COMPARATIVE NUTRITIVE VALUE OF MAIZE OIL CAKE AND UNDECORTICATED COTTONSEED CAKE FOR FATTENING LAMBS

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An experiment was designed to assess the nutritive value of maize oil cake as a substitute for cottonseed cake (undecorticated) in Sheep fattening rations. Six different rations were prepared and designated as A, B, C, D, E, and F. Ration A served as control and contained cottonseed cake (undecorticated) up to 50 per cent level. In other rations, cottonseed cake portion was decreased gradually and replaced by maize oil cake on protein equivalent basis. Non-significant differences were observed in weight gain or feed efficiency of lambs fed different experimental rations over a period of 91 days. Feed consumption was significantly higher on rations A and B than rations C, D, E and F ($P<0.05$). Differences among rations C, D, E and F was however statistically non-significant. Highest feed consumption was observed in lambs fed ration A and B, while lowest feed consumption was observed in lambs fed ration F. The difference in digestibility of dry matter, crude protein, ether extract, crude fibre and nitrogen free extract on various rations was also found to be statistically non-significant. This indicated that the digestibility of various nutrients did not differ significantly in a mixed ration containing cottonseed cake (undecorticated) or maize oil cake. Per cent nitrogen retention on various rations was also found to be non-significant. All the lambs on all the six rations remained in positive nitrogen balance.

The cost per pound of gain was highest on ration A (containing cottonseed cake) and lowest on ration F (containing maize oil cake). From the results it was, thus, concluded that maize oil cake and cottonseed cake (undecorticated) were of equal nutritive value and either of the two could be used as a substitute for the other in sheep fattening rations depending upon availability and cost.

INTRODUCTION

The high cost of the sheep rations is, in fact, chiefly due to the high cost of protein supplements like oil cakes, which constitute up to 50 per cent of the total ration. Obviously, the cheaper sources of protein would go a long way in evolving economical rations, which would in turn affect the prices of mutton

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favourably provided their efficiency of utilization is not poor. Due to high protein content, the feeding of cottonseed cake is in vogue in Pakistan since long. In recent years, however, the cost of this product has gone so high that some cheaper and efficient substitute of it is needed to be explored. Very recently, a maize by-product, the maize oil cake has come up in the local market at a quite competitive rate. Maize oil cake contains about 20 per cent protein as compared to 21 per cent of cottonseed cake (undecorticated). The easy availability, fair market price and richness of this product in protein, oil and minerals demands to have a trial on this product for livestock feeding. The present study was undertaken to :

(*a*) find out the possibility of complete or partial replacement of cottonseed cake by maize oil cake in lamb fattening rations;

(*b*) work out the economics of feeding maize oil cake in lamb fattening rations;

(*c*) study the digestibility of various nutrients in a mixed ration containing maize oil cake or cottonseed cake (undec.).

REVIEW OF LITERATURE

Morrison (1959) reported corn oil meal to be a satisfactory protein supplement for cattle, sheep and horses. Peacock and Kirk (1959) tried corn gluten meal and cottonseed cake in fattening rations of one year old steers and reported that there was no significant difference between the two and both the feeds were equally efficient. Kosanovic *et al.* (1960) reported that corn gluten meal was good in fattening of young bulls when used at 80 per cent of the concentrate. Obracevic *et al.* (1960) reported that maize gluten feed could be used to replace soya meal in production rations if necessary minerals were supplied. Malik and Akhtar (1969) concluded that cottonseed cake (undecorticated) could be successfully replaced by corn gluten feed in young rams without encountering any adverse effect on the performance, efficiency or economics of the rations. Malik and Akhtar (1970) undertook an experiment on the replacement of cottonseed cake by sunflower cake or maize oil cake in young Sahiwal calves and observed that maize oil cake was a superior protein supplement for fattening of young Sahiwal calves.

MATERIALS AND METHODS

Thirty six male lambs of about the same age, size and weight were used in this study. The experimental lambs were divided into six groups (blocks) of six lambs each according to their initial body weight. Six different rations were prepared and designated as A, B, C, D, E and F. Ration A served as the

control and it contained cottonseed cake (undecorticated) up to 50 per cent level. In other rations, cottonseed cake portion was decreased gradually and replaced by maize oil cake on protein equivalent basis. Composition of rations is shown in Table 1. All the lambs were fed *ad-libitum* for a period of 91 days. In addition to the experimental ration, each lamb received half pound of green fodder to meet the carotene requirements. Fresh and clean water was made available at all times to each lamb. Records of initial body weight, final body weight, daily feed consumption, total amount of urine excreted and faeces voided during 24 hours of the last week of the study were maintained. The composite urine samples were analysed for their nitrogen contents. The analysis of representative dried, ground and thoroughly mixed samples of rations and faeces for dry matter, crude protein, ether extract, crude fibre, nitrogen free extract and ash was carried out according to A.O.A.C. (1960) methods. The data collected were subjected to statistical analysis using analysis of variance (Snedecor, 1959). The comparison of mean feed consumption was made by Duncan's Multiple Range Test (Duncan, 1955).

TABLE 1.—*Composition of Experimental Rations.*

	RATIONS					
Description ..	A	B	C	D	E	F
Cottonseed (undecorticated) cake ..	50	40	30	20	10	—
Maize oil cake ..	..	11	21	32	42	53
Molasses (Sugarcane) ..	30	30	30	30	30	30
Wheat straw ..	20	19	19	18	18	17
Common salt ..	0.5	0.5	0.5	0.5	0.5	0.5
Total ..	100.5	100.5	100.5	100.5	100.5	100.5
Dry matter % ..	86.39	87.88	88.14	88.82	88.27	88.77
Crude protein % ..	11.12	11.19	11.08	11.15	11.04	11.11
Calcium % ..	0.395	0.378	0.369	0.345	0.328	0.312
Phosphorus % ..	0.630	0.554	0.474	0.398	0.318	0.242
Digestible protein % ..	9.0	9.02	8.88	8.91	8.77	8.79
Total digestible nutrients % ..	66.10	66.14	65.93	65.97	65.76	65.83

RESULTS AND DISCUSSION

The summary of data on weight gain, feed consumption and feed efficiency of lambs fed various experimental rations is given in Table 2.

TABLE 2.—*Summary of Growth and Feed Efficiency Data.*

Description	RATION					
	A	B	C	D	E	F
Number of animals	6	6	6	6	6	6
Days on experiment	91	91	91	91	91	91
Average initial weight (lbs.)	45.16	44.83	44.83	45.00	45.33	44.81
Average final weight (lbs.)	71.58	68.33	65.89	67.62	66.20	65.58
Total weight gain (lbs.)	26.42	23.50	21.06	22.62	20.87	20.77
Average daily weight gain (lbs.)	0.290	0.258	0.231	0.248	0.229	0.228
Average feed consumed/animal (lbs.)	290.63	284.25	252.17	251.62	250.79	243.29
Average daily feed consumed/animal (lbs.)	3.19	3.12	2.77	2.76	2.75	2.67
Average amount of feed required/lb of weight gain.	11.00	12.09	11.97	11.12	12.01	11.71

Weight Gain.—The statistical analysis of the data did not reveal any significant difference among weight gain of lambs fed different rations. It was, therefore, inferred that maize oil cake could be successfully used in sheep rations as a partial or complete substitute for cottonseed cake. The present results were in line with those of Malik and Akhtar (1970) who reported that cottonseed cake (undecorticated) could be quite economically replaced by maize oil cake or sun-flower cake for fattening of Sahiwal calves. Similar results were reported by Morrison (1959) who stated that maize oil cake was a relatively superior protein supplement than many other vegetable protein supplements for fattening of calves, cattle and sheep. The present results were also supported by the study made by Malik and Akhtar (1969) who successfully replaced cottonseed cake by corn gluten feed, a maize by-product without encountering any adverse effect on the performance, efficiency or economics of the ration. Results were in agreement with those of Peacock and Kirk (1959) who tried maize gluten

meal (a maize by-product like maize oil cake) and cottonseed cake and reported non-significant differences between nutritive value of the two, indicating thereby that both the feeds were equally efficient. The results were also in line with those of Kosanovic *et al.* (1960) who stated that there were quite comparable gains in body weight of lambs fed either corn gluten meal or soybean oil meal.

Feed Consumed.—As shown in Table 2, the lambs fed rations A, B, C, D, E and F consumed daily on an average 3.19, 3.12, 2.77, 2.76, 2.75 and 2.67 lb. feed respectively. The statistical analysis did not reveal any significant difference between rations A and B. The feed consumption on rations A and B was, however, found to be significantly higher ($P<0.05$) than rations C, D, E and F. The feed consumption on rations C, D, E and F, however, did not differ significantly from each other. Highest feed consumption was observed on rations A and B, lowest on ration F. This showed that maize oil cake was slightly less palatable to animals.

Feed Efficiency.—As shown in Table 2, the lambs fed rations A, B, C, D, E and F were found to require 11.00, 12.09, 11.97, 11.12, 12.01 and 11.71 lb. ration per lb. of weight gain respectively. The data when subjected to statistical analysis showed no significant difference. The results thus indicated that maize oil cake and cottonseed cake were almost equal in their efficiency and nutritive value as regards their effect on the growth performance of sheep.

Digestibility of Various Nutrients of the Mixed Rations.—The summary of data on the digestibility of various nutrients of the experimental rations is given in Table 3. Non-significant differences in digestibility of dry matter, crude protein, ether extract, crude fibre and nitrogen free extract were observed among experimental rations. This indicated that the digestibility of various nutrients did not differ significantly in a mixed ration containing cottonseed cake (undecorticated) or maize oil cake.

TABLE 3.—*Digestibility Coefficient Data.*

Rations	Dry matter (%)	Crude protein (%)	Ether extract (%)	Crude fibre (%)	Nitrogen-free extrac (%)
A	63.07	77.46	86.45	62.58	81.91
B	63.23	76.99	87.03	61.91	86.08
C	65.89	76.21	87.21	60.53	85.85
D	61.05	74.21	85.05	53.93	84.60
E	64.16	76.38	85.81	53.00	85.01
F	62.23	76.08	84.45	55.86	86.93

Nitrogen Balance.—The data on nitrogen balance are shown in Table 4 and its statistical analysis in Table 5.

TABLE 4.—*Nitrogen Balance Data.*

Rations	Nitrogen intake (gms)	Nitrogen outgo (gms)	Nitrogen retained (gms)	Nitrogen retained (gms)
A ..	24.92	11.82	13.10	52.56
B ..	22.72	11.22	11.50	50.61
C ..	21.06	10.76	10.30	48.90
D ..	23.76	12.51	11.25	47.34
E ..	23.28	11.14	12.14	52.14
F ..	21.68	10.47	11.21	51.70

TABLE 5.—*Analysis of Variance of Nitrogen Retained Percentage Data.*

Source of variation	D.F.	S.S.	M.S.	F. Ratio
Rations ..	5	28.80	5.76	0.257NS
Blocks ..	2	0.22	0.11	
Error ..	10	224.02	22.40	
Total ..	17	253.04		

NS=Non-significant.

The per cent nitrogen retained by lambs fed different experimental rations was 52.56, 50.61, 48.90, 47.34, 52.14 and 51.70 on rations A, B, C, D, E and F respectively. The statistical analysis revealed non-significant difference in per cent nitrogen retained. All the lambs on all the six rations remained in positive nitrogen balance.

Economic Aspect.—The cost per pound of weight gain was Rs. 1.41, 1.51, 1.43, 1.29, 1.33 and 1.25 on rations A, B, C, D, E and F respectively. The highest cost per pound of gain was observed on ration A and lowest on ration F. This led to infer that under the present circumstances use of maize oil cake as a substitute for cottonseed cake was quite feasible and economical.

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