समर्पण

'भारतभूच्या बलिवेदिवर ज्यांनी दिधले प्राण,
तयांना माझे लाख प्रणाम ।।'

स्वतःच्या जीवाची तमा न बाळगता,
अहोरात्र भारतीय सीमेचे शत्रूपासून संरक्षण
करणाऱ्या व 'कारगील - ९९' च्या युद्धात
हौतात्म्य पत्करलेल्या भारतमातेच्या ज्ञात व अज्ञात
शुर जवानांना मनोभावे अर्पण ...

जय हिंद !!

..... उमाकांत

EFFECT OF FEEDING DIFFERENT COMBINATIONS OF FODDERS ON THE GROWTH OF WEANED DECCANI LAMBS

By

UMAKANT PANDURANG NIMBALKAR
(Reg.No. 98045)

A thesis submitted to the

MAHATMA PHULE KRISHI VIDYAPEETH,
RAHURI–413 722, DIST. AHMEDNAGAR,
MAHARASHTRA STATE (INDIA).

In partial fulfilment of the requirements for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

ANIMAL SCIENCE

DEPARTMENT OF ANIMAL SCIENCE
AND DAIRY SCIENCE

POST GRADUATE INSTITUTE
MAHATMA PHULE KRISHI VIDYAPEETH,
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Approved by

Prof. B.P. Thorat
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2000

CANDIDATE'S DECLARATION

I hereby declare that this thesis or part thereof has not been submitted by me or any other person to any other University or Institute for any Degree or Diploma.

Place : M.P.K.V., Rahuri

Dated : 10/ 10 /2000

Nimbalkar

(U.P. NIMBALKAR)

Prof. B.P. Thorat
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Rahuri – 413 722, Dist. Ahmednagar,
Maharashtra State, India.

CERTIFICATE

This is to certify that the thesis entitled, **"EFFECT OF FEEDING DIFFERENT COMBINATIONS OF FODDERS ON THE GROWTH OF WEANED DECCANI LAMBS"**, submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra) for the award of the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **ANIMAL SCIENCE**, embodies the results of a piece of *bona fide* research work carried out by **Mr. UMAKANT PANDURANG NIMBALKAR**, under my guidance and supervision and that no part of the thesis has been submitted for any other degree or diploma.

The assistance and help received during the course of this investigation has been duly acknowledged.

Place : M.P.K.V., Rahuri.

Dated : 10/10/2000.

(B.P. Thorat)
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Maharashtra State, India.

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Place : M.P.K.V., Rahuri.

Dated : / /2000.

(S.S. Kadam)

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Place : M.P.K.V., Rahuri.
Dated : 10/ 10 /2000.

(Umakant P. Nimbalkar)

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LIST OF ABBREVIATIONS

Abbreviation	Description
ANOVA	Analysis of variance
C	Concentrate mixture
CF	Crude fibre
CP	Crude protein
DF	Degrees of freedom
DM	Dry matter
EE	Ether extract
MSS	Mean sum of squares
NS	Non-significant

ABSTRACT

EFFECT OF FEEDING DIFFERENT COMBINATIONS OF FODDERS ON THE GROWTH OF WEANED DECCANI LAMBS

BY

UMAKANT PANDURANG NIMBALKAR

A candidate for the degree

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MASTER OF SCIENCE (AGRICULTURE)
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Mahatma Phule Krishi Vidyapeeth, Rahuri-413 722.

2000

Research Guide	:	**Prof. B.P. Thorat**
Department	:	**Animal Science and Dairy Science**

Twenty four lambs of three months' age and of almost similar weight were distributed to four feeding treatments. The experimental feeds with different combinations of fodders were prepared maintaining required crude protein.

The results revealed that the average total and daily DM intake was the highest in T_3 (59.167 kg and 657.407 g) followed by T_0, T_2 and T_1 (56.068 kg and 622.980 g, 52.150 kg and 579.443 g, 50.125 kg and 556.942 g) treatments, respectively. The differences being significant ($P<0.05$). However, treatments T_1 and T_2, T_0 and T_2 and the treatments T_0 and T_3 were at par.

The average total gain in body weight was highest in the lambs under treatment T_3 (6.817 kg) followed by those in T_0, T_2 and T_1 (6.217, 5.217 and 4.833 kg) treatments, respectively. The differences were significant ($P<0.05$). The treatments T_2 and T_1 were at par. The treatment T_3 was again superior in average daily gain in body weight (76.296 g).

The lambs under treatment T_3 also showed the highest overall body measurements and greasy fleece weight (1.317 kg). The treatment differences were significant ($P<0.05$). The treatments T_2 and T_1 were at par.

The average feed conversion efficiency was the highest in treatment T_3 (11.52 %) followed by T_0, T_2 and T_1 (11.09, 10.00 and 9.64 %) treatments, respectively.

The average total cost of feed offered to the lambs was the highest in T_0 (Rs. 210.13) followed by T_3, T_1 and T_2 (Rs. 161.52, 155.62 and 139.45) treatments, respectively. The experimental feed under the treatment T_3 was cheapest of all the treatments (Rs. 23.69/kg gain in body weight) and can prised 1/3 DM through concentrates plus 2/3 DM through maize silage and green maize in 1:1 proportion.

INTRODUCTION

1. INTRODUCTION

India is predominantly an agricultural country. Agriculture and livestock are complementary and supplementary to each other. Livestock enterprise plays an important role in Indian rural economy by providing employment opportunities to millions of the unemployed (75 %) rural people and helps in earning additional income through livestock activities (Marimuthu and Sabbarayalu, 1987). Among the livestock enterprise sheep alone contributes Rs. 400 crores annual national income through production of mutton, wool, skin and manure (Gopalkrishnan and Mohanlal, 1985).

India is one of the major sheep producing countries and ranks sixth in the world with a sheep population of about 54 millions (Anonymous, 1990). Sheep population of Maharashtra registered an increase of 15.09 per cent during 1982 to 1992. In 1982 it was 26,71,000 and in 1992 it was 36,74,000 (Tantia and Vij, 2000). Sheep rearing is the oldest livestock industry in arid and semi-arid areas of India including Maharashtra. There is large scope for employment opportunities for the artisans and other skilled workers in the cottage and small-scale industries. Therefore, sheep farming is widely considered as one of the poverty alleviating enterprise (Dastagiri and Rao, 1990).

Sheep are economic converter of grass into mutton and wool. These are small animals, they grow faster and do not need expensive housing system. The foundation stock is relatively cheap and

flock can be multiplied rapidly due to their short gestation period. Generally in India, the sheep are reared by grazing on waste lands remnants crop residues etc. In fact there is no substitute for sheep considering the utilization of waste lands and control of weed in the fruit orchards.

Since there is a demand for sheep mutton from the Gulf countries, modern systems of animal farming based on scientific principles of breeding, management, nutrition and health cover should be judiciously followed as there are no separate pasture lands available for sheep grazing. Generally, more than 95 per cent of the sheep population is found in dryland farming system due to suitable climatic conditions, more area available for grazing due to monocrop farming system after kharif and ample tree loppings available for sheep production (Marimuthu and Subbarayalu, 1987). Indian sheep have to depend totally on waste lands, harvested fields, agro-by-products, top feeds etc.

In India, land utilised for fodder production is proportionately negligible and top priority is given to cereals and cash crops. Owing to the seasonal rainfall the availability of green grass and fodder is restricted only to three to four months in a year, hence during the major part of the year animals have to depend upon coarse fodder of low nutritive value. Non availability of nutritious feeds and fodder throughout the year is the main constraint in improving sheep enterprise in India. By providing balance nutrition and proper management

practices the improvement in production performance of sheep can be achieved (Kalra, 1991).

Hence, there is a need to preserve feed, fodders and top feeds by various means, which will be useful in lean period (Shortage of fodder). To satisfy the need of the flock during lean months *viz.*, November-December and April to June, the surplus fodder available during the rainy season must be conserved through the process of 'ENSILING' (Singh, 1984).

Silage making is an important method of forage conservation. Forages mainly used for silage making are maize (*Zea mays*), sorghum (*Sorghum bicolor*), cowpea (*Vigna catiana*), oat (*Avena sativa*), etc. Out of these, maize is considered to be the important crop for silage making, as it is quick growing, high yielding, palatable, nutritious and without any toxic substance. It is also a well known fact that the weight and milk yield of livestock increases considerably by feeding maize either in green or in silage form.

Due to shortage of fodder the shephards have to migrate in search of feed resources for their sheep. If silage along with few additives are fed to the animals and found effective, it may help to reduce the migration of sheep.

Considering these facts, the present investigation on "Effect of feeding different combinations of fodders on the growth of weaned Deccani lambs" was taken at Network Project on Sheep Improvement, Mahatma Phule Krishi Vidyapeeth, Rahuri to compare the feed value and

the effect of feeding maize silage in combination with lucerne alone, green maize alone and maize silage plus green maize.

It is likely that this preliminary work may give direction for future research on nutritional aspects of sheep. It is also hoped that the findings of this investigation may be useful to the sheep farmers for fat lamb production.

The objectives of this investigation are as under,

1. To study the feed value and to compare the effect of feeding different feed types on the growth of weaned Deccani lambs.
2. To study the feed conversion efficiency of lambs.
3. To estimate the economics of feeds fed to the lambs.

REVIEW OF LITERATURE

2. REVIEW OF LITERATURE

Silage is being used as livestock feed for over a century and considerable research in the methods of preservation and material used for ensiling has been accomplished. A great deal of work has been carried out on maize silage, as a good source of roughage to the animals. There are many references available on silage feeding in sheep, which are reviewed in foregoing pages.

2.1 Chemical composition of silage

Nehring and Laube (1959a) worked on the composition and fodder value of maize silage and green maize. They concluded that the stage of ripening had little effect on digestibility of the silage. Maize produced more digestible silage if the crop is chopped than shreded. Green maize had a higher digestibility than maize silage.

Nehring and Laube (1959b) investigated the changes in the composition of green maize during growth and their importance for ensiling. The weekly changes in chemical composition were traced during several growth stages of seven varieties of maize. The carbohydrate was only constituent to show marked change in percentage of chemical composition. Earliness in maturity was associated with early transformation of sugars to starch. This accounted for the good ensiling properties of the early varieties.

Nordfeldt (1961) worked on the silage of green maize fodder. Experiments were carried out on silage preparations of different strains of maize *viz.*, KF, KS_2, Eagle Hill and Wisconsin 335. Harvest was undertaken at different stages of development. The nutritional value increased in all strains of green maize with the delay in the harvest. The quality of silage was good as a rule, with very low content of butyric acid and pH value varied between 3.6 to 4.2.

Wernli *et al.* (1968) conducted an experiment on the influence of growth stages of maize (cv. Eureka) on the yield and nutritive value of silage and effect of protein supplementation. Maize silages made from crop, (a) at milk stage with 23 per cent DM content. (b) at hard dough stage with 34 per cent DM content.

Dry matter, were fed *ad lib* to steers. Yields of DM and TDN per hectare were slightly higher from maize cut at stage (b) but the total losses during storage were much higher than treatment (a). However, silage (b) showed slightly higher live weight gain than (a). It was concluded that there was no advantage in harvesting maize (cv. Eureka) for silage at stage (b).

Gupta *et al.* (1981) gave note on the chemical composition and nutritive value of green maize and maize silage. The CP, NFE, Ca and P contents were slightly lower and CF, Ash and EE contents were higher in maize silage than in green maize fodder. These variations were partly due to difference in stages of maturity and partly due to ensiling.

The DM intake was higher for green maize than that of maize silage. The present study indicated that the digestion coefficient for DM, CP, and DE values were higher for maize silage than of green maize.

Matsuoka *et al.* (1984) studied nutritive value of corn silage at different stages of aerobic deterioration. Silages exposed to air tended to be lower in digestibility of NFE but higher in that of CF, ADF and NDF than control silage. Percentage of N retained by sheep of given silage exposed for 11 days was less than in sheep given control silage.

Miaki *et al.* (1985) studied nutritive value of maize silages sown on different dates. In experiments on silage quality and sheep nutrition, maize (cv. Snow Dent No-2), sown at six dates was harvested at the late dough to late yellow ripe stages and ensiled in polythene bag silos. There were no differences in efficiency of N utilization by sheep between any of the 6 silages.

Buttery *et al.* (1987) studied effects of sulphur fertilization, 0 or 67 kg/ha as a single or split application on chemical composition, ensiling characteristics and utilization of maize silage by wether lambs. The S fertilised maize silage and non-S-fertilized maize silage were given alone and supplemented with Na_2SO_4 at 2 rates to 30 wether lambs in metabolism and palatability trials. Digestibility of DM and cell wall components and apperent absorption of S and N were increased by S fertilization and supplimentation.

Liu *et al.* (1987) compared grass, corn and rice silages for sheep and observed that nutrient digestibility decreased with feeding to

twice the maintenance requirement. They observed that the values of DE, ME, TDN and DCP contents were highest in corn silage.

Pinter *et al.* (1987) studied effect of stubble height and plant density on DM yield and feeding value of the whole maize plant. Sheep were fed on silage of hybrid maize at two plant densities and cut by 3 methods. They reported that livestock required fodder with high starch equivalent, maize grown at a low plant density and cut reasonably early below the ear was suitable.

Solov'EV *et al.* (1987) studied the comparative effect of pentose fermenting lactic acid starter on utilization of silage. Feeding sheep on a diet containing maize silage conserved with a pentose-fermenting lactic acid starter produced more favourable condition for microbial processes in the rumen and increased the concentration of protein N and reduction of non-protein N and ammoniacal N than maize silage not treated with bacteria.

Pachauri *et al.* (1988) studied comparative nutrient utilization from green maize in cattle, buffalo and goats. Goats digested more DM, OM and CF than did buffalos and cattle. DM intake was not significantly influenced by supplementing green maize with cowpea hay, whereas DCP, TDN (g/kg.$W^{0.75}$) and DE (Kcal/kg $W^{0.75}$) intakes were increased slightly.

Reddy and Reddy (1988) investigated that the maize silage could be the sole ration for sheep and goats. In both the species wider

protein:energy ratios were recorded, indicating that maize silage should necesserily be supplemented with protein rich feeds.

Solov'EV *et al.* (1990) reported the use of maize silage containing preparation 'somex' in diet of sheep. The 'somex' treated silage increased the pH and concentrations of volatile fatty acids, protein, non-protein and Ammonia-N_2 in rumen contents but decreased the efficiency of utilization of nitrogen.

Lanza *et al.* (1991) studied on effects of feed restriction and the use of whole maize silage in diets for lambs. From 70-130 or 180 days old, twelve groups of 15 male commisana lambs were given 1 of 3 types of diet to appetite or restricted to 80 per cent of the amount taken to appetite. Restricted feeding of the complete mixed feed significantly decreased gain in lambs from 70 to 100 days age. Inclusion of maize silage in diets decreased DM intake. Carcass indices were deteriorated.

Solov'EV *et al.* (1991) studied on processing maize silage with natural brine. Maize silage was treated with natural brine at 10 to 30 lit/t and fed immediately to Tsigai rams of initial body weight 26 to 27 kg for 30 days. Natural brine treated silage had no effect on the physiological state of rumen. Natural brine in silage at 30 lit/t increased DM digestibility in rumen.

Florek *et al.* (1992) studied performance of growing sheep fed on diets containing maize silage and beet fodders. For 151 days, 331 Kamieniec ewes were fed on a basal diet (meadow hay and commercial feed mixture) supplemented with fodder beets (var. Goliat) 2-3 kg; maize

silage 2-2.4 kg, dried whole crop maize 0.6-0.7 kg or dried sugarbeet pulp 0.5-0.6 kg. Highest ($P < 0.01$) daily gain (134.3 g) and final body weight (64.9 kg) was obtained with the group given dried sugarbeet pulp; poorest values were with the group given maize silage. Also the feed conversion was best in the sugarbeet pulp group and poorest in the maize silage group.

Fujihara and Harumoto (1992) studied the eating and rumination behaviour in sheep fed on maize silages, A, B and C, made in three consecutive years. Rumination efficiency, index and chewing rates were higher ($P<0.05$) with silage A but longest bolus time was with silage B. Results indicated that the eating and rumination behaviour was affected by the quality of silage although the chemical composition was similar.

Kirilov and Naidenov (1992) investigated that from tasseling to ripeness, intake of green maize by sheep increased from 67.3 to 72.0 g DM/$kg^{0.75}$ but then decreased to 54.4 g/$kg^{0.75}$ during full ripeness.

KO *et al.* (1992) studied quality and feeding value of maize silage alone and poultry excreted MS. They showed that intake of maize silage alone was higher than that of silage with excreta, but total DM intake was higher for silage with excreta. When concentrate was reduced by 10 per cent silage intake was increased, digestibility of silage with excreta was significantly improved ($P<0.05$). When 30 per cent excreta was added to maize silage the economic return was 331 won/head daily greater than that of controls.

Margan *et al.* (1995) compared maize silage and red clover hay combinations for energy and protein value on sheep. They invented that there were positive associative effects between the silage and clover for voluntary feed intake; digestibility of energy; N and cell wall organic matter and N balances. The ME value of silage + urea diet was one of the highest reported in sheep for maize silage.

Verbic *et al.* (1995) studied chemical composition and nutritive value of five samples of drought-stressed fodder maize, DM digestibility was estimated in sacco in 2 sheep. Silages from drought stressed maize were well fermented and stable against aerobic deterioration. It was revealed that drought reduced the nutritive value of fodder maize by about 20 per cent.

Cilliers and Cilliers (1998) compared diets based on maize silage (MS), non-bird-resistant grain sorghum silage (NBRGS), bird-resistant grain sorghum silage (BRGS) or forage sorghum silage (FS) at silage:concentrate ratios of 70:30, 60:40, 50:50, 40:60, or 30:70 for the finishing of weaner lambs. Better apparent digestibilities of DM, CP, and ADF as well as improved feed conversion ratio were found for diets with MS and NBRGS compared with those with BRGS and FS. For diets containing a low level of concentrates the dressing percentage, carcass grades and feed conversion ratio were better for the diets with MS and NBRGS.

2.2 DM intake and digestibility

Ranjhan (1980), while describing the nutritional requirements for the different species in the tropics, indicated that the DM requirement for growing lambs was about 3 to 4 per cent of their live weight.

Buchanan *et al.* (1981) studied ensiling of maize with 0, 10 and 20 % wet cage layer excreta and its effect on intake, digestion and balance by sheep. Twenty four wethers, of average weight of 25 kg were given treated silage or untreated silage supplemented with excreta. Daily intake of DM in $g/kg^{0.75}$ was 56.9, 80.7 and 80.7, respectively. Digestibility of DM was 71.2, 70.2 and 78.2 per cent.

Carneiro *et al.* (1983) compared silages of maize and soybean and its effect on intake and digestibility by sheep. Maize at milky stage and annual soya (*Glycine max*) were harvested and mixed homogenously in the ratios 100:0, 80:20 and 60:40 and immediately ensiled. Mean (daily) intake of DM by 6 sheep was 57.08, 70.68 and 80.55 $g/kg^{0.75}$ and digestibility of protein was 52.78, 61.89 and 67.87 per cent, respectively.

Deoka *et al.* (1983) studied effect of aerobic deterioration of corn silage on rumen fermentation, ruminating behaviour and digestibility by sheep. They investigated that the aerobic deterioration of silage had no significant effect on DM intake, digestibilities, nutritive value and also on pH.

Lemerle *et al.* (1983) studied utilization of maize silage by sheep. Six wether sheep were given diets of maize silage (MS) alone; MS + lucerne 33 per cent, MS + lucerne 15 per cent + wheat 50 per cent. Addition of lucerne to the diet improved digestibility with sheep and also stimulated feed DM intake.

Adebowale (1985) compared diets based on maize concentrate and containing 100, 75, 50 or 25 per cent maize silage in West African dwarf goats and sheep. For both species N_2 digestibility was greater with higher amount of concentrates.

Shimada *et al.* (1985) studied digestibility of maize stalk silage for wethers. It was concluded that preparation of maize stalk silage with either molasses (10.8 % DW) or NaOH (3.7 % DW) and urea (2.6 % DW) gave acceptable results with 58.1 and 57.6 DMD, 73.8 and 70.2 per cent OM digestibility and 49.6 and 52.5 DE, respectively.

Daniel (1986) compared silages of maize and *Medicago sativa* using sheep. He showed that daily live weight gains of individual animal was achieved with diets, 50 per cent *M. sativa* + 50 per cent maize silage and 25 per cent *M. sativa* + 75 per cent maize silage, gaining 200 and 77 g/day respectively. High proportions of *M. sativa* in the silage promoted daily DM intake.

Maslakov (1986) studied digestibility of diatary nutrients and N_2 metabolism in wethers supplied with maize silage. Maize silage was supplied in two period of trials. It was observed that digestibility of

protein was 66.4 and 66.5, fat 68.0 and 58.8, fibre 54.7 and 44.0 per cent. N retention was 4.77 and 12.35 per cent of N digested.

Weller and Phipps (1986) showed the digestibility of hemicellulose and crude protein fractions were similar in both silages. The DM intake of two silages was similar but the respective weight gains of 0.83 and 0.92 kg were significantly different.

Iliev (1988a) studied intake of maize silage and meadow hay mixtures by sheep. In 8 wethers (wt. 80 kg) given to apetite mixtures of maize silage and chopped meadow hay as 81:19, 59:41, 47:53, 23:77, 9:91, 6:94 and 2:98. The greatest intake of DM (1.602 kg) and crude protein (127 g) was with the 47:53 mixture.

Iliev (1988b) studied effect of maize silage and concentrates mixed in different ratios on intake by sheep. Results indicate that replacement of silage DM intake by concentrates took place in 3 stages and was 0, 33 and 74 per cent of surplus gain intake when concentrates were 19, 40 to 53 or 77 per cent, respectively.

Dayrell and Ivan (1989) compared the corn silage and corn silage supplemented with dicalcium or rock phosphate. Eighteen male crossbreed sheep were assigned to three groups and fed corn silage (CS), corn silage and dicalcium phosphate (CS-DP) or corn silage and rock phosphate (CS-RP). The total fecal P and total fecal endogenous fecal P was in the order CS>CS-DP>CS-RP.

Heimbeck *et al.* (1989) studied effect of different methods of preparing maize silage on nutrient digestibility in heifers and wethers.

They observed that wethers digested starch completely and generally achieved digestibilities and net energy values 6 and 10 per cent, respectively, higher than those of heifers.

Moran *et al.* (1989) studied the intake and digestion of maize silage based diets to dairy cows and sheep. The lactating and dry cows and sheep were given the maize silage diet, the results showed that the DM intake were 55.2, 43.4 and 44.9 $g\text{-}kg^{-0.9}\ day^{-1}$, the values of intake of digestible organic matter were 29.7, 26.1 and 26.9 $g\text{-}kg^{-0.9}\ day^{-1}$ and of organic matter digestibility were 65.1, 69.1 and 68.5 per cent, respectively.

Schwarz *et al.* (1989a) reported digestibility of maize silage differing in particle size in sheep. In wethers starch digestibility was >99 per cent regardless of particle size and crushing did not significantly affect digestibility of any components. If the level of feeding increased the OM digestibility was reduced from 80.1-81.2 per cent to 73.1 to 74.2 per cent in wethers.

Schwarz *et al.* (1989b) studied influence of crushing whole maize plants and grain on nutrient digestibilities. They observed that digestibilities in sheep differed little between treatments and were 6-15 per cent units higher than in heifers. Starch was completely digested.

KO and An (1990) studied digestibility and palatability of maize silage mixed with poultry manure in sheep. Amounts of DM, CP and CF in the silages were increased. They found that at 30 and 45 per cent DM poultry manure gave higher values for digestible CP and TDN.

Phillip and Hidalgo (1990) studied voluntary feed intake and acid base balance in lambs fed corn silage. This study suggested that maize silage imposed no "acid-stress" on lambs and consequently there was no nutritional benefit in adding buffers to maize silage for sheep.

Iliev (1992) worked on effect of maize silage and sunflower cake intake by sheep. Maize silage and sunflower cake mixed on DM basis, in the ratio of 100:0, 80:20, 60:40, 40:60, 20:80 and 0:100. Average daily DM intake was 0.683, 1.16, 1.84, 2.69, 3.96 and 0.583 kg, respectively. Intake of crude protein was 53.1, 157.7, 378.1, 722.1, 1314.9 and 230.8 g, respectively.

Kirchgessner *et al.* (1992) worked on digestibility of maize silage. They reported higher values of organic matter, CP, CF and NFE digestibilities in sheep. Net energy content of 4 silages was also higher in sheep.

Reddy and Murphy (1995) studied the effect of ensiling on dry matter intake and animal performance. Results of current research suggested that formic acid treated silage did not reduce DM intake when compared with the parent herbage, but did reduce milk fat and protein yield by 24 per cent.

Pex *et al.* (1996) reported on digestibility and energy content of maize silage at different stages of harvest. Digestibility significantly increased from 72.2 to 75.4 per cent in sheep with increasing stage of maturity. Medium or late harvest date increased energy content estimated in sheep 7-8 per cent compared with early harvest.

Schwarz *et al.* (1996) studied influence of starch-rich feed stuffs on digestibility and energy content of maize silage in sheep. Starch supplements increased diatary organic matter digestibility from 74 to 79 per cent in sheep. Thus maize silage organic matter digestibility decreased and energy value was decreased by about 6 per cent compared with the un-supplemented control.

Argillier *et al.* (1997) evaluated genotype x environment interactions for digestibility trates in maize silage with sheep. They revealed that the variation attributed to genotype x environment interaction for *in vivo* digestibility traitswas lower than the variation due to the main genotypic effect. This also confirmed the results obtained with *in vitro* digestibility traits from large multi environmental designs.

Soman (1997) revealed that the total DM intake/day/lamb averaged 351 to 576 g in stall feeding system.

2.3 Growth studies

Murley and Mochrie (1956) studied the effect of corn silage on dairy calves. They concluded that calves fed with corn silage upto 4 months of age gained comparable to those fed with good quality hay and similar amounts of milk and starter.

Rutter (1970) reported that the weaned lambs given concentrate had an overall feed effeciency of 4.89 kg concentrates per kg live weight gain.

Sahni and Tiwari (1975) studied milk production and pre-weaning growth of lambs in different sheep breeds under semi-arid conditions. Milk yield was the highest in Malpura and Rambouillet x Malpura and lowest in Rambouillet. The difference between breed was significant. The rate of gain between the first and second month was the highest in higher crosses than in half breds.

Singh (1980) studied the performance and nutrient utilization of Avikalin lambs on feedlot ration. The complete ration consisted of 50 per cent cowpea fodder, 20 per cent groundnut cake, 20 per cent maize, 7 per cent mollasses, 2 per cent mineral mixture, 1 per cent vitablend per quintal of feed. The growth rate was 150.5 g/day/head.

Lomos *et al.* (1982) studied the ammonia treatment to corn silage and feedlot performance of growing steers. The weight averaged across the three trials revealed that cattle fed on corn silage treated with cold-flow unhydrous ammonia (ANAM) had a 4.5 per cent lower average daily gain and 8.8 per cent higher DM intake per kg of gain than those fed untreated corn silage supplemented with soybean meal (SBM) to a similar crude protein in equivalent.

Koeln *et al.* (1984) reported that lambs fed on diets based on maize and cotton seed hulls supplemented with maize whole silage (WS) consumed significantly less feed and consequently had lower ($P<0.05$) daily gains than lambs given either soybean meal (SBM), distillers dried grains (DDG) or Urea (U). Results indicated that whole silage might be

used as a supplemental protein source for growing lambs and finishing steers.

Mohan and Murthy (1984) conducted an experiment on Mandya and Dorset x Mandya female weaners fed on a complete ration consisting of Concentrate:Sunhemp hay in 50:50 proportion. The average daily gain was 65.3 and 74.3 g in Mandya and Dorset x Mandya weaners, respectively. The feed conversion efficiency was 9.55 per cent in Mandya and 9.62 per cent in Dorset x Mandya weaners.

Robbins *et al.* (1984) studied alfalfa hylage Vs. Corn silage as a roughage source in finishing diet of yearling feed lot steer. Feed to gain ratios were significantly different across dietory source and within energy level. No statistical significance was determined for gain but steers fed with the high moisture corn silage diet tended to gain less than high moisture alfalfa hylage fed steers.

Patel (1985) studied the growth performance and nutrient utilization in Dorset x Deccani lambs fed with feeds varying in DCP levels.

Three experimental feeds varying in DCP levels (T_1 : 12.81 %, T_2 : 15.03 % and T_3 : 17.11 %) and almost the same TDN were prepared by mixing 50 per cent lucerne hay as a roughage and 50 per cent concentrate mixture prepared at the farm (a concentrate). For control group feed (T_4 : 14.35 % DCP) was prepared by mixing 50 per cent "Sugras Pellets" as concentrate mixture.

The lambs from the treatments T_1, T_2, T_3 and T_4 consumed 111.22, 111.13, 111.15 and 111.17 kg DM, respectively. The feed conversion efficiency was the highest in treatment T_3 followed by T_2, T_1 and T_4 with 11.53, 11.22, 11.21 and 10.25 per cent, respectively.

Fernandes *et al.* (1988) conducted an experiment on twenty-four lambs of approximately 6 months age and from 2 genetic groups and reported that the average daily gain in body weight was highest in T_2 i.e. maize silage + green lucerne (136.04 g) followed by T_1 i.e. maize silage + lucerne green + sorghum kadbi (105.96 g) and T_3 i.e. maize silage + sorghum kadbi (88.33 g). The feed conversion efficiency was highest i.e. 7.73 per cent in T_2 followed by 6.55 per cent in T_1 and 5.76 per cent in T_3, respectively.

Shamma and Athari (1988) studied the use of maize silage supplemented with 10 or 20 per cent poultry litter for sheep. Mean daily gain was 199 and 50 g, respectively, compared with 96 g in control given maize silage alone. They observed that intake of DM was greatest with 10 per cent poultry litter.

Burgkart *et al.* (1989) evaluated conserved maize products for lamb fattening. They reported highest values of average daily intake for maize silage (2.75 kg/lamb) and live weight gain for maize cobs. It was concluded that lambs could be fattened on maize products provided that they were of good quality and suitably supplemented.

Calatoiu *et al.* (1989) studied effect of maize silage for fattening of lambs. Male fine-wool lambs were fed for 91 days on a diet

of 48 per cent silage from green maize alone, green maize with 0.35 per cent urea or a 50:50 mixture of maize and lucerne, 28 per cent lucerne hay, 23 per cent maize cobs and 1 per cent minerals. It was observed that daily gain was 124.4, 124.0 and 104.2 g. Intake/kg gain was 4.92, 4.96 and 5.96 feed units and digestible crude protein 498, 504 and 690 g, respectively.

Upase (1989) while working with Deccani lambs, recorded the averages of total gain in height at withers, total gain in body length total gain in chest girth as 11.70 ± 0.26, 11.00 ± 0.28, 12.11 ± 0.35 (cm), respectively.

Krajinovic *et al.* (1991) studied partial substitution of classical rations by silage for an extended fattening of lambs. Tsigai x Merino x Wurttemberg lambs were fed on a maize based feed mixture (CP-13.03 %) alone or with 55.5 or 64.4 per cent feed mixture replaced by maize silage (CP-4.55 %). Average daily body weight gain was 266, 239 and 240 g, respectively.

Patil (1999) reported the averages of total gain in height at withers, total gain in body length, total gain in chest girth of Deccani lambs as 12.01 ± 0.563, 10.43 ± 0.426 and 13.19 ± 0.426 (cm), respectively.

2.4 Greasy fleece weight

Singh (1966) worked on Deccani, Rambouillet x Deccani, Rambouillet purebred, Chotanagapuri, Shahabadi, Romny Marsh x

Shahabadi (F_1) breeds of sheep and reported greasy fleece weight in kg as 0.550, 1.560, 2.550, 0.230, 0.560 and 0.660, respectively.

Tomar (1978) while working with Nali sheep, recorded greasy fleece weight of 667.80 g at 6^{th} month of age.

Acharya (1981) in his studies on Nilgiri, Rambouilet x Nilgiri, Merino x Nilgiri, Gaddi, Rambouilet x Gaddi and Merino x Gaddi sheep reported the first six monthly Greasy fleece weight as 0.421, 0.612, 0.791, 0.291, 0.395 and 0.401 kg, respectively.

Arora and Krishnamurthy (1984) collected data from two seasons i.e. spring and autumn in Nilgiri, Rambouillet x Nilgiri and Merino x Nilgiri lambs and reported that the six months' greasy fleece weight was 0.440, 0.740 and 1.070 kg, respectively.

Palve (1988) reported the greasy fleece weight for adult of Deccani, Dorset x Deccani and Merino x Deccani breeds which were 413.33, 593.33 and 673.33 g, respectively.

Jain *et al.* (2000) while working with Rambouillet sheep recorded greasy fleece weight as 2.213 ± 0.024 kg, under arid region of Rajasthan.

MATERIAL AND METHODS

3. MATERIALS AND METHODS

The present investigation "Effect of feeding different combinations of fodders on the growth of weaned Deccani lambs" was carried out at Network project on sheep improvement, Mahatma Phule Krishi Vidyapeeth, Rahuri. The present study was conducted for a period of 3 months w.e.f. 15th January to 15th April, 2000 with the pre-experimental period of 10 days. The experimental details are described in the following pages.

3.1 Selection of experimental lambs

Twenty-four lambs of three months' age and of almost similar weight were selected for the growth studies (Table 1). These lambs were alloted into four groups as treatments.

3.2 Type of feeds used for feeding

3.2.1 Maize silage

Silage was prepared from lush green maize crop in dough stage.

The underground silo was used for silage making. The green maize fodder was chopped and then filled in the silo pit layer by layer. Three per cent common salt was spread over each layer of fodder for taste. The silopit was filled carefully and was well trampled to remove air pockets at each layer of filling to get quality silage. It was filled 4 ft above the ground level and then it was covered with plastic sheet and

then covered by layer of soil of about 30 cm thickness. Finally, it was plastered with slurry/paste of mud and cow dung to make it air and water tight. The silopit was opened after 60 days.

Table 1. Details of experimental lambs

Treatments	Sr. No.	Tag No.	Birth Date	Weaning age of lambs (in days)	Weaning weight as on (15.01.2000) (kg)
T_0	1	3323	14.10.1999	89	12.400
	2	3324	14.10.1999	89	16.200
	3	3327	15.10.1999	88	16.800
	4	3328	16.10.1999	87	14.800
	5	3331	17.10.1999	86	15.400
	6	3332	17.10.1999	86	14.200
	Average			88	14.966
T_1	1	2547	29.10.1999	90	14.200
	2	2549	29.10.1999	90	12.600
	3	2552	30.10.1999	89	11.800
	4	2556	31.10.1999	88	14.200
	5	2558	01.11.1999	87	14.200
	6	2559	01.11.1999	87	15.400
	Average			89	13.733
T_2	1	3321	13.10.1999	90	16.400
	2	3322	13.10.1999	90	15.400
	3	3325	15.10.1999	88	15.400
	4	3326	15.10.1999	88	16.400
	5	3329	16.10.1999	87	13.000
	6	3330	16.10.1999	87	8.200
	Average			88	14.133
T_3	1	2548	29.10.1999	90	19.400
	2	2550	29.10.1999	90	10.600
	3	2553	30.10.1999	89	15.600
	4	2554	31.10.1999	88	13.600
	5	2557	31.10.1999	88	15.000
	6	2560	29.10.1999	87	16.800
	Average			89	15.168

3.2.2 Lucerne

Fresh green lucerne (*Medicago sativa*) at pre-flowering stage was used for feeding the lambs.

3.2.3 Green maize

Fresh chaffed green maize (*Zea mays*) was used for feeding the lambs.

3.2.4 Concentrates

Special milk ration in the form of pellets containing 18 per cent CP, procured from Vaibhav feed factory of Ahmednagar was used for feeding the lambs.

3.3 Chemical analysis of feed samples

The composite samples of silage, lucerne, green maize and concentrates were taken and analysed chemically for the following determinations.

(a) Determination of moisture from silage

Determination of moisture from silage was carried out by toluene distillation method, as described by Dewar and McDonald (1961).

Procedure

1. 400 ml of toluene was added to 80 g of silage sample.

2. Silage was heated for moisture estimation with toluene untill the toluene boils steadily.
3. The volume of aqueous phase in the receiver was noted after 90 minutes and subsequently at 15 minutes interval.
4. The heating was stopped after two consecutive equal readings.
5. The receiver was cooled to room temperature and volume was recorded.
6. 10 ml of the aqueous phase was pipetted into 100 ml conical flask, 40 ml of ethanol, previously neutralised to phenolpthalin was added into the flask and titrated with 0.1 M NaOH using phenolphthalin as an indicator.

Calculation

$$DM = 100 - \frac{99.8\ V}{W} \times \frac{1 - ft}{10}$$

Where,

V = Total volume of aqueous phase (ml)

W = Weight of silage taken (g)

t = Titre (ml of 0.1 M NaOH)

f = a factor 0.00555.

(b) Lucerne, green maize and concentrate

Standard method described by A.O.A.C. (1984) were followed to determine moisture, dry matter, crude protein, ether extract, crude fibre, ash and nitrogen free extract of the feed samples.

3.4 Pre-experimental period

The pre-experimental period of 10 days was given to accustom the lambs with the different types of feeds to be offered. For this, each group of lambs under study was given the assigned feed *ad libitum* as designed.

3.5 Housing of experimental animals

All the experimental animals were housed in the separate well protected and ventilated sheep shed having feed and water troughs. They were weighed initially then at fortnightly intervals till the end of the experiment. The compartments were burnt by fire gun before putting the animals into it and daily cleaned to maintain sanitation. To get fresh and clean water the water troughs were pasted by lime paste.

3.6 Feeding treatments

The treatment-wise proportion for feeding dry matter through roughages and concentrates is as below.

T_0 .... 1/3 DM through concentrates + 2/3 through lucerne.

T_1 .... 1/3 DM through concentrate + 2/3 through green maize.

T_2 .... 1/3 DM through concentrate + 2/3 through maize silage.

T_3 .... 1/3 DM through concentrate + 2/3 through 50 per cent maize silage + 50 per cent green maize.

The CP level from each experimental feed was estimated before conducting the feeding trial. The lambs were fed @ 4 % of their body weight throughout the experimental trial.

3.7 Feeding procedure

The DM requirement of all twenty-four lambs was estimated at the rate of 4 per cent on live weight basis. The quantity of silage, lucerne, green maize and concentrate was so worked out that all the experimental lambs will get almost required amount of CP in all the four treatments. The quantity of each feed to be given was offered to lambs in a day of 24 hours half in the morning and the remaining quantity was fed in the evening. The left over was weighed next day morning and the feed intake was recorded by difference. Fresh and clean drinking water and mineral licks were supplied to the animals free of choice throughout the experimental period.

3.8 Observations recorded

3.8.1 Body weight of lambs

The lambs were weighed at fortnightly intervals on AVERY dial scale weighing balance to workout the average weight of each group.

3.8.2 Height of lambs

In order to measure the height, the lambs were allowed to stand at ease on a levelled floor and then the perpendicular distance between the floor level and the point of wither was recorded.

3.8.3 Chest girth

The chest girth was recorded by measuring the chest just behind the shoulder.

3.8.4 Body length

It was recorded as the straight distance between the point of shoulder and the pin bone.

3.8.5 Dry matter intake

The DM contents of feeds and fodders help to calculate exactly the quantity consumed by the experimental animals. Daily weights of the quantity of feeds offered and left over were used to find out the exact quantity of feeds consumed by lambs.

3.8.6 Feed conversion efficiency

The feed conversion efficiency was worked out for the different treatments using the following formula,

$$\text{Feed conversion efficiency} = \frac{\text{Total gain in body weight (kg)}}{\text{Total dry matter consumed (kg)}} \times 100$$

Plate 1. Experimental lambs under treatment T_0

Plate 2. Experimental lambs under treatment T_1

Plate 3. Experimental lambs under treatment T_2

Plate 4. Experimental lambs under treatment T_3

Plate 5. Experimental feed offered to lambs

3.8.7 Greasy fleece yield

At the end of experiment all the lambs were shorn to estimate the effect of different treatments on wool yield. Wool was weighed on AVERY dial scale, balance.

3.9 Statistical analysis

The data collected during the experimental period was subjected to statistical analysis. The average fortnightly body weights were analysed by using Factorial Randomised Block Design (FRBD) (Panse and Sukhatme, 1957) whereas, the other parameters *viz.*, daily DM intake, total DM intake, daily weight gain, total body weight gain, total gain in body length, total height gain, total chest girth gain, greasy fleece weight, feed efficiency, total feed cost and cost of feed per kg gain in body weight were analysed by using Randomised Block Design (RBD) as described by Snedercor and Cochran (1967).

RESULTS AND DISCUSSION

4. RESULTS AND DISCUSSION

The results of the feeding trial conducted are presented in the following pages.

4. Chemical composition of experimental feed

The data regarding chemical composition of experimental feeds is presented in Table 1(a).

Table 1(a) Chemical composition of Experimental feed

Experimental feed	Poximate components				
	CP	CF	TA	EE	NFE
T_0	19.35	18.38	10.98	3.29	49.00
T_1	11.11	20.58	10.31	2.32	58.42
T_2	10.50	20.38	10.18	2.78	56.17
T_3	10.80	20.48	10.25	2.48	57.30

From the results it is seen that numerically the CP in experimental feeds was found to be 19.35, 11.11,10.50, 10.80 in T_0, T_1, T_2, T_3, respectively, whereas CF was found to be more in T_1 (20.58) and less in T_0 (18.38). The NFE per cent was found to be more in T_1 (58.42) followed by T_3 (57.30) and T_2 (56.17) while it was less in T_0 (49.00).

4.1 Dry matter intake

4.1.1 Total DM intake

The data regarding total DM intake are presented in Table 2.

It revealed that the total DM intake of lambs was the highest (59.167 kg) in treatment T_3 followed by T_0, T_2 and T_1 (56.068, 52.150 and 50.125 kg) treatments, respectively. The treatments differed significantly ($P<0.05$). However, treatments T_1 and T_2, T_0 and T_2 and the treatments T_0 and T_3 were at par.

4.1.2 Daily DM intake

The data regarding daily DM intake are presented in Table 2 and depicted in Fig. 1.

The results show that the daily DM intake was the highest (657.407 g) in treatment T_3 followed by T_0, T_2 and T_1 (622.980, 579.443 and 556.942 g) treatments, respectively. The treatments differed significantly ($P<0.05$). However, the treatments, T_1 and T_2, T_0 and T_2 and the treatments T_0 and T_3 were at par.

Table 2. Effect of various treatments on DM intake of experimental lambs

Sr. No.	Attributes	Treatment averages #				Mean
		T_0	T_1	T_2	T_3	
1	Total DM intake (kg)	56.068	50.125	52.150	59.167	54.378
2	Daily DM intake (g)	622.980	556.942	579.443	657.407	604.193

Average of 6 lambs

ANOVA

Source of variation	D.F.	MSS		F	
		Total DM intake (kg)	Daily DM intake (g)	Total DM intake (kg)	Daily DM intake (g)
Replication	5	289.225	35706.000	--	--
Treatment	3	97.682	12059.330	5.62*	5.62*
Error	15	17.391	2147.133	--	--
S.E.±	--	1.702	18.917	--	--
C.D. at 5 %	--	5.130	57.003	--	--

The above results are in confirmity with findings of Moran *et al.* (1989) and Soman (1997).

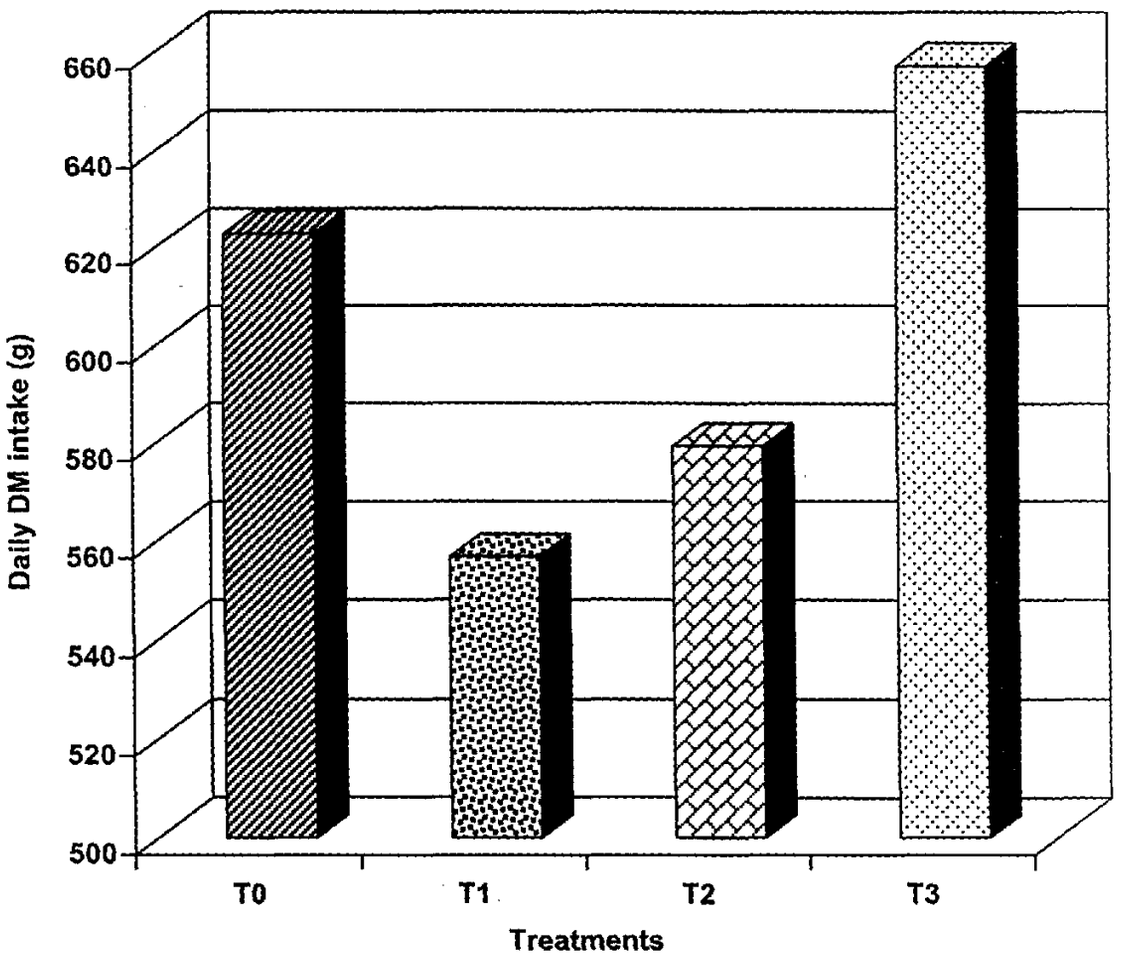


Fig.1 Daily DM intake of experimental lambs

Table 2(a) Dry matter intake and feed conversion efficiency of various experimental feeds

Particulars	Experimental feeds			
	T_0	T_1	T_2	T_3
Initial body weight of lambs (kg)	14.966	13.733	14.133	15.168
Final body weight of lambs (kg)	21.183	18.567	19.350	21.983
Gain in body weight (kg)	6.217	4.833	5.217	6.817
Daily gain in body weight (g)	69.073	53.518	57.962	76.296
Total dry matter consumed (kg)	56.068	50.125	52.150	59.167
Daily dry matter consumed (g)	622.980	556.942	579.443	657.407
Feed conversion efficiency	11.09	9.64	10.00	11.52

4.2 Growth performance

4.2.1 Total gain in body weight

The average total gain in body weight of the experimental lambs over three months period in all the four treatments are presented in Table 3 and depicted in Fig. 2.

The results presented in Table 3 revealed that the total gain in body weight was the highest for the lambs under treatment T_3 (6.817 kg) followed by T_0, T_2 and T_1 (6.217, 5.217 and 4.833 kg) treatments, respectively. The differences were significant ($P<0.05$). The treatments T_2 and T_1 were at par. This means that only green maize along with concentrates does not give suitable effect on the total gain in body weight of lambs. However, experimental feed containing green maize plus maize silage supplemented with concentrates gave significantly good results. This might be due to more energy intake through the maximum DM consumed (59.167 kg) from the assigned feed (T_3) than the other feeds.

The above results are in agreement with Murley and Mochrie (1956) and Robbins *et al.* (1984).

4.2.2 Daily gain in body weight

The data regarding average daily gain in body weight of experimental lambs are presented in Table 3.

It is revealed that the average daily gain in body weight ranged from 53.518 g to 76.296 g. The highest daily gain in body

weight was observed in lambs under T_3 (76.296 g) followed by those in T_0, T_2 and T_1 (69.073, 57.962 and 53.518 g) treatments, respectively. The treatment differences were significant ($P<0.05$). The treatments T_2 and T_1 were at par. The experimental feed containing green maize + maize silage gave the best results of daily gain in body weight whereas feed containing only green maize showed decreasing effect.

The above results are in agreement with those reported by Singh (1980), Mohan and Murthy (1984) and Fernandes *et al.* (1988).

Table 3. Effect of different treatments on total gain and daily gain in body weight of experimental lambs

Sr. No.	Attributes	Treatment averages #				Mean
		T_0	T_1	T_2	T_3	
1	Total grain in weight (kg)	6.217	4.833	5.217	6.817	5.771
2	Daily gain in weight (g)	69.073	53.518	57.962	76.296	64.212

Average of 6 lambs

ANOVA

Source of variation	D.F.	MSS		F	
		Total gain in body weight (kg)	Daily gain in body weight (g)	Total gain	Daily gain
Replication	5	0.605	73.875	--	--
Treatment	3	4.957	646.138	45.03*	44.45*
Error	15	0.110	14.538	--	--
S.E.±	--	0.135	1.557	--	--
C.D. at 5 %	--	0.408	4.690	--	--

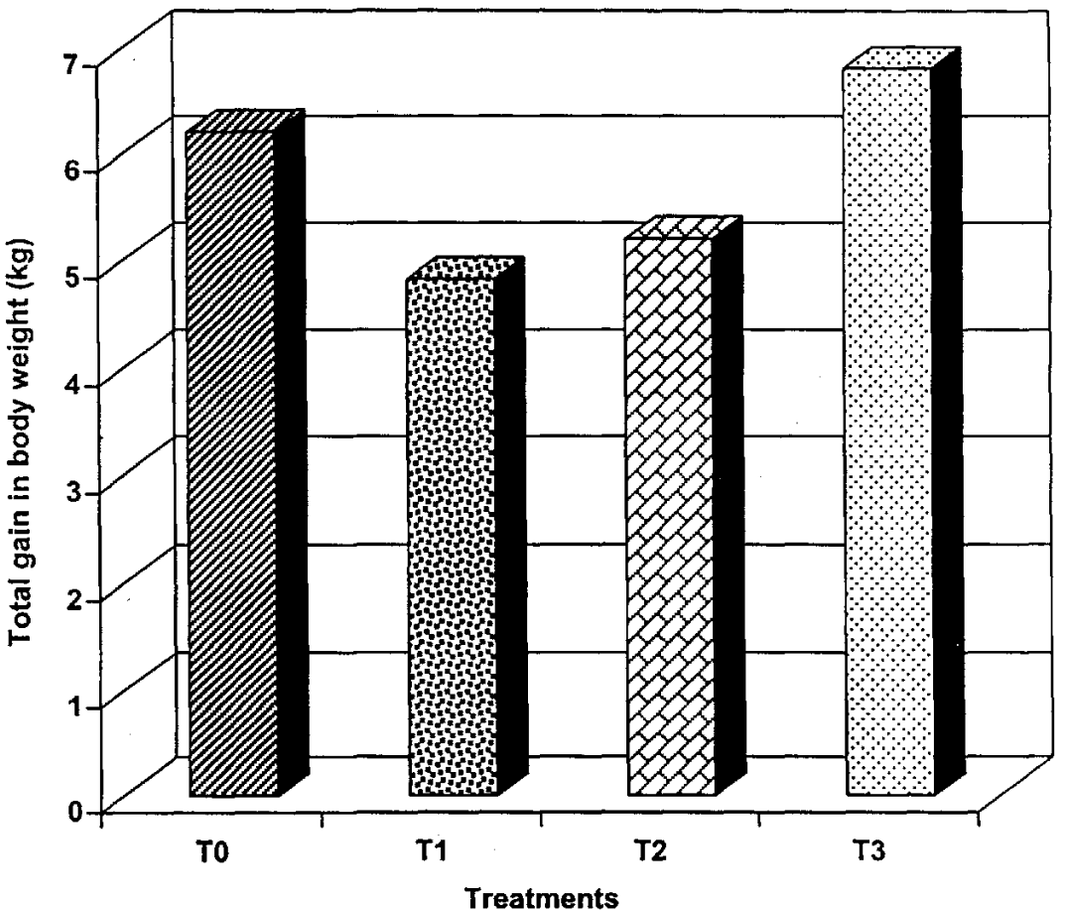


Fig.2 Total gain in body weight of experimental lambs

4.2.3 Fortnightly body weight

The average fortnightly body weights of the experimental lambs are presented in Table 4 and depicted in Fig. 3.

Table 4. Fortnightly body weights (kg) of experimental lambs

Feeding intervals (fortnights)	Treatments			
	T_0	T_1	T_2	T_3
	Initial body weight			
	14.966	13.733	14.133	15.168
1	16.000	14.500	14.933	16.200
2	16.850	15.183	15.650	17.167
3	17.783	15.950	16.450	18.250
4	18.783	16.767	17.300	19.417
5	19.917	17.617	18.267	20.650
6 (Final body weight)	21.183	18.567	19.350	21.983

= Average of 6 lambs

ANOVA

Source of variation	D.F.	MSS	F
Replication	5	42.334	--
Fact A : Treatment	3	50.158	11.68*
Fact B : Feeding interval	5	79.457	18.50*
Interaction	15	0.508	0.12NS
Error	115	4.294	--
Total	143	--	--

	S.E. ±	C.D. at 5 %
Treatment	0.345	0.969
F intervals	0.423	1.187
Interaction	0.846	NS

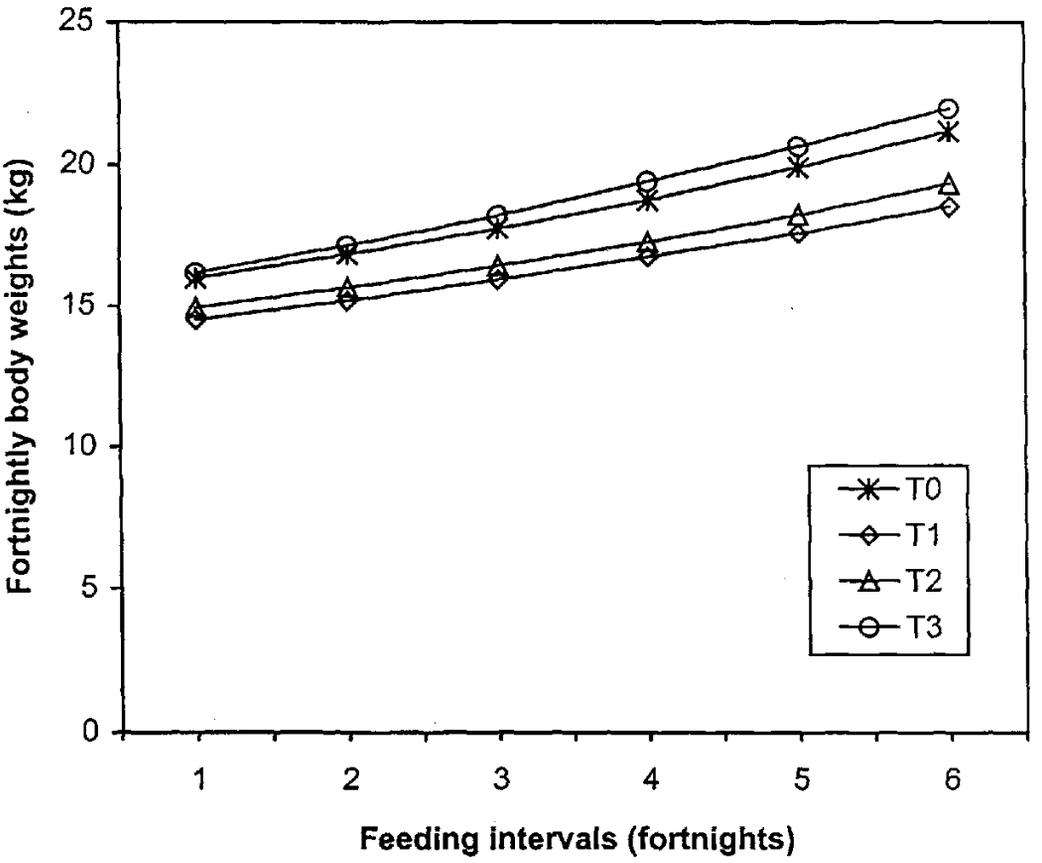


Fig.3 Fortnightly body weights of experimental lambs

The data revealed that the treatments had significant effect on the average fortnightly body weights of the lambs. Overall average body weight was highest in the treatment T_3 (21.983 kg) followed by T_0, T_2 and T_1 (21.183, 19.350 and 18.567 kg) treatments, respectively. Almost in all the average fortnightly body weights the treatments T_3 was superior over all other treatments.

4.3 Skeletal growth

4.3.1 Height at withers

The data on increase in height at periodical intervals are presented in Table 5 and depicted in Fig. 4.

The average total gain in height at withers was 13.2, 11.8, 12.3 and 14.5 cm, in lambs under treatments T_0, T_1, T_2 and T_3, respectively. The treatment differences were significant ($P<0.05$). The treatments T_2 and T_1 were at par. Each lamb gained 2.20, 1.97, 2.05 and 2.42 cm height per fortnight in all the treatments, respectively. The average daily gain in height was 0.15, 0.13, 0.14 and 0.16 cm, respectively, in treatments T_0, T_1, T_2 and T_3.

Thus, the average of total gain, fortnightly gain and daily gain in height was the highest in T_3 followed by T_0, T_2 and T_1 treatments, respectively.

The above results are in agreement with Upase (1989) and Patil (1999).

Table 5. Total gain in height at wither of experimental lambs

Treatment	Average total gain in height (cm)#	Average fortnightly gain (cm)#	Average daily gain (cm)#
T_0	13.2	2.20	0.15
T_1	11.8	1.97	0.13
T_2	12.3	2.05	0.14
T_3	14.5	2.42	0.16

= Average of 6 lambs.

ANOVA

Source of variation	D.F.	MSS	F
Replication	5	4.103	--
Treatment	3	8.420	47.40*
Error	15	0.178	--
Total	23	--	--

F test : Significant C.D. (0.05) : 0.519

S.E.± : 0.172 Mean : 12.95

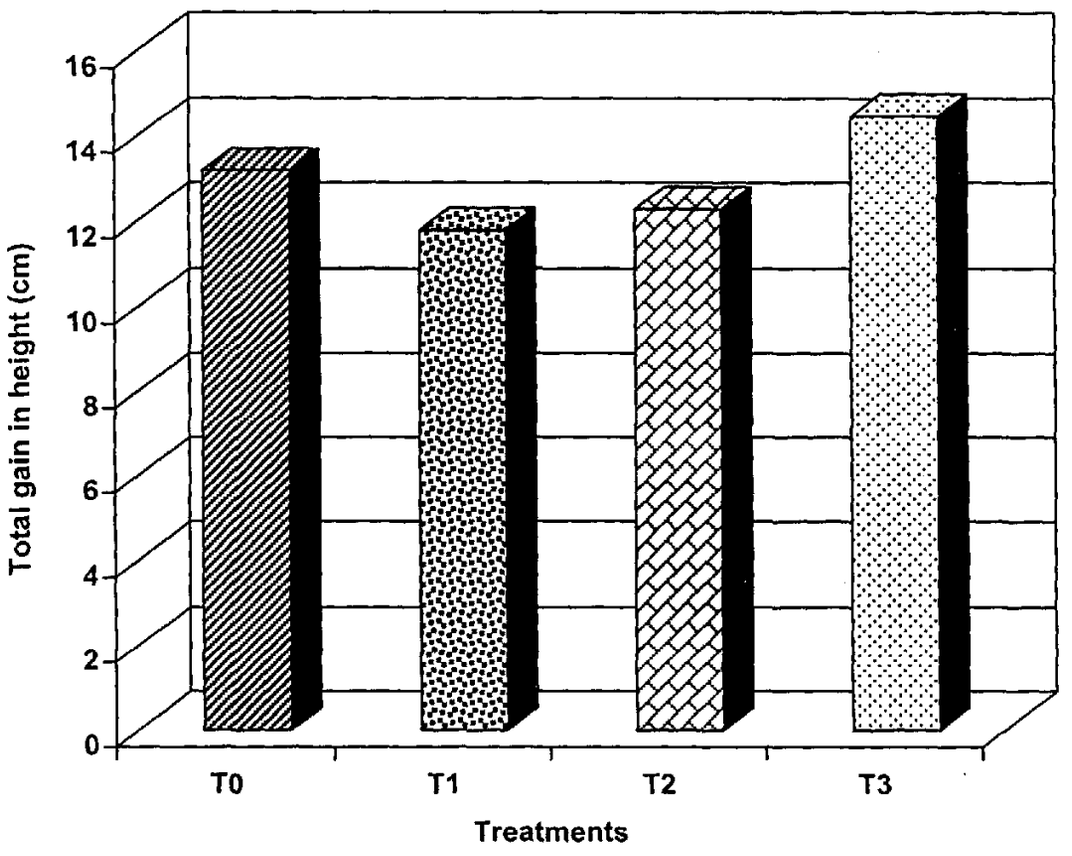


Fig.4 Total gain in height of experimental lambs

4.3.2 Body length

The data on gain in body length are presented in Table 6 and depicted in Fig. 5.

The average total gain in body length was 10.6, 9.5, 9.9 and 11.4 cm in T_0, T_1, T_2 and T_3 treatments, respectively. The treatment differences were significant ($P<0.05$). Each lamb gained on an average length of 1.77, 1.59, 1.65 and 1.90 cm per fortnight in T_0, T_1, T_2 and T_3 treatments, respectively. The daily gain in body length averaged 0.12, 0.10, 0.11 and 0.13 cm in T_0, T_1, T_2 and T_3 treatments, respectively.

Table 6. Total gain in body length of experimental lambs

Treatment	Average total gain in body length (cm)#	Average fortnightly gain (cm)#	Average daily gain (cm)#
T_0	10.6	1.77	0.12
T_1	9.5	1.59	0.10
T_2	9.9	1.65	0.11
T_3	11.4	1.90	0.13

= Average of 6 lambs.

ANOVA

Source of variation	D.F.	MSS	F
Replication	5	1.673	--
Treatment	3	4.241	91.44*
Error	15	0.046	--
Total	23	--	--

F test : Significant C.D. (0.05) : 0.265

S.E.± : 0.088 Mean : 10.35

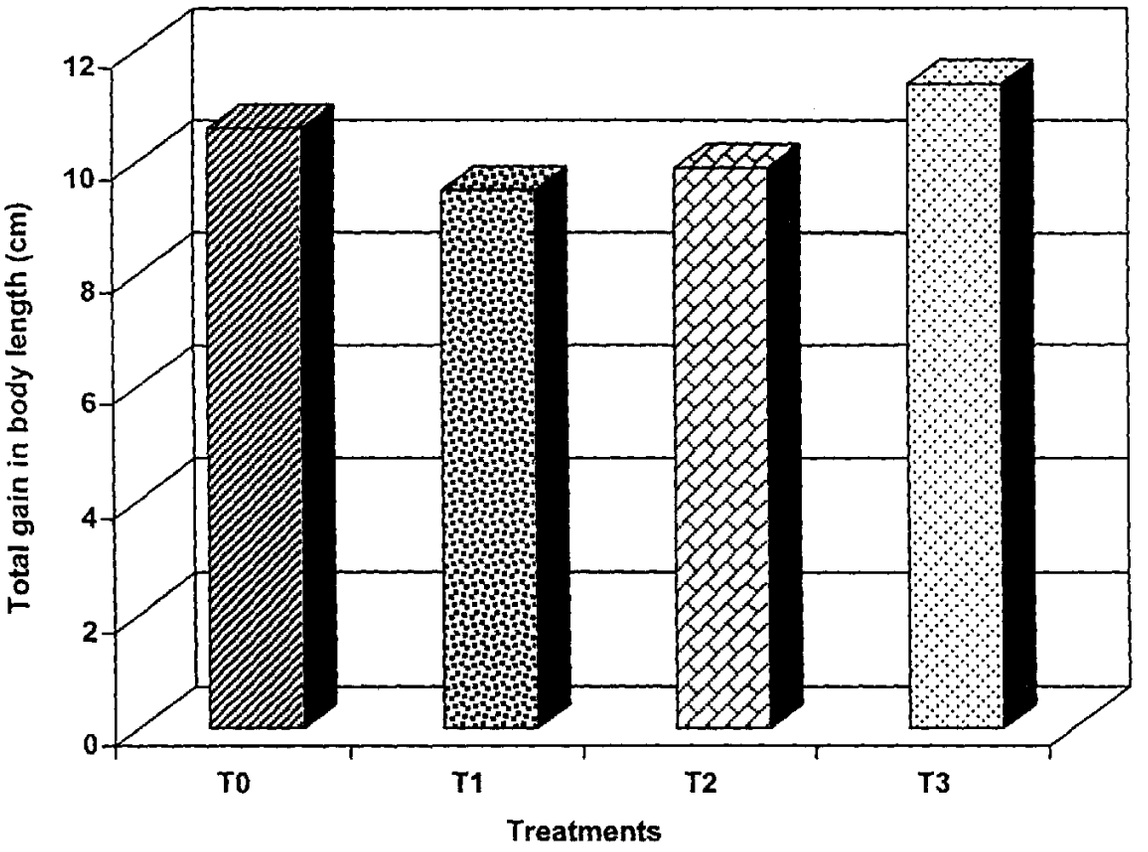


Fig.5 Total gain in body length of experimental lambs

Thus, the averages of total gain, fortnightly gain and daily gain in body length was the highest in T_3 followed by T_0, T_2 and T_1 treatments, respectively. The above results are in co-ordination with findings of Upase (1989) and Patil (1999).

4.3.3 Chest girth

The data on effect of feeding different feed combinations on chest girth of lambs are presented in Table 7 and depicted in Fig. 6.

The average total gain in chest girth was 11.4, 9.8, 10.5 and 12.5 cm, respectively in treatments T_0, T_1, T_2 and T_3, respectively. Each lamb gained on an average 1.90, 1.63, 1.74 and 2.08 cm chest girth per fortnight in T_0, T_1, T_2 and T_3 treatments, respectively. The daily gain in chest girth averaged 0.13, 0.11, 0.12 and 0.14 cm in T_0, T_1, T_2 and T_3 treatments, respectively.

Thus, the averages of total gain, fortnightly gain and daily gain in chest girth was the highest in T_3 followed by T_0, T_2 and T_1 treatments, respectively. The treatment differed significantly ($P<0.05$). However, treatments T_2 and T_1, T_0 and T_2 and the treatments T_0 and T_3 were at par.

The above results are closely associated with results of Upase (1989) and Patil (1999).

Table 7. Total gain in chest girth of experimental lambs

Treatment	Average total gain in chest girth (cm)#	Average fortnightly gain (cm)#	Average daily gain (cm)#
T_0	11.4	1.90	0.13
T_1	9.8	1.63	0.11
T_2	10.5	1.74	0.12
T_3	12.5	2.08	0.14

= Average of 6 lambs.

ANOVA

Source of variation	D.F.	MSS	F
Replication	5	3.140	--
Treatment	3	8.217	6.19*
Error	15	1.326	--
Total	23	--	--

F test : Significant C.D. (0.05) : 1.417

S.E.± : 0.470 Mean : 11.05

4.4 Greasy fleece weight

The data on average greasy fleece weight in four experimental groups are presented in Table 8.

The results show that the average greasy fleece weight in all the treatments differed significantly ($P<0.05$). The treatments T_2 and T_1 were at par. The average greasy fleece weight was highest in the treatment T_3 (1.317 kg), followed by T_0, T_2 and T_1 (1.117, 0.733 and 0.683 kg) treatments, respectively. The results are depicted in Fig. 7.

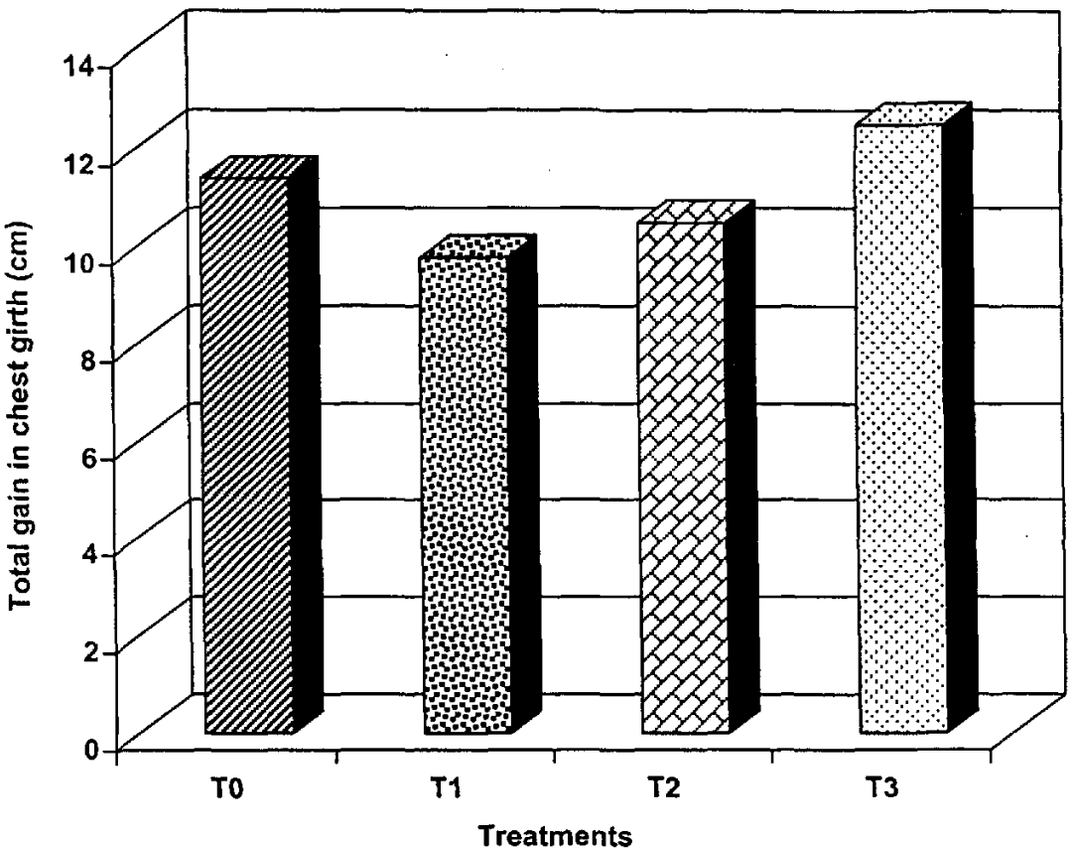


Fig.6 Total gain in chest girth of experimental lambs

The above results are in confirmation with the findings of Singh (1966), Arora and Krishnamurthy (1984) and Palve (1988).

Table 8. Greasy fleece weight of experimental lambs at the end of experiment

Treatment	Average greasy fleece weight (kg)#
T_0	1.117
T_1	0.683
T_2	0.733
T_3	1.317

= Average of 6 lambs.

ANOVA

Source of variation	D.F.	MSS	F
Replication	5	0.031	--
Treatment	3	0.559	22.40*
Error	15	0.025	--
Total	23	--	--

F test : Significant C.D. (0.05) : 0.194

S.E.± : 0.065 Mean : 0.963

4.5 Feed conversion efficiency (%)

The data on feed conversion efficiency in four experimental groups are presented in Table 9 and depicted in Fig. 8.

The results indicate that the differences were significant ($P<0.05$). The treatment T_3 showed the highest feed conversion efficiency. However, treatments T_3 and T_0 were at par. The average per

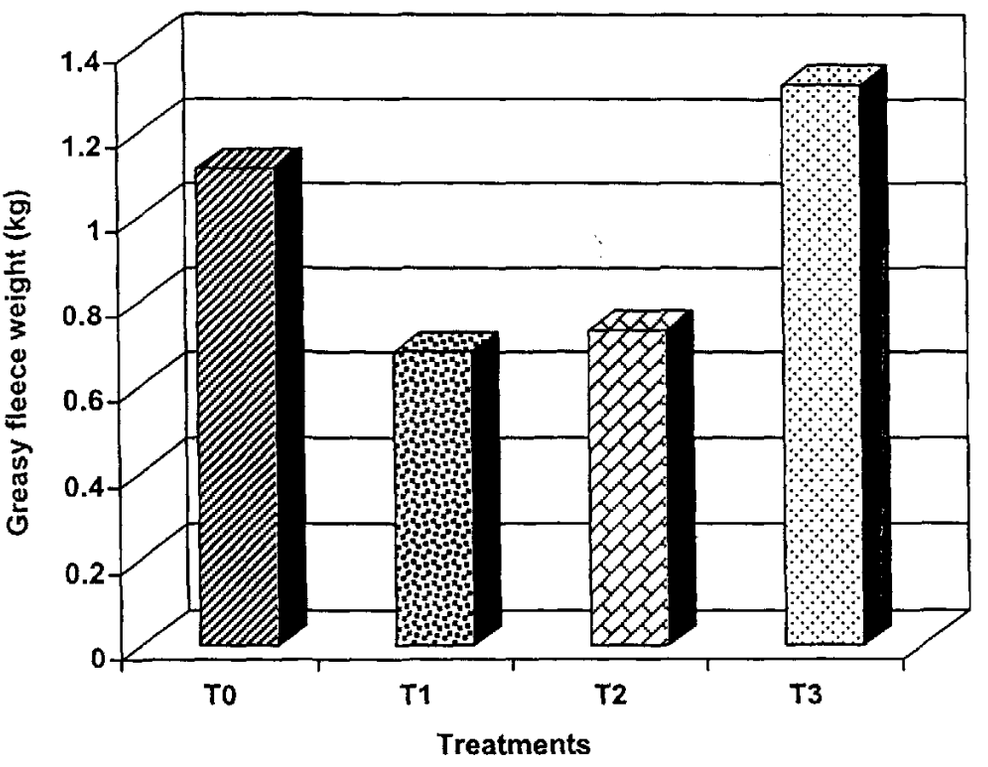


Fig.7 Greasy fleece weight of experimental lambs at the end of experiment

cent feed conversion efficiency was highest in the treatment T_3 (11.52 %), followed by T_0, T_2 and T_1 (11.09, 10.00 and 9.64 %) treatments, respectively.

The above results are in agreement with the findings of Mohan and Murthy (1984), Patel (1985) and Fernandes *et al.* (1988).

Table 9. Feed conversion efficiency (%) of experimental lambs

Treatment	Average total DM intake (kg)	Average total gain in body weight (kg)	Feed conversion efficiency (%) #
T_0	56.068	6.217	11.09
T_1	50.125	4.833	9.64
T_2	52.150	5.217	10.00
T_3	59.167	6.817	11.52

= Average of 6 lambs.

ANOVA

Source of variation	D.F.	MSS	F
Replication	5	7.278	--
Treatment	3	4.762	24.22*
Error	15	0.197	--
Total	23	--	--

F test : Significant C.D. (0.05) : 0.546

S.E.± : 0.181 Mean : 10.560

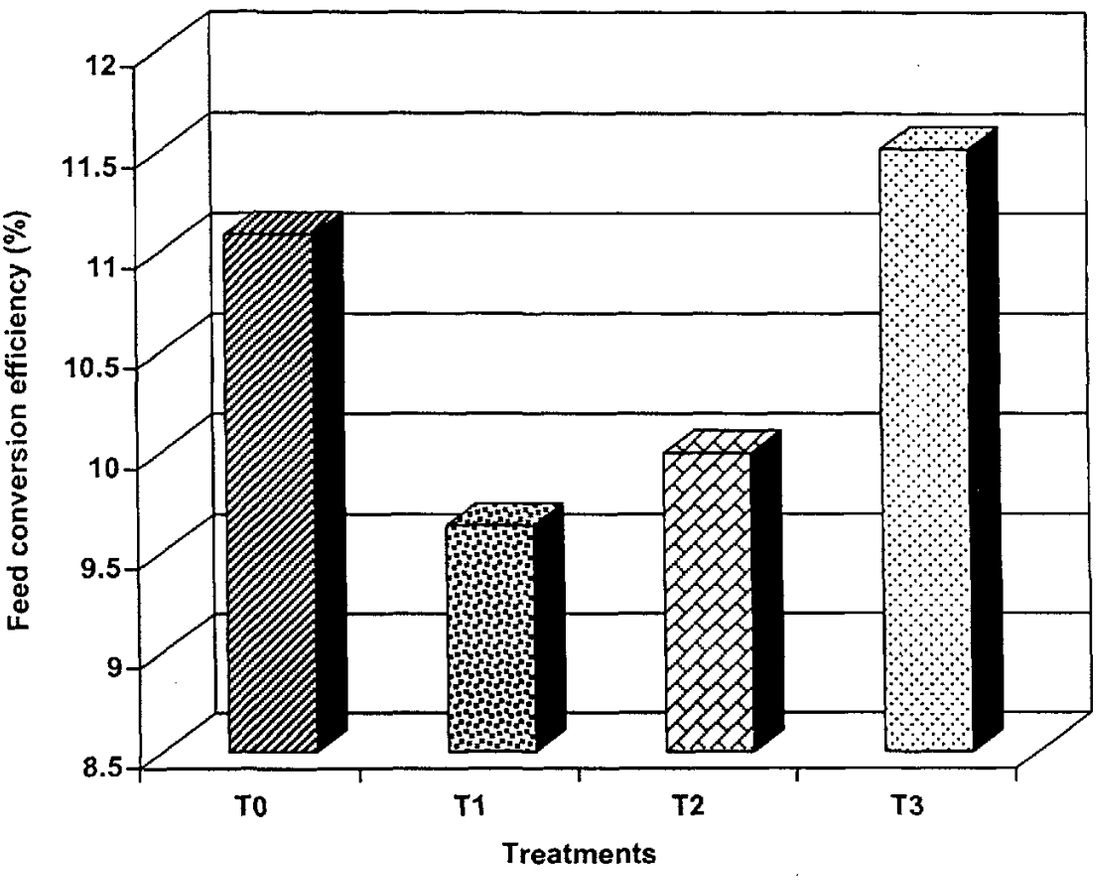


Fig.8 Feed conversion efficiency (%) of experimental lambs

4.6 Total cost of feed

The results of the average total cost of the feeds fed to experimental lambs are presented in Table 10.

It is seen from the results presented in Table 10, that the average total cost of the experimental feed was the highest (Rs. 210.13) in treatment T_0 followed by T_3, T_1 and T_2 (Rs. 161.52, 155.62 and 139.45) treatments, respectively. All the treatments differed significantly ($P<0.05$).

Table 10. Total cost of feed during experimental period

Treatment	Average total feed cost (Rs)#
T_0	210.13
T_1	155.62
T_2	139.45
T_3	161.52

= Average of 6 lambs.

ANOVA

Source of variation	D.F.	MSS	F
Replication	5	600.400	--
Treatment	3	5556.396	252.95*
Error	15	21.967	--
Total	23	--	--

F test : Significant C.D. (0.05) : 5.766

S.E.± : 1.913 Mean : 166.680

4.7 Cost of feed per kilogram gain in body weight

As per rate quoted in Appendix-II, the average cost of feed per kilogram gain in body weight of experimental lambs are presented in Table 11 and depicted in Fig. 9.

It is seen that average cost of feed required per kilogram gain in body weight was the lowest in T_3 (Rs. 23.69) followed by T_2, T_1 and T_0 (Rs. 26.73, 32.20 and 33.80) treatments, respectively. The treatment differences were significant ($P<0.05$). However, treatments T_0 and T_1 were at par.

Table 11. Cost of feed per kilogram gain in body weight during the experimental period

Treatment	Average cost of feed per kg gain in body weight (Rs.)#
T_0	33.80
T_1	32.20
T_2	26.73
T_3	23.69

= Average of 6 lambs.

ANOVA

Source of variation	D.F.	MSS	F
Replication	5	36.595	--
Treatment	3	133.274	24.39*
Error	15	5.465	--
Total	23	--	--

F test : Significant C.D. (0.05) : 2.876

S.E.± : 0.954 Mean : 29.105

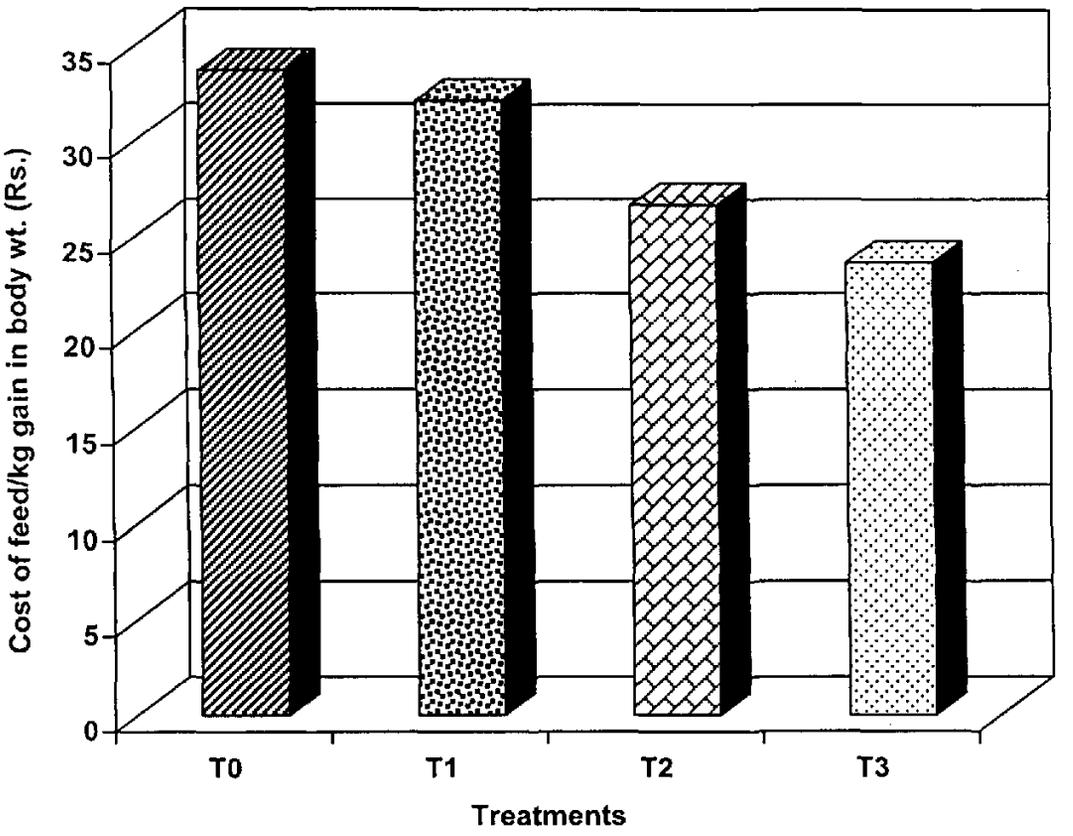


Fig.9 Cost of feed per kg gain in body weight of experimental lambs

These results therefore, clearly suggest that the feed combination under the treatment T_3 (1/3 DM through concentrate + 2/3 through 50 % maize silage + 50 % green maize) proved to be the most economical as well as the most beneficial from the growth point of view. Hence, it could be recommended to the shephards for economical sheep production.

SUMMARY AND CONCLUSIONS

5. SUMMARY AND CONCLUSIONS

5.1 Summary

The present investigation entitled, "Effect of feeding different combinations of fodders on the growth of weaned Deccani lambs" was conducted at Network Project on Sheep Improvement, Department of Animal Science and Dairy Science, Mahatma Phule Krishi Vidyapeeth, Rahuri, for the period of 3 months from 15th January to 15th April, 2000. This experiment was planned with a view to assess the DM intake, growth performance, feed conversion efficiency and cost of feeding with different feed combinations.

In all, 24 Deccani lambs of 3 months' age and of similar weight were selected and alloted to four groups as treatments. They were fed with four different types of feed. The daily feed intake, fortnightly body weight, body height, body length and chest girth were recorded during the experimental period. The data recorded on DM intake and growth performance was statistically analysed for testing the significance. The results are summarized here under.

5.1.1 Chemical composition of experimental feed

From the results it is seen that numerically the CP in experimental feeds was found to be 19.35, 11.11,10.50, 10.80 in T_0, T_1, T_2, T_3, respectively, whereas CF was found to be more in T_1 (20.58) and

less in T_0 (18.38). The NFE per cent was found to be more in T_1 (58.42) followed by T_3 (57.30) and T_2 (56.17) while it was less in T_0 (49.00).

5.1.2 DM intake

5.1.2.1 Total DM intake

The average total DM intake was highest in T_3 (59.167 kg) followed by T_0, T_2 and T_1 (56.068, 52.150 and 50.125 kg) treatments, respectively. The treatment differed significantly ($P<0.05$). However, treatments T_1 and T_2, T_0 and T_2 and the treatments T_0 and T_3 were at par. Results showed that changes in type of feeds due to feed combination had additive effect on intake, which might be due to laxativeness of maize silage included in the feed.

5.1.2.2 Daily DM intake

The results revealed that average daily DM intake was highest in T_3 (657.407 g) followed by T_0, T_2 and T_1 (622.980, 579.443 and 556.942 g) treatments, respectively. The treatment differences were significant ($P<0.05$). However, treatments T_1 and T_2, T_0 and T_2 and the treatments T_0 and T_3 were at par.

5.1.3 Growth performance

The experimental results showed that the total body weight gain was the highest in T_3 (6.817 kg) followed by T_0, T_2 and T_1 (6.217, 5.217 and 4.833 kg) treatments, respectively and all the treatments differences except T_2 with T_1 were significant ($P<0.05$). The fortnightly body weights were the highest in T_3 (18.944 kg) followed by T_0, T_2 and

T_1 (18.419, 16.992 and 16.431 kg) treatments, respectively with significant treatment differences ($P<0.05$). The average daily gain in body weight was the highest in T_3 (76.296 g) followed by T_0, T_2 and T_1 (69.073, 57.962 and 53.518 g) treatments, respectively. Treatment differed significantly ($P<0.05$). However, treatments T_2 and T_1 were at par.

It showed that feeding of only green maize along with concentrates (T_1) does not have suitable effect on the total gain in body weight. However, experimental feed containing green maize + maize silage along with concentrates (T_3) gave significantly good result. This might be due to more intake of DM by the lambs because of combinations of different types of laxative feeds i.e. maize green and maize silage.

5.1.4 Skeletal growth

5.1.4.1 Body height gain

It was observed that average total gain in body height was the highest in T_3 (14.5 cm) followed by T_0, T_2 and T_1 (13.2, 12.3 and 11.8 cm) treatments, respectively. The treatment differences were significant ($P<0.05$). However, treatments T_2 and T_1 were at par.

5.1.4.2 Body length gain

The results revealed that average total gain in body length was the highest in T_3 (11.4 cm) followed by T_0, T_2 and T_1 (10.6, 9.9 and 9.5 cm) treatments, respectively. The treatments differed significantly ($P<0.05$).

5.1.4.3 Chest girth gain

The results revealed that the average total gain in chest girth of experimental lambs was the highest in T_3 (12.5 cm) followed by T_0, T_2 and T_1 (11.4, 10.5 and 9.8) treatments, respectively. The treatment differences were significant ($P<0.05$). However, treatments T_2 and T_1, T_0 and T_2 and the treatments T_0 and T_3 were at par.

5.1.5 Feed conversion efficiency

It was seen from the results obtained of the present investigation that treatments T_3 and T_0, T_2 and T_1 were at par, but there are significant differences between others. The feed conversion efficiency was the highest in T_3 (11.52 %) followed by T_0, T_2 and T_1 (11.09, 10.00 and 9.64 %) treatments, respectively.

5.1.6 Greasy fleece weight

It was observed that average greasy fleece weight was the highest in T_3 (1.317 kg) followed by T_0, T_2 and T_1 (1.117, 0.733 and 0.683 kg) treatments, respectively. The treatment differences were significant ($P<0.05$). However, treatments T_2 and T_1 were at par.

5.1.7 Total cost of feed

Feeding of sole green maize (T_0) along with concentrate had significantly ($P<0.05$) reduced the total cost of feed (Table 10). The cost of feed to raise the lambs was the highest in T_0 (Rs. 210.13) followed by

T_3, T_1 and T_2 (Rs. 161.52, 155.62 and 139.45) treatments, respectively, during the experimental period.

5.1.8 Cost of feed required per kilogram gain in body weight

It was observed from the results that the cost of feed per kg gain in body weight was the lowest in T_3 (Rs. 23.69) followed by T_2, T_1 and T_0 (Rs. 26.73, 32.20 and 33.80) treatments, respectively. The differences were significant ($P<0.05$).

Hence, combination of green maize : maize silage (50:50) is the most economical and can be recommended to raise the lambs profitably. It is therefore suggested that combinations of feed should be made while feeding the lambs to get more gain in body weight.

5.2 Conclusions

1. Feed combination (T_3) containing green maize + maize silage in 50:50 proportion along with the concentrates had been the best feed combination giving the highest growth performance in weaned lambs.
2. Average greasy fleece weight was higher in treatment T_3 than rest of the treatments.
3. The feed conversion efficiency was the highest in T_3 than rest of the treatments and also the cost per kg gain in body weight was lower in T_3 than rest of the treatments.

Thus, from the present findings it may be stated that the feeding of maize silage in combination with green maize (50:50) along with concentrate could give superior and cost effective results over the rest of treatments. Hence, the same may be recommended to the shephards for economical and profitable fat lamb production. Such type of study by taking other combinations of feed should be undertaken to draw a concrete conclusion about effective feeding of different combinations of feeds.

LITERATURE CITED

6. LITERATURE CITED

Acharya, R.M. 1981. Status of sheep production in India. 1st proceedings of the society and National seminar on sheep and goat production and utilization . pp. 15-50.

Adebowale, E.A. 1985. The performance of West African dwarf goats and sheep fed silage and silage plus concentrate. Nutr. Abstr. and Rev. 55 (8) : 4025.

Anonymous. 1990. FAO Statistics.

A.O.A.C. 1984. "Official method of analysis" 14th Ed. Association of Official Analytical Chemists, Washington, D.C.

Argillier, O., Barriere, Y., Traineau, R., Emile, J.C. and Hebert, Y. 1997. Genotype x environment interactions for digestibility traits in silage maize estimated from in vivo measurements with standard sheep. J. Pl. Breed. 116 (5) : 423-427.

Arora, C.L. and Krishnamurthy, U.S. 1984. Growth and wool production and quality upto sixth months of age in Nilgiri and it's halfbreds with Rambouillet and Soviet Merino. Indian J. Anim. Sci. 54 (8) : 824-828.

Buchanan, J.G., Macleod, G.K. and Jofriet, J.C. 1981. Ensiling of wet cage layer excreta with corn and its effect upon intake, digestion and balance by sheep. Nutr. Abstr. and Rev. 51 (11) : 6305.

Burgkart, M., Mendel, G., Sattes, R. and Wallner, F. 1989. Conserved maize products in lamb fattening. Nutr. Abstr. and Rev. 59 (7) : 3104.

Buttrey, S.A., Allen, V.G., Fontenot, J.P. and Reneau, R.B. 1987. Effect of sulphur fertilization on chemical composition, ensiling characteristics and utilization of maize silage by lambs. Nutr. Abstr. and Rev. 57 (3) : 1266.

Calatoiu, A., Vicovan, A., Grigore, L. and Maltopol, M. 1989. Green maize silage for feeding fattening lambs. Nutr. Abstr. and Rev. 59 (7) : 3105.

Carneiro, A.M., Rodriguez, N.M., Sanches, R.L. and Socorro, E.P. 1983. Intake and apperent digestibility (by sheep) of mixed silages of maize and annual soya. Nutr. Abstr. and Rev. 53 (3) : 1594.

Cilliers, J.W. and Cilliers, H.J. 1998. Maize silage, grain sorghum silage and forage sorghum silage in diets with different proportions of concentrate for the finishing of weaner lambs. J. Anim. Sci. 66 (1) : 189-196.

Daniel, P. 1986. Intake of mixed silage of maize and Medicago sativa in sheep. Nutr. Abstr. and Rev. 56 (10) : 5592.

Dastagiri, M.B. and Rao, N.A. 1990. Economics of sheep farming. Livestock Advisor. 26 (1) : 11-17.

Dayrell, M. and Ivan, M. 1989. True absorption of phosphorous in sheep fed corn silage and corn silage supplemented with Di-calcium or Rock phosphate. Canad. Anim. Sci. 69 : 181-186.

Deoka, K., Bando, T. and Okamoto, M. 1983. Effect of aerobic deterioration of corn silage on rumen fermentation, ruminating behaviour and digestibility by sheep. Nutr. Abstr. and Rev. 53 (9) : 4711.

Dewar, W.A. and McDonald. 1961. Determination of dry matter in silage by distillation with toluene. J. Sci. Food. Agric. 12 : 790.

Fernandes, A.P., Bagal, C.G. and Deshmukh, A.P. 1988. Effect of feeding maize silage on the growth rate of Deccani and crossbred lambs. Indian J. Anim. Sci. 58 (12) 1454-1456.

Florek, S., Rydzik, W., Rusiecka, I. and Stanek, M. 1992. Performance of growing sheep fed on diets containing maize silage and beet fodders. Nutr. Abstr. and Rev. 62 (12) : 6326.

Fujihara, T. and Harumoto, T. 1992. Eating and rumination behaviour in sheep fed only maize silage. Nutr. Abstr. and Rev. 62 (9) : 4468.

Gopalkrishnan, C.A. and Mohanlal, G.M. 1985. Livestock and poultry enterprises for rural development. Vikas Publishing House Pvt. Ltd., New Delhi. pp. 1096.

Gupta, P.C., Kirpal Singh and Sharda, D.P. 1981. Note on chemical composition and nutritive value of green maize and maize silage. Indian J. Anim. Sci. 51 (10) : 975-976.

Heimbeck, W.K., Schwarz, F.J., Kirchgessner, M. 1989. Effects of different chopping lengths and subsequent crushing of whole maize plants on nutrient digestibility. First communication the effect of different methods of preparing maize silage on nutrient digestibility in heifers and wethers. Nutr. Abstr. and Rev. 59 (7) : 2836.

Iliev, F. 1988a. Intake of maize silage and meadow hay mixtures by sheep. Nutr. Abstr. and Rev. 58 (1) : 319.

Iliev, F. 1988b. Effect of maize silage and concentrates mixed in different rations on intake of sheep. Nutr. Abstr. and Rev. 58 (8) : 3534.

Iliev, F. 1992. Effect of maize silage and sunflower oilmeal, mixed in varying proportions, on intake by sheep. Nutr. Abstr. and Rev. 62 (7) : 3595.

Jain, R.D., Qureshi, M.I. and Shrikant Joshi. 2000. Genetic studies on greasy fleece yield in Rambouillet sheep in the arid region of Rajasthan. Indian Vet. J. 77 (4) : 317-320.

Kalra, D.B. 1991. Problems and solutions of adaptability of native, crossbred and exotic sheep. Livestock Advisor. 16 (2) : 27-30.

Kirchgessner, M., Heimbeck, W.K. and Schwarz, F.J. 1992. Sheep and Cattle as experimental animals for measuring the digestibility of maize silage with an increasing amount of Kernels. Nutr. Abstr. and Rev. 62 (1) : 23.

Kirilov, A. and Naidenov, T. 1992. Composition, yield, intake and digestibility of green maize. Nutr. Abstr. and Rev. 62 (7) : 3592.

KO, Y.D. and An, B.G. 1990. Ensiling of whole maize crop with broiler manure 2. Digestibility and palatability of the silage. Nutr. Abstr. and Rev. 60 (7) : 3417.

KO, Y.D., Kwack, C.H. and Song, D.J. 1992. Quality and feeding value of whole crop corn poultry excreted silage. Nutr. Abstr. and Rev. 62 (7) : 3310.

Koeln, L.L., Hunt, C.W., Bowman, D.K. and Paterson, J.A. 1984. Maize whole silage as a supplimental protein source for growing lambs and finishing steers. Anim. Feed Sci. Technol. 11 : 181-187.

Krajinovic, M., Mesaros, A. and Mamic, M. 1991. The possibility of partial substitution of classical rations by silage in an extended fattening of lambs. Nutr. Abstr. and Rev. 61 (10) : 5262.

Krishna Mohan, D.V.G. and Shreeram Murthy. 1984. Growth rate and feed efficiency of Mandya and Dorset x Mandya female weaners. Indian J. Anim. Sci. 54 (12) : 1167-1169.

Lanza, A., Lanza, E., Pennisi, P. and Licitra, G. 1991. Effects of feed restriction and the use of whole maize silage in diets for lambs. Nutr. Abstr. and Rev. 61 (7) : 3492.

Lemerle, C., Moran, J.B. and Trigg, T.E. 1983. Utilization of maize silage baed diets by dairy cows and sheep. Nutr. Abstr. and Rev. 53 (9) : 4672.

Liu, J.X., Kondo, S., Sekine, J.J., Okubo, M. and Asahida, Y. 1987. The nutritive values of grass, corn and rice silages fed to sheep at different levels. Nutr. Abstr. and Rev. 57 (11) : 5125.

Lomos, L.W., Fox, D.G. and Black, J.R. 1982. Ammonia treatment to corn silage (1) Feedlot performance of growing steers. J. Anim. Sci. 55 (5) : 909.

Margan, D.E., Moran, J.B. and Spence, F.B. 1995. Energy and protein value of combinations of maize silage and red clover hay for ruminants, using adult sheep as a model. Nutr. Abstr. and Rev. 65 (4) : 1837.

Marimuthu, N. and Subbarayalu, M. 1987. Problem of sheep farming and their remedial measures. Livestock Advisor. 12 (7) : 15-18.

Maslakov, V.V. 1986. Digestibility of diatory nutrients and nitrogen metabolism in wethers given large amount of maize silage. Nutr. Abstr. and Rev. 56 (11) : 6181.

Matsuoka, S., Itagaki, T., Hamada, M., Takahashi, J. and Fujita, H. 1984. Nutritive value of corn silage at different stages of aerobic deterioration. Nutr. Abstr. and Rev. 54 (9) : 3494.

Miaki, T., Tanaka, S. and Kawamura, O. 1985. Relative nutritive value of whole crop corn silages sown on different dates. Nutr. Abstr. and Rev. 55 (8) : 3766.

Moran, J.B., Lemerle, C. and Trigg, T.E. 1989. Intake and digestion of maize-silage based diets by dairy cows and sheep. Nutr. Abstr. and Rev. 59 (2) : 728.

Murley, W.R. and Mochrie, R.D. 1995. Corn silage as the only roughage for dairy calves. J. Dairy Sci. 19 (1) : 4-9.

Nehring, K. and Laube, W. 1959a. The composition and fodder value of maize silage and green maize. Herb. Abstr. 29 (2) : 110-111.

Nehring, K. and Laube, W. 1959b. Changes in the composition of green maize during growth and their importance for ensiling. Herb. Abstr. 29 (4) : 268.

Nordfeldt, S. 1961. Silage of green fodder maize. Herb. Abstr. 31 (1) : 32-33.

Pachauri, V.C., Upadhaya, R.S. and Verma, N.C. 1988. Comparative nutrient utilization from green maize in buffalo, cattle and goats. Indian J. Anim. Nutr. 5 (1) : 57-60.

Palve, P.K. 1988. Studies on wool quantity and quality in Deccani and its crosses with Dorset and Russian Merino, Thesis submitted to MPKV, Rahuri for M.Sc.(Agri.) degree. (Unpublished).

Panse, V.G. and Sukhatme, P.V. 1957. Statistical method for Agricultural workers, I.A.R.I., New Delhi.

Patel, S.C. 1985. Studies on growth performance of Dorset x Deccani lambs fed with varying DCP levels. Thesis submitted to MPKV, Rahuri for M.Sc.(Agri.) degree. (Unpublished).

Patil, B.N. 1999. Growth performance of Deccani lambs on different feed combinations. Thesis submitted to MPKV, Rahuri for M.Sc.(Agri.) degree. (Unpublished).

Pex, E.J., Schwarz, F.J. and Kirchgessner, M. 1996. Effect of stage of harvest on digestibility and energy content of maize silage by cattle and sheep. J. Wirtschaftseigene Futter. 42 (1) : 83-86.

Phillip, L.E. and Hidalgo, V. 1990. Voluntary feed intake, acid-base balance and partitioning of urinary nitrogen in lambs fed corn silage with added sodium bicarbonate or sodium sesquicarbonate. Nutr. Abstr. and Rev. 60 (2) : 759.

Pinter, L., Schmidt, J., Kissne, B. and Kelemen, G. 1987. Effect of stubble height and plant density on DM yield and feeding value of the whole maize plant. Nutr. Abstr. and Rev. 57 (6) : 2490.

Ranjhan, S.K. 1980. Animal nutrition in tropics. Vikas Publication House, Pvt. Ltd., New Delhi. pp. 298.

Reddy, G.V.N. and Reddy, M.R. 1988. Maize silage as a sole ration for sheep and goats. Indian J. Anim. Nutr. 5 (2) : 160-162.

Reddy, T.W.J. and Murphy, J.J. 1995. Effect of ensiling on dry matter intake and animal performance. Nutr. Abstr. and Rev. 65 (12) : 6120.

Robbins, R.D., Hawkins, D.R., Waller, J.C. and Bergen, W.G. 1984. Alfalfa hylage Vs. Corn silage as a roughage source in finishing diet of yearling feedlot steer. J. Anim. Sci. Abstr. 59 (1) : 384.

Rutter, W. 1970. A comparison of the performance of suckled lambs with lambs weaned at seven weeks of age and either graized or weaned. J. Anim. Prod. 12 (11) : 543-549.

Sahni, K.L. and Tiwari, S.B. 1975. Studies on milk production and pre-weaning of lambs in different sheep breeds under semi-arid conditions. Indian J. Anim. Sci. 45 (5) : 252-255.

Schwarz, F.J., Kirchgessner, M. and Heimbeck, W.K. 1989a. Influence of feeding level on the digestibility of maize silage differing in particle size by cattle and sheep. Nutr. Abstr. and Rev. 59 (10) : 4473.

Schwarz, F.J., Heimbeck, W.K. and Kirchgessher, M. 1989b. Influence of crushing whole maize plants and grain on nutrient digestibilities. Second communication on the effect of different methods of preparing maize silage on nutrient digestibility in heifers and weaners. Nutr. Abstr. and Rev. 59 (7) : 2837.

Schwarz. F. J., Pex, E.J. and Kirchgessner, M. 1996. Influence of starch-rich feed stuffs on digestibility and energy content of maize silage in cattle and sheep. J. Archives Anim. Nutr. 49 (4) : 349-362.

Shamma, M. and Athari, A. 1988. Use of maize silage supplemented with poultry litter in feeding sheep. Nutr. Abstr. and Rev. 58 (12) : 5472.

Shimada, A.S., Wilson, L.L. and Harpster, H.W. 1985. Digestibility of maize stalk silage for wethers. Nutr. Abstr. and Rev. 55 (9) : 4297.

Singh, A.P. 1984. A note on forage conservation strategies for feeding livestock in lean period. I.G.F.R.I. Jhansi (U.P.).

Singh, N.P. 1980. Growth and nutrient utilization in Avikalin lambs on a feedlot ration based on cowpea fodder. Indian J. Anim. Res. 14 : 113-115.

Singh, O.N. 1966. Crossbreeding of sheep for wool production in India. Seminar on Animal breeding. Haringhatal, Calcutta, 7-9 Dec., ICAR, New Delhi. pp. 206.

Snedercor, E.W. and Cochran, W.G. 1967. Statistical methods, sixth Ed. Iowa State Univ. Press Ames, IOWA, USA.

Solov'EV, A.M., Tishenkov, P.I. and Bocharova, M.I. 1987. Utilization of silage prepared with a pentose-fermenting lactic acid starter in feeding of sheep. Nutr. Abstr. and Rev. 57 (11) : 5132.

Solov'EV, A.M., Tishenkov, P.I. and Bocharova, M.I. 1990. Use of maize silage containing the preparation 'somex' in diets for sheep. Nutr. Abstr. and Rev. 60 (1) : 411.

Solov'EV, A.M., Bocharova, M.I., Sorokin, V.M. and Bobrova, T.A. 1991. Processing maize silage with natural brine. Nutr. Abstr. and Rev. 61 (5) : 2303.

Soman, P.S. 1997. Growth performance of lambs kept with Dams under grazing Vs. stall feeding management systems. Thesis submitted to MPKV, Rahuri for M.Sc.(Agri.) degree. (Unpublished).

Tantia, M.S. and Vij, P.K. 2000. Population estimates of sheep and goat breeds of India. Indian J. Anim. Res. 34 (1) : 60-63.

Tomar, S.S. 1978. Relative importance of age and live-weight in wool production of Nali sheep. Indian Vet. J. 55 (7) : 545-549.

Upase, B.T. 1989. Effects of feeding different protein:energy levels in complete feed on growth performance, quantity and quality of mutton and wool of Deccani and its corossbreed lambs. Thesis submitted to MPKV, Rahuri for Ph.D.(Agri.) degree.

Verbic, J., Babnik, D. and Puhan, J. 1995. Nutritive value and ensiling of drought-stressed maize. Nutr. Abstr. and Rev. 65 (10) : 4905.

Weller, R.F. and Phipps, R.H. 1986. The feeding value of normal and brown mid-rib-3 maize silage. Nutr. Abstr. and Rev. 56 (6) : 2922.

Wernli, K.C., Romero, T.J.J. and Caballero, D.H. 1968. Yield and nutritive value of silage from maize (Cv. Eurekha) cut at different growth stages and effect of protein supplementation (I). Influence of growth stage. Herb. Abstr. 38 (2) : 116.

APPENDICES

7. APPENDICES

APPENDIX-I

Chemical composition of experimental feeds

Experimental feeds	DM	CP	CF	TA	EE	NFE
Lucerne	24.70	18.60	23.70	12.60	3.65	41.45
Green maize	25.00	7.74	27.00	11.60	2.19	55.57
Maize silage	36.90	6.82	26.70	11.40	2.88	52.20
Concentrate	90.00	17.85	7.75	7.73	2.57	64.10

APPENDIX-II

Rates of experimental feeds

Sr. No.	Name of Article	Rate Rs.
1	Lucerne	800/mt
2	Green maize	550/mt
3	Maize silage	600/mt
4	Concentrate	4500/mt

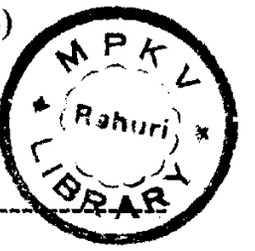
Source: The above rates are as per the university circular No. Seed Cell/QCO/MTG/Min/3400/99 for the year 1999-2000.

VITA

8. VITA

UMAKANT PANDURANG NIMBALKAR

A candidate for the degree
of
MASTER OF SCIENCE (AGRICULTURE)
in
ANIMAL SCIENCE
2000



Title of Thesis : "Effect of feeding different combinations of fodders on the growth of weaned Deccani lambs"

Major field : Animal Science

Biographical information :

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: Completed Higher secondary education at Shantiniketan Vidyamandir, Sangli.
: Received B.Sc. (Agri.) degree with First Class from College of Agriculture, Kolhapur (MPKV, Rahuri) in July, 1997.

Other activities : Participated in N.S.S. programme.
: Attended various blood donation programmes.
: Elected as a member of the 'Sports and allied activities' of "Students Council", Post Graduate Institute, MPKV, Rahuri during the year, 1998-99.
