

EFFECTS OF ABOMASAL SUPPLEMENTS OF L-CYSTINE AND DL-METHIONINE
ON WOOL PRODUCTION AT PASTURE

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SUMMARY

Intra-abomasal infusion of 3.2 g/d of DL-methionine increased clean wool production from 6.2 to 8.2 g/d over a 41-week period in fine-wool Merino wethers at pasture whereas a dose rate of 0.8 g/d produced a non-significant increase to 7.1 g/d of clean wool. Frequency of infusion (twice daily, once daily or on alternate days) did not affect wool growth.

In a second experiment fine-wool Merino wethers were given daily intra-abomasal infusions of L-cystine at dose rates ranging from 0.26 to 4.10 g/d of DL-methionine at equivalent dose rates ranging from 0.32 to 5.12 g/d. Over a 33-week period at pasture, treated sheep produced 20% (cystine) and 24% (methionine) more clean wool than untreated control sheep. Rate of growth of clean wool (W g/d) by supplemented animals over three-week intervals was related to dose rate (D g/d) of amino acid by:

$\log w = 0.3309 - 0.0226/D + 0.6779 \log C$ for methionine-treated animals and
 $\log w = 0.5123 - 0.0300/D - 0.0236 D + 0.4917 \log C$ for cystine-treated animals, where C is the contemporary growth rate (g/d) of clean wool by untreated control sheep.

INTRODUCTION

Many experiments with penned animals have demonstrated increased rates of growth of wool in response to sulphur-containing amino acids (usually L-cystine or DL-methionine) administered so as to avoid degradation in the rumen (Reis 1979). Langlands (1970) reported 30-40% increases in wool growth by sheep at pasture receiving daily intra-abomasal injections of DL-methionine over a 4-week period. The present experiments aimed to examine at pasture the importance of frequency of dosing and to establish the relationship over prolonged periods (8-10 months) between dose of amino acid and wool growth by grazing sheep. Both methionine and cystine were administered to fine-wool Merino wethers enabling differences in response between methionine and cyst(e)ine (Reis 1979) to be examined.

MATERIALS AND METHODS

Experiment 1

Twenty-five fine-wool Merino wethers with abomasal cannulae and aged six or seven years were grazed together on 1.6 ha of *Phalaris aquatica*. Seven were randomly chosen as controls and the remainder received 0.8 or 3.2 g/d of DL-methionine administered twice daily, daily or on alternate days from February to November.

Feed grade DL-methionine, dissolved in 0.001 N HCl at 32 g/l was injected via the abomasal cannula into "daily" and "alternate day" sheep at about 1000 hr. Each "twice-daily" sheep carried a reservoir from which infusions were allowed to drain slowly into the abomasal cannula commencing at about 0900 hr and 1630 hr on five days per week and at 0900 hr on two days per week.

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From November, these sheep, together with those from Experiment 2, grazed for six months on a *Phalaris* pasture at a stocking rate of 10/ha.

Experiment 2

Polyethylene tubing (2.8 mm bore) was implanted into the abomasum of 29 fine-wool Merino wethers and exteriorized on the flank. These sheep and a further seven fistulated at the abomasum grazed *Phalaris aquatica* as one flock at 20/ha. Six animals served as untreated controls and the remainder (3 per treatment) received L-cystine or DL-methionine at rates of B, 2B, 4B, 8B or 16B where B was 0.26 g/d for cystine. For methionine, B was 0.32 g/d on the assumption that one gram of methionine was metabolically equivalent to 0.8 g cystine. Doses were given once daily into the abomasum for 33 weeks from April to November; thereafter the sheep grazed with those from Experiment 1. Methionine was dissolved in 0.001 N HCl at 32 g/l and cystine in 0.2 N HCl at 10.2 g/l.

In both Experiments 1 and 2 dyebands were applied to the wool at three-week intervals, and the clean wool weight measured at shearing was apportioned between successive three-week periods and for an 18-week post-experimental period by the method of Chapman and Wheeler (1963). When comparing data from cystine and methionine, dose rates of methionine were expressed as their cystine equivalent assuming 1 g methionine = 0.8 g cystine.

RESULTS

Experiment 1

Clean wool production differed ($P < 0.05$) between high and low dose rates of methionine but there was no significant effect of either frequency of administration or of the interaction of frequency and dose (Table 1).

TABLE 1 Effect of level and frequency of methionine administration on mean clean wool production (g/d)[†] - Experiment 1.

Dose methionine	Twice daily	Daily	Alternate days	Mean
Nil				6.2 ^{††}
0.8 g/d	6.7	7.5	7.1	7.1
3.2 g/d	8.2	8.1	8.4	8.2

[†] Adjusted using wool produced from 6-24 weeks post-treatment as covariate.

^{††} Adjusted value for untreated animals calculated using the regression coefficient (0.744 ± 0.16) derived from the data for methionine-treated animals.

Sheep receiving 0.8 g/d of methionine grew slightly more wool than control animals, but the difference was not significant. However, sheep dosed with 3.2 g/d of methionine grew 30% more clean wool than control animals, a difference that was highly significant.

Experiment 2

Preliminary examination of wool growth data (Table 2) indicated that the response in wool growth to a given dose of amino acid was negatively related to rate of growth of wool by untreated sheep in the same paddock. In addition, rate of wool growth was unusually lower at amino acid levels of 8B and 16B than it was at 4B (Table 2) particularly for cystine-supplemented animals. Consequently, the data were examined in a multiple regression of the form:

$$\log W = b_5 + b_1/D + b_2D + b_3 \log C + b_4 \log U;$$

where W = g/d clean wool grown by treated animals during a three-week period,
 D = g/d amino acid administered *per abomasum*,
 C = g/d clean wool grown by untreated animals during the same three-week period in the same paddock,
 U = g/d clean wool grown by the animal during the post-experimental uniformity period.

TABLE 2 Effect of level of methionine and cystine administration (over 33 weeks) on wool production (g clean wool/d) - Experiment 2

Relative dose	0	B	2B	4B	8B	16B
methionine (g/d)	0	0.32	0.64	1.28	2.56	5.12
Apr. - May	6.1	6.2	6.3	7.1	7.2	7.3
June - Aug.	4.3	4.9	5.7	6.3	6.1	5.4
Sept. - Nov.	5.2	6.6	5.9	7.0	6.8	6.8
Overall	5.1	5.9	5.9	6.8	6.7	6.4
Cystine (g/d)	0	0.26	0.51	1.02	2.05	4.10
Apr. - May	6.1	7.6	6.8	7.6	6.6	6.3
June - Aug.	4.3	5.6	5.7	7.2	5.6	5.2
Sept. - Nov.	5.2	5.7	5.0	5.9	5.7	6.7
Overall	5.1	6.2	5.8	6.8	5.9	6.0

Data from the methionine-treated animals yielded a non-significant value of b_2 . Consequently the regression was simplified to

$$\log W = -0.3648 - 0.0266/D + 0.6779 \log C + 0.7706 \log U \quad (1)$$

(RSD = 0.10; $r = 0.56$)

At the mean value of U (8.0 g/d), the equation becomes

$$\log W = 0.3309 - 0.0266/D + 0.6779 \log C \quad (2)$$

Data from the cystine-treated animals yielded the equation

$$\log W = 0.3607 - 0.0300/D - 0.0236 D + 0.4917 \log C + 0.9554 \log U \quad (3)$$

(RSD = 0.10; $r = 0.54$)

At the mean value of U (8.2 g/d), the equation becomes

$$\log W = 0.5123 - 0.0300/D - 0.0236 D + 0.4917 \log C \quad (4)$$

Combined Data - Experiments 1 and 2

When a regression of the type in Equation 1 was fitted to the data from Experiment 1, the resulting equation was not significantly different from Equation 1. Consequently, the data from all animals receiving methionine in Experiments 1 and 2 were pooled and the equation

$$\log w = -0.3559 - 0.0307/D + 0.7215 \log C + 0.7394 \log U \quad (5)$$

(RSD = 0.09; $r = 0.72$)

was derived, which at the mean value of U (7.8 g/d) becomes

$$\log W = 0.3027 - 0.0307/D + 0.7215 \log C \quad (6)$$

Data from cystine-treated animals differed significantly from those of methionine-treated animals irrespective of whether regressions of the type in