COMPARATIVE EVALUATION OF DIET SELECTION, HERBAGE INTAKE AND PERFORMANCE OF LAMBS GRAZING YORKSHIRE FOG (*Holcus lanatus* L.), PERENNIAL RYEGRASS (*Lolium perenne* L.) AND TALL FESCUE (*Festuca arundinacea* Schreb.) AND ASSESSMENT OF EFFECTS OF CONDENSED TANNINS (CT) IN THE GRASSES ON LAMB PERFORMANCE

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ABSTRACT

A series of grazing experiments was carried out at the Pasture and Crop Research Unit, Massey University, Palmerston North, New Zealand, to compare Yorkshire fog (*Holcus lanatus* cv. Massey Basyn)/white clover (*Trifolium repens* cv. Grasslands Tahora) with perennial ryegrass (*Lolium perenne* cv. Grasslands Nui)/white clover cv. Grasslands Tahora and tall fescue (*Festuca arundinacea* cv. Grassland Roa)/white clover cv. Grasslands Tahora pastures with reference to grazing behaviour, diet selection, herbage intake and performance of lambs, and to specifically assess the effects of low concentrations of condensed tannins (CT) in grasses on body growth and wool growth of animals. Half of the lambs were drenched with polyethylene glycol (PEG) (CT inactivated) and the remainder were drenched with water as a control (CT acting) in each experiment. PEG is assumed to specifically bind and inactivate CT without influencing the digestion of other nutrients.

In the first experiment, a comparative study of grazing behaviour, diet selection, herbage intake and performance of lambs grazing Yorkshire fog/white clover and

ryegrass/white clover swards was made from late May to late June, 1993. Thirty-six lambs, balanced in sets of six based on initial fasted weight continuously grazed paddocks with three replicates of the two pasture treatments for 7 weeks. Yorkshire fog had greater sward bulk density and intake per bite (68 vs 51 ± 7.1 mg OM/bite) than ryegrass. Perennial ryegrass had a consistent superiority over Yorkshire fog in organic matter digestibility (OMD) (80 vs 77 ± 0.3 %, P≤0.05) and herbage OM intake (1117 vs 930 ± 31.5 g/day, P≤0.1), resulting in faster liveweight gain (174 vs 144 ± 9.7 g/day), significantly higher carcass weight (17.7 vs 16.3 ± 0.1 kg, P≤0.05) and dressing out % (49 vs 48 ± 0.2, P≤0.05). Low CT concentrations (1.7 - 2.2 g/kg DM) were found in the diets selected from both the grasses; these low CT concentrations had no effect on grazing behaviour, diet selection and herbage intake. Small responses to PEG administration were observed in initial liveweight gain, but PEG had no effects on overall liveweight gain, carcass weight, carcass weight gain and GR (depth of total soft tissue over the 12th rib at a point 11 cm from the mid carcass).

The next two experiments were designed to compare Yorkshire fog cv. Massey Basyn)/white clover cv. Grassland Tahora with tall fescue cv. Grassland Roa/white clover cv. Grassland Tahora pastures in terms of grazing behaviour, diet selection, herbage intake and performance of lambs, and to further quantify the effects of low CT concentrations in the grasses on lamb performance, especially on initial liveweight gain of lambs, under rotational grazing management in late spring, summer and early autumn, 1993/1994. The comparisons between Yorkshire fog and tall fescue pastures were made under similar sward conditions. Previous grazing experience on the appropriate pasture and sex were designed as treatments as well as pasture species and PEG supplementation. Forty-eight lambs balanced for previous grazing experience and sex in sets of sixteen were used in each experiment. One group of 16 was slaughtered as the initial group at the start of each experiment to measure the carcass weight. The other two groups of lambs grazed six paddocks of each pasture treatment in a 30-day rotation.

Tall fescue had higher total N than Yorkshire fog in early December (3.56 vs 3.43 ±0.018 % DM, P≤0.05) and late February (3.24 vs 2.91 ±0.022 % DM, P≤0.0001), and had higher OMD in early December (81 vs 78 ±0.6 %, P≤0.01) and late February (72 vs 68 ± 1.1 %, P≤0.05), but lower OMD in early February (71 vs 74 ± 1.1 %, P≤0.05). Yorkshire fog produced faster liveweight gain (99 vs 76 ± 6.7 g/day, P≤0.1), greater carcass weight (14.7 vs 13.9 ± 0.2 kg, ≤0.05) and faster carcass weight gain (32 vs 20 ± 3.1 g/day, P≤0.05) than tall fescue in late spring and summer (Experiment 2), but not in late summer and early autumn (Experiment 3). Male lambs had faster liveweight gain than female lambs in Experiment 2 (95 vs 80 ± 3.3 g/day, P≤0.05) and in Experiment 3 (80 vs 72 ± 2.3 g/day, P≤0.05). Previous grazing experience had no effects on final liveweight gain, carcass weight, carcass weight gain. There was no significant effect of interaction between previous pasture and current pasture on these parameters.

The results of the experiments further confirmed the low CT concentrations (1. - 2.1 g/kg DM) present in Yorkshire fog in Experiment 1 and small responses of lambs to PEG supplementation in initial liveweight gain only in Yorkshire fog (101 vs 92 ± 4.1 g/day, P≤0.1) in Experiment 2. There were no significant effects on carcass weight, dressing out, GR and wool growth rate. Lower faecal egg counts in lambs in Yorkshire fog than in tall fescue suggested some potential of Yorkshire fog for parasite control. The low CT concentrations in the Yorkshire fog reduced to some extent rumen ammonia concentration, but were not enough to effectively promote animal performance. The relatively low CT concentrations detected in tall fescue were probably an artifact, because there was no PEG effect on rumen ammonia concentration for tall fescue.

The final grazing experiment was conducted to evaluate grazing behaviour, herbage intake and performance of lambs as affected by grazing selection opportunity and low condensed tannin (CT) concentrations in Yorkshire fog/white clover pasture under rotational grazing management from late November, 1994 to early February, 1995. Twelve lambs were slaughtered as the initial group at

the start of the experiment to measure the preliminary carcass weight. Forty-eight lambs were allocated to two groups in sets of twenty-four and rotationally grazed eight paddocks each of 0.1 ha, in which a "leader" group of 24 lambs grazed each paddock for four days, followed by a similar "follower" group of 24 lambs grazing for four days.

The leader/follower grazing regime created the desired contrasts in herbage quality and quantity. The superiority in sward allowance, selection opportunity, diet quality and reduced possibility of infection by worm parasites resulted, as expected, in faster body growth and wool growth rate in the 'leader' lambs than in the 'follower' lambs. The results of the experiment further confirmed the findings of the influence of low CT concentrations in Yorkshire fog on rumen ammonia concentration. The effect of low CT concentrations on animal performance was not different for generous and restricted grazing.

The following general conclusions can be drawn from this series of experiments:

1) The diets selected by sheep comprised more green material and less dead material than the swards offered to the animals, while diet composition was determined largely by the structure and distribution of sward components rather than by deliberate selection by the animals.

2) Herbage OM intake was influenced to a greater extent by nutritional factors than by behavioral limitations, there being substantially higher herbage OMD and OM intake on ryegrass than on Yorkshire fog in winter.

3) Perennial ryegrass/white clover pasture tended to have higher animal production than Yorkshire fog/white clover pasture under continuous grazing management in winter, and Yorkshire fog pasture produced slightly higher animal performance than tall fescue in rotational grazing management in late spring and early summer.

4) The results of the trials confirmed that low CT concentrations (0.18 - 0.32 % on a DM basis) were present in Yorkshire fog, and provided evidence that perennial ryegrass contained relatively low CT concentrations, but the low CT concentrations detected in tall fescue were probably an artifact of the current procedures of analysing CT.

5) The low CT concentrations in the grasses had no effect on grazing behaviour, diet selection or herbage intake. The low CT concentrations in Yorkshire fog to some extent reduced rumen ammonia concentration, but were not enough to effectively improve animal production.

Keywords: Yorkshire fog (*Holcus lanatus*), white clover (*Trifolium repens*), perennial ryegrass (*Lolium perenne*), tall fescue (*Festuca arundinacea*), condensed tannins (CT), polyethylene glycol (PEG), grazing behaviour, diet selection, herbage intake, animal performance.

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LIST OF ABBREVIATIONS

AA	Amino acid
BTRT	The rate of biting
CCS	Carcass weight
cm	Centimetre
CP	Crude protein
Cr	Chromium
CWL	Corrected wool weight (g/100 cm^2)
CT	Condensed tannins
CTRL	Control
DOM	Digestible organic matter
DOMI	Digestible organic matter intake
EAA	Essential amino acids
FEC	Faecal egg count
FSW	Fasted weight
g	Gram
GR	A measurement of total soft tissue depth over the 12th rib at a point 11 cm from the carcass midline
GRNM	Green material
GT	Grazing time
IB	Intake per bite
INTK	Herbage intake (g/day)
kg	Kilograms
k_g	Efficiency of utilisation of ME for growth
k_l	Efficiency of utilisation of ME for lactation
k_m	Efficiency of utilisation of ME for maintenance

Cont.

Ltd	Limited
LW	Live weight
LWG	Liveweight gain
ME	Metabolisable energy
mg	Milligram
min	Minute
MW	Molecular weight
MTTK	Herbage Intake (g/kg $W^{0.75}$)
N	Nitrogen
NAN	Non-ammonia nitrogen
NH_3	Ammonia
OMD	Organic matter digestibility
OMI	Organic matter intake
PEG	Polyethylene glycol
PER	Period
PRVSP	Previous species
RUT	Ruminating time
RST	Resting time
SEM	Standard error of mean
Sig	Significance
SPP	Species
WLGTH	Wool growth rate