



Comparing the Impact of Jowar Straw and Soybean Straw on Growth Performance in Gir Heifers

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ABSTRACT

Six Gir heifers were divided into three groups on the nearness of age and weight. Treatments were studied namely T₁ (Jowar straw + hybrid Napier + concentrate), T₂ (50% Jowar straw + 50% Soybean straw + hybrid Napier + concentrate), T₃ (50% Jowar straw + 50% Salt treated Soybean straw + hybrid Napier + concentrate) to fulfil the requirement of Gir heifer in all treatments. Dry, green fodder and concentrate mixture were provided per the thumb rule. Daily DM intake differed non-significantly between the treatments. The heifer from the T₃ groups consumed more DM than that of T₁ and T₂ heifers. The average daily DM intake was 6.51, 6.68 and 7.05 kg/day/heifer in the T₁, T₂ and T₃ groups respectively. This trend thus indicated an increase in the daily DM intake when 2% salt-treated soybean straw and jowar straw were incorporated as roughage in the heifer rations. Weight gain per day was found higher in combination feeding of jowar and salt-treated soybean straw. All the heifers exhibited a satisfactory growth rate of 358 to 470 g per day and the differences were significant. It was concluded from all discussions over the experimental result that treatment T₃ shows better and more desirable results as compared to T₁ and T₂ treatments. In T₃ treatment feeding of jowar straw, 2% salt-treated soybean straw, green fodder and concentrate not only fulfilled the nutrient requirement and growth of calves but also based on weight gain reduced the cost of feeding.

HIGHLIGHTS

- We studied on impact of Jowar straw and soyabean straw on the growth performance of Gir heifers.
- Combination feeding of jowar and salt-treated soybean straw led to higher weight gain.

Keywords: Girheifers, Soybean Straw, Napier, Concentrate, Jowar Straw

India is an agricultural country and livestock plays an important role in Indian agriculture. In all livestock, the dairy animal is known as an efficient producer of food for human beings. The Gir is a famous milch cattle breed of India. The native tract of the breed is the Gir hills and forests of Kathiawar including Junagadh, Bhavnagar, Rajkot and Amreli districts of Gujarat. There is an acute shortage of grazing land and browsing resources in the country because more and more area is being brought under crop cultivation.

Further, the quality and quantity of forage available from natural grazing land are progressively diminishing due to excessive grazing pasture. This situation completes to

switch over the feeding of animals to farm by-products which to otherwise be thrown away. Soybean (*Glycine max*) is rich in carbohydrates, fat, protein mineral and vitamins and therefore, can serve as a gift to the undernourished human population as well as livestock. It is a leguminous plant and every part of this crop is useful to animals. Most crop residues are fibrous, low energy, and have very little protein and minerals.

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The feeding of straws in combination with a concentrated mixture improves the growth and performance of Sahiwal heifers. Hence, feeding soybean straw with jowar straw and concentrate mixture has been proposed to improve weight gain and linear body measurements (Kale *et al.*, 2009; Seifi *et al.*, 2021).

Soybean and jowar straw are major roughage sources among these by-products for livestock feeding but due to low nitrogen, high fibre and lignin contents, they cannot meet even the maintenance requirement of ruminants on sole feeding. Feeding complete feed ensures mixing a required proportion of roughages and concentrate into a uniform blend to supply an adequate balanced ration, avoiding the refusal of unpalatable ingredients. Therefore, an attempt was made to evaluate the effect of the incorporation of jowar and soybean straw at graded levels in complete feed on voluntary intake and utilization of nutrients in heifers (Walkunde *et al.*, 2009; Madavi *et al.*, 2020).

MATERIALS AND METHODS

The present investigation entitled “Growth performance of Gir heifer on the feeding of jowar straw in combination with soybean straw” was undertaken at Livestock Instructional Farm, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra for 120 days. The material used and methods employed for these investigations are presented in the following pages under appropriate heads.

Selection of Gir heifer

Six Gir heifers were selected and heifers were divided into 3 groups. Thus, each group consisted of 2 heifers for the study. The detail of the selected heifer is tabulated in Table 1.

Table 1: Selection of experimental Gir Heifer

Group	Tattooing Number	Body weight at the start of expt. (kg)	Average body weight (kg)
I	117	190	185
	116	180	
II	112	245	245
	113	245	
III	114	190	210
	115	230	

Allotment of treatments

The present experiment was conducted by the switch-over design with three treatments as detailed below in Table 2.

Table 2: Details of allotment of treatments in feeding trials

Treatment	Detail
T ₁	100% Jowar straw + green fodder + concentrate (as per thumb rule).
T ₂	50% Jowar straw + 50% soybean straw + green fodder + concentrate (as per thumb rule).
T ₃	50% Jowar straw + 50% treated soybean straw (2% salt solution) + green fodder + concentrate (as per thumb rule).

Table 3: Allotment of treatment

Periods	Sequence I			Sequence II		
	A1	A2	A3	A1	A2	A3
I	A	B	C	A	B	C
II	B	C	A	C	A	B
III	C	A	B	B	C	A

The sequence constituted by the columns of the above sequences was tested on an equal number of Gir heifers. One Gir heifer from each group was allotted at random to a sequence constituted by columns. Thus, each sequence was tested on two Gir heifers over an experimental period.

The Gir heifers were fed experimental feed of each treatment for 33 days and shifted to the next treatment. A gap of 7 days was given to eliminate the residual effect of previous treatments.

Preparation of experimental feeds

The ingredients used for feeding experimental heifers were a concentrated mixture, of green fodder and dry roughages.

Here, in this experiment Jowar straw 100% with green fodder and concentrate (as per thumb rule) was used for feeding in treatment T₁, 50% jowar and 50 % soybean straw with green fodder and concentrate (as per thumb rule) were used for feeding in treatment T₂ and 50% jowar and 50% soybean straw treated with 2% salt solution with green fodder and concentrate (as per thumb rule) were used for feeding in treatment T₃ respectively.

Treatment of soybean straw

For treatment T₃ 25 kg of soybean straw was treated with 2% salt overnight. Here, 25 kg of soybean straw was measured by weighing balance, and then the salt solution was prepared by mixing 0.5 kg salt and 10 litres of water, covering the straw overnight then feeding as per the thumb rule to the required animal as per the treatment assigned.

Thumb rule for cattle feeding

In the thumb rule feeding system the average DM (Dry matter) requirement of an indigenous cow is 2-2.5 kg/100 kg body weight. While it is 2.5-3.0 kg /100 kg body weight in buffalo and crossbred cows. The roughage requirement is fulfilled through green and dry fodders, about 2/3 of dry matter through roughage and 1/3 of through concentrate.

STATISTICAL METHOD

The data were subjected to statistical analysis by following the Switch Over Design for testing their difference as per the procedure described by Amble (1975).

RESULTS AND DISCUSSION

Daily DM intake

Daily DM intake was calculated from the intake of different feeds and data is tabulated in Table 4.

Table 4: The average intake of DM over the experimental period under different treatments (kg/day/heifer)

Treatments	Average body weight (kg)	Daily Dry matter intake (kg)	Daily dry matter intake 100 kg body weight
T ₁	238.07	6.51	2.73
T ₂	239.01	6.68	2.79
T ₃	237.93	7.05	2.96
'F' test		NS	Sig
SE(M)±		—	0.04
CD at 5%		—	0.12

It was noted that the daily DM intake differed significantly between the treatments. The heifer from the T₃ groups

consumed more DM per 100 kg than the T₁ and T₂ heifers. The average daily intake was 6.51, 6.68 and 7.05 kg/day/heifer in the T₁, T₂ and T₃ groups, respectively. This trend thus indicates an increase in the daily DM intake when soybean straw and 2% salt-treated soybean straw were incorporated as roughage in the heifer rations. However, past research workers Bansod (2008) reported that there was an increase in the daily DM intake of animals when soybean straw was incorporated with jowar. This observation does agree with the present trend. Thus, the inclusion of soybean straw in the ration of the heifer was beneficial to raise the intake and could form an alternative to jowar straw.

It was evident from the results of Table 4 that the average daily intake of dry matter was 6.51, 6.68 and 7.05 kg per heifer in T₁, T₂ and T₃ treatment, respectively. It was noted that the daily DM intake differed significantly between the treatments. The heifer from the T₃ groups consumed more DM than that of T₁ and T₂ heifers. The average daily intake was 6.51, 6.68 and 7.05 kg/day/heifer in the T₁, T₂ and T₃ groups, respectively. This trend thus indicates an increase in the daily DM intake when 2% salt-treated soybean straw was incorporated as roughage in the rations of the heifer.

Yadav and Chaudhary (2010) reported that the crude protein (CP) intake per 100 kg body weight was significantly higher in T₁ as compared to the T₃ group.

The present intake values are higher than those reported by past research workers like Das *et al.* (2012) reported that the average daily dry matter intake was higher in T₂ and the values were 5.89, 6.34 and 5.93 kg in T₁, T₂ and T₃ respectively. On the other hand, Lraira *et al.* (2012) reported an intake of 5.1 and 5.3 vs 4.7 and 5.0 kg dry matter (DM)/day, respectively.

These trends, therefore, indicate the feeding of soybean and 2% salt-treated soybean straw to heifers as a source of roughage had increased dry matter intake.

Water intake

The feeding trial was conducted during the summer season; therefore, it was thought necessary to record the observation of the water intake of the heifers. Water was offered 2 times daily during the period of trial. The data is tabulated in Table. 5.

Table 5: Daily water Intake of experimental heifer under various treatments

Treatments	Water intake/day/ heifer (lit)	Water intake/day/ heifer /100 kg body weight (lit)	The ratio of DM: Water
T ₁	24.67	10.36	1:4.112
T ₂	25.42	10.63	1:4.237
T ₃	31.17	13.10	1:5.195
'F' test	Sig	Sig	—
SE(M)±	1.315	0.521	—
CD at 5%	4.398	1.744	—

It was noticed that the daily water intake of the heifers differs significantly between the feeding groups. The heifers from the T₃ group drank more (31.17) than that of the T₁ (24.67) and T₂ (25.42). This trend indicated that the water intake in treatments T₁, T₂, and T₃ was significant, indicating, that the level of soybean straw had no effect on the water consumption of heifers but adding salt-treated soybean straw increased the water intake to some extent. The feeding trial was conducted during summer therefore the water intake seems to be higher.

A similar trend was observed when the water intake was converted to unit body size. The average water intake per 100 kg body weight was 9.94, 10.17 and 12.53 litre per heifer per day in T₁, T₂ and T₃ respectively. As a result of this solution dry matter to water intake ratio was more or less similar in all the groups and it was 1:4.112, 1:4.237 and 1:5.195 under T₁, T₂ and T₃ groups, respectively.

The present intake values are higher than the values reported by past research workers Tipare (2003) reported that the average water intake over an experiment period was 15.37, 13.14 and 12.14 lit per day per heifer in treatment T₁, T₂, and T₃ respectively. Shelar (2004) noticed that the daily water intake of the heifers did not differ significantly between the feeding groups. Sonune *et al.* (2018) noticed that the daily water intake of the calves differed significantly between the feeding group, the calves from the T₂ group drank more (12.88) than that of T₁ (12.50), T₃ (12.13) and T₄ (11.84). This trend indicated that the water in treatments T₁, T₂, T₃, and T₄ were significant, indicating, that the level of soybean straw affected the water consumption of calves. This observation does agree with the present trend of increased water intake in Gir heifers due to the incorporation of 2% salt-treated soybean straw without any adverse effect on animal health.

Growth performance of Gir heifers

The Growth performance of Gir heifer on jowar straw, soybean straw and salt-treated soybean straw feeding was judged based on body weight gain and gain in body measurement. The results obtained in this regard are discussed in the following table 6.

It was observed from Table 6 that there was a significant difference in weight gain under different treatments. The average final weight gain was highest in T₂ followed by T₃ and T₁ significantly lowest weight gain was recorded in the T₁ treatment i.e., jowar straw feeding daily intake of DM was highest in the treatment T₃ which had an adequate amount of DCP and TDN to heifers. This situation might have favoured the growth of heifers. The average daily body weight gain was 0.358, 0.418 and 0.470 kg per day in T₁, T₂ and T₃ treatment, respectively.

Table 6: Effect of different feeding treatments on body weight gain (kg)

Treatments	Average Initial Weight (kg)	Average Final Weight (kg)	Period weight gain (kg)	Daily weight gain gm/ kg
T ₁	230.89	245.25	14.35	0.358
T ₂	230.66	247.42	16.76	0.418
T ₃	228.51	247.46	18.82	0.470
'F' test	—	—	Sig	Sig
SE(M)±	—	—	0.943	0.026
CD at 5%	—	—	3.155	0.080

The present values are higher than the values reported by past research workers Kumar *et al.* (1997) observed the average value of daily body weight gain was 350, 353 and 311 g for Sahiwal heifers, respectively.

Adangale *et al.* (2009) observed average daily weight gain of 0.201, 0.210 and 0.204 g per day in calves by feeding jowar straw with a combination of soybean straw. Sonune (2016) observed the average daily body weight gain was 0.203, 0.243, 0.160 and 0.110 kg/ day/ calves in T₁, T₂, T₃ and T₄ treatment, respectively. The values of present studies are higher than those reported by past workers. The gain in body length was 8.68, 9.31 and 9.58 in T₁, T₂, and T₃ respectively. This revealed that the gain in length was significantly highest in T₃ and lowest in T₁ treatment.

It was observed that the increase in height under treatments T₁, T₂, and T₃ were 8.71, 9.27 and 9.49 cm, respectively in experimental heifers, however, the differences in height did not influence significantly. It is evident from the treatment that heifer from the T₃ group showed more body height as compared to other treatments and lowest in the T₁ treatment.

It was observed that the increase in chest girth was 9.11, 10.13 and 10.37 cm in treatment T₁, T₂, and T₃ in experimental heifers, however, the differences in height did not influence significantly. It is evident from the table that heifer from the T₃ group showed more body height as compared to other treatments and lowest in the T₁ treatment.

The performance of heifers fed on different diets showed a gradual increase in height, length and chest girth. However, differences were more or less similar in the different combinations of diet which may be due to feeding completely fed in all the treatments as per the equipment. The increase in body measurement was higher in a combination of jowar and 2% salt-treated soybean straw.

The present observation is nearer to the observation reported by past research workers Zanton and Heinrichs (2007) results indicated that wither height and body length were higher (103 and 111 cm vs. 101 and 108 cm) in heifers fed high concentrate comprising high dietary energy. Shelke *et al.* (2011) observed average daily chest girth gain of 0.126, 0.135 and 0.117 cm per day in heifers

by feeding silage prepared from sorghum and gliricidia. Sonune (2016) reported that the gain in body length was 6.92, 8.42, 8.62, and 8.90 in T₁, T₂, T₃ and T₄ treatments, respectively and the increase in chest girth was 8.44, 8.55, 8.80 and 9.10 cm in treatment T₁, T₂, T₃ and T₄ in experimental crossbred calves.

The height and body length differed non-significantly in T₁, T₂ and T₃ but differed significantly in chest girth which is nearer to the past researcher Singh *et al.* (2015) who recorded the highest heart girth in crossbred heifer through feeding concentrate-based diet. Habib *et al.* (2018) reported that the wither height gain (WHG) and body length gain (BLG) were found similar among the groups but group 4 heifers fed green fodder, soybean hay along with mixed concentrate showed significantly higher heart girth gain (HGG), 0.34 cm bigger than groups 2 and 3.

Economics of feeding

Any feed strategy must be economical to make it popular among cattle owners. Given this feeding economics of the different groups were ascertained. Observations on the economics of feeding are shown in Table 7.

It was observed that the total quantity of jowar straw required for the T₁, T₂ and T₃ groups was 394, 211.56 and 229.78 kg. The total quantity of soybean and salt-treated soybean straw for the T₂ and T₃ groups was 211.56 and 229.78 kg. The quantities of concentrate in T₁, T₂,

Table 7: Economics of feeding heifer under different treatment

Sl. No.	Treatments Particulars	T ₁		T ₂		T ₃	
		Quantity (kg)	Cost (₹)	Quantity (kg)	Cost (₹)	Quantity (kg)	Cost (₹)
1	Jowar straw (kg) @400 ₹/qt	394	1576	211.56	846.32	229.78	919.12
2	Soybean straw (kg) @300 ₹/qt	—	—	211.56	634.68	229.78	689.34
3	Green fodder (Hy. Napier) (kg) @150 ₹/qt	787.16	1180.74	762	1143	835.18	1252.77
4	Concentrate (kg) @19 ₹/kg	264.24	5020.56	265.08	5036.52	264.16	5019.04
5	Salt @ 6/kg	—	—	—	—	4.59	27.57
6	Labour charges @180/day	—	7200	—	7200	—	7200
7	Total cost	—	14977.30	—	14860.52	—	15107.84
8	Total Cost/day/heifer (₹)	—	124.81	—	123.84	—	125.89
9	Total BW gain (kg)	14.35	—	16.76	—	18.82	—
10	Cost/kg BW gain	—	1043.71	—	886.67	—	802.75
11	Cost/kg BW gain/heifer	—	173.95	—	147.78	—	133.79



and T₃ treatment were 264.24, 265.08, and 264.16 kg, respectively.

Total cost/day/heifer was 124.81, 123.84 and 125.89 Rs for T₁, T₂ and T₃ respectively. The total body weight gain was 14.35, 16.76 and 18.82 Kg for T₁, T₂ & T₃, respectively. The cost per kg BW gain per heifer was observed at 173.91, 147.78, and 133.79 Rs. in treatment T₁, T₂ and T₃, respectively. A higher weight gain was observed in T₃ (18.82 kg); hence it is economical for farmers. The cost per kg BW gain per heifer was higher in treatment T₁ (173.91) and lower in treatment T₃ (133.79).

It was concluded from the above discussion over the experimental result that the treatment T₃ shows the better and more desirable result as compared to T₁ and T₂ treatment. In T₃ treatment feeding of jowar straw, 2% salt-treated soybean straw, green fodder and concentrate not only fulfilled the nutrient requirement and growth of calves but also based on weight gain reduced the cost of feeding.

Adangale *et al.* (2008) observed that the cost per kg body weight gain was highest in treatment T₀ (₹ 48.99) followed by T₁ (₹ 43.09) and T₂ (₹ 39.11). Lkhar *et al.* (2011) observed that the avg. cost/animal/d for Sahiwal heifers was highest in T₁ (₹ 31.29) followed by T₂ (₹ 26.30) and T₃ (₹ 23.39).

The present observation is slightly higher than the observation reported by past research workers Kahate *et al.* (2017) observed that the cost of feeding per kg body weight gain was ₹ 126.73, ₹ 105.64 and ₹ 111.42 in T₁, T₂ and T₃ treatment, respectively. In other words, the cost per kg gain in treatment T₂ was lowest as compared to T₁ and T₃ treatments.

CONCLUSION

Based on the findings reported in the present investigation, it is concluded that the T₃ ingredient (50% jowar straw + 50% soybean straw treated with 2% salt solution + green fodder + concentrate), used for feeding experimental Gir heifers was found superior as compared to T₁, and T₂ treatments. This feeding schedule is sufficient to fulfil the appetite and nutritional requirements of the Gir heifer.

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