RESPONSE OF CHICORY (*Cichorium intybus* L.) TO DEFOLIATION

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ABSTRACT

Chicory (*Cichorium intybus* L.) is a perennial herb which has long been used as a forage crop. However, only recently has this species been re-evaluated in terms of its agronomy and animal performance. The objectives of this research were to study the persistence and the seasonal patterns of herbage mass accumulation and morphological development of forage chicory under defoliation. A series of field and glasshouse experiments were conducted at the Pasture and Crop Research Unit (PCRU), the Deer Research Unit (DRU) and the Plant Growth Unit (PGU), Massey University, Palmerston North, New Zealand (latitude 40°23'S) from 1993 to 1996. 'Grasslands Puna' chicory was used in all experiments except for one of the glasshouse experiments (Chapters 6 and 7) where two contrasting cultivars, 'PG90' and 'Orchies', were also included.

Under grazing, Puna chicory accumulated herbage masses of 8.5, 9.4 and 4.6 t dry matter (DM)/ha from November to April, with average plant densities of 66, 69 and 24 plants/m^2 and plant sizes of 2.9, 2.7 and 6.7 shoots/plant, for 1, 2 and 4 year old stands, respectively (Chapters 3, 4 and 5). It was concluded that the characteristics of a grazed chicory crop that had deteriorated to the point of not being able to accumulate half of its maximum herbage mass were 25 plants/m^2, six or more shoots/plant, or less than 150 shoots/m^2.

Defoliation stimulated the development of secondary shoots, but suppressed the growth of the primary shoot. Axillary shoots, however, developed fully regardless of whether or not plants were defoliated. The main source of feed from chicory for livestock was primary leaves during spring, and secondary and axillary leaves during summer and autumn (Chapters 4, 6 and 7). Results from

both field and glasshouse experiments suggested that Puna chicory was more sensitive to defoliation frequency than intensity. It was concluded that defoliation at 50-100 mm in height at 3 week intervals in spring, and at 100-150 mm at 5 week intervals in summer and autumn, maximised the leaf formation and minimised the stem development of chicory.

Grazing decreased the plant density of chicory regardless of grazing intensity or frequency, with the significant decrease in late spring and early summer when primary shoots were controlled (Chapters 3 and 4). Autumn grazing, especially hard grazing, was detrimental to plant persistence (Chapters 4). It was concluded that less grazing pressure through the growing season cannot be used to improve persistence without compromising leaf growth rate, but that avoidance of grazing in late autumn will improve the persistence of chicory.

In a comparison of three cultivars, Orchies was the most persistent cultivar but had the slowest growth rate, and PG90 was the least persistent but with the highest growth rate, whereas the performance of Puna was intermediate, due to their contrasting root sizes and different root carbohydrate reserves. It was suggested that to improve the persistence and enhance the leaf production of Puna by plant breeding the emphasis should be on increasing taproot size without unduly prejudicing herbage mass accumulation.

Keywords: biomass, fructans, grazing intensity, grazing frequency, herbage production, morphology, persistence, plant density, regrowth, taproot.

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STRUCTURE OF THESIS

The thesis is based on a series of papers. All chapters, including three appendices, except Chapters One (General Introduction), Two (Review of Literature) and Eight (General Discussion), have been published or accepted/submitted for publication. The paper in Chapter Three has been slightly modified in a few sections, whereas papers in Chapters Four to Seven are presented as scientific papers but in thesis format. The references relevant to individual chapters are at the end of each chapter, except for Chapter One where the references are merged into those in Chapter Two and placed at the end of Chapter Two. The results are discussed in detail in each experimental chapter and integrated into a general discussion in Chapter Eight. The main findings from the research in this thesis are also summarised at the end of Chapter Eight.

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