INTEGRATION OF GOATS INTO SHEEP AND CATTLE GRAZING SYSTEMS AS A PERMANENT WEED CONTROL TOOL

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of the requirements for the degree of

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Errata

Table 5.4, pp. xii and 90: see ~~figures~~ Figure 5.3

P.5, ln.22: (Tilman, 1987, 1988; Begon *et al.*, 1996).

P.6, ln.16: Tainton *et al.* (1996)

P.7, ln.7; p.8, ln.15 and 16: Popay (1980)

P.8, ln.3 from the bottom: is very limited

P.8, ln.15: fertilisers (Thompson, 1974; Lambert *et al.*, 1986)

P.9, ln.3 from the bottom: Penning *et al.*, 1997

P.10, ln.10: ~~Mitchell et al., 1987;~~

P.12, ln.19: Delow *et al.* (1988)

P.23, ln.18: (Kent and Coker, 1992; Braun-Blanquet, 1932)

P.39, ln.15: (it was nil in winter~~, as seen in Section 0~~)

P.39, ln.15: ~~(further results on consumption of individual components are presented in Section 3.3.4)~~

P.40, last sentence: [measurements are in centimeters]

P.45, ln.15: Parsons *et al.* (1994a)

P.48, ln.10: consumed ~~it~~ them

P.53, ln.2: ~~where~~ were

P.54, ln.7: ~~Host~~ Holst

P.54, ln.13: (range 7-41%)

P.59, ln.6: ~~fist~~ first

P.73, ln.11: McDonald *et al.* (1995)

P.79, ln.12: ~~(Cowie, 1972)~~

P.82, ln. 4 and 5: (0.13 x 0.77 m)

P.85, ln.15: ~~*BS = bare soil*~~ BS = bare soil

P.105, last line: left~~-one~~.

P.110, ln.8: i.e. wet (Edmond, 1962; 1970)

P.111, ln.7: ~~they~~ the

P.113, ln.8: the sward

P.116, ln.1: ~~irrespectively~~ irrespective

P.116, ln.12: Parsons *et al.* (1994a)

P.116, ln.13: Parsons *et al.* (1994b)

P.118, ln.1: ~~invasions than a cattle one?~~

P.128, ln.13: permanent basis (Statistics New Zealand, 2000)

P.130, ln.4 from the bottom: it has also been shown

P.136, ln.13: ~~(Section 0)~~

P.136, last line: Panetta and Wardle ~~(1995)~~ (1992)

P.138, ln.19: tips of the stolons

P.140, ln8: (Bourdôt *et al.*, 1994a)

P.144, ln.3: (Valentine and Matthew, 1999; McKenzie et al., 1999)

P.144, ln.6 from the bottom: ~~are~~ is largely

P.144, ln.7: ~~(Section 0)~~

P.145, ln16: (Bourdôt *et al.*, 1994b)

P.145, ln.20: (Preston, 2000). (For further reading see Sindel, 2000.)

P.147, ln.10: ~~becomes~~ become immaterial

P.149, ln.11: conducted by Radcliffe and Moorhouse (1988) and Radcliffe *et al.* (1991)

P.155, ln.2: same for perennials (Bridges, 1995)

P.161, ln.13: McCutcheon *et al.* (1986)

P.165, ln.20: ~~(Section 0)~~

P.169, ln.13: (f) which is likely

P.179, ln.7: points

P.182, ln.3 from the bottom: Thorhallsdottir *et al.*, 1990

P.188, ln.16: ~~Publisihng~~ Publishing

P.189, ln.2: ~~*Senecio jacobaea*~~ Senecio jacobaea

P.189, ln.15: (1994a)

P.189, ln.18: (1994b) [...] ~~thislte~~ thistle

P.190, ln.4: ~~Onopordum illyricum~~ *Onopordum illyricum*

P.190, ln.11: ~~*principals*~~ *principles*

P.193, ln.7: ~~Butter Worths~~ Butterworths

P.194: Holst, P. J., & Allan, C. J. ~~(1999)~~ (1996)

P.198, ln.1: fertiliser

P.199: Parsons, A. J., Newman, J. A. [...] (1994a)

P.199: Parsons, A. J., Thornley, J.H.M. [...] (1994b)

P.202: Sakanoue, S. [...] (1995)

P.204, ln4: ~~Southerland~~ Sutherland

P.204, ln14: ~~gaots~~ goats

Missing References:

Burhenauer, D.B. & B. Fritsch (1980). Colour vision in domestic goats (*capra hircus* L.). *Zeit Tierpsychol, 53*: 225-230.

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Key

P. and p. = page; pp. = pages; ln. = line. Underlined characters signify inserted text; crossed out characters are replaced by underlined ones in the same line.

ABSTRACT

This project evaluated the integration of goats into sheep and cattle grazing systems as a permanent herbaceous weed control tool. Foraging behaviour of goats grazing pasture with no access to browse was monitored in Experiment 1. A selection index was used to determine degrees of effort for selection or avoidance of plant species. Although most of the grazing time was spent on herbage species, no effort was made to select them, whereas moderate to strong efforts were made to select weeds. Selection index varied with season of the year. Goats preferred taller vegetation and grazed above 10 cm from the ground whenever possible, though they took 70% of their bites from below the top of the sward, regardless of organ selected. Experiment 2 consisted of feeding known numbers of weed and herbage seeds to goats and recovering them to assess destruction and viability. On average, 92% of the viable seeds were destroyed, with up to 72 hours for complete excretion. The effects of goat and cattle grazing on the structure and competitiveness of swards against weed invasions were studied in Experiment 3. A pasture competitiveness index (PCI) was calculated using structural attributes of a sward resulting from goat and cattle grazing alone and in combinations, under hard and lax grazing severities. The sward was denser, leafier, more uniform, and covered the soil more thoroughly (greater PCI) with increasing participation of goats in the treatments, especially because of severe treading damage caused by cattle contrasting with no damage from goats. The PCI explained 93% of the variation in weed seedling density. The effect of pasture surrounding thistle rosettes on their consumption by goats was investigated in Experiment 4. Thistle rosettes that were exposed by clipping the adjacent sward were severely defoliated by goats, while rosettes surrounded by the sward were only nibbled or not eaten at all. Grazing management, economics, and drawbacks of using goats for herbaceous weed control are discussed. Integration of goats into grazing systems can result in a more desirable botanical composition, more uniform and competitive sward, reduced weed control costs, greater herbage utilisation, and better pasture quality.

Keywords: weed ecology, grazing ecology, weed control, biological weed control, weed management, grazing management, mixed grazing, goat, cattle, sheep.

Beskow, W. B. (2001). Integration of goats into sheep and cattle grazing systems as a permanent weed control tool. Unpublished PhD thesis, Massey University, New Zealand.

To family and friends in Brazil

from whom we had to be away

for four long years

in order to do this

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