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Assessment of Additional Milk Yield and Prices in Different Seasons among Various Categories of Farmers

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present experiment is conducted to study about the additional milk yield and prices in different seasons among various categories of farmers. The study period is consisting of five different seasons (Viz. summer, rainy, autumn, winter and spring) of the year (2019-2021). Buffaloes are randomly selected from ten villages covering five blocks of district Lakhimpur (kheri). Each block contains two villages and from each village 25 farmers based on size of land holding capacity viz. Landless farmers (landless), Marginal Farmers (< 1.00 hectare), Small Farmers (1.00-2.00 hectare), Medium Famers (2.00-4.00 hectare) and Large Farmers (4.00- 10.00 hectare) were selected. In second phase improved feeding using mineral supplement 50 gm., 25 gm. Urea, 40gm. Chalk and common salt requirement for animal. The indicated order of lactation not vary significantly and stage of lactation data indicated was recorded highly significant variation (P<0.05) among various farm catogeries On perusal of data and also significant (P<.05) variation in data was analysis of additional input price, additional milk yield, and additional net profit among various farmer categories were found. Average mean data represent order of lactation was 2.84 ± 1.044, 2.64 ± 0.89, 2.60± 0.97, 2.63± 0.98 and 2.75 ± 0.96 respectively, in summer, rainy, autumn, winter and spring season under and different categories of farmers. Average mean data represent stage of lactation was 2.66± 0.73, 2.75± 0.71, 2.74 ± 0.76, 2.35 ± 0.74 and2.73± 0.75 respectively, in summer, rainy, autumn, winter and spring season and different categories of farmers. Additional input price (paise) average mean data were recorded was 56.50± 2.9, 54.84 ± 2.60, 54.92± 4.93, 57.07± 2.75 and 55.62 ± 3.58 respectively, in summer, rainy, autumn, winter and spring season and different categories of farmers. Additional milk yield (gram) average mean data were recorded as 450.20 ± 4.59,501.2 ± 8.59, 450 ± 5.98, 511.2± 8.05 and 462.2 ± 7.97 respectively, in summer, rainy, autumn, winter and spring season and different categories of farmers. Additional net profit (paise) average mean data were recorded as 393.50± 4.81, 410.34 ± 8.80, 395.12 ± 7.04, 454.34 ± 8.56 and 406.65± 8.98 respectively, in summer, rainy, autumn, winter and spring season and deferent categories of farmers.

Keywords: Additional milk yield; input; different seasons; different categories of farmers.

1. INTRODUCTION

India is among the leading countries in Asia for scientific and technological development in buffalo nutrition, production, reproduction, (biotechnologies) and genetic improvement. Moreover, India has implemented national programmers such as the "green revolution" (to increase crop production for vast human population), the "white revolution" (to increase milk productivity and satisfy human needs for proteins) and finally the "red revolution" (to increase meat production and strengthen the meat industry), particularly with regard to buffalo. India possesses the best River milk breeds in Asia e.g. Murrah, Nili-Ravi, Surti and Jaffarabadi, which originated from the north-western states of India and have a high potential for milk and fat production apart from their use as a work animal and as a supplementary stock for use as meat production (Sethi, 2003). Indian Murrah is the most diffuse breed in the world.

Buffaloes have high efficiency of feed utilization when fed on high roughage (fibrous) diets. The digestibility of dry matter and crude fiber/neutral detergent fiber in most of the situations is also comparatively higher in buffaloes than in cattle. Possible reasons for better utilization of nutrients in buffaloes are large rumen volume, high rate of salivation (associated with pH control, recycling of nitrogen and sulpher), slower rate of passage of digesta though the reticulorumen, slow rumen motility, higher cellulolytic activity of microbial population, and lesser dry- matter intake per unit body weight. The microbial population (protozoa, total viable bacteria, amylolytic and proteolytic bacteria) is higher in buffalo than cattle. The number of oscillospira is 10-25 times higher in buffalo rumen liquor than in cattle. This may be responsible for greater protein synthesis in buffalo rumen. The higher numbers of nitrogen from simpler sources (NPN) for synthesis of microbial protein for the host. The rumen concentration of total VFA is higher in buffaloes than in cattle. The proportions of propionic acid and butyric acids as compared to acetic acid are also higher in buffalo rumen fluid (Pawar et al 2012, Prusty et al 2014. Saxena et al 2018, Sehgal et al 2018).

Chemical treatment of poor- quality roughages which are common feed for buffaloes helps in improving intake and digestibility. Such forage supplement to the tune of 30-50% of dry matter of feed or 0.9 to 1.5% of live weight will be optimum for production and much cheaper than providing supplemental nutrients through costly concentrate feeds. (Srivastava, 2016) (Sudhakar et al 2013). Examples of such feeds include supplementation of urea molasses with green forage, viz. cultivated leguminous fodder, leaves of cassava, gliricidia, leucopenia, water hyacinth, groundnut and sweet potato vines (Abraham and Gayathri 2015).

The variation in the productivity of cows and buffaloes in different seasons is a universal phenomenon and caused by the variation in the breeding cycle of the animal, the environmental factors like temperature, humidity and the quality and quantity of feed and fodders supplied to the animals (Afzal et al 2007). The good genetic ability of buffaloes is of no use unless they are fed and managed adequately to maximize the milk production (Tadavi et al 2017). A dairy animal with good genotype represents a factory of converting large quantity of unusable roughages into milk and butter fat (Butler et al 2010). The feed conversion efficiency of the dairy animal varies from breed to breed. Dairy animals need feed for maintenance and growth as well as for milk production. Particularly, in the first lactation a cow may be still growing and thus may need nutrients to sustain growth rate, maintenance and the milk production (Nebel and McGilliard 1993).

High quality fodders are cheapest source of nutrients and accounted 25-30 per cent of cost of milk production (Bhasin, 1975) and concentrates constitute 60 per cent of total feed cost. The cost per kg milk can be reduced by 60 per cent and 40 per cent, respectively by feeding good quality leguminous or non-leguminous fodder (Upadhyay et al., 2008). Livestock production has the potential to become an economic enterprise that targets the poor and marginalized if the development focus is on the value chain approaches (Sirohi & Chauhan 2011), (Patbandha ,2015).

The feeds and fodders in country have a remarkable gap between availability and requirement (Pal and Paachauri 2011). The annual requirements of feeds and fodders are estimated to be 96 million tonnes of concentrate, 530 million tonnes of dry fodders and 880 million tonnes of green fodder. (Patel and Ashwar 2019However, only 61 million tonnes of concentrate, 408 million tonnes of dry fodder and 596 million tonnes of green fodder are available. The gap between the availability and requirement of the concentrate is very wide and there is shortage of 36 per cent of concentrate, 23 per cent dry fodder and 32 per cent of green fodder. (Estimated based on past livestock censuses published by the directorate of economic &statistics and department of animal husbandry &dairying -2020.

2. MATERIALS AND METHODS

The present study was carried out on 250 Buffaloes owners in rural area of Lakhimpur (Kheri) District of Uttar Pradesh, India during 2019-2021.The one year study was divided in five season viz. summer, rainy, autumn, winter and spring.The selected Buffaloes owners of rural area were observed for knowing the feed composition, milk production of their buffaloes, milk composition and feed to milk relationship.The study is performed in three phases viz. Feed intake, milk yield, its composition and feed to milk relationship were covered in first phase, whereas improved feeding and economic valuation of buffaloes are under taken in second and third phase, respectively.

2.1 Phase l

2.1.1 Selection of animals in different Categories of farmers

Ten lactating buffaloes are selected in each category of farmers from Thane - l, which were mostly deficient in digestible crude protein intake (DCPI). Total 50 buffaloes were selected in each season. Order and stage of lactation are recorded from Phase - l.

2.1.2 Improved feeding

During survey protein and mineral deficiency was observed in most of the animals in Phase l. To over cum the deficiency, a little amount of crude protein in the form of NPN and minerals supplements 50 gm. 25 gm Urea, 30 gm. Chalk, and 40 gm Common salt were provided per animal per day over the previous feeding (Phase - 1), Slight increase in DM, DCP and TDN intake will be also recorded from the individual farmer or by personal observation,

2.1.3 Record of milk yield

Improved feed was provided to all the animals for 21 days. After improved feeding milk yield was

Table 1. Sample of milch buffaloes in different categories of farmers

Region	Blocks	Village	No. of milch animal in different categories					Total
			Landless farmers	Marginal farmers	Small farmers	Medium farmers	Large farmers	
Lakhimpur kheri (U.P.)	Pasgawan	Oderha	5	5	5	5	5	25
		Darma	5	5	5	5	5	25
	Behjam	Bhadura	5	5	5	5	5	25
		Dhakiyabujrug	5	5	5	5	5	25
	Lakhimpur	Behta	5	5	5	5	5	25
		Ramwapur	5	5	5	5	5	25
	Bankeyganj	Daulatpur	5	5	5	5	5	25
		Mohamad pur	5	5	5	5	5	25
	Phoolbehar	Khanpur	5	5	5	5	5	25
		Brahmanpur	5	5	5	5	5	25
			50	50	50	50	50	250

Table 2. Distribution of milch Buffaloes according to order of lactation.

S. No.	Category of farmers	Order of lactation				
		I	II	III	IV	Total
2(a) Summer Season						
1	**Landless**	10 (20)	15(30)	13(26)	12 (24)	50(100)
2	**Marginal**	11(22)	19(38)	11(22)	9(18)	50(100)
3	**Small**	13(26)	15(30)	14(28)	8(16)	50(100)
4	**Medium**	16(32)	16(32)	10(20)	8(16)	50(100)
5	**Large**	14(28)	16(32)	13(26)	7(14)	50(100)
	Overall	12.8(25.6)	16.2 (32.4)	12.2(24.4)	8.8(17.6)	50 (100)
Rainy Seasons						
1	**Landless**	13(26)	18 (36)	13(26)	6 (12)	50(100)
2	**Marginal**	10 (20)	20 (40)	11(22)	9 (18)	50(100)
3	**Small**	14 (28)	16(32)	14(28)	6 (12)	50(100)
4	**Medium**	12(24)	16(32)	12(24)	10(20)	50(100)
5	**Large**	13 (26)	15(30)	12(24)	10 (20)	50(100)
	Overall	12.4(24.8)	17(34)	12.4 (24.8)	8.2(16.4)	50(100)

S. No.	Category of farmers	Order of lactation				
		I	II	III	IV	Total
Autumn Seasons						
1	**Landless**	13(26)	20 (40)	10(20)	7(14)	50(100)
2	**Marginal**	11(22)	19(38)	11(22)	9(18)	50(100)
3	**Small**	15 (30)	15(30)	12(24)	8 (16)	50(100)
4	**Medium**	15(30)	12(24)	15(30)	9(18)	50(100)
5	**Large**	13(26)	17(34)	12(24)	8 (16)	50(100)
	Overall	13.4 (26.8)	16.6(33.2)	12(24)	8.2(16.4)	50(100)
Winter Seasons						
1	**Landless**	13 (26)	25 (50)	7 (14)	5 (10)	50(100)
2	**Marginal**	10 (20)	20 (40)	12 (24)	8 (16)	50(100)
3	**Small**	11 (22)	20 (40)	11(22)	8(16)	50(100)
4	**Medium**	12 (24)	18 (36)	12(24)	8 (16)	50(100)
5	**Large**	11 (22)	20 (40)	12 (24)	7 (14)	50(100)
	Overall	11.4 (22.8)	20.6(41.2)	10.8(21.6)	7.2(14.4)	50(100)
Spring Seasons						
1	**Landless**	8 (16)	23(26)	12(24)	7 (14)	50(100)
2	**Marginal**	10 (20)	18 (34)	15 (30)	7 (34)	50(100)
3	**Small**	13 (26)	21(42)	10(20)	6 (12)	50(100)
4	**Medium**	12 (24)	19 (38)	10 (20)	9 (18)	50(100)
5	**Large**	14 (28)	12(24)	13(26)	11(22)	50(100)
	Overall	11.4(22.8)	18.6(32.8)	12(24)	8(20)	50(100)

***Figures in parenthesis indicate percentage of the total*

Table 3. Distribution of milch Buffaloes according to stage of lactation

S. No.	Category of farmers	Stage of lactation			
		I	II	III	Total
Summer Seasons					
1	**Landless**	13 (26)	23 (46)	14 (28)	50(100)
2	**Marginal**	15(30)	16 (32)	19 (38)	50(100)
3	**Small**	13(26)	16 (32)	21(42)	50(100)
4	**Medium**	8 (16)	12(24)	30 (60)	50(100)
5	**Large**	13 (26)	19 (38)	18 (36)	50(100)
	Overall	12.4(24.8)	17.2(34.4)	20.4(40.8)	50(100)
Rainy Seasons					
1	**Landless**	11(22)	9 (18)	30 (60)	50(100)
2	**Marginal**	17 (34)	21 (42)	12(24)	50(100)
3	**Small**	16 (32)	20 (40)	14 (28)	50(100)
4	**Medium**	16 (32)	14 (28)	20 (40)	50(100)
5	**Large**	19 (38)	11(22)	20 (40)	50(100)
	Overall	15.8(31.5)	15(30)	19.2(38.4)	50(100)
Autumn Seasons					
1	**Landless**	29 (58)	12(24)	9 (18)	50(100)
2	**Marginal**	19 (38)	15 (30)	16 (32)	50(100)
3	**Small**	16 (32)	17 (34)	17 (34)	50(100)
4	**Medium**	12 (24)	22 (44)	16 (32)	50(100)
5	**Large**	16 (32)	11 (22)	23(46)	50(100)
	Overall	18.4(36.8)	15.4(30.8)	16.2(32.4)	50(100)
Winter Seasons					
1	**Landless**	19 (38)	15 (30)	16 (32)	50(100)
2	**Marginal**	28 (54)	12 (24)	11 (22)	50(100)
3	**Small**	19 (38)	20 (40)	11 (22)	50(100)
4	**Medium**	21 (42)	16 (32)	13(26)	50(100)
5	**Large**	16 (32)	21 (42)	13 (42)	50(100)
	Overall	20.6(41.2)	16.8(33.6)	12.8(25.6)	50(100)
Spring Seasons					
1	**Landless**	11 (22)	15 (30)	20 (40)	50(100)
2	**Marginal**	16 (32)	20 (40)	14 (28)	50(100)
3	**Small**	15 (30)	18 (26)	17(34)	50(100)
4	**Medium**	15 (30)	20 (40)	15(30)	50(100)
5	**Large**	17 (34)	19 (38)	14(28)	50(100)
	Overall	14.8(29.6)	18.4(36.8)	14.4(28.8)	50(100)

***Figures in parenthesis indicate percentage of the total*

recorded from individual buffaloes in various categories of farmers (Venkatesh and Sangeetha, 2011, Verma et al 2005).

2.1.4 Calculation of the cost of the additional inputs

All additional inputs such urea, chalk; common salt and Increased DMI are converted into rupees (paisa) per animal per day.

2.1.5 Calculation of the additional net profit

Additional return from milk in form of rupees, are calculated as per the rate prevailing in the market. Additional milk price calculated by the market rate is subtracted from the additional inputs to find out additional net profit in the rupees (paisa) per animal per day.

3. RESULTS

3.1 Average Nutritional Status (Improved Feeding of Lactating Buffaloes)

Average nutritional status (improved feeding) of lactating buffaloes in various categories of farmers, under improved feeding in summer, rainy, autumn, winter and spring season has been presented in table and economic analysis of enhanced milk (through improved feeding) production are also presented in table.

3.1.1 Seasonal variation under various categories of farmers

(I) Order of lactation: The order of lactation of milch buffaloes under landless, marginal, small, medium and large category of farmers was 2.40 ± 0.29, 2.80 ± 0.25, 3.00 ± 0.31, 2.80 ± 0.25 and 2.65 ± 0.33 in summer .2.75 ± 0.29, 2.35 ± 0.25 2.40± 0.31 ,2.35 ± 0.25 and 2.70 ±0.24 in rainy season. 2.65 ± 0.29, 2.45 ± 0.25 2.40± 0.31, 2.80 ± 0.25 and 2.75 ±0.24 in autumn season. 3.55± 0.29, 2.15 ±0.25 ,2.45± 0.31,2.85± 0.25 and 2.85±0.24 in winter season 2.45±0.29, 2.55± 0.29 ,3.15±0.25,2.55± 0.25 and 2.55±0.24 in spring season respectively. Analysis of various showed that order of lactation of buffaloes did not difference significantly among season in all category of farmers.

(II) Stage of lactation: The stage of lactation of milch buffaloes under landless, marginal, small, medium and large category of farmers was 2.25±0.20 ,3.15±0.26 ,2.85±0.22,3.15±0.26 and 2.35±0.26 in summer season, 2.45±0.20 ,2.55±0.26, 3.15±0.25,2.55±0.27 and 3.15 ±0.26 in rainy season , 2.45±0.21 ,2.30±0.26 ,2.85±0.25 ,2.30±0.29 and 2.75±0.26 in autumn season ,2.25±0.21 ,2.65±0.26 ,2.10±0.23 ,2.65±0.26 and 2.50±0.27 in winter season and 2.75±0.20 ,3.05±0.26 ,2.25±0.23 ,3.05±0.26 and 3.05±0.27 in spring season respectively. Analysis of variance revealed that the stage of lactation among all seasons was significantly differ in all category of farmers except landless farmer where did not differ significantly between season.

(III) Additional input: The additional input in (paisa/animal/day) of buffaloes under landless , marginal, small, medium and large category of farmers was 59.16±1.09 ,55.77±1.00 ,56.66±1.01 ,55.77±±1.02 , and 55.78 ±1.04 in summer season, 54.15±1.08 , 56.05±1.02 , 53.85±1.00 , 56.05 ± 1.02 and 54.90±1.05 in rainy season , 58.56±1.09, 52.55±1.02 , 53.02±1.00 , 52.55±1.03 and 55.09±1.04 in autumn season 54.20±1.09 ,58.28±1.01,55.27±1.02 ,58.28±1.01 and 60.06±1.05 in winter season and 56.20±1.07 ,55.23±1.00 ,57.05±1.02 ,55.35±1.01 and 55.35±1.04 in spring season respectively. The statically analysis of data revealed that there was significant differences in all category of farmers.

(IV) Additional milk production: The additional milk production (gm/animal/day) under improved feeding of buffaloes in landless, marginal, small, medium and large category of farmers was 452±5.10 ,402±5.22,490±5.71,402±5.51 and 415±5.52 in summer season, 467±2.09,439±5.22,462±2.71,439±5.52 and 456 ±5.51 in rainy season,457± 5.09,424±5.21,427±5.71,424 ±5.51 and 472±5.53 in autumn season 509±5.11 ,522±5.20,508±5.72,522± 5.51 and 500±5.55 in winter season 472±5.13,426±5.23,488±5.70,426±5.71 and 457 ± 5.54 in spring season respectively. The statistical analysis showed that milk production varied significantly between seasons in all categories of farmers.

(V) Additional milk price: The additional milk price (paise/ animal/day) under improved feeding of buffalo in landless, marginal, small, medium and large categories of farmers were 452±5.10,402±5.22,490±5.71,402±5.51and 415±5.52 in summer season , 467±2.09,439±5.22,462±2.71,439±5.52 and 456 ±5.51 in rainy season,457± 5.09,424±5.21 ,427±5.71,424 ±5.51 and 472±5.53 in autumn season 509±5.11 ,522±5.20 ,508±5.72 ,522± 5.51 and 500±5.55 in winter season 472±5.13 ,426±5.23 ,488±5.70 ,426±5.71 and 457 ± 5.54 in spring season respectively. The statistical analysis showed that milk production varied significantly between seasons in all categories of farmers.

(VI) Additional net profit: The additional net profit (paisa/animal/day) of buffalo under landless, marginal, small, medium and large category of farmers was 392.83±2.22 ,346.21±5.66 ±5.18 ,434.08±5.66 and 359.26±5.57 in summer season, 412.84±2.23 ,382.94±5.65,428.14±5.20,382.94±5.65 and 401.09±5.56 in rainy season , 392.43±2.25,371.45±5.66,473.97±5.45,37 1.45±5.54 and 416.90±5.57 in autumn season , 455.91±5.10,465.71±5.52,453.27±5.66,46 3.15±5.56 and 439.93±5.54 winter season and 415.79±5.11 ,370.64±5.52,430.89±5.62,370.64±5.66 and 401.64±5.58 in spring season respectively. Analysis of data revealed that net profit differed significantly between seasons in all categories of farmers.

3.1.2 Variation in different category of farmers under different season

(1) SUMMER SEASON

(I) Order of lactation: The order of lactation of milch buffaloes under landless, marginal, small, medium and large category of farmers was 2.40 ± 0.29, 2.80 ± 0.25, 3.00 ± 0.31, 2.80 ± 0.25 and 2.65 ± 0.33 respectively. The order of lactation does not differ significantly among various categories of farmers.

(II) Stage of lactation: The stage of lactation of milch buffaloes under landless, marginal, small, medium and large category of farmers was 2.25±0.20, 3.15±0.26, 2.85±0.22, 3.15±0.26 and 2.35±0.26 respectively. Analysis of variance showed that stage of lactation varied significantly among various categories of farmers.

(III) Additional inputs: The additional input n (paisa/animal/day) of buffaloes under landless, marginal, small, medium and large category of farmers was 59.16±1.09, 55.77±1.00, 56.66±1.01, 55.77±±1.02, and 55.78 ±1.04 respectively. Analysis of variance indicated that additional inputs significantly varied among the various categories of farmers.

(IV) Additional milk yield: The additional milk production (gm/animal/day) under improved feeding of buffaloes in landless, marginal, small, medium and large category of farmers was 452±5.10, 402±5.22, 490±5.71, 402±5.51, and 415±5.52 respectively. Analysis of variance showed that additional milk production was significantly higher in small farmers followed by marginal, medium, landless and large category of farmers.

(V) Additional milk price: The additional milk production (gm/animal/day) under improved feeding of buffaloes in landless, marginal, small, medium and large category of farmers was 452±5.10, 402±5.22, 490±5.71, 402±5.51, and 415±5.52 respectively. Analysis of variance showed that additional milk production was significantly higher in small farmers followed by marginal, medium, landless and large category of farmers. Critical difference analysis revealed that differences between small and marginal, landless and medium and large category of farmers.

(VI) Additional net profit: The additional net profit (paisa/animal/day) of buffalo under landless, marginal, small, medium and large category of farmers was 392.83±2.22, 346.21±5.66 ±5.18, 434.08±5.66 and 359.26±5.57 respectively. Analysis of variance revealed that additional net profit was significantly higher in marginal farmer followed by small, medium, large and landless category of farmers.

(2) RAINY SEASON

(I) Order of lactation: The order of lactation of milch buffaloes under landless, marginal, small, medium and large category of farmers was 2.75 ± 0.29, 2.35 ± 0.25 2.40± 0.31, 2.35 ± 0.25 and 2.70 ±0.24 respectively. The order of lactation does not differ significantly among various categories of farmers.

(II) Stage of lactation: The stage of lactation of milch buffaloes under landless, marginal, small, medium and large category of farmers was 2.45±0.20, 2.55±0.26, 3.15±0.25, 2.55±0.27 and 3.15 ±0.26 respectively. Analysis of variance showed that stage of lactation varied significantly among various categories of farmers.

(III) Additional inputs: The additional input (paisa/animal/day) of buffaloes under landless, marginal, small, medium and large category of farmers was 54.15±1.08, 56.05±1.02, 53.85±1.00, 56.05 ± 1.02 and 54.90±1.05 respectively. Analysis of variance showed that additional inputs varied significantly among the various categories of farmers.

(IV) Additional milk yield: The additional milk production (gm/animal/day) under improved feeding of buffaloes in landless, marginal, small, medium and large category of farmers was 467±2.09,439±5.22 ,462±2.71 ,439±5.52 and 456 ±5.51 respectively. Analysis of variance showed that additional milk production was significantly higher in marginal category of farmers followed by small, medium, landless and large category of farmers.

(V) Additional milk price: The additional milk production (gm/animal/day) under

improved feeding of buffaloes in landless, marginal, small, medium and large category of farmers was 467±2.09, 439±5.22, 462±2.71, 439±5.52 and 456 ±5.51 respectively. Analysis of variance showed that additional milk production was significantly higher in large category of farmers followed by marginal, medium, landless and small category of farmers. Critical difference analysis revealed that differences between small and marginal, landless and medium and large category of farmers.

(VI) Additional net profit: The additional net profit (paisa/animal/day) of buffalo under landless, marginal, small, medium and large category of farmers was respectively. Analysis of variance revealed that additional net profit was 412.84±2.23, 382.94±5.65, 428.14±5.20, 382.94±5.65 and 401.09±5.56 significantly higher in medium followed by small, marginal, large and landless category of farmers.

(3) AUTUMN SEASON

(I) Order of lactation: The order of lactation of milch buffaloes under landless, marginal, small, medium and large category of farmer's was 2.65 ± 0.29, 2.45 ± 0.25 2.40± 0.31, 2.80 ± 0.25 and 2.75 ±0.24 respectively. The order of lactation does not differ significantly among various categories of farmers.

(II) Stage of lactation: The stage of lactation of milch buffaloes under landless, marginal, small, medium and large category of farmers was 2.45±0.21, 2.30±0.26, 2.85±0.25, 2.30±0.29 and 2.75±0.26 respectively. Analysis variance showed that stage of lactation varied significantly among various categories of farmers.

(III) Additional inputs: The additional input (paisa/animal/day) of buffaloes under landless, marginal, small, medium and large category of farmers was 58.56±1.09, 52.55±1.02, 53.02±1.00, 52.55±1.03 and 55.09±1.04 respectively. Analysis of variance indicated that additional inputs varied significantly among the various categories of farmers.

(IV) Additional milk yield: The additional milk production (gm/animal/day) under improved feeding of buffaloes in landless, marginal, small, medium and large category of farmers was 457± 5.09, 424±5.21, 427±5.71, 424 ±5.51 and 472±5.53 respectively. Analysis of variance showed that additional milk production was significantly higher in small farmers followed by marginal, medium, landless and large category of farmers.

(V) Additional milk price: The additional milk production (gm/animal/day) under improved feeding of buffaloes in landless, marginal, small, medium and large category of farmers was 457± 5.09, 424±5.21, 427±5.71, 424 ±5.51 and 472±5.53 respectively. Analysis of variance showed that additional milk production was significantly higher in small farmers followed by marginal, medium, landless and large category of farmers. Critical difference analysis revealed that differences between small and marginal, landless and medium and large category of farmers.

(VI) Additional net profit: The additional net profit (paisa/animal/day) of buffalo under landless, marginal, small, medium and large category of farmers was respectively. Analysis of variance revealed that additional net profit was 392.43±2.25, 371.45±5.66, 473.97±5.45, 371.45±5.54 and 416.90±5.57 significantly higher in marginal category of farmers followed by small, medium, large and landless category of farmers.

(4) WINTER SEASON

(I) Order of lactation: The order of lactation of milch buffaloes under landless, marginal, small, medium and large category of farmers was 3.55± 0.29, 2.15 ±0.25, 2.45± 0.31, 2.85± 0.25 and 2.85±0.24 respectively. The order of lactation does not differ significantly among various categories of farmers.

(II) Stage of lactation: The stage of lactation of milch buffaloes under landless, marginal, small, medium and large category of farmers was 2.25±0.21, 2.65±0.26, 2.10±0.23, 2.65±0.26 and 2.50±0.27 respectively. Analysis variance showed that stage of lactation varied significantly among various categories of farmers.

(III) Additional inputs: The additional input n(paisa/animal/day) of buffaloes under landless, marginal, small, medium and

large category of farmers was 54.20±1.09 ,58.28±1.01,55.27±1.02 ,58.28±1.01 and 60.06±1.05 respectively. Analysis of variance showed that additional inputs varied significantly among the various categories of farmers.

(IV) Additional milk yield: The additional milk production (gm/animal/day) under improved feeding of buffaloes in landless, marginal, small, medium and large category of farmers was 509±5.11, 522±5.20, 508±5.72, 522± 5.51 and 500±5.55 respectively. Analysis of variance showed that additional milk production was significantly higher in marginal farmers' followed by small medium, landless and large category of farmers.

(V) Additional milk price: The additional milk production (gm/animal/day) under improved feeding of buffaloes in landless, marginal, small, medium and large category of farmers was 509±5.11, 522±5.20, 508±5.72, 522± 5.51 and 500±5.55 respectively. Analysis of variance showed that additional milk production was significantly higher in large farmers followed by marginal, medium, landless and small category of farmers.

(VI) Additional net profit: The additional net profit (paisa/animal/day) of buffalo under landless, marginal, small, medium and large category of farmers was 392.43±2.25, 371.45±5.66, 473.97±5.45, 371.45±5.54 and 416.90±5.57 respectively. Analysis of variance revealed that additional net profit was significantly higher in medium followed by small, marginal, large and landless category of farmers.

(5) SPRING SEASON

(I) Order of lactation: The order of lactation of milch buffaloes under landless, marginal, small, medium and large category of farmers was 2.45±0.29, 2.55± 0.29, 3.15±0.25, 2.55± 0.25 and 2.55±0.24 respectively. The order of lactation does not differ significantly among various categories of farmers.

(II) Stage of lactation: The stage of lactation of milch buffaloes under landless, marginal, small, medium and large category of farmers was 2.75±0.20, 3.05±0.26, 2.25±0.23, 3.05±0.26 and 3.05±0.27respectively. Analysis of variance showed that stage of lactation significantly varied among various categories of farmers.

(III) Additional inputs: The additional input n(paisa/animal/day) of buffaloes under landless, marginal, small, medium and large category of farmers was 54.15±1.08, 56.05±1.02, 53.85±1.00, 56.05 ± 1.02 and 54.90±1.05 respectively. Analysis of variance reveled thatadditionalinputsvaried significantly among the various categories of farmers.

(IV) Additional milk yield: The additional milk production (gm/animal/day) under improved feeding of buffaloes in landless, marginal, small, medium and large category of farmers was 472±5.13, 426±5.23, 488±5.70, 426±5.71 and 457 ± 5.54 respectively. Analysis of variance showed that additional milk production was significantly higher in marginal farmers' followed by small, medium, landless and large category of farmers.

(V) Additional milk price: The additional milk production (gm/animal/day) under improved feeding of buffaloes in landless, marginal, small, medium and large category of farmers was 472±5.13, 426±5.23, 488±5.70, 426±5.71 and 457 ± 5.54 respectively. Analysis of variance showed that additional milk production was significantly higher in large farmers followed by marginal, medium, landless and small categories of farmers. Critical difference analysis revealed that differences between small and marginal, landless and medium and large category of farmers.

(VI) Additional net profit: The additional net profit (paisa/animal/day) of buffalo under landless, marginal, small, medium and large category of farmers was 415.79±5.11, 370.64±5.52, 430.89±5.62, 370.64±5.66 and 401.64±5.58 respectively. Analysis of variance revealed that additional net profit was significantly higher in medium followed by small, marginal, large and landless categories of farmers.

4. DISCUSSION

4.1 Improved Feeding

Average nutritional status of lactating cross-bred cows in various categories of farmers under

Table 4. Additional milk yield and prices in different seasons among various categories of farmers

Summer							
	Order of lactation (Number)	**Stage of lactation (Number)**	**Additional input price (Paise)**	**Additional milk yield (gram)**	**Additional milk price (Paise)**	**Additional net profit (paise)**	**Return per Rupees**
Landless	2.45 ± 0.94	2.25 ± 0.55	59.16 ± 3.12	452 ± 6.39	452 ± 6.34	392 ± 6.29	1:6.65
Marginal	3.25 ± 1.33	2.7 ± 0.86	55.15 ± 3.54	492 ± 4.90	492 ± 4.90	436 ± 6.80	1:7.96
Small	3.05 ± 1.19	2.85 ± 0.81	56.66 ± 2.20	490 ± 3.94	490 ± 3.94	434.08 ± 4.06	1:7.32
Medium	2.8 ± 0.95	3.15 ± 0.87	55.78 ± 2.82	402 ± 3.82	402 ± 3.82	346.21 ± 3.87	1:6.22
Large	2.65 ± 0.81	2.35 ± 0.58	55.78 ± 2.82	415 ± 3.94	415 ± 3.94	359.21 ± 3.09	1:3.72
A.V. & S.E.	2.84 ± 1.044	2.66± 0.73	56.50± 2.9	450.20 ± 4.59	450.2 ±4.59	393.50± 4.81	1: 6.37

Table 5. Seasonal variation in additional milk yield and prices across different farmer categories (Rainy)

Rainy							
	Order of lactation (Number)	**Stage of lactation (Number)**	**Additional input price (Paise)**	**Additional milk yield (gram)**	**Additional milk price (Paise)**	**Additional net profit (Ppaise)**	**Return per Rupees**
Landless	2.75 ± 1.06	2.45 ± 0.60	54.15 ± 2.29	667 ± 6.65	467 ± 6.65	412.85 ± 7.69	1:7.64
Marginal	2.75 ± 1.06	2.45 ± 0.60	55.29 ± 2.72	482 ± 7.25	482 ± 7.25	426.70 ± 9.07	1;7.74
Small	2.65 ± 0.87	3.15 ± 0.81	53.85 ± 3.36	462 ± 14.72	482 ± 7.25	428.14 ± 7.11	1:8.41
Medium	2.35 ± 0.58	2.55 ± 0.68	56.05 ± 1.69	439 ± 11.07	439 ± 11.07	382.94 ± 11.28	1:6.84
Large	2.7 ± 0.92	3.15 ± 0.87	54.90 ± 2.95	456 ± 10.76	456 ± 10.76	401.09 ± 10.25	1:7.32
A.V.& S.E.	2.64 ± 0.89	2.75± 0.71	54.84 ± 2.60	501.2 ± 8.59	501.2 ± 8.59	410.34 ± 8.80	1:7.59

Table 6. Seasonal variation in additional milk yield and prices across different farmer categories (Autumn)

Autumn							
	Order of lactation (Number)	**Stage of lactation (Number)**	**Additional input price (Paise)**	**Additional milk yield (gram)**	**Additional milk price (Paise)**	**Additional net profit (Ppaise)**	**Return per Rupees**
Landless	2.65 ± 0.93	2.45 ± 0.60	58.56 ± 4.82	451 ± 6.68	451 ± 6.68	392.43 ± 6.91	1:6.74
Marginal	2.95 ± 1.19	3.05 ± 0.82	55.15 ± 5.10	491 ± 3.72	491 ± 3.72	436.14 ± 6.73	1:7.97
Small	2.4 ± 0.88	2.85 ± 0.81	53.02 ± 4.07	427 ± 6.18	427 ± 6.18	373.97 ± 6.89	1:7.09
Medium	2.45 ± 0.94	2.3 ± 0.73	52.55 ± 4.04	424 ± 7.27	424 ± 7.27	371.44 ± 7.77	1:7.11
Large	2.55 ± 0.94	3.05 ± 0.88	55.35 ± 4.03	457 ± 6.06	457 ± 6.06	401.64 ± 6.92	1:7.61
A.V. & S.E.	2.60 ± 0.97	2.74 ± 0.76	54.92± 4.93	450 ± 5.98	450 ± 5.98	395.12 ± 7.04	1:7.30

Table 7. Seasonal variation in additional milk yield and prices across different farmer categories (Winter)

Winter							
	Order of lactation (Number)	**Stage of lactation (Number)**	**Additional input price (Paise)**	**Additional milk yield (gram)**	**Additional milk price (Paise)**	**Additional net profit (paise)**	**Return per Rupees**
Landless	2.55 ± 0.94	2.25 ± 0.71	54.20 ± 2.94	509 ± 5.04	509 ± 5.04	455.91 ± 4.95	1:8.68
Marginal	3.15 ± 1.34	2.25 ± 0.71	57.13 ± 1.65	516 ± 3.07	516.05 ± 3.11	458.91 ± 3.94	1:8.04
Small	2.45 ± 0.82	2.1 ± 0.55	55.72 ± 3.87	509 ± 6.82	509 ± 6.82	453.27 ± 7.51	1:8.18
Medium	2.15 ± 0.48	2.65 ± 0.93	58.28 ± 2.58	522 ± 8.22	522 ± 8.22	463.71 ± 8.77	1:7.97
Large	2.85 ± 1.34	2.5 ± 0.82	60.06 ± 2.75	500 ± 17.11	500 ± 17.11	439.93 ± 17.64	1:7.34
A.V. & S.E.	2.63± 0.98	2.35 ± 0.74	57.07± 2.75	511.2± 8.05	511.2± 8.05	454.34 ± 8.56	1:8.04

Table 8. Seasonal variation in additional milk yield and prices across different farmer categories (Spring)

Spring							
	Order of lactation (Number)	**Stage of lactation (Number)**	**Additional input price (Paise)**	**Additional milk yield (gram)**	**Additional milk price (Paise)**	**Additional net profit (paise)**	**Return per Rupees**
Landless	2.45 ± 0.82	2.75 ± 0.78	56.20 ± 3.63	472 ± 8.04	472 ± 8.04	415.79 ± 8.48	1:7.43
Marginal	3.05 ± 0.99	2.55 ± 0.68	54.11 ± 4.21	468 ± 6.67	468.45 ± 6.83	414.33 ± 7.36	1:7.71
Small	3.15 ± 1.08	2.25 ± 0.55	57.10 ± 2.02	488 ± 7.34	488 ± 7.34	430.89 ± 8.22	1:7.55
Medium	2.55 ± 0.94	3.05 ± 0.88	55.35 ± 4.03	426 ± 11.76	426 ± 11.76	370.64 ± 13.96	1:6.74
Large	2.55 ± 0.94	3.05 ± 0.88	55.35 ± 4.03	457 ± 6.06	457 ± 6.06	401.64 ± 6.92	1:7.30
A.V. & S.E.	2.75 ± 0.96	2.73± 0.75	55.62 ± 3.58	462.2 ± 7.97	462.2 ± 7.97	406.65± 8.98	1: 7.34

improved feeding in winter, spring, summer, rainy and autumn season and economic analysis of enhanced milk production (through improved feeding) has been incorporated in Tables 4 and 5, respectively.

Improved feeding trial was conducted on those animals, which were mostly deficient in DCPI under phase -1". Under improvement feeding trial 25 gm urea, 40 gm chalk and 40 gm common salt /animal/ day was given as additional feeding over the usual feeding practices by the farmers. Due to improved feeding additional milk yield was increased in all category of farmers in all season as follows.

The additional inputs did not differ significantly in all may be due to feeding of same amount of additional input under different categories of farmers in all seasons. Urea, chalk and mineral mixture were same quantity in different categories of farmers in all seasons. Overall additional input was observed to be 56.50± 2.9, 54.84 ± 2.60, 54.92± 4.93, 57.07± 2.75 and 55.62 ± 3.58 paise / animal/day in winter, spring, summer, rainy and autumn seasons, respectively.

The additional milk yield was 450.20 ± 4.59, 501.2 ± 8.59, 450 ± 5.98, and 511.2± 8.05 gram/animals /day in winter, spring, summer, rainy and autumn season, respectively (Table 5). The statistical analysis showed that milk production differed significantly (P< 0.01) in between seasons in all categories of farmers. It differs due to great difference in manage mental practices between categories under different seasons.

Additional net profit was significantly higher (P< 0.01) in different categories of farmers in different season because the net profit depends up on the milk selling price of milk and it has been already discussed that milk yield was differed significantly in different categories of farmers in different seasons. In the present study, the additional milk yield and additional net profit was positively correlated. Overall net profit was 393.50± 4.81, 410.34 ± 8.80, 395.12 ± 7.04,454.34 ± 8.56 and 406.65± 8.98 paise / animal/day in, summer, rainy autumn winter and spring seasons, respectively (Table 5).

The additional input did not differ significantly between categories under winter season, the additional milk yield and additional net profit was significantly (P<0.01) differed among the different farmer categories. Significant difference in additional milk yield was due to great difference in managemental practices. While, the net profit depends upon the additional milk yield. The additional input was 59.16 ± 3.12, 55.15 ± 3.54,56.66 ± 2.20, 55.78 ± 2.82and 55.78 ± 2.82 paise/animal/day in landless, marginal, small, medium and large category of farmers in summer season. While, While, net profit was 392 ± 6.29, 436 ± 6.80, 434.08 ± 4.06, 346.21 ± 33.87 and 359.21 ± 32.09 paise/animal/day in landless. 454.00+3.15, marginal, small, medium and landless category of farmers (Table 5). A Maximum additional input was in landless category of farmers hut maximum additional net profit was observed in marginal category of farmers. It may be due to that marginal category of farmers adopted better management practices in summer season than other categories.

In rainy season additional input differ non-significant between categories. It may be due to same intake of urea etc. in different categories of farmers. Additional milk yield varied significantly (P<0.01) among the categories. It may be due to great difference in managing mental practices between categories under spring season. Additional net profit also differed significantly (P<0.01) between categories. The net profit also depends on the milk yield. The additional input was 54.15 ± 2.29, 55.29 ± 2.72, 53.85 ± 3.36, 56.05 ± 1.69 and 54.90 ± 2.95 paise/animal/day while the profit 412.85 ± 7.69, 426.70 ± 9.07, 428.14 ± 7.11, 382.94 ± 11.28 and 401.09 ± 10.25 paise/animal/day in landless, marginal, small, medium and large Maximum category of farmers, respectively. Additional input and maximum additional net profit was observed in small category of farmers. It may be possible due to better management practices followed by small category of farmers in rainy season than other categories of farmers.

Under autumn season additional inputs did not differ significantly between categories. It may be due to the same improved feeding practices adopted by farmers among different categories. The Additional milk yield differed significantly (F<0.01) between different categories of farmers. It may be due to great differences in manage mental practices between categories. Additional net profit also differed significantly (P<0.0) among the categories because it depends upon milk yield. The additional input was 58.56 ± 4.82, 55.15 ± 5.10, 53.02 ± 4.07, 52.55 ± 4.04 and 55.35 ± 4.03 paise/animal/day. While, the net profit was 392.43 ± 6.91, 436.14 ± 6.73, 373.97 ±

6.89, 371.44 ± 7.77 and 401.64 ± 6.92 paise/animal/day respectively (Table 5). Maximum additional input was incurred by landless category of farmers but maximum additional net profit was observed in marginal category of farmers. It may be due to the reasonthat marginal categories of farmers followed better management practices in summer season than other categories of farmers. In winter season additional input did not differ significantly between categories. It may be due to same improved feeding practices adopted by various categories of farmers. The additional milk yield differed significantly (P<0.01) among the various categories of farmers. It may be due to great differences in housing, healthcare and milking management practices. Additional net profit also differs significantly (P<0.01). The net profit also depends upon the milk yield. The additional input cost 54.20 ± 2.94, 57.13 ± 1.65, 55.72 ± 3.87, 58.28 ± 2.58 and 60.06 ± 2.75 paise/animal/day while the net profit was 455.91 ± 4.95, 458.91 ± 3.94, 453.27 ± 7.51, 463.71 ± 8.77 and 439.93 ± 17.64 paise/animal /day in landless, marginal, small, medium and large category of farmers, respectively. Maximum additional input was involved in large category of farmers and maximum additional net profit was noted in medium category of farmers. It may be due to that medium category of farmers followed improved husbandry tpractices in winter season than other categories of farmers. In spring season additional input did not differ significantly between categories. It may be due to adoption of same improved feeding practices by various categories of farmers. Additional milk yield showed significant (P<0.01) difference among the categories. It may be due to great differences in overall husbandry practices between different categories of farmers under autumn season. Additional net profit, which depends on milk yvield and also differs significantly (P<0.01) between different categories of farmers. The additional input was 56.20 ± 3.63, 54.11 ± 4.21, 57.10 ± 2.02, 55.35 ± 4.03 and 55.35 ± 4.03 paise/animal/day while the net profit was 415.79 ± 8.48, 414.33 ± 7.36, 430.89 ± 8.22, 370.64 ± 13.96 and 401.64 ± 6.92 paise/animal/day in landless, marginal, small, medium and large category of farmers, respectively. Maximum additional input involved in small category of farmers and maximum net profit was observed under small category of farmers. It may possibly be due to following of better management practices by small category of farmers in autumn season than other categories of farmers. Overall 56.50± 2.9 paise/ animal/day of additional input generated 450.20 ± 4.59 gram/ animal / day as additional milk yield and gain in net profit from additional input of 393.50± 4.81paise/animal/day. In summer season additional input of 54.84 ± 2.60 paise/ animal/day as additional input produced 501.2 ± 8.59 gram/animal/ day as additional milk and gain in net profit from additional input 410.34 ±8.80paise/animal/day, in rainy season, 54.92± 4.93 paise/animal/day as additional input produced 450 ± 5.98 gram/animal/day as additional milk yield and gain in net profit from additional input 395.12 ± 7.04 paise/animal/day, in autumn season 57.07± 2.75 paise/animal/day additional input additional as season. produced 511.2± 8.05 gram/animal/davy as additional milk yield and gain in net profit from additional input was 454.34 ± 8.56 paise/animal/day in winter season. In spring season 55.62 ± 3.58 paise/animal/day as additional input produced 462.2 ± 7.97 gram/animal/day as additional milk yield and gain in net profit from additional input 406.65± 8.98 paise/animal/day. In a similar study urea feeding was were reported by Solimanet al. (2007) concluded that the lower the production manufacturing costs, the greater the local supplier's ability to compete, whether on the worldwide export market or in the home market, with the dumping practices of exporters. Tanwar et al. (2019)Studying 60 breast feeding buffaloes from four villages in the Jaipur area, researchers found that UMMB had a positive influence on the animals' milk production. When pretreated, the milk output was enhanced by 1.02 liters (13.21 percent) every day. Urea molasses mineral block consumption per buffalo averaged 375 grams per day, which resulted in increase of net profit from the sale of additional milk of Rs. 13.75 per day and a BC ratio of 1:13.67. Lactating buffaloes were fed UMMB to enhance milk output and revenue from maintaining them, thereby boosting milk production and ultimately increase in income money from keeping them. Maheshwari et al. (2021) concluded that crossbred cows should be promoted in the research region since they have a better net return than buffaloes, according to the findings of this study. A Break-even study showed that crossbred cow owners were able to cover their overall expenditure at a lower point than buffalo owners because crossbred owners achieved greater milk yield than buffalo owners.

4.2 Phase II

i. **Order of Lactation:** In the different farmers categories including landless, marginal, small, medium, as well as large,

the order of lactation among buffaloes were 2.45 ± 0.94, 3.25 ± 1.33, 3.05 ± 1.19, 2.8 ± 0.95 and 2.65 ± 0.81 respectively in summer season, 2.75 ± 1.06, 2.75 ± 1.06, 2.65 ± 0.87, 2.35 ± 0.58 and 2.7 ± 0.92 in rainy season, 2.65 ± 0.93, 2.95 ± 1.19, 2.4 ± 0.88, 2.45 ± 0.94 and 2.55 ± 0.94 in autumn season 2.55 ± 0.94, 3.15 ± 1.34, 2.45 ± 0.82, 2.15 ± 0.48 and 2.85 ± 1.34 in winter season, and 2.45 ± 0.82, 3.05 ± 0.99, 3.15 ± 1.08, 2.55 ± 0.94 and 2.55 ± 0.94 in spring season respectively. It was highest in the marginal group during the summer season, followed by small, medium, large, and landless farmers. In the rainy season, order of lactation was similar in landless, marginal and large categories, following small and medium categories. In autumn, marginal farmers had the highest order of lactation, followed by landless, large, medium, and then small farmers, The lactation order It was found to be greater in the marginal group in the winter, followed by large, landless, small, and medium in the winter, but in the spring, small farmers had the highest order of lactation, followed by marginal, medium, large, and landless categories of farmers. Statistically, it showed a significant difference in the order of lactation in various categories of farmers (P ≤ 0.05).

ii. **Stage of Lactation:** The stage of lactation among different farmers categories were 2.25 ± 0.55, 2.7 ± 0.86, 2.85 ± 0.81, 3.15 ± 0.87 and 2.35 ± 0.58 respectively in summer,, 2.45 ± 0.60, 2.45 ± 0.60, 3.15 ± 0.81, 2.55 ± 0.68 and 3.15 ± 0.87 in rainy season,2.45 ± 0.60, 3.05 ± 0.82, 2.85 ± 0.81, 2.3 ± 0.73 and 3.05 ± 0.88 in autumn season 2.25 ± 0.71, 2.25 ± 0.71, 2.1 ± 0.55, 2.65 ± 0.93 and 2.5 ± 0.82 in winter season and in spring season, it was 2.75 ± 0.78, 2.55 ± 0.68, 2.25 ± 0.55, 3.05 ± 0.88 and 3.05 ± 0.88, under landless, marginal, small, medium and large farmers, respectively. In the summer, medium farmers were found to be at a greater stage of lactation followed by small, marginal, large, and landless farmers. During the rainy season, small farmers had the highest lactation stage, followed by large, medium, marginal, and landless farmers. During the rainy season, the marginal and landless groups had comparable outcomes. In the autumn, the order of lactation was greater in the marginal and large categories, followed by the small, landless, and medium farmers, During the winter, the medium group had a greater lactation stage than the large, landless, marginal, and small categories, and in the spring, it was higher in the medium and large categories, followed by landless, marginal, and small categories. The statistical analysis of variance demonstrated a significant difference between various categories of farmers (P ≤ 0.05).

iii. **Additional Inputs cost:** The additional input cost (paise/animal/day) of buffaloes among landless, marginal, small, medium and large categories of farmers were 59.16 ± 3.12, 55.15 ± 3.54,56.66 ± 2.20, 55.78 ± 2.82and 55.78 ± 2.82 respectively in summer season, 54.15 ± 2.29, 55.29 ± 2.72, 53.85 ± 3.36, 56.05 ± 1.69 and 54.90 ± 2.95 in rainy season, , 58.56 ± 4.82, 55.15 ± 5.10, 53.02 ± 4.07,52.55 ± 4.04and 55.35 ± 4.03 in autumn season and 56.20 ± 3.63, 54.11 ± 4.21, 57.10 ± 2.02, 55.35 ± 4.0354.20 ± 2.94, 57.13 ± 1.65, 55.72 ± 3.87, 58.28 ± 2.58 and 60.06 ± 2.75 in winter season, and 55.35 ± 4.03 in spring season respectively. There was a significant difference in additional inputs cost in various categories of farmers among the seasons (P ≤ 0.05). The additional input cost differs significantly among different seasons in all farmer's categories.

iv. **Additional milk yield:** The additional milk yield (gm/animal/day) of buffaloes under various farmers categories were 452 ± 6.39, 492 ± 4.90,490 ± 3.94, 402 ± 33.82 and 415 ± 31.94 grams respectively in summer season, 6.65 ± 6.65, 482 ± 7.25, 462 ± 14.72, 439 ± 11.07and 456 ± 10.76in rainy season, , 451 ± 6.68, 491 ± 3.72, 427 ± 6.18,424 ± 7.27 and 457 ± 6.06in autumn season 509 ± 5.04, 516 ± 3.07, 509 ± 6.82, 522 ± 8.22 and 500 ± 17.11in winter season , and 472 ± 8.04, 468 ± 6.67, 488 ± 7.34, 426 ± 11.76 and 457 ± 6.06 in spring season among landless, marginal, small, medium and large categories of farmers, respectively. On perusal of data it was noticed that tThere was a significant difference(P ≤0.05) in increased milk production amongst different farmers 'categories (P ≤0.05), according to the data. During the summer season, there was increased milk output in the marginal farmer group followed by small, landless, large, and thenmedium farmers group was

much greater. It was discovered that in the winters, it was greater in the medium category, followed by marginal, small, landless, and large categories. During the rainy season, the marginal category produced more extra milk than the small, large, medium, and landless categories. Following large, landless, small, and medium categories, the marginal group demonstratedincreased milk output in autumn. During spring, small farmers had greater milk yields than landless, marginal, large, and medium farmers.

v. **Additional milk price:** Among landless, marginal, small, medium and large farmers categories, the additional milk prices were 451.55 ± 6.34, 492 ± 4.90, 490 ± 3.94, 402 ± 33.82 and 415 ± 31.94 paise, respectively, in the summer season, , 467 ± 6.65, 482 ± 7.25, 482 ± 7.25, 439 ± 11.07 and 456 ± 10.76 paise in the rainy season, 451 ± 6.68, 491 ± 3.72, 427 ± 6.18, 424 ± 7.27 and 457 ± 6.06 paise in the autumn season 509 ± 5.04, 516.05 ± 3.11, 509 ± 6.82, 522 ± 8.22 and 500 ± 17.11 paise in the winter season, and 472 ± 8.04, 468.45 ± 6.83, 488 ± 7.34, 426 ± 11.76 and 457 ± 6.06 paise in the spring season, respectively. During the summer season, marginal farmers received a higher additional milk price, followed by small, landless, large, and medium farmers. It was greater in the marginal and small categories during the rainy season, followed by landless, large, and medium. In the autumn season, marginal farmers received a higher extra milk price than large, landless, small, and medium farmers, During the winter, the medium group had a higher additional milk price than the marginal, landless, small, and large categories, while in the spring season, small farmers received a higher additional milk price than landless, marginal, large, and medium farmers. The statistical analysis showed a significant difference in additional milk prices among different categories of farmers ($P \leq 0.05$).

vi. **Additional net profit:** The additional net profit among landless, marginal, small, medium as well as large farmers categories were 392 ± 6.29, 436 ± 6.80, 434.08 ± 4.06, 346.21 ± 33.87 and 359.21 ± 32.09 respectively in summer season, 412.85 ± 7.69, 426.70 ± 9.07, 428.14 ± 7.11, 382.94 ± 11.28 and 401.09 ± 10.25 in rainy season, 392.43 ± 6.91, 436.14 ± 6.73, 373.97 ± 6.89,371.44 ± 7.77 and 401.64 ± 6.92 in autumn season 455.91 ± 4.95, 458.91 ± 3.94, 453.27 ± 7.51, 463.71 ± 8.77 and 439.93 ± 17.64 in winter season, and 415.79 ± 8.48, 414.33 ± 7.36, 430.89 ± 8.22, 370.64 ± 13.96 and 401.64 ± 6.92 in spring season respectively .During the summers, the marginal group had the highest additional net profit, following small, landless, large, and medium. Compared to marginal and small categories, the landless, large, and medium groups exhibited much lower incremental net profit. The increased net profit was greatest in small categories of farmers during the rainy season, followed by marginal, small, large, and medium. The marginal group demonstrated greater incremental net profit followed by large, landless, small, and medium farmers, the marginal group demonstrated greater incremental net profit in the autumn. Additional net profit was greater in the medium category in the winters, followed by the marginal, landless, small, and large categories. It was highest in the small category in the spring season, followed by landless, marginal, large, and medium. The results revealed that there was a substantial difference in additional net profit across landless, marginal, small, medium, and large categories of farmers ($P \leq 0.05$).

vii. **Return per Rupees:** Among various seasons of the year, return per rupee among landless, marginal, small, medium and large farmers categories were 6.65 ± 0.37, 7.96 ± 0.66, 7.32 ± 0.35, 6.22 ± 0.71 and 3.72 ± 0.69 respectively in summer, , 7.64 ± 0.43, 7.74 ± 0.51, 8.41 ± 0.57, 6.84 ± 0.31 and 7.32 ± 0.46 in rainy season,6.74 ± 0.61, 7.97 ± 0.76, 7.09 ± 0.61, 7.11 ± 0.61 and 7.61 ± 0.67 in autumn season 8.68 ± 0.59, 8.04 ± 0.28, 8.18 ± 0.73, 7.97 ± 0.41 and 7.34 ± 0.51 in winter season and in spring season, it was 7.43 ± 0.56, 7.71 ± 0.71, 7.55 ± 0.37, 6.74 ± 0.76 and 7.30 ± 0.65 respectively. During the summers, marginal farmers had a better return per rupee than small, landless, medium, and large farmers respectively. Compared to the other groups, the return per rupee for large farmers was much lower. It was highest in the landless category during the winter, followed by small, marginal, medium, and large farmers respectively. During the rainy

season, it was highest in small farmers, following marginal, landless, large, and medium farmers respectively. In the autumn season, marginal farmers earned more per rupee than large, medium, small, and landless farmers, It was highest in the landless category, followed by small, marginal, medium, and large farmers respectively during the winter, while in the spring season, marginal farmers earned more per rupee than small, landless, large, and medium farmers respectively. In all seasons, statistical analysis revealed a significant difference among various groups of farmers ($P \leq 0.05$).

5. CONCLUSION

The variation in the productivity of cows and buffaloes in different seasons is a universal phenomenon and caused by the variation in the breeding cycle of the animal, the environmental factors like temperature, humidity and the quality and quantity of feed and fodders supplied to the animals. The good genetic ability of buffaloes is of no use unless they are fed and managed adequately to maximize the milk production.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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