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BRIEF COMMUNICATION

Responses to poplar supplementation in ewes grazing drought pasture during mating.

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Over the past 160 years, poplar and willow trees have been extensively planted on New Zealand pastoral land for shade and shelter, aesthetics and conservation purposes (Wilkinson, 1999). In North Island East Coast regions, some hill-country farmers are pruning the branches of poplar and willow trees to feed them to livestock during the late summer and autumn dry period, to supplement low-quality pastures. Drought poses a serious management issue for farmers in the East Coast regions of both the North and South Islands and predictions suggest droughts will become more frequent and severe in the future (Salinger, 2000). Supplementation with conserved forages, such as hay and silages, or grains such as barley, is a common management practice for farms suffering drought conditions (Leng, 1992). However, many East Coast hill-country farms have little or no flat land on which to produce hay or silage.

Poplar and willow trees will grow a bank of feed in spring, which will continue to grow and remain green when pastures have succumbed to water stress (McCabe & Barry, 1988). There has been very little research on the feed value of poplar or willow trees and there is no scientific information available on the responses in production and reproduction to supplementing breeding ewes under drought conditions, during mating, with poplar or willow cuttings.

In the summer and autumn of 2001, a grazing trial involving 300 mixed-age Romney-based ewes, with a mean initial live weight of 57 kg (±0.68), was conducted at Massey University's Riverside Farm, in the Wairarapa. The purpose of the trial was to determine the effects of poplar supplementation during a summer/autumn drought on whole-year ewe production and reproduction. Poplar supplementation was carried out over 71 days from the 1 February 2001 (late summer) to the 12 of April (autumn) 2001, including mating. Wellington Regional Council's Akura Nursery, near Masterton, supplied the poplar tree trimmings, cv. Veronese.

The experiment involved ewes grazing simulated drought pastures; poplar cuttings with stem diameter less than 15mm were offered daily as supplementary feed. One hundred ewes were randomly allocated to each of three treatment groups. The high and low treatment groups were offered 1.50 kg/head/day (fresh) and 0.75 kg/head/day (fresh) of poplar, respectively. The control group was offered no poplar. All three groups were offered 0.70 kg/head/day of dry, low-quality pasture, in weekly breaks, in a rotational-grazing system.

Pre- and post-grazing herbage mass was determined immediately before and after grazing each break, by cutting eight random quadrats per treatment group per break, to ground level. Pasture diet selected samples were collected from each break, by hand-plucking from exclusion cages immediately following grazing. Poplar fodder offered was weighed daily and samples were collected twice weekly to determine the DM content of poplar offered. Poplar residual was collected and weighed after each break and samples taken to determine DM content. Thus, the total amount of poplar (kg DM) consumed was calculated for each break. The diameter of poplar stems eaten was determined for the high and low treatment groups, at the end of grazing each break, by collecting 75 stems per treatment group and measuring the diameter eaten with electronic callipers (Mitutoyo Corp., Japan). Samples of poplar diet selected were also pruned daily from the poplar fodder on offer, at a diameter that was consistent with the diameter consumed by the ewes (5-7 mm), and pooled for each break.

Ewes were weighed fortnightly using electronic scales (Tru-test, New Zealand) during the period of poplar supplementation and body condition, scored from 1 to 5, assessed monthly. After mating, the ewes were managed as one group and weighed and scored for body condition monthly, until weaning in late November. The number of lambs per group at ultrasound scanning (early June), lambing, docking and weaning was recorded. Lambs were weighed at docking and weaning. After shearing, in early December, ewe fleeces were weighed using electronic scales (Tru-test, New Zealand).

Dry matter (DM) of pasture and poplar was determined by drying samples at 80°C for 16 hours. Total nitrogen (N) concentration was determined using the Kjeldahl method, *in vitro* Organic Matter Digestibility (OMD) determined by the enzymatic method of Roughan & Holland (1977) and total condensed tannin (CT) determined by the butanol-HCL colorimetric procedure of Terrill *et al.* (1992).

Changes in ewe live weight and body condition were analysed using PROC MIXED of SAS (2001) with a linear model that considered the effect of treatment. Differences in pregnancy rate between treatments were tested using PROC CATMOD of SAS (2001). Least-squares means for reproductive rate at scanning, lambing, docking and weaning were obtained for each treatment using PROC MIXED of SAS (2001). Reproductive performance was expressed as number of lambs born as a proportion of the number of ewes mated.

Mean initial pasture mass for the three groups was 1040 kg DM/ha and mean post grazing residual was 530 kg DM/ha (Table 1), with no difference between the three treatment groups. Pasture consumed during the experiment had an average total N content of 17.8 ± 1.0 g/kg DM, average NDF content of 622.5 ± 7.1 g/kg DM, average OMD of 0.542 ± 0.006 and average CT

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concentration of 1.5 ± 0.01 g/kg DM, with no difference between the three treatment groups (Table 1). Poplar consumed was higher in average N content, 28.4 ± 1.5 g/kg DM, lower in average NDF, 389.9 ± 14.1 g/kg DM, higher in average OMD, 0.746 ± 0.015, and higher in average CT concentration, 6.9 ± 1.1 g/kg DM than pasture consumed. The amount of poplar consumed by both poplar-supplemented groups substantially increased over time (Figure 1; $P<0.01$).

Control ewes lost 82g of live weight per day and 1.31 points of body condition during the 71-day supplementation period, as would typically occur in a drought (Table 1). Poplar supplementation slightly reduced liveweight loss over the period of supplementation and markedly increased reproductive rate (Table 1). The high rate of poplar supplementation reduced liveweight loss by 15g/day ($P<0.05$) and body condition score by 0.53 points ($P<0.001$) (Table 1). Ultrasound pregnancy scanning showed increases in reproductive rate of 41% ($P<0.001$) for the high and 25% ($P<0.01$) for the low rate of poplar supplementation, compared to the control group. At lambing, the advantage in reproductive rate decreased to 34% ($P<0.001$) for the high and 20% ($P<0.05$) for the low treatment groups. The increase in reproductive rate, in ewes supplemented with poplar, was due to increases in conception rate and number of multiple-births.

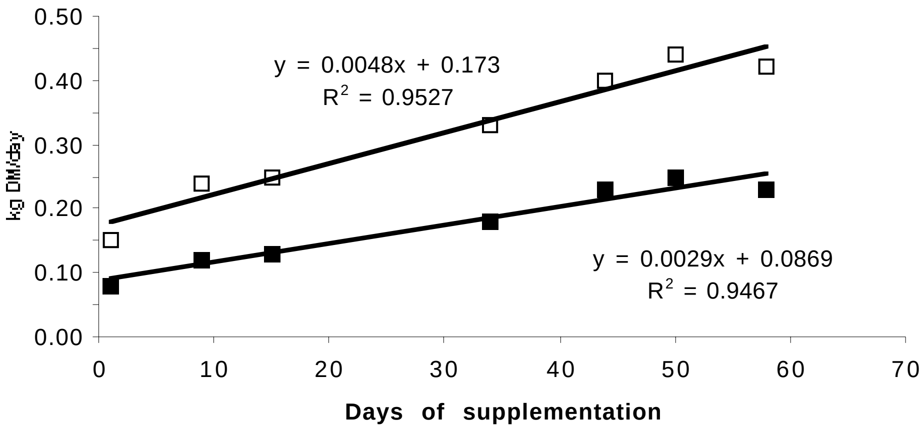
There were no effects of poplar supplementation on ewe fleece weight or in the live weight of single- and twin-born lambs at weaning.

TABLE 1: Pasture mass, composition of pasture diet selected, live weight change and reproductive rate in ewes supplemented with high or low amounts of poplar or no poplar for 71 days, including the mating period, when grazing low quality drought pasture.

	Control	Low	High	SEM
Poplar offered: (kg fresh/day)	0	0.75	1.50	.
Ewes/group	100	100	100	
Pasture mass: (kg DM/day)				
Pre-grazing	1034	1044	1042	.
SEM	(94.3)	(93.7)	(101.7)	
Post-grazing	533	547	512	.
SEM	(52.4)	(39.9)	(49.3)	
Composition of pasture diet selected: (g/kg DM)				
Total N	17.0	18.4	18.0	.
SEM	(1.9)	(1.5)	(1.8)	
NDF	623.2	621.0	623.2	.
SEM	(10.6)	(15.0)	(12.5)	
OMD	0.537	0.549	0.538	.
SEM	(0.007)	(0.015)	(0.009)	
Liveweight and body-condition-score change:				
Live weight (g/day)	-82[a]	-71[ab]	-67[b]	5.24
Body condition score (units)	-1.31[a]	-1.27[a]	-0.78[b]	0.05
Reproductive data:				
Conception rate (% ewes mated)	93	96	100	.
Scanning[1]	122[a]	147[b]	163[b]	5.7
Lambing[1]	121[a]	141[b]	155[b]	5.8
Docking[1]	97[a]	113[ab]	127[b]	6.4
Weaning[1]	96[a]	113[ab]	125[b]	6.4

1. Lambs per 100 ewes mated.
a,b. Means within rows with different superscripts differ significantly ($P<0.05$).

FIGURE 1: Change in the amount of poplar consumed over time in ewes offered low and high amounts of poplar as a supplement to drought pasture. ❑ High poplar supplementation (n=100) ■ Low poplar supplementation (n=100)



It can be concluded that poplar supplementation of ewes grazing drought pasture substantially increased reproductive rate. An obvious explanation is that this was caused by the higher feed intake of the supplemented groups during mating (i.e., a flushing effect). However, it seems unlikely that all the increase in reproductive rate in poplar-supplemented ewes can be explained by the increase in the amount of feed consumed by those groups, as the reduction in liveweight loss and loss in body condition were much smaller than the increase in reproductive rate. The CT content of poplar tree fodder (6g/kg DM) may explain some of the increase in reproductive rate, as CT increases protein absorption and utilisation (Barry & McNabb, 1999). Studies by Min *et al.* (1999 & 2001) have shown that feeding CT-containing *Lotus corniculatus*, during mating, similarly increased reproductive rate by 20 to 30%. Further research is needed to establish the mechanism of how a relatively small quantity of poplar consumed causes such a large increase in reproductive rate.

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REFERENCES

Barry, T.N.; McNabb, W.C. 1999: The implications of condensed tannins on the nutritive value of temperate forages fed to ruminants. *British journal of nutrition 81:* 263-272

Leng, R.A. 1992: Drought Feeding Strategies: Theory and Practice. University of New England. Penambul Books

McCabe, S.M.; Barry T.N. 1988: Nutritive value of Willow (*Salix* sp.) for sheep, goats and deer. *Journal of the science of food and agriculture 111:* 1-9

Min, B.R.; McNabb, W.C.; Barry, T.N.; Kemp, P.D.; Waghorn, G.C.; McDonald, M.F. 1999: The effect of condensed tannins in *Lotus corniculatus* upon reproductive efficiency and wool production in sheep during late summer and autumn. *Journal of agricultural science 132:* 323-334

Min, B.R.; Fernandez, J.M.; Barry, T.N.; McNabb W.C.; Kemp, P.D. 2001: The effect of condensed tannins in *Lotus corniculatus* upon reproductive efficiency and wool production in ewes during autumn. *Animal feed science & technology 192:* 185-202

Roughan, P.G.; Holland, R. 1977: Predicting *in vitro* digestibilities of herbages by exhaustive enzymatic hydrolysis of cell walls. *Journal of the science of food and agriculture 28:* 1057-1064

Salinger, J. 2000: The genesis of a new ark: Integrating preparedness for increasing climate variability and change. Managing the Impacts of Climate Variability: The Noah Paradigm. NIWA. Auckland, New Zealand

SAS 2001: Version 8e. SAS Institute. Cary, NC, USA

Terrill, T.H.; Rowan, A.M.; Douglas, G.B.; Barry, T.N. 1992: Determination of extractable and bound condensed tannin concentration in forage plants, protein concentrate meals and cereal grains. *Journal of the science of food and agriculture 58:* 321-329

Wilkinson, A.G. 1999: Poplars and willows for soil erosion control in New Zealand. *Biomass and bioenergy 16:* 263-274