributes that contribute to persistence, in other words, an inability to clearly define objectives. However, it was pointed out that 'failures as well as successes have contributed to an understanding of such attributes'.

In summary, the book is an excellent review of the present knowledge of legume management and persistence — more so if the reader is prepared to devote the time necessary to read the entire book. This is because the 'picture' is developed or emerges as the workshop proceeds. Further, while the summary chapter lists known restraints to persistence it does not provide an answer to the question posed as an objective to the workshop, namely, 'what are the gaps in the knowledge of persistence?' Interested readers will rise to the challenge and find the 'keys' themselves. This book is recommended for all those involved with research into the agronomy of pasture legumes.

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