IAFMM
international association of fish meal manufacturers
Hoval House, Mutton Lane, Potters Bar, Herts. EN6 3AR U.K.
Tel: (Potters Bar) 0707 42343 Telex: 8811909 London

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BEEF CATTLE IN DUTCH TRIAL RESPOND TO FISH MEAL - 22% SAVINGS IN COST OF SUPPLEMENTARY FEED

SUMMARY

In view of the growth responses in beef cattle fed fish meal found in extensive trials in the UK and Scandinavia, a trial has been undertaken in Holland.

The trial was carried out at the Government Institute 'Hoorn' using 36 bull beef, initially weighing 150kg. They were housed throughout and fed a maize silage diet and a high (2kg per day) or low (1.4kg per day) concentrate diet containing soyabean meal or soyabean meal plus fish meal.

Growth rates were increased feeding fish meal compared with soyabean meal on the low concentrate diets (1345g v 1248g per day) but not on the high concentrate diets (1333g v 1339g per day). The growth achieved by the bulls receiving the low concentrate diet with fish meal was almost as high as that on the high concentrate diets.

Comparing feed costs for the high concentrate soyabean meal diet with the low concentrate fish meal diet, there was a 22% saving for the latter. This reflects the more effective use of dietary energy in terms of liveweight gain achieved.

It is recommended that further trial work should be undertaken in Holland to assess the effect of feeding fish meal with reduced amounts of concentrate to maize silage fed bulls.

INTRODUCTION

Extensive trial work in the UK and Scandinavia has shown marked responses in liveweight gain of beef cattle fed fish meal as a supplement to grass silage and, in many cases, concentrates.

To extend the work to Holland, arrangements were made to carry out a trial at the Institute 'Hoorn', one of the main Government centres for ruminant nutrition in that country.

Beef cattle in Holland, usually bull beef, are generally raised indoors and fed maize silage plus compound feed. With relatively high energy intakes, growth rates achieved are high - usually over 1kg liveweight gain per day. In most of the trial work reported in the UK and Scandinavia, diets fed were based on grass silage, and growth rates were variable, often below 1kg per day. There are indications that with maize silage diets, which are relatively high in energy, beef cattle do not respond to supplementary fish meal. In the Dutch trial amounts of supplementary concentrate (high and low) were fed to find out if the response to fish meal was affected by the quantity of supplementary feed offered.

METHODS

Trial design : two supplementary proteins (soyabean meal and fish meal) and two amounts of concentrate (high and low) were tested in a 2 x 2 = 4 treatment factorial design. Four balanced groups of bulls, 9 animals in each, were randomly allocated to the treatments :

Group 1 Soyabean meal; approx. 2kg per day of concentrate (S - 100)

Group 2 Fish meal; approx. 2kg per day of concentrate (F - 100)

Group 3 Soyabean meal; approx. 1.4kg per day of concentrate (S - 67)

Group 4 Fish meal; approx. 1.4kg per day of concentrate (F - 67)

Diets : Details of the ingredient and nutrient composition of the maize silage and concentrates fed are given in appendix tables 1a and 1b. Approximate daily intakes of soyabean meal and fish meal provided by these diets were as follows :

Diet	Soyabean meal (g per day)	Fish meal (g per day)
S 100	680	0
F 100	180	340
S 67	476	0
F 67	126	204

The high level of concentrate feeding (2kg per day) was designed to provide the energy requirements (net energy) according to Dutch requirement figures whereas the low level (1.4kg per day) was designed to provide about two thirds of the Dutch requirement figure. Diets S 100 and F 100 were isonitrogenous; diets S 67 and F 67 were isonitrogenous.

Animals : 36 red and white MR1J bulls were used. They were held in

stalls and individually fed for the duration of the trial (18 weeks). Liveweights were recorded every two weeks. During the last two weeks (17 and 18) all bulls received the high level of concentrate (2kg per day) in order to equalise gut fill.

RESULTS

Feed intake

The average intakes of maize silage and concentrates over the 16 weeks treatment period were as follows :

	Intake (kg dm per day)			
	S 100	F 100	S 67	F 67
Maize silage	3.34	3.38	3.68	3.59
Concentrate	1.87	1.90	1.27	1.27
TOTAL	5.21	5.28	4.95	4.86

The intake of maize silage was higher with the lower level of concentrate feeding, partly off-setting the reduced dry-matter intake.

Liveweight Gain (kg)

	S 100	F 100	S 67	F 67
Initial weight	149.9	149.5	150.1	150.6
Daily liveweight gain (g)	1339	1333	1248	1305

* Covariance analysis was carried out on the estimated daily liveweight gain, with the estimated initial weight and covariate. The standard error of the difference between two treatment means were :

S 100 v F 100 S 67 v F 67	37.6g
S 100 v S 67	36.5g
F 100 v F 67	38.6g

At the low level of concentrate intake (67) the difference in liveweight gain on the fish meal treatment (57g per day) was greater than that on the soyabean meal treatment and approached statistical significance ($0.05 < P < 0.10$). At the high level of concentrate feeding (100) there was no difference in growth rate of bulls fed soyabean meal (S-100) or fish meal (F-100). The liveweight gain of those bulls receiving the low level of concentrate with fish meal (F-67) was similar to that of bulls fed both diets (soya and fish meal) at the high level (S-100 and F-100).

Dietary energy conversion

The intake of dietary energy (net energy) was determined and the net energy intake per kg liveweight gain calculated. Average figures for eight periods, each of two weeks, were as follows :

Dietary energy conversion (MJ net energy per kg livewieght gain)

S 100	F 100	S 67	F 67
28.7	28.9	29.6	27.2

There was an indication that less net energy was used to produce 1kg of liveweight gain in cattle fed the low level of concentrate with fish meal (F 67). However, differences were not significant.

Costings

Raw material costs (delivered to farm) prevailing in Holland in June 1985 in guilders per 100kg were fish meal (65) - 130; soyabean meal (44) - 70; sugarbeet pulp - 60; fat - 180; limestone - 12; dicalcium phosphate - 85; proprietary beef concentrate (without fish meal)- 55. Based on these costs, and the price of a beef concentrate, it is estimated that the price of the concentrate would increase to 61.5 guilders to include fish meal as shown in appendix table 1a. However, assuming similar growth could be achieved during 1.4kg of the fish meal containing concentrate rather than 2kg per head per day of the normal concentrate, the saving in cost of supplementary feed would be 22%.

Discussion

According to Dutch protein requirements[1] the high and low concentrate diets (100 and 67) should have provided sufficient protein for a daily liveweight gain of 1500g and 1000g per day respectively. In other words, protein would only have been limiting in the animals fed the low concentrate diet. This may be the reason there was a response in liveweight gain to fish meal feeding on the low but not on the high concentrate diet. It is possible that the supply of microbial protein produced in the rumen was adequate on the high but not on the low concentrate diet. The additional undegraded dietary protein (UDP) from the fish meal may have augmented the inadequate supply of microbial protein from the low concentrate diet.

[1]Benedictus N. Bedrijfsontwikkeling 8 (1977) CVB Verkorte Tabel, 1979

The more efficient conversion of dietary energy into liveweight gain by the low concentrate fish meal (F 67) could have resulted for a number of reasons, including a better supply of protein beyond the rumen in relation to protein requirements and improved fermentation in the rumen, or changes in carcass composition. If the carcass contained more lean tissue and less fat, less energy would have been required. No measurements of carcass composition were made.

The interesting practical implication of these results is that in the Dutch situation of feeding bull beef maize silage, reduction of concentrate feeding may be possible through the inclusion of fish meal, reducing production costs.

Recommendation

It is reommended that further trials with bull beef should be undertaken in Holland to assess the response to fish meal fed with reduced amounts of concentrate. As well as liveweight gain, feed intake and conversion, measurements of carcass composition should also be made.

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Appendix Table 1a Composition ($g.kg^{-1}$) of concentrates

	S-100 and S-67	F-100 and F-67
Fish meal		170
Soyabean meal	340	90
Sugarbeet pulp	600	715
Fat	20	10
Mineral/vitamin mixture*	40	15
Calculated analysis :		
VEVI**	1041	1049
Crude protein	215	223
Digestible crude protein	177	177

* The composition of the mineral/vitamin mixture was :

	S-100 and S-67	F-100 and F-67
Magnesium oxide	5	5
Calcium carbonate	7.5	-
Calcium phosphate	15	-
Salt	7.5	5
Trace element/vitamin mixture	5	5

The composition of the trace element/vitamin mixture per kg was :

Vitamin A	1,000,000 IU
" D	200,000 IU
" E	400 IU
Cu	2,000 mg
Fe	10,000 mg
Zn	10 000 mg
Mn	6,000 mg
Co	200 mg
Se	20 mg
I	100 mg
Mg	100 g
Ca	200 g

** VEVI = Net energy value (feed unit) for fattening
(VEVI x 1.65 x 4.185 = kJ net energy)

Appendix Table 1b Chemical composition of concentrates and maize silage ($g.kg^{-1}$).

	maize silage		(S - 100/S - 67)		(F - 100/F - 67)	
	Silage 1	Silage 2	calculated from feed table	by analysis	calculated from feed table	by analysis
dm	332	303	898	884	901	887
ash	19	16	92	91	85	94
cp	32	25	215	254	223	250
cfat	-	-	24	27	27	32
c.fibre	61	58	131	80	136	88
NFE[1]	220	204	436	432	430	424
VEVI	332	304	1041	1047	1049	1043
cp	32	25	215	254	223	250
dcp	18	13	177	214	177	202

[1]nitrogen free extract