RESEARCH ARTICLE Indian Journal of Animal Research, Volume 58 Issue 6: 1047-1052 (June 2024)

Effect of Urea-molasses Multinutrient Block Supplementation on Productive and Reproductive Performance of Rural Buffalo Farms

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10.18805/IJAR.B-4527

ABSTRACT

Background: Buffaloes (*Bubalus bubalis*) have an immense importance in rural economy by virtue of their high production potential as triple purpose animal. Application of scientific technologies can further lead to significant productivity enhancement in buffaloes. Hence, the study was aimed to investigate adoption and effect of urea-molasses multinutrient block (UMMB) supplementation on buffalo productivity in rural areas of Punjab, India.

Methods: An expost-facto research design was employed to collect data from selected buffalo farmers (N-501) through personal interview by using pretested research instrument. Based on the response, the buffalo farms were categorized as technology adopter farms (TAF) and non-adopter farms (TNAF). The effect of UMMB supplementation on productivity was evaluated by considering various productive and reproductive parameters of buffaloes. Both parametric and non-parametric statistical tests were employed to analyse the data by using SPSS software.

Result: The results indicated that the buffalo farms (36.93%; 185/501) following an additional supplementation with UMMB had significantly ($p<0.05$) higher average daily milk yield per animal and lowered values of all reproductive parameters. This has proved the viability of UMMB technology at buffalo farms in study area. The study revealed that the technology plays valuable role in buffalo productivity enhancement, hence should be recommended to the government and propagated through vigorous activities at grass-root level to improve adoption.

Key words: Buffalo farms, Buffalo productivity, Technology adoption, UMMB supplementation.

INTRODUCTION

Buffaloes (*Bubalus bubalis*) have an immense importance in agriculture by virtue of their high production potential as a triple purpose animal that provides milk, meat and mechanical power to mankind (Sidikki *et al.,* 2015). Though the world population of 200 million buffaloes has been distributed over 40 countries, 97% population is confined to Asia and India with 109 million buffaloes hosts 57 per cent of the total population (Qureshi *et al.,* 2002; Sahoo *et al.,* 2004; Wynn *et al.,* 2009). Poor breeding ability in buffaloes as compared to cattle, is characterized by late maturity, poor and irregular expression of oestrous symptoms, silent heat, poor conception rate, early embryonic mortality and prolonged inter-calving interval (Phogat *et al.,* 2016). During recent years, buffalo milk is regaining its popularity with better awareness about the quality of milk and available technologies to reduce the fat content without changing other qualities. Better awareness and application of modern science and technologies can result into significant productivity enhancement in buffaloes The economy of buffalo can surpass cattle in all aspects (Hegde, 2019), however low milk yield, poor reproductive performance and low growth rate have been reported in buffaloes.

Supplementation of nutrients can improve buffalo productivity by the proper utilization of poor-quality roughages and fulfill the deficiency of nutrients (Sampath *et al.,* 1995). Urea-molasses multinutrient blocks (UMMB), also known as Uromin-lick (UML), Urea-molasses Mineral Blocks (UMMB), are multi nutrient blocks acting as a blend of energy, protein and minerals which act as an important feed supplement and life saver in ruminants. The results of previous UMMB supplementation studies in buffaloes

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How to cite this article: Nimbalkar, V., Verma, H.K. and Singh, J. (2024). Effect of Urea-molasses Multinutrient Block Supplementation on Productive and Reproductive Performance of Rural Buffalo Farms. Indian Journal of Animal Research. 58(6): 1047-1052. doi: 10.18805/IJAR.B-4527.

Submitted: 18-05-2021 **Accepted:** 31-08-2021 **Online:** 28-09-2021

showed rise in growth, supported moderate milk production and hence animal productivity (Prasad *et al.,* 2001; Sahoo *et al.,* 2004; Tanwar *et al.,* 2013). Results regarding animal response and economic benefits of using UMMB have been reported by a number of on station trials in India (Patel, 2002; Misra and Reddy, 2004). Feeding of UMMB supported 30 to 40% reduction in concentrate allowances without any loss of milk production (Singh and Singh, 2003; Misra and Reddy, 2004). The adoption of UMMB technology is carried out over 60 countries of the world including India where it was introduced first in 1983 by National Dairy Development Board (NDDB), Anand (Kunju, 1986a, b). On farm and large-scale field trials of the technology were conducted on replacement heifers and lactating crossbred cattle and buffaloes and revealed improvement in animal performance (Tanwar *et al.,* 2013).

However, the adoption of UMMB supplementation at buffalo farms is rare and only scanty information is available on its effect on animal productivity at farmer's field under routine management conditions in India. Hence, the study was aimed to investigate the socio-economic characteristics of buffalo farmers along with the adoption and effect of UMMB supplementation on productive and reproductive performance at their farms maintained under rural management practices. The study was conducted in state of Punjab, India as buffalo is native animal of the state and is well adapted to the local climatic conditions of the area.

MATERIALS AND METHODS

Locale of the study

The study was conducted in an agrarian state of India *i.e.* Punjab, which is located at the northwest end of India between 29″30′N to 32″32′N latitude and 73″55′E to 76″50′E longitude.

Research design and data collection

An expost-facto research design was used to study the adoption of UMMB technology as described by Wadhawa and Bakshi (2010). The study population was the buffalo farms belonging to 24 selected villages from six districts of the state. Multi-stage random sampling technique was followed to achieve a sample size of 501 buffalo farms calculated as per procedure given by Dhand and Khatkar (2014) for the proposed study. An interview schedule as a research instrument was designed for the purpose of collecting data and piloted on owners of buffalo farms having similar characteristics in proportion of 5% of sample size. The questions comprised both open and closed ended type regarding socio-economic and communication-profile of buffalo farmers. Technology adoption part of the questionnaire dealt with use, source and duration of adoption. The quantitative data focusing on productive and reproductive parameters were also recorded. The interview was followed in local language after receiving the buffalo farmer's participatory consent for the study. The study was conducted from June 2018 to May 2019 and data for the preceding one year was recorded during this study.

Operationalisation of variables and data analysis

A dictomous response in form of Yes (Score-1) or No (Score-0) was recorded for adoption of technology. Based on the response of farmers, the farms were categorized as technology adopter (TAF) and non-adopter farms (TNAF). The effect of UMMB supplementation on productivity of buffalo farms was evaluated by considering various productive and reproductive parameters. Services per conception was measured as the average number of natural services or artificial insemination required by the animal to get conceived or become pregnant.

The data were compiled by Microsoft Excel and analysis was done by using SPSS Statistic software for Windows, Version 20 developed by IBM company, USA.

Descriptive statistics were run for continuous/categorical variables. Chi-square analysis was performed to study the association between the adoption and socio-economic factors of respondent. Independent 't' test was performed to analyze subgroup differences in relation to outcome variables *i.e.* to compare means for productive and reproductive parameters of buffaloes between TAF (n=185) and TNAF (n=316). All results were considered statistically significant when $P \leq 0.05$.

RESULTS AND DISCUSSION

Socio-economic characteristics of buffalo farmers and technology adoption

Socio-economic characteristics of buffalo farmers presented in Table 1, revealed that most of the respondents belonged to middle age (44.90%), medium size family (53.50%) and had education up to high school level (32.30 %). The findings regarding education level are partially similar with buffalo owners of previous studies (Amin *et al.,* 2015; Singh *et al.,* 2011; Singh *et al.,* 2012). About 32.30% farmers were small land holders followed by medium (21.60%), marginal (19.80%), semi-medium (14.20%), land less (9.00%) and large farmers (3.20%). Almost half of the farmers were dependent on dairy as a primary source of income and majority (59.70) owned medium herd size (between 6-15 animals). Around 3/4th of buffalo owners possessed more than 10 years of dairy farming experience.

The data regarding adoption of UMMB supplementation, indicates that an additional supplementation with UMMB were followed at 36.93% (185/501) buffalo farms. Rest of the farms (63.07%, 316/501) were considered as Technology Non-Adopter Farms (TNAF). Chi-square statistics indicated that most of the socio-economic characteristics of buffalo farmers were significantly associated ($p<0.05$) with technology adoption except family size, agricultural land holding and dairy as a primary source of income. The findings are also supported by earlier studies (Quidus, 2012; Nimbalkar *et al.,* 2020).

The communication and social profile of respondents presented in Table 2, depicted that majority of farmers had medium level of extension contacts (70.50%) and mass media exposure (68.50%). Few of them had social participation (36.50%), training about dairy farming (12.20) and involvement in dairy projects (9.40%). All the characteristics studied as communication and social profile were found significantly associated with technology adoption. The adoption was found to be increased with more social participation as well as after attending the training on dairy farming. The finding corroborates with the study conducted by Kaaya *et al.* (2005) and Dehinenet *et al.* (2014).

Management practices followed at buffalo farms in India

Majority (311/501, 62.10%) buffalo farmers were also rearing cattle to boost their income, while rest (190/501, 37.90%) were owing buffaloes only. The total population of buffaloes in the study area was 2960 with average holding of 3.5 breedable buffaloes (Range: 1-23). Various management practices followed at buffalo farms in study area are presented in Table 3. Almost 4/5th of farmers owned Murrah buffaloes followed by Nili-Ravi (4.80%) and non-descript buffaloes (14.57%). Permanent housing was provided at 2/3rd of buffalo farms and majority were feeding green fodder regularly except few (11.78%). Wheat straw (Locally known as tudi) was mainly used as dry fodder. Mere feeding (0.60) of paddy straw was noticed along with regular silage feeding (8.98%). Concentrate feeding is followed at almost every buffalo farm, where majority of them were using commercial feed. As 37.72% farmers were using home-made feed, efforts must be done to train them in making balanced feed. Similar feeding practices were observed in villages of Punjab, Haryana and Madhya Pradesh (Yadav *et al.,* 2020). Around 3/4th of farmers have adopted mineral mixture supplementation in buffaloes. In case of breeding in

Table 1: Socio-economic characteristics of buffalo farmers in association with UMMB technology adoption.

Characteristics/categories	Non-adopters	Adopters	Total (%)	χ^2 value	p value
Age (years)					
Young (< 36)	72	61	133 (26.5)	6.244	0.044
Middle (36-50)	150	75	225 (44.90)		
Old (> 50)	94	49	143 (28.50)		
Education level					
Illiterate (no education)	42	13	55 (11.00)	11.943	.036
Primary (upto 4th)	46	21	67 (13.40)		
Middle (between 5th-8th)	52	28	80 (16.00)		
High school (between 9th-10th)	102	60	162 (32.30)		
Higher sec (between 11th-12th)	58	43	101 (20.20)		
Graduate (more than 12th)	16	20	36 (7.20)		
Family size (No. of family members)					
Small (upto 4)	94	63	157 (31.30)	1.129	0.569
Medium (between 5-8)	171	96	267 (53.30)		
Large (more than 8)	51	26	77 (15.40)		
Agricultural land holding (Hectors)					
Land less (no land)	37	8	45 (9.00)	10.406	0.065
Marginal (upto 1)	62	37	99 (19.8)		
Small (between 1-2)	96	66	162 (32.30)		
Semi-medium (between 2-4)	40	31	71 (14.2)		
Medium (between 4-10)	72	36	108 (21.60)		
Large (more than 10)	9	7	16 (3.20)		
Dairy as a primary source of income					
No	175	97	272 (54.30)	.408	0.292
Yes	141	88	229 (45.70)		
Dairy farming experience (Years)					
High (more than10)	254	131	385 (76.80)	6.250	0.044
Low (upto 5)	17	17	34 (6.80)		
Medium (between 5-10)	45	37	82 (16.40)		
Herd size					
Large (more than 15)	34	21	55 (11.00)	8.647	.013
Medium (between 6-15)	175	124	299 (59.70)		
Small (up to 5)	107	40	147 (29.30)		
Adoption of UMMB technology	**316 (63.07)**	**185 (36.93)**	**501 (100.00)**		

buffaloes, around 90.00% farms have adopted Artificial insemination (AI). Two third of the farmers followed herd replacement by both raising their own calves or by purchasing from outside farm.

Effect of UMMB technology adoption on productive and reproductive performance of buffaloes

From the results presented in Table 4, significant difference ($P<0.05$) was found in mean values of daily milk production

Table 2: Communication and social profile of buffalo farmers in association with UMMB technology adoption.

Characteristics/categories	Non-adopters	Adopters	Total (%)	χ^2 value	p value
Extension contacts (Mean score)					
High (upto 4)	36	67	103 (20.60)	57.864	.000
Low (more than 9)	43	2	45 (9.00)		
Medium (between 4-9)	237	116	353 (70.50)		
Mass media exposure (Mean score)					
High (more than 12)	60	44	104 (20.80)	13.132	.001
Low (upto 4)	46	8	54 (10.80)		
Medium (between 4-12)	210	133	343 (68.50)		
Social participation					
No	213	105	318 (63.50)	5.707	0.011
Yes	103	80	183 (36.50)		
Training attended					
No	286	154	440 (87.80)	5.756	0.016
Yes	30	31	61 (12.20)		
Project beneficiary					
No	301	153	454 (90.60)	21.620	0.000
Yes	15	32	47 (9.40)		

Table 3: Management practices followed at buffalo farms in Punjab, India.

Particulars	Categories	Frequency	Percentage
Breed reared	Murrah	404	80.64
	Nili-Ravi	24	4.80
	Non-descript	73	14.57
Housing/Shelter provided	Temporary (Kaccha) house	176	35.13
	Permanent (Pucca) house	325	64.87
Green fodder feeding	Regular	442	88.22
	As per availability	59	11.78
Dry fodder feeding	Wheat straw regular	483	96.41
	Wheat straw regular as per availability	15	2.99
	Paddy straw	3	0.60
Silage feeding	Regular with green fodder	45	8.98
	Sometimes with green fodder	26	5.19
	No silage feeding	430	85.83
Concentrate feeding	Regular	500	99.80
	Sometimes	1	0.20
Type of concentrate feed used	Commercial	234	46.71
	Homemade	189	37.72
	Both	78	15.57
Mineral mixture feeding	No	132	26.35
	Yes	369	73.65
Breeding	Artificial Insemination	447	89.22
	Natural Service	11	2.20
	Both	43	8.58
Herd replacement	Raised own calves	170	33.93
	Purchased from outside	12	2.40
	Both	319	63.67

Table 4: Effect of UMMB feeding on production performance of buffaloes at technology adopter and non-adopter farms.

Variables in cattle	Category	Mean±SE	Mean difference (MD)	't' Value	Sig.
Daily milk production per animal (litres)	TAF	4.93±0.09	.69	5.498	.000
	TNAF	4.23±0.09			
FAT percentage	TAF	7.09±0.03	.19	4.216	.000
	TNAF	6.90±0.02			
Peak yield (litres)	TAF	10.88±0.16	.53	1.106	.269
	TNAF	10.35±0.36			
Lactation yield (litres)	TAF	1603.86±30.79	130.99	3.124	.002

(TAF:185, TNAF:316).

Table 5: Effect of UMMB feeding on reproduction performance of buffaloes at technology adopter and non-adopter farms.

Variables in cattle	Category	Mean±SE	Mean difference	't' Value	Sig.
Age at maturity (months)	TAF	34.11±.32	-3.31	-7.298	.000
	TNAF	37.42±0.32			
First calving age (months)	TAF	44.84±0.35	-3.64	-7.221	.000
	TNAF	48.48±0.33			
Service period (days)	TAF	87.54±1.12	-12.57	-7.708	.000
	TNAF	100.11±1.18			
Dry period (days)	TAF	95.78±0.70	-6.30	-6.117	.000
	TNAF	102.09±0.75			
Lactation length (days)	TAF	327.38±2.86	-26.40	-6.817	.000
	TNAF	353.78±2.45			
Services per conception (In nos)	TAF	2.16±0.05	-.40	-5.962	.000
	TNAF	2.56±0.05			
Calving Interval (days)	TAF	423.16±3.06	-32.71	-7.986	.000
	TNAF	455.87±2.73			

per animal, fat percentage and lactation yield except in peak yield among TAF and TNAF. The average daily milk yield per animal was found higher by 0. 69 liters at TAF.

The mean values of all reproductive parameters in buffaloes (Table 5) were found significantly better (P<0.01) in TAF than TNAF indicating that UMMB feeding plays important role in improving the reproductive performance of buffaloes. The TAF observed reduction in maturity age, first calving age, service period, dry period, calving interval and lactation length than TNAF. The number of services per conception were also reduced at TAF. This could be observed because dietary supplementation of UMMB might have improved the voluntary dry matter intake and nutrient utilization, checked mineral deficiency and improved the productive and reproductive performance of buffaloes. The findings of the study were supported by Wadhawa and Bakshi (2010 and 2011), who had indicated that UMMB supplementation played pivotal role in productivity enhancement in buffaloes reared under rural management conditions.

CONCLUSION

The study concluded that majority of socio-economic characteristics and communication profile of buffalo farmers had major influence on adoption of UMMB supplementation. The feeding of these multi-nutrient blocks had beneficial effects in improving productivity of dairy buffalo by increasing daily milk production per animal and improving reproductive efficiency by means of lowering age at maturity, first calving age and calving interval with a smaller number of services. Thus, UMMB played valuable role in improving overall productivity of buffalo farms maintained under rural management practices. The study has also proved the viability of technology among buffalo farmers and further suggested that UMMB technology can be widely proposed for productivity enhancement of buffalo farms and consequently economic welfare of farmers. There is also an intense need to recommend the technology to the government for propagating it through vigorous activities at grass-root level to improve adoption.

ACKNOWLEDGEMENT

Authors are highly thankful to GADVASU, Ludhiana for permitting, supporting and facilitating this study. Further authors are highly thankful to farmers for spared their valuable time for this study.

Conflict of interest

All authors declare that they have no conflict of interest.

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