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Effect of feeding garden cress (*Lepidium sativum*) seeds in the ration on growth and economics of production in crossbred heifers

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Abstract
A feeding trial was carried out for a period of 5 months to evaluate the effect of dietary inclusion of garden cress (GC) seeds in the ration on growth and economics of production in crossbred heifer calves. Eighteen crossbred heifer calves of ten to twelve months of age were selected from University Livestock Farm and Fodder Research and Development Scheme (ULF & FRDS), Mannuthy and were divided into three groups of six animals each based on age and body weight. The animals were randomly allotted to three dietary treatments, T_1 (concentrate with 20 percent CP and 70 percent TDN), T_2 (T_1 containing 5 percent GC seed) and T_3 (T_1 containing 10 percent GC seed). Analysis of data obtained from the study revealed that the growth performance and average feed cost per kg body weight gain were similar between groups. Thus, it was determined that GC seeds can be safely incorporated up to 10 percent in the ration of heifers without compromising the growth performance.

Keywords: Garden cress seeds, growth, economics, heifers

Introduction
Heifer rearing, plays a crucial role in the dairy industry, as the successful development of replacement heifers directly influences the future productivity and profitability of a dairy herd. Proper nutrition and growth management during the heifer-rearing phase are essential for ensuring optimal production of dairy herd. Heifer rearing incurs more than 12 percent of farm expenses without providing any immediate returns to farmers, but effective management during this period is important as it influences future production (Tozer and Heinrich, 2001) [16].

In recent years, there has been increasing interest in exploring the potential of medicinal seeds that enhance growth rates, improve overall health, and optimize the cost of production in livestock farming (Ashour *et al.*, 2020) [4]. One such promising medicinal seed is garden cress (*Lepidium sativum*) seeds, known for their rich nutrient profile. Garden Cress (GC), *Lepidium sativum* is a widely used medicinal plant with seeds rich in protein, omega-3 fatty acids, dietary fibre, various minerals and vitamins (Agarwal and Sharma, 2013) [2].

This study investigates the effects of incorporating garden cress seeds in the ration of crossbred heifers, aiming to assess not only the impact on growth parameters but also the overall cost-effectiveness of production. By evaluating this novel feeding strategy, the study offers insights into how garden cress seeds can contribute to more efficient and sustainable livestock production systems, improving both animal performance and economic returns for farmers.

Materials and Methods
Location of study
The present study was conducted by the Department of Animal Nutrition at University Livestock Farm and Fodder Research Development Scheme (ULF & FRDS), Mannuthy, College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala, India.

Experimental animals, management and feeding

Eighteen healthy crossbred heifer calves of ten to twelve months of age were selected from University Livestock Farm and Fodder Research Development Scheme (ULF&FRDS), Mannuthy formed the experimental subjects for the study. The calves were housed individually in well ventilated, clean and dry shed with facilities for feeding and watering. The calves were divided into three groups of six each as uniformly as possible with regard to age, and body weight. The animals were allotted randomly to one of the three dietary treatments, T_1(Concentrate with 20 percent CP and 70 percent TDN), T_2 (T_1 containing 5 percent garden cress seed) and T_3(T_1 containing 10 percent garden cress seed). All the calves were dewormed before the commencement of the study. All the animals were maintained under uniform managemental conditions throughout the experimental period of 150 days.

Clean fresh drinking water was offered to all the animals *ad libitum*. All the calves were fed as per ICAR standards (ICAR, 2013) [8]. Ingredient composition of experimental feed for three dietary treatments of the experimental calves is given in Table 1.

Table 1: Ingredient composition of experimental rations offered to heifers maintained on three dietary treatments

Ingredient	Percentage composition of Experimental ration's		
	T_1	T_2	T_3
Maize	28	27	25
Corn gluten fibre	18	20	21
Tapioca starch waste	1	1	1
Coconut cake	18	14	10
Alfalfa	14	13	13
Rice polish	7	8	7
Black gram husk	4	3	4
De oiled rice bran	7	6	6
Garden cress seed	-	5	10
Calcite	1.5	1.5	1.5
Salt	1	1	1
Mineral mixture	0.5	0.5	0.5
Total	100	100	100

Analysis of feed, fodder and garden cress seed

Proximate analysis of garden cress seed, feed and green grass were done as per the standard procedures (AOAC, 2016) [3]. Calcium and phosphorous in the GC seed, feed and fodder were analysed by conventional precipitation and titration method as per AOAC (2016) [3].

Data collection

Body weight of the animals was recorded at fortnightly intervals during the trial. Based on the body weight, feed and fodder allowances were revised fortnightly. Weighed quantities of feed and fodder were fed individually based on the requirement as per ICAR (2013) [8] recommendation to all the animals in the morning 9 AM and afternoon 3 PM. The residue if any in the manger was collected manually and weighed daily for analysing the moisture content and estimating daily dry matter intake. The data on daily dry matter intake was recorded during the entire experimental period.

Statistical analysis

Statistical analysis of the data obtained was carried out in accordance with Snedecor and Cochran (1994) [15] using SPSS 24.0 computer software.

Results and Discussion

Chemical composition of garden cress seeds

The percent chemical composition of garden cress seed used in the present study is given in Table 2. Dry matter percent of garden cress seed was 93.24±0.23. The CP, CF, EE, TA and NFE were 22.80±0.16, 10.80±0.02, 18.15±0.05, 5.16±0.07, and 43.09±0.02 percent, respectively. Findings of the present study are in accordance with the values obtained by Zia-Ul-Haq *et al*. (2012) [17] and Nayana *et al*. (2023) [12] on proximate analysis of GC seeds.

Garden cress seed contained 0.33±0.01 g percent of Calcium and 0.71±0.02 g percent of Phosphorus. Mohite *et al*. (2012) [11] and Doke and Guha (2014) [6] reported more or less similar observations on mineral profiling of GC seeds.

Table 2: Chemical composition[1] of garden cress seed, %

Nutrients	Percentage
Dry matter (DM)	93.24±0.23
Crude protein (CP)	22.80±0.16
Ether extract (EE)	18.15±0.05
Crude fibre (CF)	10.80±0.02
Total ash (TA)	5.16±0.07
Nitrogen free extract (NFE)	43.09±0.02
Calcium	0.33±0.01
Phosphorus	0.71±0.02

[1]Mean values are based on six replicates with SE

Chemical composition of feed and fodder

The percent chemical composition of the various experimental rations and green fodder are given in Table 3. On proximate study, the crude protein contents of T_1, T_2, T_3 and fodder were 20.30±0.13, 20.30±0.15, 20.40±0.15 and 12.59±0.93 percent, respectively. The crude fibre contents were 8.41±0.14, 8.67±0.15, 8.60±0.23 and 31.58±0.13 percent respectively for T_1, T_2, T_3 and fodder. Margret (2022) [10] also formulated feed for buffalo heifers with similar CP content of the present study. The proximate analysis of fodder by Reddy *et al*. (2023) [13] revealed more or less similar results with the current study.

Table 3. Chemical composition[1] of experimental rations and fodder fed to the heifers

Nutrients	Dietary Treatments			Green grass
	T_1	T_2	T_3	
Dry matter (DM)	92.59 ±0.25	92.90±0.09	92.41±0.17	16.95±0.05
Crude protein (CP)	20.30±0.13	20.30±0.15	20.40±0.15	12.59±0.93
Ether extract (EE)	4.01±0.05	4.46±0.08	4.65±0.03	2.17±0.54
Crude fibre (CF)	8.41 ±0.14	8.67±0.15	8.60±0.23	31.58±0.13
Total ash (TA)	9.48±0.10	8.71±0.08	8.42±0.07	10.54±0.74
Nitrogen free extract (NFE)	57.80±0.12	57.86±0.25	57.93±0.09	43.12±0.07
Neutral detergent fibre (NDF)	38.11±0.31	36.38±0.21	39.03±0.60	64.74±0.33
Acid detergent fibre (ADF)	14.27±0.02	14.52±0.07	16.71±0.21	36.64±0.76
Calcium	1.33 ±0.01	1.73±0.002	1.95±0.007	0.98±0.62
Phosphorus	0.85 ±0.01	0.90±0.01	0.97±0.02	0.41±0.09

[1]Mean values are based on six replicates with SE

Growth performance of experimental animals

The data on average initial and final body weights, total weight gain and average daily gain of heifers maintained on three experimental rations during the five months of feeding trial is presented in Table 4. The initial body weight of heifers under T_1 (control), T_2 (5 percent GC seeds) and T_3 (10 percent GC seeds) were 162.83±10.94, 164.17±10.61 and 164.50±9.14 kg, respectively. Average final body weights were found to be 234.67±14.99, 249.50±14.68, 251.50±15.50 kg respectively for T_1, T_2 and T_3. Total weight gain obtained during the five months trial were 71.83±4.74 kg, 85.33±5.41 kg and 87.00±6.76 kg for T_1, T_2 and T_3, respectively. The average daily gain for heifers maintained on rations T_1, T_2 and T_3 were 0.51±0.03, 0.61±0.04 and 0.62±0.05kg, respectively. Statistical analysis of data showed no significant difference in average initial and final body weights, total body weight gain and average daily gain of experimental cross bred heifer calves during the experimental period.

Similar to the findings of the present study, Imade *et al.* (2018) [9] supplemented female rabbits with *Lepidium sativum* at 4 levels (0%, 5%, 7%, 10%) for assessing its effect on growth performance and they reported similar average bodyweight gain between treatment groups. Nayana *et al.* (2023) [12] also observed similar (p>0.05) weekly average body weight, total weight gain and average daily gain in rabbits fed with diet containing 0 percent, 5 percent and 7.5 percent GC seeds.

In contrast, Bilen *et al.* (2018) [5] supplemented juvenile common carp diet with dill, garden cress separately at two different doses 1g/kg and 2g/kg in order to study the effect of this supplements on their growth performance and found that growth rate and final body weight were higher in treated group than in the control. Abdelrahman *et al.* (2022) [1] studied the effect of dietary GC seeds on growth performance, feed utilization and carcass characteristics of growing rabbits and reported that the dietary GC seed improved final weight, weight gain and total relative growth rate at 3 percent and 4.5 percent levels compared to control.

Table 4: Summarized data on body weight, total body weight gain and average daily gain[1]

Parameters	T_1	T_2	T_3	P value
Initial body weight (kg)	162.83±10.94	164.17±10.61	164.50±9.14	0.993 ^{ns}
Final body weight (kg)	234.67±14.99	249.50±14.68	251.50±15.50	0.695 ^{ns}
Total body weight gain (kg)	71.83±4.74	85.33±5.41	87.00±6.76	0.154 ^{ns}
Average daily gain (kg)	0.51±0.03	0.61±0.04	0.62±0.05	0.154 ^{ns}

Parameters	T_1	T_2	T_3	P value
Initial body weight (kg)	162.83±10.94	164.17±10.61	164.50±9.14	0.993 ^{ns}
Final body weight (kg)	234.67±14.99	249.50±14.68	251.50±15.50	0.695 ^{ns}
Total body weight gain (kg)	71.83±4.74	85.33±5.41	87.00±6.76	0.154 ^{ns}
Average daily gain (kg)	0.51±0.03	0.61±0.04	0.62±0.05	0.154 ^{ns}

[1]Mean values are based on six replicates with SE

ns- non significant (p>0.05)

Economics of production

Data on total body weight gain, total intake of concentrate feed and fodder, total feed cost, and cost per kg weight gain of experimental heifers maintained on three different dietary treatments were presented in Table 5. The mean feed cost /kg weight gain of experimental heifers maintained on T_1, T_2 and T_3 were Rs. 335.96±18.28, Rs. 332.07±17.79 and Rs. 335.54±21.98, respectively for 150 days feeding trial. Statistically, the mean cost of production per kg body weight were similar between the treatment groups.

In agreement to the present study, Margret (2022) [10] observed similar cost per kg gain in buffalo heifers fed with dried Moringa leaves at 0, 10 and 20 percent levels.

On contrary to the above findings, Seethal (2018) [14] reported a reduced cost per kg body weight gain in calves fed with starter containing Dhanwantharam thailam residue compared to control group. Hassan and Shoukary, (2019) [7] assessed the economic efficiency of feeding GC seed at 1 percent level in broiler ration and found that the net benefit per kg body weight was higher for 1 percent group compared to control.

Table 5: Economics of production[1] of heifers maintained on the three experimental rations

Parameters	T_1	T_2	T_3	P value
Total Concentrate feed intake (kg)	1978.58±5.75	2116.94±7.61	2069.10±8.12	-
Concentrate feed intake per animal (kg)	329.76±5.75	352.82±7.61	344.84±8.12	0.106^{ns}
Cost of concentrate feed per kg (Rs)	31	37	43	-
Total grass intake (kg)	16462.32±172.94	17993.23±104.15	16596.04±154.53	-
Grass intake per animal (kg)	2743.72±172	2998.87±104.10	2766.00±154.53	0.417 ^{ns}
Cost of grass per kg (Rs)	4.95	4.95	4.95	-
Total cost of feed (Rs/animal)	23804.07^{b}±1016.47	27898.87^{a} ±792.57	28520.26^{a}±1090.92	0.007**
Total body weight gain (kg/animal)	71.83±4.74	85.33±5.41	87.00±6.76	0.154 ^{ns}
Cost per kg gain (Rs)	335.96±18.28	332.07±17.79	335.54±21.98	0.988 ^{ns}

[1]Mean values are based on six replicates

ns- Non significant

**- Means with different super scripts within a row differ significantly (p<0.01)

Conclusion

On summarising the results obtained from the study, it could be concluded that GC seeds can be safely incorporated up to 10 percent in the ration of heifers without compromising the growth performance and without increasing the cost of rearing.

Conflict of Interest

Not available.

Financial Support

Not available.

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