A STUDY OF COMPETITIVE RELATIONSHIPS BETWEEN SELECTED GRASSES DURING THE ESTABLISHMENT PHASE

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UPATISSA RAVINDRANATH SANGAKKARA

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ABSTRACT

Competition has been identified as a major phenomenon affecting the growth of pasture species in mixtures. Thus a study comprising of field, glasshouse and climate laboratory experiments was conducted to identify the occurrence and the nature of competitive relationships during establishment and early growth of three common grass species used in the pastoral industry of New Zealand. Simple models of competitive situations were created by the use of the de Wit replacement series principle, in order to carry out these studies.

The results of all experiments demonstrated that the selected species, namely perennial ryegrass (*Lolium perenne* L.) "Grasslands Nui"; prairie grass (*Bromus catharticus* Vahl) "Grasslands Matua" and cocksfoot (*Dactylis glomerata* L.) "Grasslands Apanui" compete for the same environmental resources. The competitive abilities of the three species were in the order of prairie grass > ryegrass > cocksfoot. The superior performance of the more competitive species when compared with its monoculture was associated with a corresponding proportional decrease in the performance of the weaker species in a mixture. These relationships were observed within 3-4 weeks after planting and did not alter under the adopted experimental conditions. In addition, the field experiment illustrated that these relationships were persistant in the second year, under an infrequent cutting regime, although seasonal growth patterns of the three species were identified.

Initial and subsequent plant size had a deterministic effect on the respective competitive abilities of the selected grasses. This was assisted by their growth patterns and earlier germination of the more competitive species. Seed characters also showed a positive relationship with the plant size and competitive abilities of the selected grasses.

Yields of the mixtures lay between those of the respective monocultures in all experiments, irrespective of seasonal growth patterns of the species. Simulated spring and autumn temperatures

within the climate laboratories did not change the pattern of yield or the competitive abilities and relationships of these three species.

Evaluation of the effects of competition on the growth of individual plants of these species when grown in mixtures revealed that both tiller appearance rate and to a greater extent the rate of leaf appearance on the main stem in all species were affected by competition during early growth. These effects were associated with the dry matter accumulation patterns of the selected species in mixtures.

Root competition began earlier and had a greater impact on the overall competitive relationships between the selected species than shoot competition. This was attributed to the earlier and greater intermingling of the root systems than shoot systems. Evaluation of the root growth of species both as single plants and in mixtures supported this conclusion. However, the mechanisms of root competition were not elucidated.

In order to identify the pasture establishment practices of farmers and thereby relate the results of these studies to the practical situation, a survey was carried out among farmers in central New Zealand. The results highlighted that farmers use seed mixtures containing 2-4 grasses to establish their pastures. The grasses selected for this study were shown to be those most commonly used by farmers.

The results of the experiments of this study are discussed in relation to the pastoral industry of New Zealand.

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