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Research Article

Effect of Feeding Silage Prepared from Fall Army Worm (*Spodoptera frugiperda*) on Feed Intake and Hematobiochemical Parameters of *Red kandhari* Heifers

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ABSTRACT

The study objective was to evaluate the feed intake, and hematobiochemical parameters of Red Kandhari heifers fed a total mixed ration (TMR) based on silage produced from a fall army worm (FAW) affected maize fodder compared with silage prepared from normal maize fodder. Two treatment groups, T1 and T2, consisted of 6 Red Kandhari heifers, each having average body weights 164.17 and 165.52 kg for 90 days trial. T1 and T2 groups offered 40% normal maize silage and 40% FAW-affected maize silage, respectively along with 40% concentrate and 20% chaffed sorghum stovers. Fortnightly dry matter intake (kg/day) was observed to be statistically similar (p>0.05) between T1 and T2 groups. The Hematobiochemical parameters viz. Hb, PCV, blood glucose, blood urea nitrogen, ALT and AST concentration were analyzed fortnightly and found statistically not different (p>0.05) between the T1 and T2 group, respectively.

Keywords: *Fall army worm, maize silage, dry matter intake, blood, haematology.*

INTRODUCTION

Livestock production is an integral part of Indian agriculture, contributing 4.6% to the National GVA, whereas the agricultural sector contributes 17.9 GVA (National Accounts Statistics-2016). Maize is an important fodder crop cultivated throughout the year in our country, which gives highly succulent and nutritionally rich fodder. This green fodder is particularly suitable for silage preparation.

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The quality of maize fodder is much higher than sorghum and pearl millet because both sorghum and pearl millet have anti-quality components such as HCN and oxalate. To a large extent, milk production depends upon the availability of good quality fodder. Farmers in India routinely face an acute shortage of green fodder twice a year, particularly during Nov-Dec and May-June (called the lean period). It is, therefore, essential that forages are grown and conserved in sufficient quantities and of good enough quality as silage. Silage may play a major role in growing the country's green fodder shortage. Silage made especially from corn could help enormously to expand the dairy sector, particularly in the country's peri-urban regions (Chaudhary et al., 2012). But in 2018, it was the first time reported that maize crop was severely affected with fall armyworm (*Spodoptera frugiperda*), (Chormule et al., 2019) and following that many rumors went on social media, newspaper, etc. like animal died due to eating fall armyworm affected maize fodder (Maharashtratimes.com and www.agrowon.com).

Because of the shortage of green fodder, maize has been considered desirable for silage preparation. Dairy farmers also made inquiries in different agricultural and veterinary universities regarding the preparation of silage from FAW affected maize fodder and its safety from an animal point of view. As no study was available regarding feeding silage prepared from FAW affected maize fodder, the present study was planned on *Red Kandhari* heifers.

MATERIALS METHODS

Twelve Red Kandhari heifers of similar age and body weights were selected from the Red Kandhari Cattle unit of Livestock Farm Complex, COVAS, Parbhani. The experimental heifers with an average body weight of 164.14±0.5 Kg were randomly divided on the basis of their body weights into 2 groups, two treatment groups, T1 and T2 for 90 days experimental period. Experimental heifers were fed as per ICAR (2013) cattle and buffalo nutrients requirement. The animals were allotted to different dietary treatments as follows (Table 1), and the chemical composition of silages and feed are presented in Table 2. The chemical composition of silage, sorghum straw and concentrate was analyzed for proximate principles as per AOAC (2019), fibre fractions by Van Soest et al. (1991), dry matter of silage by the method of Dewar and McDonald (1961), pH using digital pH meter and TVFA via the method of Barnett & Reid (1956).

Daily feed consumption was noted on the basis of the quantity of feed consumed by each heifer in a day. The feed intake was calculated from the total feed offered and the feed residue left over on the next day morning. The quantity of feed offered was adjusted as per change in the fortnightly body weight of heifers and the consequent change in their nutritional requirement.

Blood samples were collected from the experimental heifers at fortnightly intervals for the estimation of hematobiochemical parameters. The content of haemoglobin in blood samples was determined using the acid hematin method (Jain, 1986). Packed cell volume was determined by Wintrobe microhematocrit method (Jain, 1986). Serum glucose was estimated by the glucose oxidase/peroxidase method (Tinder, 1969). The Berthelot method estimated blood urea nitrogen level (Chaney & Marbach, 1962). ALT and AST analysis were carried out by using UV kinetic method (Teitz, 1976).

Observations of various parameters recorded during the experimental period were tabulated and data were statistically analyzed by using student t-test as per Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The feed intake of experimental *Red Kandhari* heifers measured in terms of average daily dry matter intake (kg) is summarized in Table 3. Mean DMI during the trial was 4.90 and 4.80 kg/day, respectively, for T1 and T2. Statistical analysis revealed that fortnightly dry matter intake was not significantly different ($p>0.05$) in heifers fed silage prepared with FAW

affected maize in relation to normal maize silage at any stage of the experiment. DMI reported in the present study is at par with Ballard et al. (2001), who noticed that DMI intake was similar in dairy cows fed on 2 different silages prepared from corn hybrids. Cargill and Pioneer, respectively. Likewise, Kung et al. (2008) who found no difference in dry matter intake when high-cut and normal-cut regular corn hybrid silage is compared to brown midrib corn silage. Akins et al. (2014) observed similar dry matter intake in Holstein cows given corn silage prepared from three different hybrids at 40% inclusion level in the diet.

The Hb (g/dl) analyzed fortnightly during the experiment is demonstrated in Table 4. The overall mean values for Hb were 11.84 and 11.67 g/dl for T1 and T2 groups, respectively. The results indicated that differences were not significant ($p>0.05$), and the Hb values were within the normal range between maize silage and FAW affected maize silage-fed experimental Red Kandhari heifers. Hb values are in akin with reference ranges for cattle 8-14 g/dl (Brar et al., 2000). Hb concentration was found to be similar in Hariana heifers fed different proportions of corn silage in diets (Verma et al., 2020).

Fortnightly analyzed values for PCV (%) are listed in Table 5. The mean PCV concentration was 35.32 and 34.64 per cent for T1 and T2, respectively. PCV concentration remained within the normal range, and no significant difference ($p>0.05$) was observed at any stage of the experiment. This observation from the present study is closely in agreement with the hematologic reference range for PCV (%) 24 - 44 (Brar et al., 2000). Verma et al. (2020) observed a non-significant difference in PCV values of Hariana heifers fed various proportions of maize silage with TMR.

The overall mean blood glucose concentration (Table 6) was 46.72 and 45.94 mg/dL in normal maize silage and FAW affected maize silage. It persisted within the standard range and was significantly not different between the two groups during the experiment. In agreement with the present experiment, the concentrations of blood glucose were not affected by dietary treatments of partially replacing corn silage with alfalfa hay in primiparous lactating dairy cattle (Polat et al., 2009). Gandra et al. (2011) observed no significant difference in the blood glucose concentration of cattle (Holstein and Nellore) and Mediterranean buffaloes fed on corn silage-based diets. Also, Kanani et al. (2019) reported no difference in blood glucose due to similar DMI and digestibility in young calves fed maize silage and alfalfa hay combinations.

The blood urea nitrogen concentration was 10.15 vs. 9.84 (mg/dL) in normal maize silage compared to FAW affected maize silage fed heifers, respectively and is presented in Table 7. The blood urea nitrogen concentrations did not differ in response to any dietary treatments, suggesting that overall N utilization was similar in both groups and within the normal range. Similar results were reported by Polat et al. (2009), who observed no significant differences in blood glucose and BUN concentrations in Holstein cows fed different proportions of maize silage and alfalfa hay. Similar results were observed by Verma et al. (2020) in Hariana heifers that replaced green fodder with maize silage.

The ALT concentration is demonstrated in Table 8. The values of ALT concentration were 13.49 and 14.67 (U/L) in T1 and T2 groups, respectively. AST persisted inside the normal range, and no alteration was observed at any stage of trial. Similar results were observed by Verma et al. (2020) who observed that there was no difference in AST value of Hariana heifers fed different levels of corn silage. Abido (2005) described that there was no significant difference recorded for ALT concentration in lactating buffalo fed on microbial inoculated and un-inoculated corn silage. One more researcher, Hafez et al. (2012) registered similar results in Rahmani lambs offered un-inoculated and inoculated maize silage.

The AST concentration remained within the normal range and no difference was observed at any stage of the experiment (Table

9). Value of AST was 90.40 and 89.31 (IU/L) recorded in T1 and T2 group, respectively. In agreement with the present study, Verma et al. (2020) reported similar values for AST in heifers fed diverse proportions of maize silage. Hafez et al. (2012) reported a non-significant difference in the AST concentration between normal and corn silage inoculated by microbes in Rahmani lambs. In another trial, Abido (2005) noticed that feeding lactating buffalo on maize silage inoculated with microbes and with un-inoculated maize silage showed no significant differences in AST.

Table1. Experimental group details

Sr. No.	Treatment groups	Number of heifers
1)	**(T_1)** – Concentrate (40 parts) + Maize silage (40 parts) + Dry fodder (20 parts) on dry matter basis	06
2)	**(T_2)** – Concentrate (40 parts) + Maize silage (FAW)* (40 parts) + Dry fodder (20 parts) on dry matter basis	06
	Total heifers	**12**

*****Silage prepared from fall armyworm (*Spodoptera frugiperda*) affected maize fodder

Table2. Chemical composition of feed offered to the experimental *Red Kandhari* heifers (% DM basis)

Particulars	Concentrate %	Sorghum Stovers %	Maize Silage %	FAW affected maize silage %
Dry matter	92.40	92.56	32.31	29.16
Organic matter	93.34	94.12	91.84	92.05
Crude protein	20.43	4.20	7.41	7.83
Crude fiber	3.98	42.36	22.18	20.73
Ether extract	4.26	1.57	3.92	3.96
Ash	6.66	5.88	8.16	7.95
NFE	64.67	45.99	58.33	59.53
ADF	27.56	41.12	33.17	32.41
NDF	40.61	60.41	52.45	50.52
pH	-	-	4.02	4.15
TVFA (mmol/100ml)	-	-	2.26	2.23

Table3. Fortnightly average dry matter intake (kg/d) in *Red Kandhari* heifers fed on maize silage (T1) and FAW affected maize silage (T2) on average fortnightly daily DM intake (Kg).

Fortnights	T1	T2
1	4.76±0.21	4.47±0.35
2	5.17±0.21	4.95±0.27
3	4.96±0.11	4.92±0.28
4	4.91±0.42	4.81±0.60
5	4.82±0.13	4.90±0.35
6	4.73±0.12	4.71±0.34
Overall Mean	4.90±0.07	4.80±0.07

($p>0.05$) = NS

NS- Non significant

Table4. Effect of feeding maize silage (T1) and FAW affected maize silage (T2) on haemoglobin (Hb) of experimental *Red Kandhari* heifers

Fortnights	Hb (g/dl)	
	T1	T2
Initial	10.67 ± 0.67	10.73 ± 0.75
1	12.10 ± 0.20	11.33 ± 0.46
2	12.33 ± 0.30	12.17 ± 0.67
3	12.17 ± 0.30	11.77 ± 0.40
4	12.40 ± 0.40	11.60 ± 1.03
5	11.27 ± 0.39	12.17 ± 0.81
6	11.93 ± 0.37	11.87 ± 0.36
Overall Mean	11.84 ± 0.24	11.67 ± 0.19

($p>0.05$) = NS

NS- Non significant

Table5. Effect of feeding maize silage (T1) and FAW affected maize silage (T2) on Packed Cell Volume (PCV) of experimental *Red Kandhari* heifers

Fortnights	PCV %	
	T1	T2
Initial	31.57 ± 2.16	32.18 ± 2.17
1	35.73 ± 0.67	33.40 ± 1.40
2	36.30 ± 1.01	36.10 ± 1.86
3	36.53 ± 0.83	34.80 ± 1.34
4	37.82 ± 1.37	34.60 ± 2.79
5	33.43 ± 1.05	35.90 ± 2.36
6	35.87 ± 1.11	35.50 ± 1.09
Overall Mean	35.32 ± 0.86	34.64 ± 0.58

($p>0.05$) = NS

NS- Non significant

Table6. Effect of feeding maize silage (T1) and FAW affected maize silage (T2) on Blood glucose of experimental *Red Kandhari* heifers

Fortnights	Blood glucose (mg/dL)	
	T1	T2
Initial	46.64±0.23	45.76±0.39
1	48.12±0.15	47.84±0.68
2	47.68±0.55	46.06±0.40
3	46.48±0.54	45.62±0.35
4	46.10±0.33	45.24±0.37
5	46.28±0.43	45.48±0.41
6	45.74±0.53	45.58±0.69
Overall Mean	46.72±0.33	45.94±0.33

($p > 0.05$) = NS

NS- Non significant

Table7. Effect of feeding maize silage (T1) and FAW affected maize silage (T2) on blood urea nitrogen (BUN) of experimental *Red Kandhari* heifers

Fortnights	BUN (mg/dL)	
	T1	**T2**
Initial	10.80±0.27	10.57±0.30
1	10.37±0.28	10.13±0.30
2	10.00±0.80	9.45±0.60
3	10.38±0.72	10.21±0.60
4	9.87±0.61	9.57±1.12
5	9.77±0.19	9.48±0.35
6	9.83±0.40	9.50±0.47
Overall Mean	10.15±0.14	9.84±0.17

($p > 0.05$) = NS
NS- Non significant

Table8. Effect of feeding maize silage (T1) and FAW affected maize silage (T2) on ALT of experimental *Red Kandhari* heifers

Fortnights	ALT (U/L)	
	T1	**T2**
Initial	13.49±0.90	14.67±1.40
1	14.78±0.89	14.23±1.63
2	14.25±0.58	13.85±1.44
3	14.37±0.75	14.07±1.19
4	14.28±0.84	13.94±0.98
5	14.13±0.85	13.79±0.81
6	13.93±0.76	14.08±0.74
Overall Mean	13.49±0.15	14.67±0.11

($p > 0.05$) = NS
NS- Non significant

Table9. Effect of feeding maize silage (T1) and FAW affected maize silage (T2) on AST of experimental *Red Kandhari* heifers

Fortnights	AST (IU/L)	
	T1	**T2**
Initial	92.70±1.84	89.43±3.25
1	91.47±3.31	89.32±3.57
2	87.20±4.67	88.70±3.41
3	93.00±2.53	90.60±4.21
4	91.00±3.64	90.05±4.52
5	89.03±2.44	88.05±3.81
6	88.37±3.56	89.05±2.39
Overall Mean	90.40±0.84	89.31±0.32

($p > 0.05$) = NS
NS- Non significant

CONCLUSION

The feed intake of *Red Kandhari* heifers was not affected on feeding silage prepared from FAW affected maize fodder and was significantly not different in compare to normal maize silage. Feeding FAW affected maize silage did not adversely affect the hematobiochemical parameters of *Red Kandhari* heifers.

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Conflict of Interest

The author(s) declares no conflict of interest.

Author contribution

The first author is named the lead author who did this research work. The second author was major guide and also involved in the preparation and correction of the manuscript. All authors were involved in experiment procedures during the research work.

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