RESPONSES OF YOUNG SHEEP TO SUPPLEMENTS

R.M. DIXON* **, R. THOMAS*, A. THALEN* AND A.R. EGAN*

SUMMARY

Three pen experiments were undertaken to investigate growth responses of young BL x M wether lambs fed medium quality roughage (0.85 oat/0.15 lucerne hay mixture) or barley straw to various levels and types of supplement. Supplements examined included barley grain fortified with urea and inorganic (Bar/N/S), lupins, cottonseed meal (CSM), fishmeal (FM) and formaldehyde treated casein (F.casein) and urea and inorganic sulphur. Measurements included intake, liveweight (LW) change, in *vivo* digestibility and wool growth. Voluntary intake of lambs fed the oat/lucerne hay alone was high (Experiment A and B) (59 and 74 g DM/kg $W^{0.75}$.d). Isonitrogenous amounts of CSM, lupins and Bar/N/S supplements fed at up to 10 g DM/kg LW.d increased LW gain similarly. Greater intake of metabolizable energy (ME) observed with FM supplement was associated with higher digestibility of the roughage rather than increased intake of roughage, and higher LW gain with the FM supplement was due partly to higher ME intake and partly to greater efficiency of utilization of ME for LW gain In Experiment C voluntary intake of barley straw fed alone was low (38 g DM/kg $W^{0.75}$.d) and lambs lost LW rapidly. CSM and FM-based supplements increased LW more per g of supplement and per MJ dietary ME intake than equivalent levels of Bar/N/S supplement. Efficiency of utilization of ME for LW change was similar in the lambs fed straw and CSM or FM-based supplements and in the lambs fed the oat/lucerne hay mixture alone or with supplements. It is proposed that the low efficiency of use of the Bar/N/S supplement by the lambs fed straw was associated with a low protein:energy (P:E) ratio of absorbed nutrients, and that as this ratio was increased by the CSM and FM supplements efficiency of utilization of ME also increased. Furthermore, we postulate that in lambs fed the oat/lucerne hay mixture alone the P:E ratio approached the optimum for these lambs, and thus CSM and FM supplements with this roughage had a smaller effect on the efficiency of utilization of ME for LW gain. When medium quality roughage was fed Grazfeed predictions of LW gain responses of the lambs to supplements were close to the observed responses for CSM supplements, but responses were overestimated for Bar/N/S and lupin supplements and underestimated for FM supplements. When straw was fed Grazfeed predictions of lamb growth were not satisfactory.

INTRODUCTION

Despite numerous experiments and reviews on responses to supplements by ruminants in various physiological states and consuming various amounts and types of roughage, animal responses to supplements are often difficult to predict and the topic remains controversial (Kellaway and Liebholz 1981; Preston and Leng 1987; Leng 1991: Rowe et al. 1991). This is most obviously due to the complexity of factors involved in the ability of a specified supplement to change the quantity and array of absorbed nutrients, the consequences of physiological state and nutritional history on animal responses and the potential of animals in a grazing herd situation to modify the above factors.

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The experiments reported in this paper were undertaken as part of a project attempting to improve the prediction of responses by grazing sheep to supplements. The project has initially focussed on the ability of various levels of several classes of supplements to increase LW changes of lambs of a genotype (Border Leicester x Merino) commonly used for prime lamb production, and where roughage was readily available and of medium quality (such as in early summer when pasture is partly senesced and lamb growth declines) or of low quality (such as with fully senesced grass pasture). Supplements examined have been cereal grain (barley and oats plus or minus fortification with urea and inorganic sulphur), lupins as a grain legume, cottonseed meal (CSM) and sunflower meal (SFM) as oilseed meals likely to supply low and high amounts of undegraded dietary protein (UDP), fishmeal (FM) and formaldehyde-treated casein (F.casein) as high-quality proteins containing high proportions of UDP and urea and inorganic sulphur as sources of microbial substrates. The first experiment of this series was reported by Ponnampalam et al. (1992). To make comparisons with responses to supplements predicted by current Australian feeding standards (SCA 1991) the growth responses observed in the present series of experiments have been compared with those predicted by the Grazfeed software package.

MATERIALS AND METHODS

General

Experiments A, B and C consisted of feeding trials during which young, recently weaned lambs were fed a basal roughage diet and a range of supplements for 10 to 12 weeks. A similar set of procedures was used for each of the experiments. Border Leicester x Merino wether lambs (4-6 months of age, initially 20-28 kg LW and condition score 1.5 to 2.5) were purchased from commercial farms. Lambs were housed indoors in individual pens, and experiments commenced after 2-4 weeks to allow recovery from transport. Sixty lambs were used in Experiments A and C, and 90 lambs in Experiment B.

The basal roughage diet fed during Experiments A and B consisted of chopped oat hay fed *ad* libitum and chopped lucerne hay offered at 0.17 of the previous day's intake of oat hay. A mineral mixture (20 g/d) was also fed. The two hays were given each day in separate feeders, and the oat hay was fed about 20% in excess of intake. Supplements were offered twice each week and were mixed with the lucerne hay allocation. The basal diet fed during Experiment C consisted of chopped barley straw also offered at a level of approximately 20% in excess of the previous intake, and a mineral mixture was also fed.

Measurements were made each day of intake of roughage and supplement, and each week of the liveweight (LW) of the lambs. Wool growth on midside patches was measured by clipping after approximately 4 and 10 weeks of the experiment. Growth of clean wool (Experiments A and B) or greasy wool (Experiment C) on the midside patches was calculated as mg wool per 100 mm x 100 mm patch per day (mg/p.d). Total collections of faeces and urine voided during a 7-day period were made from all sheep, collections being made in blocks of *30* sheep within each experiment. The feeding and total collection procedures used were standard to our laboratories, and have been described by Doyle et al. (1988).

Experiment A

In Experiment A lambs were fed the oat/lucerne hay roughage either alone (T1) or were fed approximately isonitrogenous amounts (11-12 g N/d) of six supplements; T2, barley grain fortified with urea and sodium sulphate (Bar/N/S) (10 g/kg LW.d); T3, lupin grain (10 g/kg LW.d), T4, cottonseed meal (CSM) (6.5 g/kg LW.d); T5, sunflower meal (SFM) (8.6 g/kg LW.d), T6, fishmeal (FM) (4.1 g/kg LW.d), and T7, formaldehyde-treated casein (F.casein) (3.1 g/kg LW.d). The barley grain was fortified with 180 ml/kg air dry grain of a solution of urea (322 g/l) and sodium sulphate (67 g/l), which was mixed with the grain immediately before feeding. The total N content of the Bar/N/S used in this experiment was similar to that of lupins. The formaldehyde treated casein was prepared from hydrochloric acid casein (60/40 mesh) by spraying formaldehyde solution (40% w/w; 8 g formaldehyde per kg protein) over the casein while it was being mixed in a horizontal mixer, followed by storage in plastic bags for at least one week.

Experiment B

In Experiment B the lambs were fed the oat/lucerne hay roughage either alone (T1) or were fed one of four levels, each approximately isonitrogenous of Bar/N/S, lupin grain or CSM, or one level of fishmeal. Thus treatments T2, T3, T4 and T5 consisted of 2.5, 5, 10 and 20 g/kg LW.d respectively of Bar/N/S, and treatments T6, T7, T8 and T9 of the same amounts of lupin grain. Treatments T10, T11, T12 and T13 consisted of 1.6, 3.2, 6.5 and 13 g CSM/kg LW.d. The one level of FM (T14) (4.1 g FM/kg LW.d) was approximately isonitrogenous with T4, T8 and T12. Amounts of supplement N provided ranged from 4 to 22 g N/d).

Experiment C

In Experiment C the lambs were fed barley straw roughage either alone (T1) or supplemented with one of three levels, each level approximately isonitrogenous (5, 10 and 20 g N/d), of Bar/N/S, CSM or a FM/lucerne hay mixture (FM/L, 0.40:0.60) or one level (6.0 g N/d) of urea and sodium sulphate solution mixed with the roughage (T11). Treatments T2, T3 and T4 consisted of 3, 6 and 12 g/kg LW.d of Bar/N/S, treatments T5, T6 and T7 consisted of the same amounts of CSM, and treatments T8, T9 and T10 of the same amounts of FM/L. The barley grain was fortified with 145 ml/kg air dry grain of a solution of urea (644 g/l) and sodium sulphate (133 g/l) which was mixed with the grain immediately before feeding, and the total N content of the Bar/N/S was similar to that of CSM. A mixture of fishmeal and lucerne hay was used to obtain a supplement which would be consumed by the lambs, but since approximately 71% of the total N in the FM/L mixture was fishmeal N it was expected that the animal responses would largely reflect the fishmeal component of the supplement.

Analyses and calculations

Laboratory analysis of components of feed, faeces and urine were carried out using procedures described by Doyle et al. (1988). Liveweight change of lambs was calculated by regression of LW with time. Metabolizable energy (ME) intake was calculated from organic matter (OM) (Experiments A and B) or dry matter (DM) (Experiment C) digestibility measured by total collection of faeces, and use of the prediction equations 1.13B and 1.13C described by SCA (1990).

The substitution of supplement for roughage and the LW change responses observed in the lambs were compared with the responses which were predicted by the Grazfeed (Version 1.3, Horizon Agriculture Pty Ltd) software package. Since Grazfeed is intended for the grazing animal situation and does not allow direct entry of the amount or quality of roughage consumed in pens, inputs for the quality of pasture were based on the measured digestibility and other known parameters of the roughage. A set of inputs were arbitrarly chosen where Grazfeed predicted roughage intake and LW gain reasonably well, and then changes predicted by Grazfeed in roughage intake and LW change due to the supplements were compared with the actual changes in these responses measured in the experiments.

RESULTS

The total N contents of the oat hay used in Experiment A and B were 8.5 and 10.5 g N/kg DM respectively, and of the lucerne hay 35 and 34 g N/kg DM respectively. N contents of the supplements were: barley grain 19 g N/kg DM, lupin grain 51 g N/kg DM, CSM 73 g N/kg DM, FM 124 g N/kg DM and SFM 57 g N/kg DM. The total N content of the straw used in Experiment C was 5.5 g N/kg DM.

Table 1 Experiment A. Measured intake and productivity of crossbred lambs fed on oat hay/lucerne hay mixture *ad lib.* and supplements (n = 8 to 10). Mean initial LW 26 kg. Supplements provided 11-12 g N/d

Treatment	DM intake (g/kg $W^{0.75}$.d)			OM dig (%)	ME intake (MJ/d)	LW gain (g/d)	FC (g LW /MJ ME)	Wool (mg /p.d)
	Rough	Supp	Total					
Control (T1)	59	0	59	58	5.4	46	8.5	62
+Bar/N/S (T2)	47	20	67	66	7.3	103	14.2	84
+ Lupins (T3)	42	18	60	69	7.1	98	13.7	90
+ CSM (T4)	54	11	65	62	6.8	96	14.2	90
+ SFM (T5)	47	16	63	61	6.2	82	13.3	86
+ FM (T6)	61	7	68	65	7.6	126	16.5	102
+F.casein (T7)	61	6	67	63	7.2	110	15.4	98
s.e.m.	1.9	-	1.3	1.0	0.18	7.6	1.1	4.4
Signif.	***	-	***	***	***	***	***	***

In Experiment A intake of roughage when fed alone was 59 g DM/kg $W^{0.75}$.d and was reduced by the Bar/N/S, lupin and SFM supplements with substitution rates for these supplements in the range 0.6-0.7 (Table 1). Roughage intake was not changed by the CSM, FM or F.casein supplements. Differing effects of the supplements on OM digestibility resulted in ME intake being increased to a similar extent by the Bar/N/S, lupin and CSM supplements from 5.4 MJ/d for the control lambs to 6.8-7.3 MJ/d. FM tended to further increase ME intake to 7.6 MJ/d. FM supplements increased digestibility of both total OM and the fibrous components of the diet; for example cellulose digestibility across the entire gastrointestinal tract was increased from 50% in the control diet to 55% with the FM diet. LW gain was increased by all the supplements. LW gain for Bar/N/S, lupins and CSM (96-103 g/d) was greater than for the unsupplemented lambs (46 g/d), and less than for FM (126 g/d). Across all treatments LW gain was correlated with ME intake (Fig 1). The higher growth with FM was associated partly with a high intake of ME, and apparently partly with increased efficiency of use of ME for LW gain. Efficiency of conversion of supplement N to LW gain was similar for the Bar/N/S, lupins and CSM treatments (4.4-4.6 g LW gain/g supplement N), lower for SFM (3.1 g LW gain/g supplement N) and higher for FM and F.casein (6.7 and 5.4 g LW gain/g supplement N respectively).

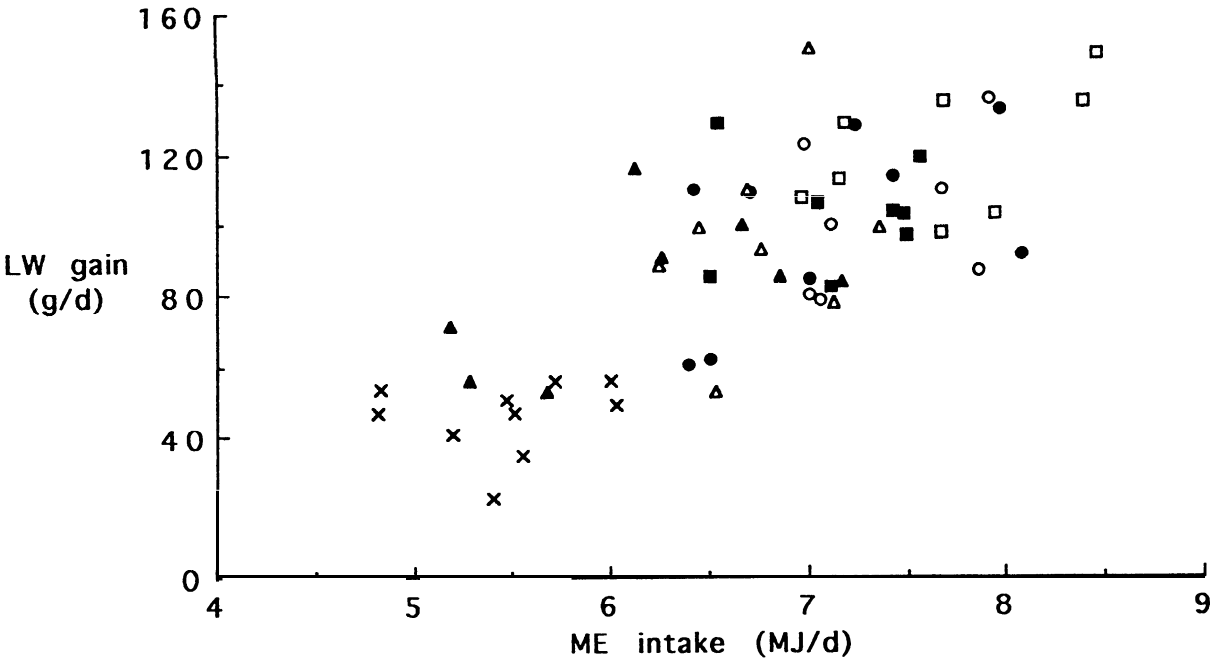

Figure 1. The relationship between ME intake and liveweight gain in Experiment A. Symbols for the various treatments are as follows; T1 x, T2 O, T3 ●, T4 ▲, T5 △, T6 □, T7 ■. The equation of the regression relationship was Y= -89 + 27 x (R^2=0.54)

In Experiment B intake and LW gain of the unsupplemented control diet lambs were higher than in Experiment A by 25% and 70% respectively (Table 2). However, the responses in terms of substitution rates and increase in LW gain due to supplements were similar to those observed with similar levels of the same supplements in Experiment A. For the full range of supplement intakes the increase in LW gain per unit of supplement intake was curvilinear for Bar/N/S supplement, tended. to be curvilinear for lupins and was linear for CSM. However, increases in LW gain per unit of supplement N up to 12 g supplement N/d could be well described by a single regression relationship for all three types of supplement, and was increased 3.1 g LW gain/d for each g supplemental N. However, this increase was less than with the fishmeal supplement (4.2 g LW gain/d supplement N).

When the responses to supplements predicted by Grazfeed were compared with those actually observed in Experiment A the substitution rate of supplement for roughage and the increase in LW gain due to CSM supplement were predicted reasonably well by Grazfeed. However, when Bar/N/S or lupin supplements were fed the substitution rate predicted by Grazfeed (0.3-0.4) was much lower than the observed rate (0.6-0.8), and the predicted increase in LW gain due to the supplements (85-92 g/d) was much greater than the observed increase in LW gain (52-57 g/d) (Fig 2). In contrast when FM supplement was fed the predicted SR (0.3) was much greater than the observed SR (-0.7), and the predicted increase in LW gain (32 g/d) was much less than the observed increase (80 g/d). When similar comparisons between observed and predicted substitute rates and LW gain responses were made for results from Experiment B, trends were similar to those found for Experiment A (Fig 3). Hence Grazfeed seriously overestimated the LW gain response to the cereal grain based or grain legume supplements, but underestimated the value of fishmeal supplement.

Table 2 Experiment B. Measured intake and productivity of crossbred lambs fed on oat hay/lucerne hay mixture ad lib. and supplements (n = 6 to 9). Mean initial LW 26 kg

Treatment	DM intake (g/kg $W^{0.75}$.d)			OM dig (%)	ME intake (MJ/d)	LW gain (g/d)	FC (g LW /MJ ME)	Wool (mg /p.d)
	Rough	Supp	Total					
Control (T1)	74	0	74	60	7.0	78	12	64
+ Bar/N/S (T2)	68	6	74	60	7.0	81	12	64
+ Bar/N/S (T3)	67	10	77	60	7.5	100	14	68
+ Bar/N/S (T4)	60	18	78	61	8.0	131	17	70
+ Bar/N/S (T5)	48	28	76	61	7.8	125	18	71
+ Lupins (T6)	70	6	76	60	7.3	79	12	62
+ Lupins (T7)	68	10	78	63	8.1	112	14	66
+ Lupins (T8)	55	18	73	65	8.2	128	16	84
+ Lupins (T9)	34	34	68	70	8.6	144	18	79
+ CSM (T10)	74	4	78	61	7.7	86	12	64
+ CSM (T11)	69	6	75	60	7.2	96	14	71
+ CSM (T12)	66	12	78	59	7.7	114	16	81
+ CSM (T13)	64	23	87	61	9.4	155	17	88
+ FM (T14)	63	8	71	65	8.1	143	18	96
s.e.m.	2.2	-	2.3	1.1	0.32	10	1.2	5.3
Signif.	***	-	***	***	*	***	***	***

In Experiment C intake of straw when fed alone was only 38 g DM/kg $W^{0.75}$.d even though the DM digestibility was 54% (Table 3). Sheep fed this diet consumed only 2.8 MJ ME/d and lost LW at 28 g/d. Addition of urea and inorganic S increased ME intake to 3.7 MJ/d, and these sheep also lost LW at 10 g/d. Straw intake decreased linearly with increasing levels of each of the supplements but the substitution rate was greater for the Bar/N/S supplement (0.4) than for the CSM or FM/L supplements (0.2). ME intake increased linearly by approximately 1 MJ per 100 g supplement DM, and there was little difference between the supplement types. However, LW change was increased much more by the CSM and FM/L supplements (4.0-4.6 g LW change/g supplement N or 0.26-0.30 g LW change/g supplement DM) than by the Bar/N/S supplement (2.6 g LW change/g supplement N or 0.17 g LW change/g supplement DM). Hence ME was used considerably more efficiently for LW maintenance and LW gain in the lambs supplemented with CSM and FM/L than in the lambs supplemented with Bar/N/S.

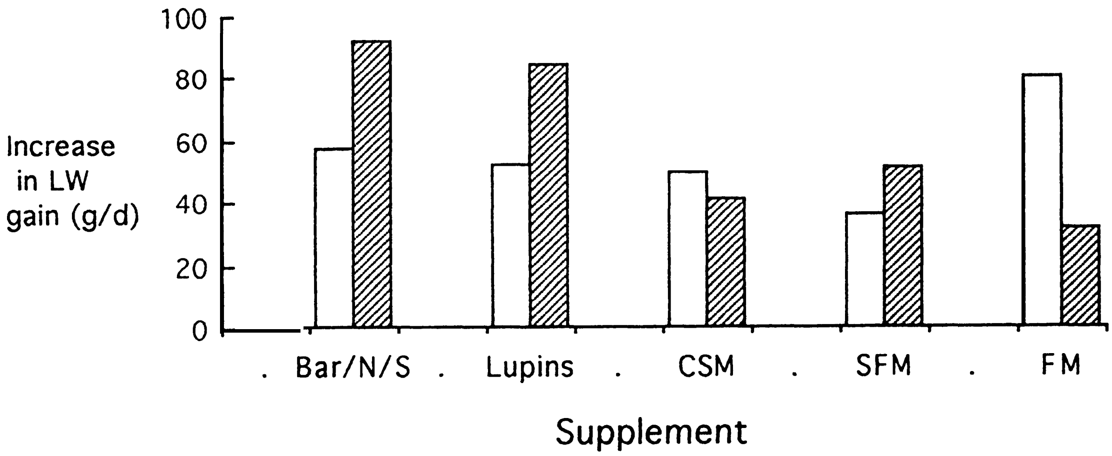

Figure 2 Experiment A. A comparison of measured increases (□) in LW gains due to supplements compared with those predicted (▨) from Grazfeed for lambs fed medium quality roughage and isonitrogenous supplements of fortified barley (Bar/N/S), lupins, cottonseed meal (CSM), sunflower meal (SFM) and fishmeal (FM)

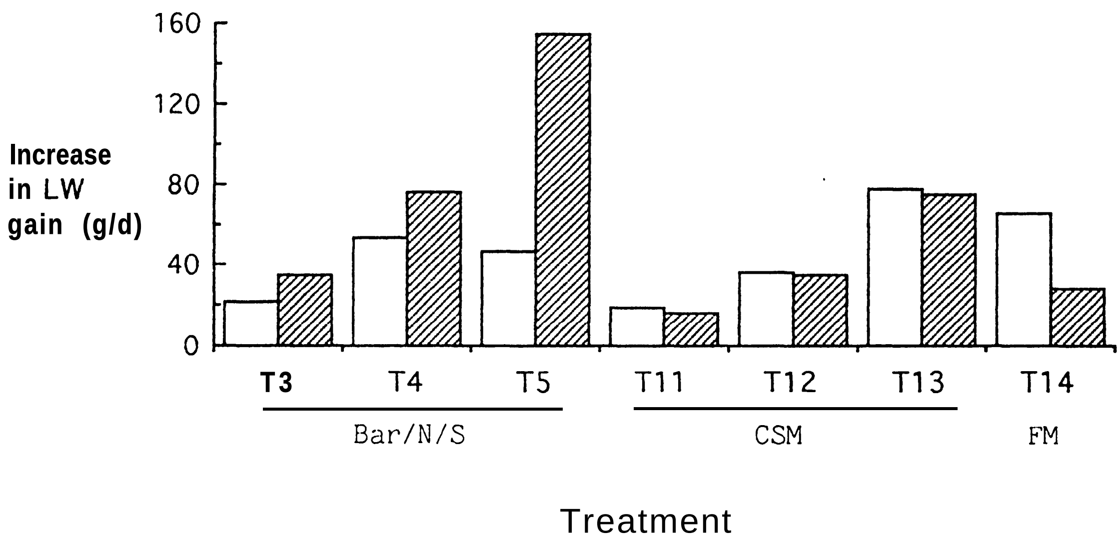

Figure 3 Experiment B. Comparison of measured increases (□) in LW gains due to supplements compared with those predicted from Grazfeed (▨) for lambs fed medium quality roughage and various levels of supplements of fortified barley (Bar/N/S), cottonseed meal (CSM) and fishmeal (FM). Results for lupins (not shown) were similar to those for the fortified barley

DISCUSSION

When lambs were fed the oat/lucerne hay mixture in Experiments A and B voluntary intake of the hay was high in the absence of supplements (59 and 74 g DM/kg $W^{0.75}$.d respectively). The general correlation between ME intake and LW gain across the range of supplement treatments, and the observation that the LW gain response attributable to the UDP component of FM or F.casein (as opposed to the LW gain response due to increased ME intake) was only about 10 g LW gain/d, indicating that only small changes occurred in the efficiency of utilization of ME for LW in these lambs. Isonitrogenous amounts of Bar/N/S, lupin and CSM supplement resulted in similar increases in ME intake, but the extent to which changes in roughage intake or digestibility contributed to the change in ME intake varied between the supplements. Roughage intake was severely reduced by the Bar/N/S and the lupin supplements, but since digestibility of the diet was increased there was an overall increase in ME intake. In contrast with the CSM supplement roughage intake was little affected and total intake increased, but digestibility was not increased as much as for Bar/N/S or lupin supplements. Roughage intake also tended to be maintained with FM supplement, and because OM digestibility was increased by 5-7 percentage units the ME intake was increased over the unsupplemented control diet by 41% and 16% in Experiments A and B respectively. In Experiment A digestibility of hemicellulose and cellulose were each increased by 5% units by FM supplements, but not by F.casein or CSM supplements. Several laboratories (McAllen 1991; Hussein et a1.1991; Stritzler et al. 1992) have reported similar increases in digestibility of OM and fibrous components of roughage diets due to fishmeal supplements. The most likely reason for such increases in digestion would appear to be that FM was an effective source of microbial substrates such as peptides and amino acids which increased digestion of fibrous components in the rumen.

In contrast in Experiment C where cereal straw was used as the basal roughage and where voluntary intake of the roughage was low, the growth responses to the Bar/N/S were much lower than to the CSM or to the FM/L supplement. In part the lower growth response was associated with a higher substitution rate of Bar/N/S supplement than of CSM or FM/L and similar DM digestibilities at each level of supplementation. However, the much more important reason for the lower growth response to the fortified barley supplement was a lower efficiency of utilization of ingested ME with this supplement (13 g LW gain/MJ ME) than with the CSM or FM/L supplements (25 g LW gain/MJ ME) (Fig 4).

The similarity of the genotype and stage of growth of the sheep and the experimental conditions suggests that the difference between Bar/N/S and CSM or FM supplements in efficiency of utilization of ME was associated with differences between the roughages. The digestibility of the barley straw used in Experiment C was high (54%) for this class of roughage, and was little less than that of the oat/lucerne hay mixture used in Experiments A and B (58 and 60% respectively). However, large differences did occur between the roughages in total N content (barley straw 5.5 g N/kg DM, oat/lucerne hay mixture 12.5-14.0 g N/kg DM) and in voluntary intake. Intake of roughage fed alone was 59 and 74 g DM/kg $W^{0.75}$.d in Experiments A and B respectively, but only 38 g DM/kg $W^{0.75}$.d in Experiment C. On the basis of data derived from experimentation with cattle summarized by Owens and- Goetsch (1986) it seems likely that efficiency of microbial protein production expressed as microbial N flowing to the small intestine per kg OM digested in the rumen could have been 20-30% greater due to the higher roughage intake. Perhaps even more importantly efficiency of microbial protein production was probably reduced in the lambs fed barley straw by deficiency of substrates such as N and S in the rumen even when Bar/N/S supplements were fed.

Table 3 Experiment C Measured intake and productivity of crossbred lambs fed barley straw ad lib. and supplements (n = 5 to 8). Mean inital LW 26 kg

Treatment	DM intake (g/kg $W^{0.75}$.d)			OM dig (%)	ME intake (MJ/d)	LW gain (g/d)	FC (g LW /MJ ME)	Wool (mg /p.d)
	Rough	Supp	Total					
Control (T1)	38	0	38	54	2.8	-28	-70	59
+ Bar/N/S (T2)	34	6	40	53	3.1	-17	-38	67
+ Bar/N/S (T3)	32	12	44	61	4.5	0	0	56
+ Bar/N/S (T4)	26	24	50	64	5.7	21	36	88
+ CSM (T5)	40	6	46	58	4.4	20	35	75
+ CSM (T6)	35	12	47	62	4.8	36	63	96
+ CSM (T7)	33	23	56	62	6.1	64	94	138
+ FM/L (T8)	36	6	42	60	4.2	5	10	83
+ FM/L (T9)	33	12	45	60	4.4	25	48	116
+ FM/L (T10)	30	23	53	63	5.6	49	72	150
+ Urea/S (T11)	42	1	43	59	3.7	-10	-19	57
s.e.m.	3.6	-	1.9	11	0.19	8.4	2.4	10.3
Signif.	***	-	***	***	***	***	***	***

When fortified barley grain supplements are fed with straw on a twice-weekly basis rumen ammonia concentrations are low for much of the supplementation cycle due to the rapid absorption of ammonia from the rumen (Dixon et al. 1989). It seems likely that when cereal straw was used as the basal roughage the microbial protein supply to the lamb was low, the fortified barley grain supplement was not a very effective means to increase the microbial protein supply and the supply of absorbed amino acids and the protein:energy (P:E) ratio of nutrient supply was sub-optimal. However, CSM and FM/L supplements were more effective means to increase the supply of absorbed amino acids derived from both microbial protein and UDP, this improved the P:E ratio and this was reflected in a higher efficiency of utilization of ME for LW gain. Furthermore we postulate that in Experiments A and B where the lambs were fed the oat/lucerne hay mixture efficiency of microbial protein production was high due to the high DM intake, low retention time of rumen digesta and a more satisfactory supply of microbial substrates. This hypothesis is supported by the observation that efficiency of utilization of ME for LW gain was similar for the lambs fed the oat/lucerne hay mixture alone or fed the cereal straw and high levels of the CSM or FM/L supplements (Fig 4). Also we postulate that in Experiments A and B the efficiency of utilization of ME for LW gain was not greatly changed by the supplements high in UDP because the P:E ratio of nutrient supply from rumen digestion approached the optimum and because of differences between diets in the composition of the LW gain.

The growth responses to the lupin grain and fortified barley grain supplements were similar at levels of supplementation of up to 10 g/kg LW used in Experiments A and B and where the lambs were fed the oat/lucerne hay mixture. However, in Experiment B when 20 g/kg LW of each of these supplements was offered the LW gain tended to be higher for the lupin (144 g/d) than for the Bar/N/S supplement (125 g/d). However, at this level of supplementation 97% of the lupins but only 78% of the offered Bar/N/S was consumed. Furthermore the increase in intake of Bar/N/S from 18 to 28 g/kg $W^{0.75}$.d did not affect OM digestibility (both 61%), although the equivalent increase in level of lupin supplement increased OM digestibility from 65 to 70%. The overall effect was that ME intake was 10% higher when the lupin supplement rather than the Bar/N/S supplement was offered at 20 g/kg LW.d. This was presumably due to more severe detrimental effects of the Bar/N/S supplement on rumen fibre digestion and other consequences of acidosis even though the lupin grain was probably extensively fermented in the rumen (Dixon and Hosking 1993).

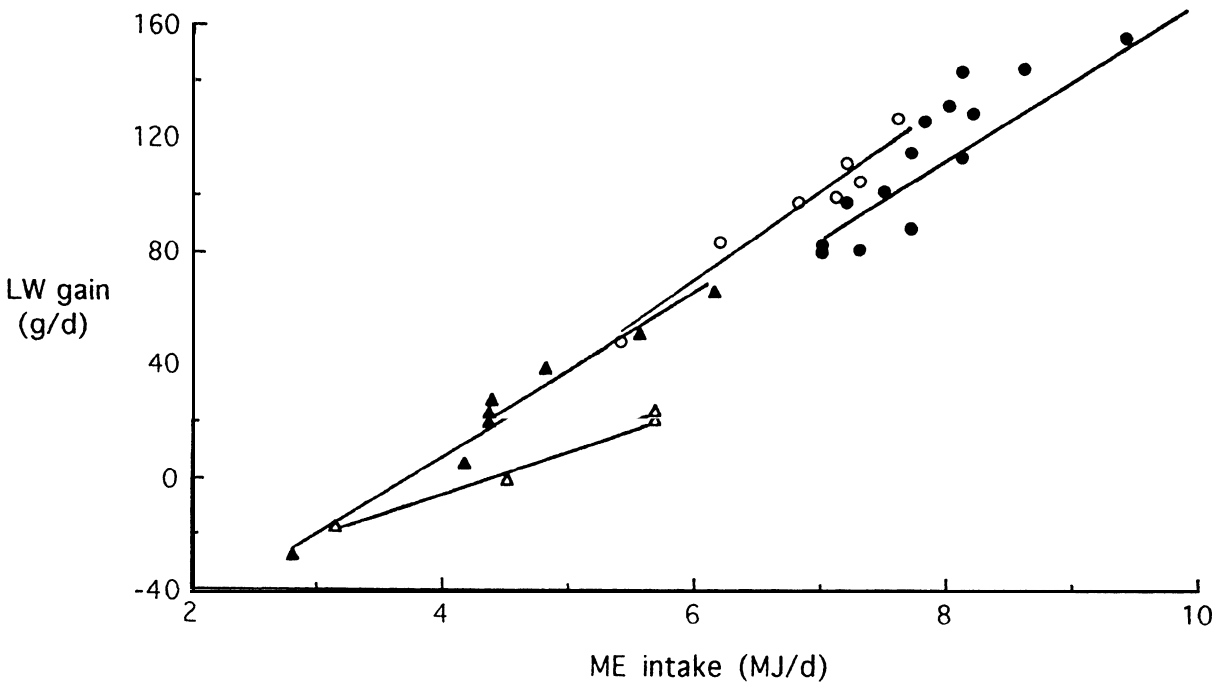

Figure 4 The relationships between ME intake and LW gain in Experiment A (0), Experiment B (●) and in Experiment C for Bar/N/S supplement (△) or CSM and FM/L supplements (▲). Means of treatment groups are shown The respective regression equations are as follows:

Experiment A (_) Y= -89 + 27 x (R^2=0.54)
Experiment B (•) Y= -47 + 21 x (R^2=0.47)
Experiment C ( ) Y= -58 + 13 x (R^2=0.34)
Experiment C ( ) Y= -92 + 25 x (R^2=0.66)

Use of Grazfeed to predict animal performance when supplements are provided appears to be less satisfactory than for animals grazing pastures without supplements. Although in lambs fed the medium quality roughage LW gain responses to the CSM supplement were close to those predicted, LW gains were overestimated when cereal grain based or lupin supplements were fed, and were underestimated when fishmeal supplements were fed. The former effect may be principally associated with interactions of rumen fermentation where fibre digestion and hence roughage intake may be reduced by fermentation of readily fermentable carbohydrate. The latter effect in these experiments may be principally associated with the increase in fibre digestion by the fishmeal supplement. No satisfactory means was found to use Grazfeed to predict growth performance of the lambs in Experiment C fed barley straw. Grazfeed predictions of LW loss were much greater than the measured LW loss. Also Grazfeed predicted that roughage intake would increase when the high N supplements were fed, but in the experiment roughage intake decreased with both the fortified barley grain and the supplements high in UDP. Further examination of the ability of Grazfeed to predict responses of grazing animals to supplementation regimes appears to be justified in view of the acceptance of Grazfeed by industry as a management tool.

In the lambs fed medium quality roughage the growth responses to isonitrogenous amounts of Bar/N/S, lupins and CSM were similar, but because of the higher N content of CSM the amount of this supplement needed to achieve a given growth response was only about 65% of the amount of lupins or Bar/N/S. However, since CSM is usually considerably more expensive per tonne than cereal grains or grain legumes, the latter supplements may still be more cost effective. In contrast the much greater response to the CSM and FM/L supplements than to the Bar/N/S supplement by the lambs fed cereal straw suggests that supplements high in UDP may be more cost effective in this situation.

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