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Productivity attributes of six desi cow breeds in Karnataka

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ABSTRACT

Desi cows are playing crucial role in the national economy for their draught power, milk, dung, fuel and urine. It is a source of subsidiary income for many families in India especially the resource poor. The present study was carried out in six districts of Karnataka with higher population of each of the six desi breeds. Forty farmers served as respondents for each breed, making the total sample size of 240 farm households. Deoni productivity was the best with 3.85 L/anim./day followed by 3.07 in case of Krishna Valley. Daily net return per animal was ₹ 18.20 in Deoni and ₹ 15.51 in Krishna Valley, while it was lowest in Malnad Gidda. Without considering cost of fodder, net return (₹/anim./day) was the highest for Hallikar followed by Deoni and Krishna Valley. Draught power, dual purpose utility, quality and taste of milk, adaptability to harsh tropical climate, religious sentiments and social esteem were the important attributes of desi cows. Natural service, open grazing, feeding concentrates, green fodder and hay, closed housing system, vaccination, utility of dung and urine in the farm, full hand milking method were the management strategies adopted. Shrinking holding size, non-availability of grazing land, longer inter-calving period, and poor milk production were the important constraints perceived by farmers. Non-availability of superior quality breeding bulls and high price of cattle feed were perceived as causes for decreasing indigenous cattle population.

Keywords: Dairy farming, Desi cows, Economics, Nutrition, Productivity

Rearing of cows has been a traditional livelihood option in India and is closely linked to the rural economy. In India, 73.45% of about 193.47 million cattle (as per 20th Livestock Census 2019) are desi cattle, out of which about 80% are non-descript. Remaining 20% is accounted by 50 indigenous breeds according to National Bureau of Animal Genetic Resources (2022) data. India is the highest milk producer at 198.4 million tonnes (Pathak *et al.* 2022). Desi cows contribute to the national economy through supply of draught power, milk, dung, fuel and cow urine (Harris 2011). Cow is a source of subsidiary and regular income for the resource poor who maintain few heads of animals. Desi cattle is said to be least affected by climate change as they are hardier and robust, having qualities of heat tolerance, resistance to diseases and the ability to thrive under extreme climatic stress despite less than optimal nutrition (GoI 2014). Zebu cattle breed possess A2 allele of beta casein which does not have any association with metabolic disorders (Woodford 2009).

Karnataka is prone to drought with 18 of 30 districts experiencing drought often, during which availability of crop residues for livestock become substantially low (GoK 2013). Only desi cows are able to thrive on poor quality roughages and act as the buffer in such crisis. As per the National Bureau of Animal Genetics Resources (2022), there are six indigenous cattle breeds in Karnataka, namely, Amrithmahal, Deoni, Hallikar, Khillari, Krishna Valley and Malnad Gidda. The population trend of indigenous cattle is declining and especially Krishna Valley cattle is under severe threat. According to Initiative for Domestic Animal Diversity report (2010), under certain conditions even large populations can decrease rapidly and reach an endangered status within a short term. Therefore, conservation and development of indigenous cattle is crucial in reducing the risk and enhancing food security for millions of resource poor farmers. The Rashtriya Gokul Mission (RGM) has been launched in 2014 for development and conservation of indigenous breeds through selective breeding and genetic upgradation of non-descript bovine population. The scope and potential of any programme can be better understood through a thorough analysis of the secondary data and assessment of the ground realities reflected from the primary data. Considering the above facts, present study was undertaken.

MATERIALS AND METHODS

The present study was carried out purposively in Karnataka and the respondent farmers were identified through a three-stage stratified random sampling without replacement. Using the secondary data available from the development departments, one district was identified based

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on population for each of the desi breeds, i.e. Amrithmahal (Hassan), Deoni (Kalaburgi), Hallikar (Mysuru), Khillari (Belagavi), Krishna Valley (Raichur) and Malnad Gidda (Shivamogga). From each district, two taluks with higher density of desi cows were selected for the next stage of sampling. Using the same criteria, one cluster in each taluk and from each cluster, 20 households owning desi cows constituted the sample size. Thus, 20 cattle owners from each cluster of villages in a taluk, made the sample size of 40 per district (per breed) and the total sample size of 240 covering all the six breeds. One adult member or head of the household actively engaged in management of desi cows was considered as the respondent.

The parameters considered for the study were socio-economic characteristics, management practices adopted, reproduction and production variables, livelihood security, preferences and constraints in rearing desi cows. The primary data to cover all the set objectives of the study were collected through semi-structured interview schedule during 2017-18. The data so collected were analyzed by estimating frequency, percentages, the costs, returns from milk production and contribution in livelihood security of farmers from desi breeds. The socio-economic characteristics like age, family size, experience, and income were categorized on the basis of equal class intervals between maximum and minimum achieved scores. Respondents were categorized into five groups on landholding as landless, marginal (up to 2.5 acres), small (above 2.5-5.0 acres), medium (above 5-10 acres) and large (above 10 acres) as per the standards of the state government. Livelihood security was operationalized as contribution made by desi breeds in terms of income generation, nourishment to the family, nutrients to farm, employment generation, security during uncertainties and social status symbol. The index developed by Biradar *et al.* (2013) was used with required modifications as given below:

Contribution to the total household income: The net return was measured by collecting information on different production values of each cow and average values of each parameter were calculated.

Nourishment to the family: Based on the daily average milk consumed by the family, the nutrients were computed in terms of protein, fat and calcium as suggested by Gopalan *et al.* (1971).

Nutrients to the farm: The average farmyard manure applied to their respective farm was converted in terms of N, P and K by following the conversion factors suggested by Gautam (2007), that is, one ton of farmyard manure was equivalent to 8 kg N, 4 kg P_2O_5 and 16 kg K_2O.

Employment generation: Number of hours engaged in desi cows rearing for one year was collected. Total hours spent in a year were divided by 8 hours to convert them in to man-days. Total number of man-days contributed was expressed as mean values.

Security during uncertainties: Number of households having used desi cows to overcome the uncertainties in the past two years.

Status symbol: The number of households who regard keeping desi cows as symbol of social status.

The statistical significance of differences for different parameters were tested by using Chi-square, z and F tests with the help of SPSS software.

RESULTS AND DISCUSSION

Data on age, caste, education, family size, landholding, experience and income level of respondents were collected and the percentage distribution was calculated and given in Table 1. Majority of cattle owners belonged to middle age group and were from general category. Only a smaller portion of the respondents represented SC/ST category. The cattle owners mostly had high-school or intermediate level of education. There were illiterate respondents and also graduates, although few in numbers. Majority of cattle owners had small family size as well as small land holding with an exception to Raichur and Kalaburgi districts which had medium family size and larger land holdings. This may be because of joint family structure and desi breeds reared here being more productive as compared to other districts. It may also be because of frequent droughts and hence higher dependence on cattle. The annual income of majority cattle owners was low despite majority farmers had medium to high level of experience in cattle farming. Chi-square test for the association between farmers of different districts and socio-economic characteristics revealed that farmer categories of different districts were significantly ($P<0.05$) associated with socio-economic characteristics such as caste, education, family size, land holding, annual income and experience.

Management practices: Stall feeding with hay (100%) was the most common practice with open grazing (95%) followed by feeding green fodder (96%) during night hours. Majority households provided concentrates (88%) to the desi cattle, but few were feeding mineral mixture (25%) and none was adopting the practice of silage. Majority of the desi cattle in the studied villages was provided with natural service (92%) and about 29% with artificial insemination using semen of indigenous breed. Majority adopted closed housing (51%), with either thatch (48%) or asbestos (45%) roofing. Stone (37%) or brick-walls (37%) had open sides (52%) or windows, mostly without plastering (62%). Concrete floor (37%) and feed manger (38%) were less common. But majority cattle-sheds had good drainage (79%) with shed cleaning done twice daily (61%). In majority cases, animals were confined only during night (56%) and provided special protection to newborn calf (61%). Adoption of healthcare practices was partial as only about 53% ensured vaccination, about 47% protected desi cows against ecto-parasites, and 34 to 36% followed deworming of adult cows and calves. This could be due to lack of awareness among farmers about vaccination, deworming and timely in-access of these facilities in interior and remote areas. Most newborn were allowed to suckle colostrum within 30 min (99%),

Table 1. Socio-economic characteristics of cattle owners

Socio-economic characteristics	Category	Mysuru (%)	Shivamogga (%)	Hassan (%)	Belagavi (%)	Kalaburgi (%)	Raichur (%)	Total (%)	P value
Age	Young	10	12.5	30	30	32.5	27.5	23.8	0.168
	Middle	50	55	45	40	40	55	47.5	
	Old	40	32.5	25	30	27.5	17.5	28.8	
Caste	General	55	82.5	12.5	85	47.5	65	57.9	0.000
	OBC	40	17.5	72.5	10	42.5	10	32.1	
	SC	5	0	15	2.5	7.5	7.5	6.3	
	ST	0	0	0	2.5	2.5	17.5	3.8	
Education	Illiterate	27.5	12.5	35	2.5	12.5	10	16.7	0.000
	Primary	5	0	7.5	20	5	12.5	8.3	
	High School/Inter.	62.5	87.5	45	67.5	70	62.5	65.8	
	Graduate & above	5	0	12.5	10	12.5	15	9.2	
Family size	Small	67.5	57.5	72.5	62.5	20	20	50.0	0.000
	Medium	32.5	40	17.5	32.5	60	55	39.6	
	Large	0	2.5	10	5	20	25	10.4	
Land Holding	Landless	0	0	0	5	0	0	0.8	0.000
	Marginal	25	35	55	45	2.5	0	27.1	
	Small	57.5	50	32.5	25	20	15	33.3	
	Medium	17.5	10	5	20	12.5	20	14.2	
	Large	0	5	7.5	5	65	65	24.6	
Experience	Low	10	12.5	47.5	25	37.5	35	27.9	0.002
	Medium	60	50	40	40	27.5	45	43.8	
	High	30	37.5	12.5	35	35	20	28.3	
Income	Low	97.5	97.5	95	72.5	62.5	57.5	80.4	0.000
	Medium	2.5	2.5	5	5	17.5	22.5	9.2	
	High	0	0	0	22.5	20	20	10.4	

but disinfection of naval cord (32%) was not practiced by majority farmers. Treatment of sick animal was done mostly by paravets (58%) followed by veterinarians (42%). Majority farmers were regularly cleaning the animals (69%) and animal shed (92%). Majority farmers adopted clean milk production with either full hand milking (46%) or full hand and stripping. Only few were following trimming of hoof (28%).

The findings related to artificial insemination are supported by the findings of Meena *et al.* (2007) and Yadav *et al.* (2009) who reported higher percentage of natural service. It was also reported that less number of farmers practiced vaccination against contagious diseases, deworming of adult animals and calves, isolation of sick animals and tick control measure. Varied and mixed type of housing for draught cattle in South India (Akila and Chander 2010), open grazing (53.70%) and natural service for the Gangatiri cattle (Singh 2013) were also in support of the present study.

Reproduction parameters: Reproductive parameters of desi cattle were ascertained based on the data related to age of puberty, age at first calving, lactation length, dry period, productive life span, inter-calving period, conception rate, service period, insemination time (time taken to inseminate animal after showing heat symptoms), and number of inseminations carried out during each service (Table 2). Khillari and Hallikar reached early puberty (2.46 & 2.50 yrs, resp.) and also early first calving (3.46 & 3.43 yrs, resp.). Khillari also had least inter-calving period, service period, insemination time and required lesser number of inseminations. Inter-calving period (17.25 yrs) and number of inseminations (2.34) were also better in Malnad Gidda after Khillari. Malnad Gidda had better conception rate (1.25) followed by Hallikar (1.48). Service period was good in case of Krishna Valley next to Khillari. Insemination time was good in case of Deoni and Krishna Valley after Khillari. Deoni was too good in terms of lactation length (8.70 months), least dry period (4.48 months) and long productive life (12.95 yrs). Lactation length (8.08 & 7.91 months, respectively) was good in case of Amritmahal and Khillari after Deoni. Dry period (5.14 months) is also less in case of Khillari after Deoni. Productive life span (11.98 & 11.58 yrs, respectively) is good in case of Krishna Valley and Khillari after Deoni. Overall, Khillari for early maturity purpose and Deoni for production purpose, are perceived to be preferred breeds among the six desi breeds studied here. So, these breeds can be used for breeding purpose to effectively utilize certain characteristics and improve the production from desi breeds.

On the negative side, age of puberty and age at first calving were more in case of Krishna Valley. Shorter lactation length, longer dry period, service period and insemination time were the negative parameters in case of Malnad Gidda. Productive life span (9.28 yrs) was less in case of Hallikar. Inter-calving period was more and conception rate was lower in case of Deoni. Service period was also more in case of Deoni. Number of inseminations (2.63, 2.63 & 2.61, resp.) required were higher in case of

Table 2. Reproduction parameters of desi cows perceived by cattle owners

Parameter	Hallikar (n=40)		Malnad Gidda (n=40)		Amritmahal (n=40)		Khillari (n=40)		Deoni (n=40)		Krishna Valley (n=40)		P value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Age of puberty (Yrs)	2.50	0.45	2.85	0.32	2.88	0.29	2.46	0.45	2.78	0.50	2.96	0.20	0.000
Age at first calving (Yrs)	3.43	0.51	3.85	0.32	3.86	0.30	3.46	0.48	3.78	0.51	3.95	0.25	0.000
Lactation length (Months)	6.95	0.79	6.78	0.80	8.08	1.62	7.91	1.20	8.70	2.09	7.18	0.78	0.000
Dry period (Months)	5.68	1.23	6.95	0.68	5.78	1.86	5.14	1.25	4.48	1.30	5.68	1.12	0.000
Productive life span (Yrs)	9.28	1.13	9.60	0.74	9.50	1.32	11.58	1.72	12.95	1.60	11.98	1.17	0.000
Inter calving period (Months)	18.05	2.04	17.25	1.45	17.78	1.86	17.13	1.07	18.18	2.11	17.90	1.30	0.025
Conception rate (No. of service)	1.48	1.33	1.25	0.41	1.72	0.74	1.89	0.45	1.98	0.39	1.95	0.19	0.000
Service period (Months)	5.95	0.50	6.43	0.68	5.96	0.89	5.00	1.34	6.16	1.09	5.60	0.74	0.000
Insemination time (hrs)	14.01	2.78	16.30	1.70	11.73	2.74	7.08	3.41	9.48	3.34	9.55	2.75	0.000
No. of inseminations carried out	2.61	0.59	2.34	0.46	2.63	0.77	1.94	0.74	2.51	0.60	2.63	0.49	0.000

Amritmahal, Krishna Valley and Hallikar. These attributes need to be kept in mind while implementing breeding programmes. The 'F' test was used to test the differences in the perceived reproductive attributes among the six breeds. Analysis showed that there was a significant difference between all the reproduction parameters of all the six breeds.

Production parameters: Data on production parameters included milk production per animal and per day, quantity of dry, green fodder and concentrates fed, cost of feed, labour, health, total expenditure, net return/ animal, milk nourishment to the family, dung production, draught animal power, and employment generation. The average values presented in Table 3 indicate that Deoni breed has better productivity with 3.15 L/anim./day followed by 3.07 in case of Krishna Valley. It was 2.97, 2.96, 2.66 and 2.34 for Amritmahal, Hallikar, Khillari and Malnad Gidda, respectively. Although, the productivity largely depends upon genetic potential of particular breed, it is possible that management practices may also have contributed to difference in productivity. The number of milking desi cows kept by farmers was more in case of Krishna Valley and Deoni, may be due to better productivity. Therefore, daily milk production of farm was more in these two breeds around 10 L per day in Krishna Valley and eight litres per day in Deoni. Feeding of green fodder and concentrates largely influenced productivity of these breeds as more dry fodder was fed in less productive breeds. Daily green fodder fed per animal was 12.30 and 12.15 kg, while daily concentrates fed per animal was 1.06 and 0.93 kg respectively in Deoni and Krishna Valley breeds, leading to higher feed cost (₹ 60/day/animal). In Amritmahal also, it was more due to higher quantity of dry fodder fed along with green fodder and concentrates. Daily average expenditure per animal on health and labour was taken as ₹ 4 and 10 respectively for all six breeds. Thus, daily net return per animal was ₹ 18.20 in Deoni and ₹ 15.51 in Krishna Valley, while it was lowest in Malnad Gidda i.e. ₹ 7.63. Daily dung production depended upon feeding level, it was highest in Deoni followed by Krishna Valley. Daily employment generation per animal was around one hour except Krishna Valley which was 0.75 hour. Draught animal power utilization was highest 3.58 hrs/day/anim. in Deoni followed by 3.05 in Hallikar. Daily milk nourishment to the family was highest 1.71 L from Hallikar followed by 1.61 L in Amritmahal and 1.60 L in Malnad Gidda. It could be attributed to regional differences as in some region, people preferred buffalo milk as compared to cow milk. Cow milk is more preferred in South Karnataka as compared to North Karnataka.

Majority of the cattle owners used own farm grown dry and green fodder to feed their cattle or from grazing. Dung produced was used for manure in own farms including draught power and some milk for nourishment to family. Without considering cost of fodder, daily feed cost ranged from ₹10.60/animal/day (Malnad Gidda) to ₹17 (Deoni) and total expenditure (₹/anim./day) ranged from 21.10 (Malnad Gidda) to 27.50 (Deoni). Thus, net return (₹/anim./day) was higher for Hallikar (₹61.05/animal/day) followed by Deoni and Krishna Valley. Higher net return in case of Hallikar was due to less expenditure on concentrate feed. The 'F' test was used to test the difference between the production parameters perceived by cattle owners of six breeds. Analysis showed that there was a significant difference between production parameters of all the six

Table 3. Production parameters of desi cows perceived by cattle owners

Parameter	Hallikar		Malnad Gidda		Amritmahal		Khillari		Deoni		Krishna Valley		P value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Total milking animals (no.)	1.48	0.64	1.58	1.39	1.45	0.75	1.90	1.45	2.48	1.87	3.30	2.95	0.000
Total milk production (L/day)	4.20	1.79	3.60	2.86	4.167	1.767	5.18	4.23	7.95	6.37	10.06	9.24	0.000
Total milk production (L/anim./day)	2.96	0.89	2.34	0.63	2.97	0.50	2.66	0.58	3.15	0.70	3.07	0.47	0.000
Total dry fodder fed (kg/anim./day)	8.75	2.60	7.43	2.81	7.18	1.65	6.66	2.18	6.03	2.37	6.76	1.93	0.000
Total daily green fodder fed (kg/anim./day)	8.09	1.92	4.80	2.27	11.45	5.09	10.13	2.26	12.30	3.64	12.15	4.63	0.000
Total concentrate fed (kg/anim./day)	0.71	0.49	0.66	0.52	0.90	0.30	0.74	0.52	1.06	0.59	0.93	0.46	0.002
Total feed cost (₹/anim.)	58.53	16.09	47.50	16.30	60.28	11.82	53.74	13.50	59.55	12.57	60.08	13.39	0.000
Labour cost (₹/anim./day)	10.00	0.00	10.00	0.00	10.00	0.00	10.00	0.00	10.00	0.00	10.00	0.00	Na
Health cost (₹/ anim./day	0.50	0.00	0.50	0.00	0.50	0.00	0.50	0.00	0.50	0.00	0.50	0.00	Na
Total expenditure (₹/anim./day)	69.03	16.09	58.00	16.30	70.78	11.82	64.24	13.50	70.05	12.57	70.58	13.39	0.000
Net return/ anim. (₹/day)	13.92	12.52	7.63	7.85	12.32	14.45	10.34	6.31	18.20	13.82	15.51	3.35	0.000
Milk nourishment to the family (L/day)	1.71	0.49	1.60	0.44	1.61	0.57	0.98	0.63	1.25	0.72	1.26	1.05	0.000
Dung production (kg/day/anim.)	20.00	1.60	17.63	2.53	18.25	2.67	19.75	3.70	20.66	3.73	20.41	3.15	0.000
Draught animal power (hrs/day)	3.05	2.71	0.30	1.07	0.98	1.76	1.33	1.73	3.58	2.61	2.48	2.21	0.000
Employment generation (hrs/day)	0.98	0.09	0.95	0.19	0.97	0.12	0.92	0.48	1.00	0.34	0.75	0.30	0.001
Without considering cost of fodder													
Total feed cost (₹/anim./day)	11.40	7.87	10.60	8.38	14.40	4.86	11.90	8.38	17.00	9.45	14.80	7.37	0.002
Total expenditure (₹/anim./day)	21.90	7.87	21.10	8.38	24.90	4.86	22.40	8.38	27.50	9.45	25.30	7.37	0.002
Net return/anim. (₹/day)	61.05	20.41	44.53	13.42	58.19	12.34	52.17	11.52	60.75	16.00	60.78	11.26	0.000

breeds.

Contribution to the farmers livelihood: Income from cattle with and without considering the cost of fodder, nourishment to the family, soil nutrients enriched, employment generated, number of farmers using the desi cows as security for overcoming uncertainties, and the number of farmers treating ownership of desi cows as status symbol are presented in Table 4. The net return (₹/anim./day) were 7.63, 10.34, 13.92, 12.32, 15.51 and 18.20 in case of Malnad Gidda, Khillari, Hallikar, Amritmahal, Krishna Valley and Deoni, respectively. For the same breeds in that order, net return for the household (₹/farm/day) was 11.83, 20.59, 17.58, 14.78, 54.86 and 43.45. The corresponding net return per liter of milk produced (₹/L/day) was 2.77, 2.85, 3.42, 3.79, 2.24 and 3.17 from the six breeds, respectively. As majority of the cattle owners used own farm grown dry and green fodder to feed their cattle and the dung produced was used as manure, economics without considering cost of fodder provided a different scenario. Without considering cost of fodder, net return (₹/anim./day) was 44.53, 52.17, 61.05, 58.19, 60.78 and 60.75 in case of six breeds, respectively. Although the net return per day was high for Krishna Valley breed, both with and without considering fodder cost (₹54.86 and ₹200.70), its return per litre of milk produced was the least (₹8.74). In terms of return per litre of milk produced without considering cost of fodder, Malnad Gidda and Hallikar breeds were perceived as more economical with a return of ₹16.27 and ₹16.22/litre respectively. Based on the milk consumed by the households, protein, and fat and calcium nourishment to the family ranged from 31.36, 40.18, 0.12 to 54.72, 70.11, 0.21 gm/day /family, respectively

Table 4. Contribution of desi cows to the farmers livelihood perceived by cattle owners

Type of contribution	Units	Hallikar	Malnad Gidda	Amritmahal	Khillari	Deoni	Krishna Valley	P value
Income from cattle	Net return/anim./day (₹)	13.92	7.63	12.32	10.34	18.20	15.51	0.000
	Net return/farm/day (₹)	17.58	11.83	14.78	20.59	43.45	54.86	0.000
	Net return/L (₹)	3.54	2.77	3.42	2.85	3.17	2.24	0.273
Income from cattle (Without considering cost of fodder)	Net return/anim./day (₹)	61.05	44.53	58.19	52.17	60.75	60.78	0.000
	Net return/farm/day (₹)	85.51	66.66	81.53	97.25	152.41	200.70	0.000
	Net return/L (₹)	16.22	16.27	15.75	15.58	11.62	8.74	0.000
Nourishment to the family	Protein (gm/day/family)	54.72	51.20	51.52	31.36	40.00	40.32	0.000
	Fat (gm/day/family)	70.11	65.60	66.01	40.18	51.25	51.66	0.000
	Calcium (mg/day/family)	2052.00	1920.00	1932.00	1176.00	1500.00	1512.00	0.000
Nutrients to the farm	N kg/year	58.40	51.48	53.29	57.67	60.33	59.60	0.000
	P kg/year	29.20	25.74	26.65	28.84	30.16	29.80	0.000
	K kg/year	116.80	102.96	106.58	115.34	120.65	119.19	0.000
Generating employment	Man days/year	44.71	43.34	44.26	41.98	45.63	34.22	0.001
Security for uncertainties	Percentage	18.00	23.00	14.00	22.00	19.00	17.00	0.000
Status symbol	Percentage	27.00	32.00	26.00	17.00	24.00	32.00	0.000

in case of six breeds. The households in Mysuru region rearing Hallikar breed consumed more quantity of milk followed by Amritmahal in Hassan region and Malnad Gidda in Shivamogga region thus contributed more to the family nourishment. Nutrients to farm in the form of NPK ranged from 51.48, 25.74, 102.96 to 60.33, 30.16, 120.65 kg/anim./year, respectively. Since the quantity of dung produced by Deoni breed was the highest, the manure and nutrients supplied to farm was also high. Krishna Valley breed was the next best in terms of contribution to farm manure. Employment generation (Man days/anim./year) ranged from 34.22 to 45.63 in six breeds. Security for uncertainties and status symbol (percentage) ranged from 14 and 17 to 23 and 32, respectively in six breeds. Similar results reported in western Maharashtra (Kolekar *et al.* 2015 and Biradar *et al.* 2013).

Preference in rearing of desi cows: Preferences in rearing cows by the farmers was ascertained on a 15-statements scale. Desi cattle were preferred due to dual purpose (milch and draught power). Majority small and marginal farmers preferred desi cattle for draught purpose, may be due to non-availability or high one-time cost involved in mechanization. Superior quality and taste of milk of desi cows was preferred over the milk of crossbred cattle by rural people. Since the desi cows are allowed for grazing for much part of day time and they feed on varied species of grasses and trees, the nutritional quality of milk and taste might have been perceived as better. Also, desi cows possess A2 allele of beta casein as compared to crossbred cows (Woodford 2009). Breeding bulls of desi cattle were easily available at nearby places and therefore they did not favour artificial insemination. Being small built and low in production as compared to crossbred cattle, desi cows may require low input for maintenance. Due to small built, docile nature, comfortable adaptation etc, desi cattle were handled easily and taken for grazing on common resources. Better adaptability to harsh tropical climate due to its hardy nature and genetic composition was another plus point with desi cattle. Along with economic benefits, religious/cultural sentiments, emotion attachment, sense of satisfaction and social prestige were also the factors for rearing desi cattle.

Keeping desi cattle gave social prestige in the society (Akila and Chander 2009). In Tanzania (Ngowi *et al.* 2008), most farmers preferred to keep Tarime cattle rather than exotic dairy cattle for their good tolerance to diseases, draught purpose, and better milk quality. Msanga *et al.* (2012) revealed better draught power, disease tolerance, body size, meat and manure as the preferred traits in Ufipa cattle.

Constraints in rearing of desi cows: Production constraints were perceived by most of the respondents. Longer inter-calving period, non-availability of grazing land, longer maturity age and poor milk production were perceived as the major constraints by more than 90% farmers. Competition from commercial dairy and lack of market demand for cow milk were less important constraints due to availability of dairy cooperatives at village level. Also, disease incidence was less important due to resistance, hardy nature, and adaptability to harsh climate by desi cows. Among the economic constraints, poor economic condition and costly wages for workers were the major constraints perceived by farmers. Non-availability of quality bulls for natural service was perceived as a constraint by more than 50% respondents due to lack of breeding policies at village level. Lack of organized market was a constraint for 38.75%. Veterinary dispensary located at far away distance, unavailability of veterinary services in time and poor supply of quality semen were the other infrastructural constraints. Poor mass media or extension agency contact, lack of knowledge on improved practices, unavailability of

extension advisory services, non-participation in training programmes and unavailability of improved technologies were the other major technical constraints. All the utility constraints were perceived as important by more than 90% farmers. Shrinking land holding size was non-economical to maintain draught animal in case of small and marginal farmers, and increasing mechanization of agriculture was also having adverse effect on it. Also, agriculture operations by draught animal takes longer period and unavailability of labour to handle bullock results in lesser demand for draught power which in turn leads to lesser working days per year for the draught animals were other important utility constraints.

Deficiency of quality feed and fodder, prolonged age at first calving, poor disease management system and little knowledge about vaccination of livestock were the major constraints of animal husbandry in Kumaon region of Uttrakhand as reported by Meena *et al.* (2007). Patil *et al.* (2009) reported that majority of the respondents perceived low milk production from the local breeds and shortage of green fodder as the main constraints of dairy farming in Maharashtra. Farmers constraints in keeping Kherigarh cattle in Uttar Pradesh were higher labour wages, lack of training facility by government and lack of knowledge on disease prevention and control according to Verma *et al*. (2014).

In conclusion, Khillari and Hallikar breeds had better reproductive parameters as they reached early puberty and early first calving. Khillari breed also had least inter-calving period, service period, insemination time and required lesser number of inseminations per conception. Deoni and Krishna Valley breeds were better on productivity and daily net return per animal. Without considering the cost of fodder, net return (₹/anim./day) was marginally higher for Hallikar breed over Deoni and Krishna Valley. Protein, fat and calcium supplementation from desi cows to the farmers family was reasonably good due to preference of milk from desi cattle. Substantial quantities of soil nutrients were supplemented from manure application upto 60 kg N, 30 kg P, and 120 kg K/anim./year. Employment generation was mostly coming from the draught power utility towards various agricultural practices. Longer inter-calving period, non-availability of grazing land, longer maturity age and poor milk production were the perceived constraints by most farmers. This highlights the potential to enhance the productivity of the desi breeds through professional farm management and balanced nutrition. The non-availability of superior quality breeding bulls was the most important cause for decreasing desi cattle population, which needs to be addressed through policy and programmatic support. The Gokul Mission may address most of these issues if properly implemented by all the states. Increasing production from indigenous cattle through proper breeding programs and supporting farmers with good management practices are the achievable objectives of Rashtriya Gokul Mission.

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