

## International Journal of Agriculture Extension and Social Development

Volume 7; SP-Issue 5; May 2024; Page No. 17-22

Received: 27-02-2024  
Accepted: 30-03-2024

Indexed Journal  
Peer Reviewed Journal

### Perceived constraints by crossbred Jersey rearing farmers in adoption of balanced feeding

<sup>1</sup>Saravanan KP, <sup>2</sup>MS Kannadhasan, <sup>3</sup>K Ayyappan, <sup>2</sup>P Silambarasan and <sup>4</sup>R Nithiaselvi

<sup>1</sup>Assistant Professor, Department of Veterinary and Animal Husbandry Extension Education, Veterinary College and Research Institute, Tamil Nadu Veterinary and Animal Sciences University, Tamil Nadu, India

<sup>2</sup>Assistant Professor, Veterinary University Training and Research Centre, Tamil Nadu Veterinary and Animal Sciences University, Tamil Nadu, India

<sup>3</sup>Assistant Professor, Department of Animal Nutrition, Veterinary College and Research Institute, Tamil Nadu Veterinary and Animal Sciences University, Tamil Nadu, India

<sup>4</sup>Assistant Professor, Livestock Farm Complex, Veterinary College and Research Institute, Tamil Nadu Veterinary and Animal Sciences University, Tamil Nadu, India

DOI: <https://doi.org/10.33545/26180723.2024.v7.i5Sa.635>

Corresponding Author: Saravanan KP

#### Abstract

Balanced feeding is essential for sustained milk production in high milk producing milch animal cross-bred cattle breed such as Jersey and Holstein Friesian. According to Tamil Nadu state breeding policy 2008, Jersey cross bred cattle is the breed of choice in the plains of Tamil Nadu. The importance of balanced feeding is consistently emphasised by public extension and advisory services (EAS) offering institutions, scientists and extensionists; however, the adoption of balanced feeding practices by the farmers is poor and the study carried out on causes for the poor adoption is meagre. Under this background the study was carried out to examine the profile of dairy farmers; to know the constraints perceived by crossbred Jersey cattle rearing farmers in adoption of balanced feeding and; to seek animal husbandry experts' strategies to overcome constraints. The study was conducted during May to July 2022 through a well-structured pre-tested interview schedule from 195 dairy farmers in Cauvery delta region which lies on plains of Tamil Nadu. Constraints were analyzed by Weighed Mean Score (WMS) and experts' strategies were obtained for constraint management. The study found that lack of technical skills on enrichment of paddy straw (WMS 86.49), lack of technical skills on preparation of concentrate ration (WMS 77.78), dearth of technical skills on surplus fodder conservation (WMS 76.41), low knowledge on nutrient contents of fodder sorghum, hedge lucerne and CO 4 (WMS 76.24), poor awareness about feeding of mineral mixture (WMS 72.82), high cost of concentrate feed during unseasonal rain/drought/summer (WMS 71.45) and lack of knowledge on feeding during transition periods (WMS 69.23) as important constraints. Experts suggested the following strategies viz., conducting awareness programme on ration balancing, emphasising local veterinarians to encourage progressive farmers on use of non-conventional feed resources and display ration balancing software applications at public areas to overcome the constraints. Addressing the dairy farmers problems on balanced feedings and the opinions of experts would be helpful to policymakers at the time of policy decision.

**Keywords:** Balanced feeding, constraints, crossbred jersey, fodder, ration balancing software

#### Introduction

In India, dairy farming is a key source of income for farmers, especially at times of crisis. The current total livestock population in India is 535.78 million (Anonymous, 2019) <sup>[2]</sup>. Growing livestock population increases the demand for feed and fodder. At present, the country faces a net deficit of 35.6 percent green fodder, 10.5 percent dry crop residues and 44 percent concentrate feed ingredients (Singh *et al.*, 2022) <sup>[20]</sup>. The demand for green and dry fodder will reach to 1012 and 631 million tonnes by the year 2050 (Anonymous, 2013) <sup>[1]</sup>. On the other side, demand for milk, meat, eggs, and other livestock-related products is growing substantially due to the growing population and changing consumption trends. Balanced ration feeding improves the palatability of feed, health and reproductive

performance of cattle and also increase farmers' income (Singh *et al.*, 2011; Singh *et al.*, 2019) <sup>[22, 19]</sup>. Furthermore, dairy cattle milk production and farmers economics can be improved (Deen *et al.*, 2019) <sup>[5]</sup>. Unbalanced nutrition in dairy farming is one of the key causes of lower productivity in the majority of developing countries (Otte *et al.*, 2012) <sup>[12]</sup>. In addition, studies indicated that farmers had not adopted balanced feeding and detailed studies on barriers in the adoption of balanced rations are also lacking (Singh and Fulzele, 2006; Yadav and Naagar, 2021) <sup>[21, 24]</sup>. Under this background, the study was formulated with an objective to study the profile of dairy farmers; to know the constraints perceived by crossbred Jersey rearing farmers in adoption of balanced feeding and; to seek animal husbandry experts' strategies to overcome constraints.

## Methodology

### Study area

Tamil Nadu comprised a total livestock population of 245.00 lakhs which ranks XIV<sup>th</sup> in bovine population in the country (Anonymous, 2019) <sup>[2]</sup>. Cauvery delta region, a fertile area and rice bowl of Tamil Nadu, is the study area. Farmers' primary occupation in this region is paddy cultivation followed by dairy farming for their livelihood.

### Data collection

Expost-facto research design was employed for the study. The study was conducted to know the constraints perceived by dairy farmers in adoption of balanced feeding. Data were collected from the randomly selected 195 dairy farmers in Cauvery delta region of Tamil Nadu through pretested interview schedule during the period from May to July 2022.

### Socio-economic profiles of dairy farmers

With the help of available literature, the variables were selected, operationalized and measured using appropriate measurements to analyse the socio-economic profile ten variables were included.

### Constraint analysis

In constraint analysis, five components were included *viz.*, feeding of different stages, concentrate feeding, green fodder feeding, dry fodder feeding and mineral mixture supplementation. Four constraint statements were included in feeding of different stages section. Regarding concentrate feeding and green fodder feeding, seven and 14 constraint statements were provided respectively. Further, on dry fodder feeding and mineral mixture supplementation, eight and three constraint statements were included respectively. Dairy farmers were asked to express their level of constraint on a three-point continuum (SC - Serious constraint, SWC - Somewhat constraint and NC - No Constraint). Respondents expressed their perceived constraints based on their farming experiences. Constraint level was determined by comparing their Weighted Mean Score (WMS) and ranked (Meena *et al.*, 2018 and Saravanan *et al.*, 2021) <sup>[11, 17]</sup>.

$$\text{Weighed Mean Score} = \frac{\text{Total score in each constraint obtained by all respondents}}{\text{Each constraint's total maximum possible score}} \times 100$$

### Experts' strategies

Experts' strategies to reduce the unbalanced feeding were obtained from 30 subject matter specialists in animal husbandry and presented in percentage.

## Results and Discussion

**The results are interpreted in three aspects:** First section deals on socio-economic profile of the farmers, second on different constraints perceived by farmers and the last on experts' strategies.

### Distribution of the respondents according to socio-economic profile

The analysis of the profiles of dairy farmers reveals that an overwhelming majority of the respondents (85.64%) had education ranging from primary to college and 85.64 percent had possessed upto five dairy animals. The majority

of the respondents (73.84%) were male, more than half of the respondents (54.36%) were middle-aged farmers; and 50.26 percent of them had dairy farming as their primary occupation. Table 1 shows that nearly half of the farmers (45.31%) were small and marginal farmers, 71.79 percent had high level of veterinary health care facilities, half of the respondents (49.74%) were non-members of co-operative society and nearly half of the respondents (48.72%) had sought dairy farming information from veterinarians. Similar results were reported by Karthikeyan *et al.*, (2018) <sup>[9]</sup> who reported that majority of the farmer were approached the private veterinarian for health care.

### Constraints on feeding of different stages

The constraints perceived by the respondents in different stages of feeding is given in Table 2. The majority of the respondents had lack of knowledge on feeding during transition periods and it has been ranked first (WMS 69.23). The probable reason for this situation is that there is an unwillingness to change the traditional feeding habit, unaware of the economic consequences and also farmers believe that feeding during the last trimester of gestation would increase the body weight of the calf, leading to difficulty in parturition. Study conducted at Rajasthan by Yadav and Naagar, (2021) <sup>[24]</sup> who reported that only 15.00 percent of the dairy farmers had adopted the practice of feeding concentrate during pregnancy. Next major constraint was the respondents' poor knowledge on feeding calf starter to new born calves (WMS 62.91). Unavailability of calf starter in the local market and the practice of allowing one teat to calf upto weaning or for a period of six months might be the reasons.

### Constraints on feeding of concentrate

The constraints on concentrate feeding perceived by the sampled respondents are presented in Table 2. The results revealed that majority of the respondents faced constraint of lack of technical skills on preparation of concentrate rations (WMS 86.67) which was the foremost constraint on feeding concentrate. Poor training exposure, adoption of non-scientific traditional feeding practices, small number of livestock holdings, unavailability of machineries at local areas, false beliefs about the fattening of animals and ignorance of the ingredients' nutrient value might be the reasons for the above constraint. Following this, constraints such as high cost of concentrate during unseasonal rain/drought/summer (WMS 71.45) and lack of awareness about importance of nutrients in concentrate (WMS 69.06), secured second and third ranks respectively. Unavailability of raw feed ingredients in the local market, long distances to markets, limited knowledge to good quality oilseed cakes and feed ingredients and price fluctuation of feed ingredients might have been the reasons for the above constraints. Studies conducted at Nagaland by Khoveio *et al.*, (2012) <sup>[10]</sup>, Rajasthan by Rajawat *et al.*, (2018) <sup>[16]</sup>, Tamil Nadu by Henry *et al.* (2021) <sup>[8]</sup> and; Saravanan *et al.* (2021) <sup>[17]</sup> and Karnataka by Govindaraj *et al.*, (2022) <sup>[7]</sup> reported that the high price of concentrate as an important constraint. Beside these, the respondents in the study area were predominantly perceived awareness and knowledge related constraints.

**Table 1:** Socio-economic profile of dairy farmers, n= 195

S. No.	Profile	Frequency (f)	Percentage (%)
<b>1</b>	<b>Gender</b>		
A	Male	144	73.84
B	Female	51	26.16
<b>2</b>	<b>Education</b>		
A	Illiterate	28	14.36
B	Primary	47	24.10
C	Secondary	56	28.72
D	Higher secondary	26	13.33
E	Diploma	12	6.15
F	Graduation	26	13.33
<b>3</b>	<b>Age</b>		
A	Young	31	15.90
B	Middle	106	54.36
C	Old	58	29.74
<b>4</b>	<b>Occupation</b>		
A	Dairy farming as primary occupation	98	50.26
B	Dairy farming as secondary occupation	97	49.74
<b>5</b>	<b>Family type</b>		
A	Nuclear	148	75.90
B	Joint	47	24.10
<b>6</b>	<b>Landholding</b>		
A	Landless	28	12.82
B	Marginal	88	45.31
C	Small	51	26.15
D	Medium	20	10.26
E	Large	2	1.02
<b>7</b>	<b>Herd size</b>		
A	Small	167	85.64
B	Medium	23	11.79
C	Large	5	2.56
<b>8</b>	<b>Proximity to veterinary support system</b>		
A	Less than 5 kms	140	71.79
B	More than 5 kms	55	28.21
<b>9</b>	<b>Membership of co-operative society</b>		
A	Member	98	50.26
B	Non-member	97	49.74
<b>10</b>	<b>Information seeking behaviour*</b>		
A	Progressive farmers	85	43.59
B	Veterinarian	95	48.72
C	Para-veterinarian	20	10.26
D	Television	5	2.56
E	Radio	8	4.10
F	Internet	10	5.13
G	WhatsApp and other social media	15	7.69
H	Co-operative society member	70	35.90

\* Multiple responses

**Table 2:** Constraints perceived by dairy farmers during different stages of feeding and feeding of concentrate, n=195

S. No.	Constraints	WMS	Rank
<b>I</b>	<b>Different stages of feeding</b>		
1	Lack of knowledge on feeding during transition periods	69.23	I
2	Poor knowledge on feeding calf starter to new born calves	62.91	II
3	Inadequate knowledge on concentrate feeding during dry periods	62.39	III
4	Poor knowledge on concentrate feeding during early lactation	53.85	IV
<b>II</b>	<b>Feeding of concentrate</b>		
1	Lack of technical skills on preparation of concentrate ration	77.78	I
2	High cost of concentrate during unseasonal rain/drought/summer	71.45	II
3	Lack of awareness about importance of nutrients in concentrate	69.06	III
4	Lack of knowledge on quantity to be fed during early lactation periods	67.52	IV
5	Lack of awareness on feeding of concentrate to calf	63.42	V
6	Non-availability of retail price concentrate feed shop at local areas	62.05	VI
7	Lack of awareness on feeding of concentrate to heifer	61.03	VII

Source: Field data

### Constraints in feeding of green fodder

It could be observed from Table 3 that the respondent's dearth of technical skills on surplus green fodder conservation (WMS 76.41) is a severe constraint with top value and ranked first, followed by low knowledge on nutrient content of fodder sorghum, hedge lucerne and CO 4 (WMS 76.24) and high cost of fodder seed and fodder production (WMS 72.82). Due to the above constraints, farmers were not able to utilise the available surplus fodder properly and also, they purchased fodder. In addition, preparation of silage was not feasible and uneconomical for small-herd and landless farmers. Moreover, small farmers are discouraged on fodder production due to the need of family labour by their main agricultural operations. Further, round the year non availability of irrigation facilities for

fodder cultivation might be the other reason. Besides a study conducted in West Bengal, India and Pakistan also reported the same kind of problems (Ali *et al.*, 2019) <sup>[1]</sup>

According to Table 3, the majority of the respondents had felt that lack of knowledge about conservation of excess fodder (WMS 70.26) followed by dearth of information on seed variety, quantity of seed required for fodder cultivation (WMS 69.23) and non-availability of green fodder during summer (WMS 69.06) as subsequent constraints ranked IV, V and VI respectively. Supported by the findings of Pawar *et al.*, (2017) <sup>[14]</sup>, which found that 76.76 percent had lack of knowledge about conservation of excess fodder and 77.59 percent scarcity of improved fodder seeds. The other constraints were perceived to lesser extent by the respondent in the study area.

**Table 3:** Constraints perceived by dairy farmers on green fodder feeding, dry fodder feeding and mineral mixture supplementation, n=195

S. No.	Constraints	WMS	Rank
<b>I</b>	<b>Green fodder feeding</b>		
1	Dearth of technical skills on surplus fodder conservation	76.41	I
2	Low knowledge on nutrient content on fodder sorghum, hedge lucerne and CO 4	76.24	II
3	High cost of fodder seed and fodder production	72.82	III
4	Lack of knowledge about conservation of excess fodder	70.26	IV
5	Dearth of information on seed variety, quantity of seed required on fodder cultivation	69.23	V
6	Non-availability of green fodder during summer	69.06	VI
7	Non-availability of commercial retail fodder shop	68.55	VII
8	Preference to food/cash crops rather than fodder crops	67.69	VIII
9	Non availability of inputs at village level	64.27	IX
10	Non-availability of scarcity of fodder seeds/saplings	63.25	X
11	Lack of knowledge about advantages of feeding green fodder for livestock health/production	60.00	XI
12	Lack of water facility/scarcity of water for fodder crop irrigation	54.70	XII
13	Unavailability of land for fodder production	54.19	XIII
14	Poor soil condition for green fodder cultivation	52.99	XIV
<b>II</b>	<b>Dry fodder feeding</b>		
1	Lack of technical skills on enrichment of paddy straw	86.49	I
2	Poor knowledge on nutrient availability of paddy straw	69.40	II
3	High cost of dry fodder during summer	68.89	III
4	Non-availability of marketing shop for dry fodder sales	66.83	IV
5	Low availability of dry fodder during summer season	62.56	V
6	Difficulty in storage of other dry fodders such as groundnut haulms, black gram husk for long duration	61.54	VI
7	Utilization of paddy straw for other industrial purposes	61.37	VII
8	Unavailability of other dry fodders throughout the year	58.63	VIII
<b>III</b>	<b>Mineral mixture supplementation</b>		
1	Poor awareness about feeding of mineral mixture	72.82	I
2	High cost of mineral mixture	69.74	II
3	Non-availability of mineral mixture in local areas	62.39	III

Source: Field data

### Constraints in dry fodder feeding

It could be noted from Table 3 that among the various constraints listed, lack of technical skills on enrichment of paddy straw (WMS 86.49) received the highest value and ranked first, followed by "poor knowledge on nutrient availability of paddy straw" (WMS 69.40). This indicates majority of respondents faced these two constraints to a greater extent. Due to lack of technical skills the available excess crop residues had not been utilised appropriately. Further, family labour spent more on agricultural operations and poor socio-economic status might be reasons for not acquiring technical knowledge and developing skills. The high cost of dry fodder during summer (WMS 68.89) is the third constraint. In the study area, farmers preserved dry fodder as bundles or heaps and utilized during rainy season. Further fluctuations in availability and seasonal variations

might have been the reasons. The other constraints such as non-availability of marketing shops for dry fodder sale, low availability of dry fodder during summer, difficulty in storing other dry fodders for long duration and utilization of paddy straw for other industrial purposes were assigned fourth, fifth, sixth and seventh ranks, respectively according to the respondents.

### Constraints on mineral mixture supplementation

Table 3 reveals that the respondents had faced the constraint of poor awareness about feeding mineral mixtures (WMS 72.82) followed by high cost of mineral mixture (WMS 69.74) and non-availability of mineral mixture in local areas (WMS 62.39) as most important constraints. Farmers unawareness on the health benefits of feeding mineral mixture supplementation, distance between the peripheral



centres of Tamil Nadu Veterinary Animal Sciences University, unavailability of co-operatives to supply mineral mixture, underutilization of veterinary health care facilities, poor willingness to use mineral mixture, lack of visible outcomes on use of mineral mixture and unavailability of shops in rural areas might be the reasons for the above constraints. Besides, the respondents believed supplementation with salt as mineral supplementation. Similar kinds of constraints were addressed among dairy farmers in Punjab, Tamil Nadu and Nagaland (Gamit *et al.*, 2021; Srinivasan 2021) [6, 23]. Study conducted in Haryana by Rachna *et al.*, 2018 [15] who reported that 60.00 (MPS) of the mixed dairy farmers had perceived constraint of the unavailability of mineral mixture in rural areas. Study conducted in Uttarakhand by Sharma *et al.*, (2018) [18] 90 percent of the dairy farm women reported that they were uninformed of the use and purpose of mineral mixtures.

### Expert strategies to reduce the unbalanced feeding

Table 4 reveals that the majority of the experts suggested conducting an awareness programme on ration balancing for progressive farmers (70.00%), followed by imparting frequent training and conducting demonstrations to women farmers on low-cost compound feed preparation through cooperative societies (60.00%), emphasising local veterinarians to encourage progressive farmers on use of non-conventional feed resources (60.00%) and displaying visuals on ration balancing software applications at local veterinary dispensaries, co-operative and other public areas (56.67%) to overcome imbalanced feeding. Patel and Ashwar, (2019) [13] reported that participation of training programme was positively associated with financial situation of dairy farms. Farmers had positive opinion on using mobile apps to improve their knowledge (Belakeri *et al.*, 2017) [4].

**Table 4:** Experts strategies to overcome the unbalanced feeding, n=30

S. No.	Expert strategies*	f	%
1	Conducting awareness programme on ration balancing for progressive farmers	21	70.00
2	Impart frequent training/demonstration to women farmers on low-cost compound feed preparation through cooperative society	18	60.00
3	Emphasising local vets to encourage progressive farmers on use of non-conventional feed resources	18	60.00
4	Display the ration balancing software applications visuals at local veterinary dispensaries, co-operatives and other public areas	17	56.67
5	Providing concentrates at subsidized rate during critical periods and adverse conditions	15	50.00
6	Creating awareness on mineral mixture feeding	14	46.67
7	Encouraging fodder entrepreneur	13	43.33
8	Conducting training to progressive farmers on silage preparation and enrichment of paddy straw	13	43.33
9	Creating awareness through stage dramas or puppet shows on the benefits of balanced feeding on the production	10	33.33
10	Promoting cooperative societies to sell mineral mixture and cattle feed to the members of society	10	33.33

\* Multiple responses

### Conclusion

Based on the study, lack of skills on fodder conservation, high cost of concentrate, high green fodder production cost, dearth of availability of information and infrastructure facilities were found to be major constraints perceived by crossbred Jersey cattle rearing farmers in Cauvery delta region of Tamil Nadu. The experts suggested the following strategies: ration balancing programme for progressive farmers; skill management programmes for women farmers through co-operative societies; and displaying the balanced ration software application visuals at local veterinary dispensaries, co-operatives other public areas to manage the unbalanced feeding. Overall, addressing dairy farmers constraints and experts' strategies would be helpful to policymakers at the time of policy decision for confronting the identified constraints.

### References

- Ali J, Khooharo AA, Mirani Z, Siddiqui BN. Farmer's perception regarding constraints faced in adoption of dairy farming practices in Sindh province, Pakistan. *Tropical Animal Health and Production*. 2019;51(6):1707-1715.
- Anonymous. 20th Livestock Census, 2019. Department of Animal Husbandry and Dairying, Ministry of Agriculture, Government of India, New Delhi, India; c2019.
- Anonymous. Indian Council of Agricultural Research. Vision 2050. 2013. Available from: <https://www.igfri.res.in/2013/Vision-2050.pdf>
- Belakeri P, Satyanarayan K, Jagadeeswary V, Yathiraj S, Veeranna KC, Rajeshwari YB. Effectiveness of mobile app on fodder production in terms of knowledge gain among livestock farmers of Karnataka. *Indian Research Journal of Extension Education*; c2017. p. 10-15.
- Deen AU, Tyagi N, Yadav RD, Kumar S, Tyagi AK, Singh SK. Feeding balanced ration can improve the productivity and economics of milk production in dairy cattle: a comprehensive field study. *Tropical Animal Health and Production*. 2019;51(4):737-744.
- Gamit V, Odedra M, Ahlawat A, Prajapati V, Patel H, Gamit K. Constraints faced by dairy farmers in different states of India: An overview. *Journal of Entomology and Zoology Studies*. 2021;9:1901-1906.
- Govindaraj G, Shanabhoga MB, Swamy HM, Nagalingam M, Shome BR, Habibar Rahman. Impact of COVID-19 lockdown on various stakeholders associated with dairy food supply chain in Karnataka, India: An evidence-based study. *Indian Journal of Dairy Science*. 2022;75(4):365-375.
- Henry ACE, Sivakumar T, Ramesh V, Ramachandran M, Rajarajan G. Management practices and constraints in crossbred cattle rearing in Cauvery delta region of Tamil Nadu. *The Pharma Innovation Journal*. 2021;SP-10(4):219-226.
- Karthikeyan S, Devi M, Narmatha N, Uma V, Thirunavukkarasu D. Perceived effectiveness of animal

- health services offered by different service providers in Namakkal District of Tamil Nadu. *Indian Journal of Dairy Science*. 2018;71(4):430-434.
10. Khoveio LM, Jain DK, Chauhan AK. Economics of milk production and its constraints in Nagaland. *Indian Journal of Dairy Science*. 2012;65(6).
  11. Meena OP, Sharma NK, Jeph NK, Meena DS. Constraints perceived by dairy members in adoption of new technologies in dairy farming in Rajasthan. *Veterinary Practitioner*. 2018;19(2):317-319.
  12. Otte J, Costales A, Dijkman J, Pica-Ciamarra U, Robinson T, Ahuja V, Ly C, Roland-Holst D. Livestock sector development for poverty reduction: an economic and policy perspective. *Livestock's many virtues. Food and Agriculture Organization of the United Nations (FAO)*; 2012.
  13. Patel N, Ashwar B. Factors in economics of milk production on commercial dairy farms in Aravalli district of north Gujarat. *Indian Research Journal of Extension Education*. 2019;19(2):83-88.
  14. Pawar MM, Ashwar BK, Joshi PC, Patil SS, Madhavatar MP, Thakkar NK, Patel JV, Gupta JP. Constraints perceived about fodder production by the dairy farmers of North Gujarat. *Indian Journal of Dairy Science*. 2019;72(5):565-568.
  15. Rachna, Gautam, Anika Malik. Mixed dairy farming systems in Haryana: A constraint analysis. *Indian Research Journal of Extension Education*. 2018;18(1):45-52.
  16. Rajawat BS, Hadiyal S, Rathod R, Rathod A, Kumawat PD, Gaur M, Tailor SP, Yadav MC. Feeding management and their constraints in dairy bovines. *Indian Journal of Extension Education*. 2018;54(2):1-4.
  17. Saravanan KP, Silambarasan P, Manivannan A, Sasikala V, Sivakumar T. Constraints and management practices of dairy farming during COVID-19 pandemic situation. *Asian Journal of Dairy and Food Research*. 2021;40(1):20-24.
  18. Sharma A, Kumar S, Kandpal NK. Constraints faced by dairy farm women: A study in Nainital District of Uttarakhand. *Indian Research Journal of Extension Education*. 2018;18(2):86-90.
  19. Singh DK, Sahu SP, Teufel N. Increasing dairy cows productivity through new balanced concentrate feed: A study in Bihar, India. *Indian Journal of Animal Nutrition*. 2019;36(1):11-16.
  20. Singh DN, Bohr JS, Tyagi V, Singh T, Banjara TR, Gupta G. A review of India's fodder production status and opportunities. *Grass and Forage Science*. 2022;77(1):1-10.
  21. Singh K, Fulzele RM. Factors affecting transfer and adoption of dairy farming practices under field conditions. *Journal of Dairying, Foods and Home Sciences*. 2006;25(1):70-72.
  22. Singhi S, Sharma CS, Kumar U, Kumar A, Kumar R. Knowledge empowerment and awareness through on-farm trails on balanced animal feeding management. *Journal of Progressive Agriculture*. 2011;2(1):19-20.
  23. Srinivasan G. Feeding and other management practices of Pulikulam cattle rearers in its native tract. *Indian Journal of Dairy Science*. 2021;74(4):373-377.
  24. Yadav CM, Naagar KC. Dairy farming technologies adopted by the farmers in Bhilwara District of Rajasthan. *Indian Research Journal of Extension Education*. 2021;21(1):7-11.