

Impact of Watering Frequency and Feed Source on Growth Performance in Crossbred Calves

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ABSTRACT

The present investigation was conducted at University Livestock Research Station, Anand, Gujarat to study the effect of watering frequency on growth performance of crossbred calves over 98 days experimental period. The calves (n=24, 6-8 month old) were randomly assigned to four watering frequency and two feeding treatments, a total of eight treatments, on the basis of sex (8 M, 12 F) and body weight (Av. 104.96±2.85 kg), viz, T₁F₁: watering frequency *ad libitum* with 50:50 mixture of legume straw and cereal (wheat) straw, T₁F₂: watering frequency *ad libitum* with Jowar hay, T₂F₁: watering frequency once a day with 50:50 mixture of legume and cereal straw, T₂F₂: watering frequency once a day with Jowar hay, T₃F₁: watering frequency twice a day with 50:50 mixture of legume and cereal (wheat) straw, T₃F₂: watering frequency twice a day with Jowar hay, T₄F₁: watering frequency thrice a day with 50:50 mixture of legume and cereal (wheat) straw and T₄F₂: watering frequency thrice a day with Jowar hay. In all treatments, fixed quantity of concentrate and green fodder were also offered to calves. At the end of the experiment, average body weight and overall growth rate were highest in T₄ (134.43±3.28 kg and 600.68±36.21 g/head/day), followed by T₁ and T₃, and significantly higher than T₂ (p<0.05). Calves fed jowar hay (F₂) recorded significantly higher body weight and growth rate than those fed the soybean and wheat straw mixture (F₁) (p<0.05). Body length increased by 13.56% and was significantly higher in T₁, T₃, and T₄ compared to T₂ (p<0.05), with higher values in F₂ (p<0.05). Heart girth increased by 12.88% and was significantly higher in T₄ (p<0.05). Height at withers increased by 10.13% and was significantly higher in T₄ and in calves fed F₂ (p<0.05). Thrice-daily watering (T₄) significantly improved body weight and morphometric traits of crossbred calves compared to lower watering frequencies. Feeding jowar hay further enhanced growth performance, indicating that higher watering frequency combined with jowar hay feeding is beneficial for optimum calf growth.

Key words: Crossbred calves, Growth performance, Height at wither, Morphometric trait, Water frequency.

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INTRODUCTION

Livestock plays a vital role in the rural economy of India, providing income, employment, and nutritional security, especially to small and marginal farmers (Hegde, 2019). India remains the largest milk producer in the world, with milk production reaching 230.58 million tonnes during 2022-23 and per capita availability of about 459 g/day (BAHS, 2024). In dairy farming, proper care and scientific management of calves are essential, as they represent the future productive stock, and their early growth determines later performance.

Water is a fundamental nutrient required for digestion, metabolism, circulation, growth, and regulation of body temperature, yet it is often neglected in calf management (ICAR, 2013). Inadequate water intake adversely affects feed consumption, growth rate, and overall well-being of calves (Beede, 2005; Kertz *et al.*, 2017). Studies have shown a positive relationship between water intake, feed intake, and average daily gain (Brew *et al.*, 2011), while restricted watering reduces body weight and performance (Sahana *et al.*, 2020).

Along with watering management, the quality of roughage also influences growth and body measurements. Legume straws contain higher protein and better nutritive value than cereal straws and can improve growth performance when used in calf feeding (Mahesh and Mohini, 2014; Chauhan *et*

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al., 2017). Therefore, the present study was undertaken to evaluate the effect of watering frequency and feed source on growth and morphometric traits of crossbred calves.

MATERIALS AND METHODS

The experiment was conducted at Livestock Research Station (LRS), Anand Agricultural University, Anand, Gujarat (India) for 98 days as per guideline of Institutional Animal Ethics

Committee (No. 300/LPM/2019) of College of Veterinary Science & Animal Husbandry, Anand. Total 24 crossbred male and female (HF x Kankrej) calves (6-8 month) were allotted to eight groups (each treatment had 1 male and 2 female calves) with average similar body weight (104.96 ± 2.85 kg).

Calves were subjected to four watering frequency (T_1 , T_2 , T_3 & T_4) and two feeding treatments (F_1 & F_2), a total of eight treatments. Watering of experimental animals was done into four treatment group, viz., T_1 calves were offered *ad libitum* water, T_2 calves were offered once a day water at 10 a.m., T_3 calves were offered twice a day water at 10 a.m. and 9 p.m. and T_4 calves were offered thrice a day at 10 a.m., 3 p.m. and 9 p.m. *ad libitum* mixture of legume (soyabean) and cereal (wheat) straw (50:50) or chaffed Jowar hay were offered at 3:00 pm to fulfill their nutrient requirement as per treatment schedule. To meet nutrient requirements (ICAR, 2013) all calves were individually fed green hybrid Napier and concentrate. T_1F_1 : watering frequency *ad libitum* with 50:50 mixture of legume (soyabean) straw and cereal (wheat) straw, T_1F_2 : watering frequency *ad libitum* with Jowar hay, T_2F_1 : watering frequency once a day with 50:50 mixture of legume (soyabean) and cereal (wheat) straw, T_2F_2 : watering frequency once a day with Jowar hay, T_3F_1 : watering frequency twice a day with 50:50 mixture of legume (soyabean) and cereal (wheat) straw, T_3F_2 : watering frequency twice a day with Jowar hay, T_4F_1 : watering frequency thrice a day with 50:50 mixture of legume (soyabean) and cereal (wheat) straw and T_4F_2 : watering frequency thrice a day with Jowar hay. All experimental animals were kept under iso-managerial conditions in well-ventilated hygienic shed and were provided clean drinking water and feed as per treatment.

Body weights (kg) of the all experimental animals were measured on electronic platform individually at fortnightly (once in two weeks) interval throughout the experiment starting from day one. Body weight was recorded at 8.00 am before feeding and watering after taking left over. The difference between the current body weight and body weight taken during previous fortnight was considered as the weight gain during that period. Body measurement, viz., heart girth, body length and height at withers (cm) of experimental animals were measured fortnightly by using standard measuring tape. The heart girth was measured as circumference of body at point of wither and the point of elbow; body length was measured as distance between point of shoulder to pin bone; and height at withers was measured as a perpendicular distance between the ground level and the highest point of wither were at biweekly intervals. All the measurements were taken by keeping the animals on flat floor while standing in normal position and when they were neither urinating nor defecating and unduly stretching the body.

The data was analyzed statistically using two-way analysis of variance under factorial randomized block design and Duncan's post-hoc test as per Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

Body Weight (kg)

Average fortnightly body weight of crossbred calves recorded during the experiment is given in Table 1. During the experimental period, body weight increased by 52.25 %. The body weight (kg) of experimental animals in T_1 , T_3 and T_4 was significantly ($p < 0.05$) higher as compared to T_2 group. Body weight of crossbred calves significantly ($p < 0.05$) decreased to the tune of 5.62, 5.29 and 8.07 % in T_2 as compared to T_1 , T_3 and T_4 , respectively. Although there was no significant difference among T_1 , T_3 and T_4 , highest body weight was observed in later group. Therefore, it is recommended to go for thrice a day watering with regard to gain in body weight of animals. Irrespective of watering frequency and period, body weight (kg) was significantly ($p < 0.05$) higher in calves fed Jowar hay (F_2 : 132.80 ± 4.60) as compared to mixture of legume (soyabean) & cereal (wheat) straw (F_1 : 127.89 ± 5.07). The interaction between the watering frequency and feed ($T \times F$) was found to be non-significant on body weight of experimental animals. However, highest body weight was observed in combination of thrice a day watering frequency & Jowar hay feed (58.42 % increase) and lowest in once a day watering frequency & mixture of legume and cereal straw feed (42.28 % increase).

Body weights observed in this study were in accordance with reports of Hatendi *et al.* (1996) with significant ($p < 0.05$) effect of watering frequency (every 24 and 72 h) on the body weight (255.9 ± 2.95 and 252.4 ± 2.81 kg) of steers during eighteen-week experiment, and of Sahana (2019) on indigenous sheep showing significantly ($p < 0.05$) declined body weight in once a day watering frequency than twice or thrice a day frequency. Contrary to present study, Burgos *et al.* (2001) reported that body weight of cows restricted to 50 % water reduced significantly ($p < 0.05$) whereas body weight of cows restricted to 25 % water had non-significant reduction in body weight as compared to *ad libitum* water. Gottardo *et al.* (2002) reported that water restriction in veal calves (milk replacer diet without and with water supplement) did not affect the final body weight. More (2018) observed significant influence of feed sources diet containing 40% Jowar straw + 60% Soyabean straw + 3 kg berseem + concentrate) on body weight of crossbred calves as compared to other combinations, which concurrent with the preset finding of F_1 and F_2 groups.

Daily Body Weight Gain (Growth Rate)

The effect of watering frequency and feed on growth rate (g/head/d) of crossbred calves was worked out at fortnightly interval and average data for daily weight gain in body weight are presented in Table 1. Irrespective of watering frequency, feed source and period, the overall mean daily gain was 559.69 ± 17.32 g/head/d in the study population. Growth rate was significantly ($p < 0.05$) higher in T_4 and T_1 as compared to T_2 . However, growth rate of experimental animals in T_3 group

Table 1: Average body weight and body weight gain of crossbred calves under different treatment groups (Mean $\pm$ SE)

Period	T ₁		T ₂		T ₃		T ₄		Mean		Grand Mean
	F ₁	F ₂	F ₁	F ₂	F ₁	F ₂	F ₁	F ₂	F ₁	F ₂	
Average body weight (kg)											
Initial BW	106.13 ±11.28	104.60 ±10.89	102.40 ±11.45	104.40 ±11.46	103.13 ±9.03	105.20 ±9.29	107.33 ±6.53	106.47 ±4.55	104.75 ±4.21	105.17 ±4.03	104.96 ±2.85
Last fortnight	163.67 ±18.21	160.63 ±11.61	145.70 ±14.16	159.33 ±15.02	151.50 ±12.07	166.10 ±11.42	162.87 ±11.58	168.67 ±8.06	155.93 ±6.49	163.68 ±5.15	159.80 ±4.13
Mean of Exptl period	131.46 ±5.63	131.40 ±5.02	120.30 ±4.70	128.58 ±5.32	127.33 ±4.44	134.73 ±5.23	132.48 ±4.60	136.49 ±4.75	127.89 ^a ±5.07	132.80 ^b ±4.60	130.35 ±1.79
Overall mean T	131.43 ^B ±3.73		124.44 ^A ±3.56		131.03 ^B ±3.43		134.48 ^B ±3.28		130.35±1.79		130.35±1.79
Average growth rate (g/head/d)											
1 st fortnight	314.29 ±8.25	476.19 ±12.60	119.05 ±42.32	300.00 ±107.22	290.47 ±108.90	404.76 ±56.14	347.62 ±79.25	466.67 ±45.43	267.86 ±40.21	411.91 ±34.85	339.88 ±30.04
Last fortnight	909.52 ±115.87	811.91 ±74.27	888.09 ±77.96	838.10 ±88.19	407.14 ±8.25	616.67 ±16.67	890.48 ±76.30	628.57 ±59.48	773.81 ±72.32	723.81 ±41.44	748.81 41.09
Mean of Exptl period	587.08 ±57.51	571.77 ±40.64	441.84 ±57.88	560.54 ±43.90	493.54 ±43.99	621.43 ±42.79	566.67 ±59.02	634.69 ±42.14	522.28 ^a ±28.68	597.11 ^b ±15.84	559.69 ±17.32
Overall mean T	579.42 ^B ±34.80		501.19 ^A ±37.05		557.48 ^{AB} ±31.91		600.68 ^B ±36.21		559.69±17.32		559.69±17.32

Means with dissimilar superscripts in a row (A, B) differ significantly for watering frequency and (a, b) differ significantly for feed source ($p < 0.05$).

was at par with remaining treatments. The growth rate of experimental animals was decreased to the tune of 3.66 % in T₁ as compared to T₄. Regardless of watering frequency and period, average daily gain (g/head/d) was 522.28 $\pm$ 28.68 and 597.11 $\pm$ 15.84 in mixture of legume (soyabean) & wheat straw (F₁) and Jowar hay (F₂) feed source, respectively, which differed significantly ($p < 0.05$). The interaction between the watering frequency and feed (T $\times$ F) was found to be non-significant indicating that all the watering frequency behaved in a similar fashion for different feed sources over a period of 98 d. However, highest growth rate (T₄F₂: 634.69 $\pm$ 42.14 g/head/d) was observed in thrice a day watering frequency and Jowar hay feed source while lowest in once a day watering frequency and mixture of legume & cereal straw (T₂F₁: 441.84 $\pm$ 57.88 g/head/d). The growth rate of the calves in all treatment groups increased during P5 to P7 due to higher DM, DCP and TDN intake.

In accordance with the present study, Brew *et al.* (2011) reported that *ad libitum* drinking water intake was positively correlated with average daily gain in 7 to 9 months old growing beef cattle. Nayak (2018) observed that average growth rate of crossbred calves was 499.15 $\pm$ 41.91 g/head/d in thrice a day watering frequency, which was lower than present findings. Further, as per the study of Kshatriya (2009), overall mean growth rate of crossbred calves was 382.06 $\pm$ 40.63 g/head/d in twice a day drinking water, while Sharma *et al.* (2017) reported average daily gain of Murrah buffalo calves as 446.78 $\pm$ 8.68 g/head/d in *ad libitum* drinking water. Both these values were lower than present study which might be due to feeding treatment. Yacob *et al.* (2005) on the contrary reported higher growth rate of crossbred calves as 539 $\pm$ 0.02 g/head/d in twice a day drinking water, which might

be due to high level of protein feeding. The current trend of ADG between F₁ and F₂ groups concurred well with More (2018), who recorded significantly ($p < 0.05$) higher average daily body weight gain (381 g/d) in calves receiving diet containing 40% Jowar straw + 60% Soyabean straw + 3 kg berseem + concentrate as compared to other combinations (313, 350 and 330 g/d). Adangale *et al.* (2009) however reported non-significantly higher ADG in calves fed T₁ diet (50 % Jowar straw + 50 % soyabean straw + concentrate) than T₂ (100 % soyabean straw and concentrate) and T₀ (*ad libitum* jowar straw + concentrate) diets.

Body Length

As an indicator of growth, the body length (cm) of crossbred calves was recorded at fortnightly interval (Table 2). The overall mean body length of experimental animals was observed to be 107.56 $\pm$ 0.46 cm. Irrespective of watering frequency and source of feed, the overall mean of body length (cm) at beginning and end of the experiment was 101.42 $\pm$ 0.71 and 115.17 $\pm$ 0.92, respectively, showing 13.56 % increase. The body length (cm) of experimental animals in T₁, T₃ and T₄ were significantly ($p < 0.05$) higher as compared to T₂ group. However, the body length (cm) was found to be highest in thrice a day (T₄) watering frequency followed by T₃, T₁, and T₂. Irrespective of watering frequency and period, body length (cm) was significantly ($p < 0.05$) higher in calves fed Jowar hay (F₂: 108.60 $\pm$ 0.64) as compared to mixture of legume & cereal straw (F₁: 107.60 $\pm$ 0.64). The interaction between the treatment and feed (T $\times$ F) was found to be significant ($p < 0.05$). However, highest body length (T₄F₁: 109.62 $\pm$ 1.25 cm) was observed in thrice a day watering frequency and Jowar hay feed source while lowest in once a day watering frequency



Table 2: Morphometric traits of crossbred calves under different treatment groups (Mean $\pm$ SE)

Period	T ₁		T ₂		T ₃		T ₄		Mean		Grand Mean
	F ₁	F ₂	F ₁	F ₂	F ₁	F ₂	F ₁	F ₂	F ₁	F ₂	
Average body length (cm)											
1 st fortnight	101.83 ±3.09	100.67 ±1.48	100.17 ±2.60	101.50 ±2.75	101.67 ±2.60	102.17 ±2.40	100.83 ±1.88	102.50 ±1.89	101.13 ±1.09	101.71 ±0.95	101.42 ±0.71
Last fortnight	116.67 ±4.78	115.33 ±2.89	112.17 ±1.86	113.33 ±2.46	113.83 ±2.60	116.50 ±3.33	115.67 ±2.40	117.83 ±1.48	114.58 ±1.42	115.75 ±1.22	115.17 ±0.92
Mean of Exptl period	108.21 ±1.68	107.07 ±1.29	105.52 ±1.12	106.98 ±1.23	107.17 ±1.20	108.57 ±1.42	107.33 ±1.29	109.62 ±1.25	107.06 ^a ±0.66	108.06 ^b ±0.64	107.56 ±0.46
Overall mean T	107.64 ^B ±1.05		106.25 ^A ±0.83		107.87 ^B ±0.93		108.48 ^B ±0.91		107.56±0.46		107.56±0.46
Average heart girth (cm)											
1 st fortnight	110.17 ±1.74	111.50 ±3.77	110.00 ±2.84	110.50 ±3.04	111.17 ±2.89	112.17 ±3.88	111.67 ±3.11	111.83 ±1.01	110.75 ±1.17	111.50 ±1.35	111.13 ±0.87
Last fortnight	126.00 ±3.88	126.33 ±3.35	122.00 ±3.79	123.67 ±2.91	123.83 ±3.66	126.00 ±4.25	127.00 ±3.75	128.17 ±1.30	124.71 ±1.71	126.17 ±1.42	125.44 ±1.09
Mean of Exptl period	117.64 ±1.47	118.81 ±1.63	115.00 ±1.37	116.69 ±1.38	116.79 ±1.40	118.52 ±1.62	118.17 ±1.59	119.71 ±1.32	116.90 ^a ±0.72	118.44 ^b ±0.74	117.67 ±0.52
Overall mean T	118.23 ^{BC} ±1.09		115.85 ^A ±0.97		117.65 ^B ±1.07		118.94 ^C ±1.03		117.67±0.52		117.67±0.52
Average height at withers (cm)											
1 st fortnight	99.67 ±3.03	99.50 ±2.36	98.83 ±2.77	99.17 ±2.46	98.50 ±1.89	100.33 ±3.22	100.00 ±1.26	101.17 ±2.52	99.25 ±1.01	100.04 ±1.15	99.67 ±0.75
Last fortnight	111.00 ±3.62	110.67 ±2.89	107.00 ±3.50	108.17 ±2.68	107.17 ±2.49	109.83 ±3.94	111.33 ±1.96	113.00 ±2.47	109.13 ±1.41	110.42 ±1.40	109.77 ±0.98
Mean of Exptl period	104.52 ±1.36	104.71 ±1.13	102.33 ±1.17	103.17 ±1.03	103.00 ±0.93	105.05 ±1.39	105.04 ±0.98	106.60 ±1.26	103.73 ^a ±0.56	104.88 ^b ±0.60	104.30 ±0.41
Overall mean T	104.62 ^B ±0.87		102.75 ^A ±0.77		104.02 ^B ±0.84		105.82 ^C ±0.80		104.30±0.41		104.30±0.41

Means with dissimilar superscripts in a row (A, B) differ significantly for watering frequency and (a, b) differ significantly for feed source ($p < 0.05$).

and mixture of legume & cereal straw (T₂F₁: 105.52 $\pm$ 1.12 cm). The higher values in thrice a day watering frequency and Jowar hay feed source observed in present study might be because of higher water intake, dry matter intake and TDN consumption, better utilization and voluntary consumption of feed and water which led better skeletal growth.

The results of present study were in agreement with findings of Kshatriya (2009), who observed average body length gain of crossbred calves as 13.79 cm in twice a day watering. In accordance with present study, Wickramasinghe *et al.* (2019) reported the effect of provision of drinking water from 0 day of birth (W₀) and from 17 days after birth (W₁₇) on body measurements in Holstein heifer calves, and concluded that body length was significantly ($p < 0.05$) higher in W₀ group as compared to W₁₇ (86.80 vs. 85.30 cm). Like present finding of significantly ($p < 0.05$) higher body length gain in calves fed F₂ than F₁ diet, More (2018) also reported significantly ($p < 0.05$) higher body length (105.28 cm) in crossbred calves fed T₃ diet (40% Jowar straw +60% Soyabean straw + 3 kg berseem + concentrate), as compared to other groups (97.36, 101.28 & 99.42 cm).

Heart Girth

Irrespective of watering frequency and source of feed, the overall mean heart girth (cm) at beginning and end of the experiment was 111.13 $\pm$ 0.87 and 125.44 $\pm$ 1.09, respectively.

During the experimental period, heart girth increased by 12.88 % from beginning to end of experiment (Table 2). At the end of experiment, average heart girth recorded was 118.23 $\pm$ 1.09, 115.85 $\pm$ 0.97, 117.65 $\pm$ 1.07 and 118.94 $\pm$ 1.03 cm in *ad libitum* (T₁), once a day (T₂), twice a day (T₃) and thrice a day (T₄) watering frequency, respectively. Heart girth (cm) was significantly ($p < 0.05$) higher in T₄ followed by T₃ and T₂, however, T₁ was at par with T₃ and T₄ groups. If the watering frequency of experiment and period are ignored, heart girth (cm) was significantly ($p < 0.05$) higher in calves fed mixture of legume & cereal straw (F₁: 118.44 $\pm$ 0.74) as compared to Jowar hay (F₂: 116.90 $\pm$ 0.72). The interaction (T $\times$ F) effect was observed to be non-significant. However, highest heart girth was observed in thrice a day watering frequency and Jowar hay feed source (T₄F₁: 119.71 $\pm$ 1.32 cm) while lowest in once a day watering frequency and mixture of legume & cereal straw (T₂F₁: 115.00 $\pm$ 1.37 cm). However, as a routine the period effect was significant indicating that with the increasing in age, size of animal also increases.

Kshatriya (2009) observed overall mean heart girth of crossbred calves to be increased by 15.39 % in twice a day watering for a period of nine fortnightly intervals. Nayak (2018) observed increased heart girth of crossbred calves by 19.30 % in 15-week experiment for thrice a day watering frequency. Both values were higher than present findings

which might be due to long duration of experiment. In partial accordance with present study, Wickramasinghe *et al.* (2019) concluded that there was no significant difference in heart girth between W_0 and W_{17} but W_0 calves had numerically greater heart girth, then W_{17} calves during the experimental period (100.30 vs. 99.60 cm). In contrast to present study, Rahman *et al.* (2016) reported significantly ($p < 0.05$) higher heart girth in crossbred calves under T_3 (sorghum and wheat straw mixture in equal proportion to form of complete feed) as compared to T_1 (sorghum straw and concentrate used separately), or T_2 (sorghum straw and concentrate used as complete feed) treatment. The present significantly higher heart girth noted with legume + cereal straw diet (F_1) than the jowar hay alone (F_2) also concurred with More (2018), who noted significantly ($p < 0.05$) higher heart girth (107.24 cm) with 40% Jowar straw + 60% Soyabean straw as compared to other combinations of 100% Jowar straw (104.52 cm), 100% Soyabean straw (105.44 cm), and 60% Jowar straw + 40% Soyabean straw (105.82 cm).

Height at Withers

Average fortnightly height at withers of crossbred calves recorded during the experiment is given in Table 2. Irrespective of watering frequency and source of feed, the overall mean height at withers (cm) at beginning and end of the experiment was 99.67 ± 0.75 and 109.77 ± 0.98 , respectively. During the experimental period height at withers increased by 10.13 % from beginning to end of experiment. Height at withers was significantly ($p < 0.05$) higher in T_4 followed by T_1 , T_3 , and T_2 however, T_3 was at par with T_1 group. Height at withers (cm) was 103.73 ± 0.56 and 104.88 ± 0.60 in mixture of legume & cereal straw (F_1) and Jowar hay (F_2) feed source, respectively which differed significantly ($p < 0.05$). The interaction between the treatment and feed (TxF) was found to be non-significant.

Results of present study were similar to the findings of Kshatriya (2009), who observed overall mean height at withers of crossbred calves as 103.50 ± 1.24 cm in twice a day drinking water. In accordance with present study, Wickramasinghe *et al.* (2019) studied the effect of provision of drinking water on height at withers in Holstein heifer calves from birth to 70 d of age, and recorded significantly ($p < 0.05$) higher value in W_0 group as compared to W_{17} (93.30 vs. 92.20 cm). Significantly ($p < 0.05$) higher height at withers noted with Jowar hay (F_2) than a mixture of legume & cereal straw (F_1) in the current study also supported the earlier observation of More (2018), who reported significantly ($p < 0.05$) superior height at withers in crossbred calves (99.78 cm) fed with T_3 diet (40% Jowar straw + 60% Soyabean straw) than other combinations (98.58, 98.62, and 97.92 cm).

CONCLUSIONS

The study shows that both watering frequency and feed type affect the growth and body development of crossbred calves. Calves given water three times a day (T_4) or freely (T_1)

grew better, while calves given water only once a day (T_2) showed the lowest growth. Among the feeds, Jowar hay (F_2) gave better results than the soybean-wheat straw mixture (F_1). Although the combined effect of watering and feed was not significant, calves receiving more water along with Jowar hay showed the best growth. Overall, proper water supply and good quality feed like Jowar hay are important for better growth of calves.

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