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# Nutritional Evaluation of Maize Top Hay and Maize Top Silage Based Diets in Lactating Crossbred Cows

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## ABSTRACT

The study was conducted to evaluate maize top silage and maize top hay in lactating crossbred cows on dry matter intake, nutrient intake, digestibility, milk yield, milk composition and composition yield. Six lactating crossbred cows (Avg. b.wt; 358; milk yield 9.08 kg/day) were divided into two groups of three cows each in switch over design comprising two periods and allocated one of the following treatments; T1 - maize top silage (MTS) based diet, T2 - maize top hay (MTH) based diet. The experimental cows were offered an average 2 kg of paddy straw, MTS (5kg DM from silage of total DMI), *ad libitum* of MTH, and CFM was offered to meet the requirement of nutrients (ICAR, 2013), in respective treatment. There was a significant difference in body condition score between the groups. The total dry matter intake in T1 and T2 were 10.43 and 11.27, kg/d respectively. There was no significant difference in DMI but significantly higher intake of MTH than MTS was noticed. No significant difference in the nutrients intake and digestibility of nutrients, MN supply to the intestine and also in nitrogen balance was observed. The corrected lactometer reading (CRL) of the milk of experimental cows were 28.90 and 28.97 and 4 % FCM yield (kg/d) was 9.86 and 9.72 in T1 and T2 groups, respectively and difference was non-significant. There was no significant difference between groups in the component of the milk and composition yield. It was concluded that MTS and MTH can efficiently be used either as a part of diet or as sole roughage source *adlibitum* in the feeding of lactating dairy animals so that benefit of nutritious part of the maize plant like tops can be better utilized before attaining higher lignification.

**KEY WORDS:** Maize top silage, Maize top hay, Milk Yield, Milk composition, Nutrient Intake

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## INTRODUCTION

Indian livestock farming system essentially depends on crop residues but unfortunately available crop residues either from agricultural or horticultural sector is burnt in the field to circumvent the higher cost of labor towards collecting and processing it for livestock feeding (IARI, 2012; Jain et al., 2014). As the portion of arable land diverted exclusively for fodder crop production is meager, hence applying any technical intervention for efficient utilization of residues obtained from regular crops grown for commercial purposes in farmer's field is most convenient for farmers without any additional cost. In maize crop (grain variety), after pollination when the grains set in the cob, the top portion of maize crop can better be utilized either as fresh green fodder or converted to silage and hay (Methu et al., 2006) instead of keeping the top till the harvest of the cob which renders the portion of the plant unutilizable by the livestock due to higher lignification. It was estimated that topping of the green part of the maize crop above the cob after seven weeks of silk emergence yield about seven tones of green matter per hectare (Methu et al., 2006). However, the data of utilizing maize tops either as green or silage or hay as a component of the diet in different species, particularly in lactating crossbred cattle is scanty. Hence, the present study is designed to study the maize top hay and silage on nutrient intake, digestibility, nitrogen balance, milk yield and composition in cross bred lactating cows.

## MATERIALS AND METHODS

### Phase – I

Maize crop (Maize hybrid seeds: variety- CP-818, seed rate-6kg/acre, spacing-60cm x 30cm) was cultivated during *kharif* season (June to October 2018) in the farm section of Livestock Farm Complex of Veterinary College, Shimoga. The maize tops were harvested at the physiological maturity stage (R-6) of growth (black layer is visible at the base of the grain or around at 90-112 days of date of sowing) where the grains attained the maximum (65-70%) dry matter accumulation. Some quantity of harvested maize tops were chopped to about 1-2 inch length using electrical chaff cutter (M/s Fortune Ltd.) and filled in silo tank (12 kg/cuft.) without any additives to prepare silage where as some portion was sun dried for 4 to 5 days around 27 to 30$^0$C with raking for every one hour to prepare hay. The sun dried maize tops were filled in polythene bags and stored in airtight rodent proof room for further use.

### Phase-II

Six lactating crossbred cows (avg. b.wt.: 358kg, avg. milk yield; 8.5kg / day; avg. lactation day; 113 days, avg. lactation no.; 3) were divided into two groups of three cows each in a switch over design. Three cows of each group were assigned to one of the two dietary treatments viz., maize top silage (MTS) (T1) and maize top hay (MTH) (T2) based diets. For T1 group, MTS was offered so as to meet 5 kg DM from silage alone out of total DM requirement of cows. The silage feeding was distributed throughout the day and was offered 4-5 kg each at 10.00 a.m., 12.00 p.m., 2.00 p.m., 5.00 p.m. In the same interval of time, maize top hay was offered *ad lib* to T-2 group at 2 kg/time/per cow. The cows of these two groups were commonly fed paddy straw (2 kg/cow/day) at 8.30 pm and the daily allowance of concentrate feed mixture (CFM) (Maize-58kg, SBM-12, wheat bran-26kg, urea-1kg, mineral mixture-2kg, salt-1kg) for individual cows for maintenance and milk yield (ICAR, 2013). The CFM was fed at the time of milking at 5.30 a.m. and 4.00 pm in two portions. The cows were allowed to have free access to water at 9.00 a.m. and 5.30 p.m.

During the experiment, weekly body weight, daily feed intake and milk yield were recorded. The body condition score before and after the experiment for all the cows were done on 5 point scale (Edmonson et al., 1989). Milk samples were collected twice a week and analyzed for milk composition (SNF, protein, fat and lactose) by using electronic milk analyser (M/S Vector automation system). Total ash and total solids were estimated according to AOAC (2016) and CLR were recorded using lactometer. The metabolic trial was conducted for 5 days on all cows at the last week of each period where total collection of dung and urine voided in 24 hour was done manually. The samples of PS, MTH, MTS and CFM offered were subjected to proximate analysis (AOAC, 2016), fiber fractions (Van Soest, et al. 1991) and mineral composition (AAS, M/S Perkin Elmer, Analyst 400). The ME content of feeds was estimated by rumen in vitro gas production technique (RIVGPT) test proposed by Manke and Steingass (1988). The urinary allantion (UAe) was determined by the procedure of Chen and Gomes (1992), uric acid was determined by uricase kit method (Erba, Transasia bio- medicals LTD.,) and microbial N supply to the duodenum was estimated assuming that allantoin constituted 850 mg/g of total purine derivatives (PD) excreted in urine (Chen and Gomes, 1992).The net energy output was calculated by using energy for maintenance, body weight gain/loss and milk production using the equations of NRC (1989) and Tyrrell and Reid (1965). The total daily feeding cost was calculated based on the current market prices of paddy straw, maize top silage, maize top hay and CFM. Experimental data were analyzed using statistical tool/software (Graph pad prism, 2007. version 5.01) and inferences were drawn.

## RESULTS AND DISCUSSION

The maize top silage (% on DMB) had 8.06 CP, 71.49 NDF, 42.12 ADF and 3.65 ADL. The CP and ADL levels were comparable to whole plant maize silage (Gouri, 2012; Petrovska, 2015). The NDF and ADF were slightly higher but lower than values reported for maize stover silage and sorghum stover silage (Gouri, 2012; Ningaraju, 2014). The maize top hay (% on DMB) had 7.65 CP, 65.39 NDF and 3.65 ADL. The CP level was higher and NDF and ADL were lower than the values reported for cereal stovers like maize stover, sorghum stover and finger millet straw (CP 2.0 - 5.5 %; NDF 70 - 75%; ADL 6-12%) (Gouri, 2012; Babu, 2014; Ningaraju, 2014; Rashmi et al., 2024). The CFM had 17.31 % CP, 3.11 % EE and 37.62 % NDF which was prepared to contain 18% CP and 11 MJ of ME /kg DM to support nutrient requirement of lactating cows fed MTS and MTH based diets. The mineral composition of PS and CFM were almost in normal ranges and the ratio of calcium and phosphorus in the PS and CFM were 1:3 and levels of minerals were sufficient enough to meet the requirement of crossbred cows for maintenance and production (Rahman et al., 2010; Imran et al., 2017). However, the phosphorous content of maize top silage and hay was higher and care was taken to avoid the imbalance in the diet.

Table 1. Chemical and mineral composition (% on DMB) and ME of PS, MTS, MTH and CFM used in the feeding trial.

| Parameter | PS | MTS | MTH | CFM |
|---|---|---|---|---|
| Proximate composition | | | | |
| OM | 86.4 | 87.1 | 87.4 | 94.4 |
| CP | 3.70 | 8.06 | 7.46 | 17.3 |
| CF | 32.0 | 27.7 | 28.08 | 4.30 |
| EE | 0.84 | 2.77 | 1.00 | 3.11 |
| NFE | 49.8 | 48.6 | 50.9 | 69.6 |
| TA | 13.5 | 12.8 | 12.5 | 5.60 |
| AIA | 11.6 | 7.41 | 7.71 | 0.67 |
| Fiber fractions | | | | |
| NDF | 71.5 | 58.3 | 65.4 | 37.6 |
| ADF | 42.1 | 32.6 | 34.9 | 6.33 |
| Hemicellulose | 29.3 | 30.5 | 25.7 | 31.3 |
| Cellulose | 35.7 | 28.8 | 26.3 | 5.09 |
| ADL | 2.87 | 2.78 | 3.65 | 0.83 |
| Energy value | | | | |
| ME, MJ/kg | 6.72 | 7.77 | 6.65 | 12.1 |
| Minerals | | | | |
| Calcium, g/kg | 2.28 | 3.49 | 3.11 | 6.98 |
| Phosphorus, g/kg | 1.32 | 2.26 | 2.69 | 2.14 |
| Potassium, g/kg | 5.42 | 3.13 | 5.53 | 2.62 |
| Zinc, mg/kg | 62.8 | 45.2 | 25.83 | 49.4 |
| Manganese, mg/kg | 208.21 | 153.23 | 132.63 | 55.2 |
| Copper, mg/kg | 5.02 | 8.86 | 7.76 | 3.50 |

PS = Paddy straw, MTS= Mize top silage, MTH=Maize top hay, CFM=Concentrate feed mixture

The body condition score recorded at initial and end of each period was improved by 0.44 and 0.39 in T1 and T2 respectively, but there was no significant difference between the treatment groups. Significantly higher (P<0.01) intake of DM from MTH was noticed than from MTS because of voluntary intake limit of silage where cows consumed around 18-20 kg/d fresh silage while cows consumed more DM from MTH which was fed *ad libitum*. Higher proportion of CFM intake was observed in total DMI of T1 group to meet the requirement which was not met by roughage portion. However, there was no significant difference in total DMI between T1 and T2 treatment groups. The DM intake from MTS was 4.9 kg/d and MTH was 5.72 kg/d, on per cent body weight for MTS and MTH were 1.24 and 1.60 for T1 and T2, groups respectively. DMI from maize top silage was 24% less than MTH and the results were similar to the observations made by Mayne and Cushnahan (1994) in cattle, Giridhar et al. (2016) in sheep and Saini (2024) in buffaloes. However, DMI recorded in this study was lower than the values reported for maize stover silage (Gouri, 2012) and sorghum stover silage (Ningaraj, 2014) in lactating crossbred cows. But inclusion level of silage in the diet of lactating cows in present study was well within the range given for dry matter contribution to total dry matter intake of lactating cows as given by Stockdale (1995) and Kolver, et al. (2001) where they recommended dry matter intake levels of silage in the diet should be 20 to 35, 30 to 40 and 60 to 70% for early lactation, late lactation and dry period respectively. The DMI of maize top hay (MTH) in the current study was higher than the intake of maize stover, maize stover dry and sorghum stover dry as reported in the lactating crossbred cows (García-martínez, 2009; Gouri, 2012; Ningaraju, 2014).

Table 2. Mean body condition score, DMI and nutrient intake in lactating cross bred cows.

| Parameter | T-1 | T-2 | SEM | P |
|---|---|---|---|---|
| Body condition score | | | | |
| Initial | 2.63 | 2.73 | 0.083 | 0.616 |
| Final | 3.07 | 3.11 | 0.052 | 0.720 |
| Difference | 0.44 | 0.39 | 0.056 | 0.692 |
| Dry matter intake (kg/d) | | | | |
| Paddy straw | 0.98 | 0.73 | 0.11 | 0.289 |
| MTS/MTH** | 4.39[b] | 5.72[a] | 0.27 | 0.006 |
| CFM | 5.07 | 4.83 | 0.27 | 0.672 |
| Total | 10.43 | 11.27 | 0.39 | 0.305 |
| % of body weight | | | | |
| Paddy straw | 0.27 | 0.21 | 0.03 | 0.339 |
| MTS/MTS* | 1.24[b] | 1.60[a] | 0.08 | 0.022 |
| CFM | 1.43 | 1.34 | 0.08 | 0.634 |
| Total | 2.94 | 3.15 | 0.13 | 0.452 |
| Nutrient intake, kg/d | | | | |
| OM | 9.50 | 10.19 | 0.35 | 0.357 |
| CP | 1.27 | 1.29 | 0.05 | 0.833 |
| EE | 0.29[a] | 0.21[b] | 0.02 | 0.003 |
| NFE | 6.17 | 6.64 | 0.24 | 0.356 |
| CF | 1.77[b] | 2.05[a] | 0.07 | 0.050 |
| TA | 0.99 | 1.09 | 0.04 | 0.173 |
| NDF | 5.09 | 5.13 | 0.18 | 0.912 |
| ADF | 2.19[b] | 2.61[a] | 0.10 | 0.026 |
| Hemicellulose | 3.01 | 3.47 | 0.13 | 0.080 |
| Cellulose | 1.78[b] | 2.16[a] | 0.08 | 0.018 |

** ($P \leq 0.01$), *($P \leq 0.05$), Means bearing different superscripts between the columns differ significantly.

The OM, CP and NDF intake in T1 and T2 groups were non-significant whereas intake of EE was significantly higher (P<0.01) in T1 group than T2 due to higher EE content in maize top silage (2.77%) (Table1). The NDF and HC intake between the groups were non-significant because of lesser variation in NDF content of feed stuffs offered to crossbred cows. But the intake of ADF and cellulose (kg/d) in T2 group was significantly higher (P<0.05) than T1. This might be due to higher ratio of roughage in the diet. These findings were similar to intake of fiber fractions noticed in lactating crossbred cows of other studies (Mrudhula, 2008; Nagesh, 2009). However, NDF and ADF levels of diets of experimental cows were higher than the recommended level to maintain normal fat % in the complete diet (ARC, 1984).

The digestibility of DM, OM, CP, NFE, CF, NDF and ADF was not significant between treatment groups. However, the digestibility of EE in T1 was significantly (P<0.01) higher than T2, whereas, the digestibility of hemicellulose and cellulose was significantly (P<0.01) higher in T2 than in T1. The higher digestibility of EE in T1 might be due to significantly higher EE intakes which lead to significantly lower digestibility of HC and cellulose. This clearly indicated that higher levels of EE hindered the digestibility of fibers (Table. 3). All animals of the experiment were in positive nitrogen balance which reflected in improvement of BCS and body weight gain. The nitrogen retained (g/day) and per cent of retention were non-significant (P>.05) between groups. The results were similar to results of Gouri (2012) and Ningaraju (2014) in lactating cows fed maize stover silage and sorghum stover silage respectively.

There was no significant difference between two groups in total purine derivatives excretion (PDe) however, allantoin excretion (89.55% of total PDe) in T2 was noticed than in T1 (88.62% of total PDe). Usually, the silage based diet synthesize less quantity of microbial protein (Van Soest, 1994) when compared to organic matter digested from hay because silage is pre-fermented feed stuff and some part of the organic matter degraded in silo itself. Therefore, less microbial nitrogen (MN) supply is expected than the hay fed group, but in this experiment, similar MN supply were obtained. The ME intake influence the microbial protein (MP) production and commonly it is suggested that 1 MJ of ME intake results in production of 10 g of MP (AFRC, 1992), where as in this study, for intake of 89.23 and 97.01MJ/d in T1 and T2, 667.1 and 682.43 g of MP respectively were obtained against 890.23 and 970.1 g /d MP. However, MP supply was higher in hay fed group. The same trend was noticed in lactating cross bred cows and heifers fed ragi straw based diets (Thirumalesh and Krishnamoorthy, 2007; Darshan, 2007).

The TDN and DCP levels of diets fed to lactating crossbred cows of T1 and T2 groups were 57.11 and 9.53%; 57.89 and 11.37%; respectively (Table 3). There was no significant difference in TDN %, TDN and DCP intake (kg/day) in the corresponding groups, however there was significant difference in DCP % (P<0.05). The ME (MJ/kg diet) in T1 and T2 groups were 8.64 and 8.76, respectively and were statistically non-significant. The mean intake of ME, MJ/day were 89.23 and 97.01 in T1 and T2 groups respectively and significantly higher for T2 (P<0.05). Crossbred cows consumed ME in the range 61.48 to 115.79 ME, MJ/day as maintenance, body weight gain and milk production requirement.

Table 3. Digestibility of nutrients (%), nitrogen balance, microbial protein synthesis indices and nutrient density in lactating crossbred cows.

| Parameter | T-1 | T-2 | SEM | P |
|---|---|---|---|---|
| DM | 57.1 | 59.5 | 1.06 | 0.278 |
| OM | 59.7 | 62.2 | 0.94 | 0.192 |
| CP | 61.3 | 60.7 | 1.28 | 0.829 |
| EE** | 83.4[a] | 67.5[b] | 3.19 | 0.005 |
| NFE | 58.7 | 62.2 | 0.98 | 0.077 |
| CF | 57.8 | 62.7 | 1.40 | 0.074 |
| NDF | 62.7 | 67.3 | 1.28 | 0.069 |
| ADF | 54.4 | 61.03 | 2.10 | 0.119 |
| HC** | 64.7[b] | 72.4[a] | 1.47 | 0.002 |
| C** | 53.4[b] | 65.7[a] | 2.61 | 0.010 |
| N-balance, g/day | | | | |
| Intake | 202.71 | 202.70 | 7.92 | 1.000 |
| Out go | | | | |
| Feces | 83.7 | 79.2 | 2.53 | 0.398 |
| Urine | 62.06 | 61.1 | 3.22 | 0.891 |
| Milk | 44.6 | 45.8 | 3.17 | 0.866 |
| Retained, g/d | 12.3 | 16.6 | 3.40 | 0.552 |
| Microbial protein synthesis indices | | | | |
| Ae (mmol/day) | 138.59 | 142.9 | 7.09 | 0.7751 |
| Ue (mmol/day) | 17.8 | 16.6 | 0.86 | 0.5383 |
| PDe (mmol/day) | 156.39 | 159.6 | 7.68 | 0.8448 |
| PD absorption (mmol/day) | 146.80 | 150.19 | 8.96 | 0.8602 |
| MN supply (g/day) | 106.73 | 109.19 | 6.51 | 0.8602 |
| g/kg ADOM | 18.8 | 17.61 | 0.65 | 0.3526 |
| g/kg DOMR | 29.03 | 27.09 | 0.99 | 0.3527 |
| Nutrient Density | | | | |
| TDN, % | 57.1 | 57.9 | 0.848 | 0.667 |
| Intake, kg/d | 5.90 | 6.41 | 0.275 | 0.375 |
| DCP*, % | 9.53 | 11.3 | 0.456 | 0.034 |
| Intake, kg/d | 0.78 | 0.77 | 0.0419 | 0.926 |
| DOMD, % | 54.1 | 56.3 | 0.852 | 0.235 |
| Intake, kg/d | 5.60 | 6.24 | 0.271 | 0.259 |
| ME, MJ/kg diet | 8.64 | 8.76 | 0.1282 | 0.666 |
| Intake, MJ/d* | 89.2[b] | 97.01[a] | 4.876 | 0.034 |

** ($P \leq 0.01$), *($P \leq 0.05$), Means bearing different superscripts between the columns differ significantly. Ae-Allantoin excretion;Ue-uric acid excretion,PDe-purine derivative excretion; MN-microbial nitrogen; ADOM-apparent digestible organic matter; DOMR-digestible organic matter in rumen.

There was no significant difference in milk yield and 4% FCM yield between T1 and T2 groups even though ME was significantly higher ($P<0.05$) in T2. On contrary, McDonald et al. (1999) observed that for every MJ of ME intake increased, 0.016 kg milk yield in cow produced 10 kg per day and 0.172 kg at 25 kg milk yield. However, ME intake in T2 groups could not elicit any significant difference in milk yield. The results were similar to the study conducted by Nagesh, (2009). Whereas Gebrehawariat (2010) noticed significantly higher milk yield (11.2 kg/cow/d) for maize crop silage in lactating HF crossbred cows. However, in general the cows and buffaloes received higher green fodder compared to higher silage based diets produced higher milk because of higher DMI (Tauqir, 2009; Bhatti et al., 2018.). Among several fodder crop silages, corn silage produced higher milk yield than pearl millet (Amer and Mustafa, 2010), napier chopped and napier whole silage (Haque, 2018). The milk yield in MTH (T2) fed cows was higher than milk yield (6.3kg/cow/d) reported in crossbred cows fed with maize stover and CFM (Mediksa, 2017) and milk yield (8.01kg/cow/d) for sorghum stover dry (Ningaraju, 2014). The milk energy obtained in the milk of experimental cows (3.59 and 3.64 MJ/kg of milk) were comparable to the values (3.10 to 3.58) reported by Xue et al. (2011) for pure and crossbred cows. However, energy values obtained in the current study were higher (3.17 and 3.29) than reported in Malnad Gidda cows (Manjunatha et al., 2020).

The SNF (%) and yield (kg/d) in T1 and T2 groups were 8.68 and 8.78; 0.72 and 0.71 respectively. The difference between groups was non-significant but the SNF levels in all the groups were well above the acceptable value recommended by Karnataka Milk Federation for considering the milk price. There was no significant difference between groups in fat % and yield, CP % and yield, lactose % and yield in MTS and MTH fed groups. However, the results of this study were higher than the values reported in several studies where the cows were fed with green fodder, maize stover, normal maize silage and sorghum stover silage (Gebrehawariat, 2010: Gouri, 2012 ; Ningaraju, 2014).

Table 4. CLR, milk yield, milk composition and composition yield in lactating crossbred cows.

| Parameter | T-1 | T-2 | SEM | P |
|---|---|---|---|---|
| CLR | 28.9 | 28.9 | 0.19 | 0.859 |
| Milk yield, kg/d | 8.37 | 8.09 | 0.58 | 0.827 |
| 4% FCM yield, kg/d | 9.86 | 9.72 | 0.63 | 0.919 |
| Milk energy, MJ/kg milk [#] | 3.59 | 3.64 | 0.14 | 0.857 |
| Milk composition and yield | | | | |
| TS, % | 14.1 | 14.3 | 0.31 | 0.768 |
| TS Yield, kg/day | 1.17 | 1.15 | 0.08 | 0.910 |
| SNF, % | 8.68 | 8.78 | 0.10 | 0.669 |
| SNF Yield, kg/day | 0.72 | 0.71 | 0.05 | 0.910 |
| Fat, % | 5.35 | 5.45 | 0.32 | 0.885 |
| Fat Yield, kg/day | 0.44 | 0.43 | 0.03 | 0.959 |
| Crude Protein, % | 3.15 | 3.18 | 0.03 | 0.688 |
| Crude Protein Yield, kg/day | 0.27 | 0.27 | 0.02 | 0.838 |
| Lactose, % | 4.77 | 4.82 | 0.06 | 0.695 |
| Lactose Yield, kg/day | 0.40 | 0.39 | 0.03 | 0.883 |
| Ash, % | 0.73 | 0.73 | 0.01 | 0.808 |
| Ash Yield, kg/day | 0.06 | 0.06 | 0.00 | 1.000 |

[#] Milk Energy (MJ/ kg of milk) = [41.63(% fat) + 24.13(% protein) + 21.6(% lactose) – 11.72] × 2.2/239 (NRC, 2001)

There was no significant difference in partition of net energy and efficiency of ME between T1 and T2 groups. However, out of total energy output, 44.82 and 42.74 % of net energy was diverted for maintenance, 53.14 and 49.31% for milk production and 2.04 and 7.95 % for weight gain in T1 and T2 respectively. Similar results were observed in studies conducted by Mrudhula (2008) and Nagesh (2009) in lactating crossbred cows. Whereas Manjunath et al. (2020) noticed higher partition of net energy for maintenance (77%) than for milk production (19%) in lactating Malnad Gidda cows.

Table 5. Partition of net energy in lactating crossbred cows

| Particulars | T-1 | T-2 | SEM | P |
|---|---|---|---|---|
| Net Energy (MJ day) | 62.6 | 65.5 | 3.04 | 0.653 |
| Maintenance (MJ/ day) | 27.5 | 27.7 | 0.91 | 0.932 |
| Milk production (MJ/day) | 33.3 | 32.5 | 2.60 | 0.884 |
| Weight gain / loss (MJ/kg) | 1.78 | 5.36 | 1.27 | 0.171 |
| % of Net Energy | | | | |
| Maintenance | 44.8 | 42.7 | 1.738 | 0.576 |
| Milk production | 53.1 | 49.3 | 2.632 | 0.493 |
| Weight gain / loss | 2.04 | 7.95 | 2.235 | 0.200 |
| Efficiency of ME | 70.6 | 67.5 | 2.207 | 0.514 |

Efficiency of ME = (NE output / ME intake) x100

The total cost incurred towards feeding of crossbred cows with the diet comprising of paddy straw, MTS, MTH and CFM in T1 and T2 was worked out to be Rs. 159.86 and 161.97, respectively and cost of milk production per kg of milk in corresponding groups was Rs. 19.10 and 20.02. The price of milk per litre production for both the groups in this study was lesser than the market price (Rs. 27 to 33). Incorporating either MTS or MTH in the diet of lactating cross bred cows did not make any difference with respect to cost of milk production.

Table 6. Economics of milk production in lactating crossbred cows.

| Particular | T-1 | T-2 | SEM | P |
|---|---|---|---|---|
| Feed consumed (kg/d) | | | | |
| Paddy straw | 1.04 | 0.77 | 0.140 | 0.289 |
| MTS/MTH** | 15.6[a] | 5.57[b] | 1.571 | 0.001 |
| CFM | 5.33 | 5.08 | 0.281 | 0.672 |
| Total cost (Rs) | | | | |
| Cost of labor (milking, cleaning of shed and animals) | ----- | ----- | ------ | ----- |
| Paddy straw | 6.24 | 4.62 | 0.722 | 0.289 |
| MTS/ MTH** | 46.9[b] | 55.7[a] | 2.696 | 0.020 |
| CFM | 106.67 | 101.58 | 5.620 | 0.157 |
| Total cost | 159.86 | 161.97 | 6.432 | 0.634 |
| Milk yield per day (kg) | 8.37 | 8.09 | 0.580 | 0.827 |
| Cost per kg milk production | 19.1 | 20.0 | 0.901 | 0.347 |

** ($P \leq 0.01$), Means bearing different superscripts in a row differ significantly
Cost in Rs: Paddy straw- 6.00/kg, MTS - 3/kg, MTH - 10/kg and CFM- 20/kg.
[#] Cost of preparation of MTS and MTH includes seeds, fertilizers and labor cost, harvest and processing charges.

## CONCLUSION

Hence, it can be concluded that the highly nutritious part of the maize plant like tops can be harvested at physiological stage of maturity without allowing for lignification and can be incorporated either as MTS or as MTH in the diet or as sole roughage source in feeding of lactating dairy animals to improve both milk yield and composition. However, it is more convenient to prepare silage than hay.

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