CHAPTER 9

GENERAL CONCLUSIONS

i) POT TRIALS

Intraspecific competition, in which individual development is restricted due to interference from neighbours, has been studied as an agronomic problem - what is the optimal density of plants per unit area to achieve maximal dry matter production per area, or economic yield per unit area? Plants may not interfere with each other at low densities, but as density increases the growth of the population becomes limited by a shortage of environmental factors - such as light, water and nutrients - and the growth of the population becomes a function of the availability of supplies rather than the number of individuals. The effect of intra - and interspecific competition was conclusive in both species investigated. Increasing density (intraspecific competition) resulted in decreased total vegetative yield per plant. The total vegetative yield per pot initially increased and then decreased; 12 plants per pot being the optimum density yielding maximal dry matter in both A. pubescens and E. curvula at the third harvest

date. The effect of competition intensified over the growing season, limiting the total vegetative yield per plant. Data analysis affirmed the superior competitive ability of E. curvula, in contrast to the inferior competitive ability of A. pubescens.

In a monoculture intraspecific competition intensifies the expression of small differences between individuals, while in a mixture interspecific competition exaggerates interspecific differences. The differential effects of both intra - and interspecific competition were evident; the total vegetative yield of A. pubescens was favoured in a monoculture (intraspecific competition), while that of E. curvula was favoured in a mixture (interspecific competition).

The biomass allocated to the separate vegetative plant parts remained relatively unaltered under intra - and interspecific competition. Supposed differences in the pattern of root allocation over the growing season between the two species suggest that A. pubescens and E. curvula possibly exhibit different root allocation strategies over the growing season, which may accrue for their differing competitive abilities. This supposition, however, needs to be tested. Biomass allocation to reproductive structures was absent in both species. The absence of the production of inflorescences under conditions of limited space, signifies the importance of the role played by environmental constraints - stress, on plant growth and

production. According to Harper (1967) self - thinning is absent in many agronomic experiments, so that all density stress is absorbed in the plastic development of the individuals, which was applicable to E. curvula, but not A. pubescens.

It appears that under conditions of density stress not only is there a forced sharing of limited resources with a compensating plastic reduction in individual development, but that a hierarchy emerges amongst individuals in the population. This hierarchy consists of a few large individuals and a number of small individuals. The RGR of the total plant and respective plant parts, leaf production per plant, LA per plant and per leaf and LAI of A. pubescens and E. curvula was retarded by the intense competition for the limited resources that were available to both species. Intraspecific competition had a greater negative affect on the growth characteristics of E. curvula, while interspecific competition had a greater negative affect on A. pubescens. The constraints placed on the growth of the two species by density stress intensified over the growing season. Increased density resulted in possible shading and resultant competition for light. Maximal net CO_2 uptake rate per unit leaf area and the concomitant carbon assimilation was favoured under low competitive stress. Eragrostis curvula attained greater height and produced more lateral tillers than A. pubescens under both intra - and interspecific competition. The height advantage of E. curvula enhanced its interception of light energy, possibly explaining it's competitive superiority at the expense of

A. pubescens.

ii) FIELD TRIAL

According to Harper (1967) the direct consequences of density stress on a plant population are three - fold: (i) a plastic response as the individuals adjust to share limiting resources, (ii) increased mortality, and (iii) exaggeration of differences within the population which encourages a hierarchy of exploitation. The inferior competitive ability of A. pubescens in the pot trials was not affirmed by the field survey conducted. Anthephora pubescens appeared to be prevalent only in an intraspecific situation in a natural plant community. An explanation for this occurrence was, however, indecisive. The experiments of Pimental et al. (1965) and of Seaton & Antonovics (1967) illustrate three evolutionary solutions to the problem of inter - group competition for limited resources: (i) extinction of one group, (ii) mutual oscillating inter - group selection leading to increased stability of the mixture, and (iii) mutual divergence in behaviour leading to the avoidance of inter - group competition. Results of the field survey suggest that A. pubescens may follow the latter evolutionary solution, leading to virtually pure populations of A. pubescens in a natural plant community.

Darwin (1859) wrote: "It has been experimentally proved that if a plot of ground be sown with one species of grass, and a plot be sown with several distinct genera of grasses, a greater number of plants and a greater dry weight of herbage can be raised in the latter than in the former case." The present study conclusively supports Darwin's finding in the case of E. curvula, but not in the case of A. pubescens. It may therefore be suggested that E. curvula should be used for intercropping, as a management strategy, if the aim is to obtain a productive pasture. Further investigation is, however, essential pertaining to A. pubescens, as successful management of A. pubescens will only be possible once clarity is found on the reaction of this species to competitive interactions in a natural plant community.