



Production and reproduction performance of buffalo, crossbred and indigenous cows in different agro-climatic zones of Uttar Pradesh

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Received: 25 July 2018; Accepted: 20 August 2018

ABSTRACT

The present study was undertaken to assess the production and reproduction performance of dairy animals among the farmers using mKisan services in different agro-climatic zones of Uttar Pradesh. A total of 225 farmers (45 each from five agro-climatic zones of UP) with their 301 buffaloes, 235 crossbred cows and 304 indigenous cows were considered. The study revealed that average daily milk yield, lactation length, lactation milk yield, peak milk yield, dry period, age at first calving, service period, services/ conception and calving interval for buffaloes were 5.7 ± 0.6 L/day, 298 ± 20 days, 1746.4 ± 94 L, 8.7 ± 0.5 L, 215 ± 21 days, 1295 ± 104 days, 174 ± 15 days, 2.1 ± 0.3 and 446 ± 42 days, respectively, for crossbred cows, 7.2 ± 0.5 L/day, 280 ± 21 days, 2200.4 ± 104 L, 11.0 ± 0.4 L, 232 ± 20 days, 1175 ± 111 days, 179 ± 18 days, 2.6 ± 0.4 and 439 ± 53 days, respectively and for indigenous cows, 3.8 ± 0.4 L/day, 193 ± 18 days, 1180.8 ± 83 L, 5.9 ± 0.3 L, 165 ± 15 days, 1548 ± 94 days, 261 ± 14 days, 2.5 ± 0.5 and 314 ± 43 days, respectively. The production and reproduction performance of dairy animals of Western zone and Mid-Western zone was significantly higher than Central Plain zone, North Eastern zone and Bundelkhand zone. Experience in livestock farming, accessibility of information sources, social relation & participation and herd size were positively and significantly correlated (0.167–0.359) with performance of dairy animals at household level. Whereas knowledge about dairy farming and message utilization index were having highly significant and positive relation (0.548, 0.511) with performance of dairy animals at household level.

Key words: Agro-climatic zones of UP, Buffalo, Crossbred cows, Indigenous cows, Production and Reproduction performance

Uttar Pradesh has a large livestock population, representing 10.2% of the cattle and 28.2% buffalo population in the country (GOI, 2012). Estimates indicated that 60% of farmers do not access any source of agricultural information and very small (< 6%) fraction of households obtain information about animal husbandry practices, resulting in huge adoption gap for recommended practices (NSSO, 2005). Government of India started mKisan services in the year 2013 to provide a unified platform to all the agencies involved in agricultural information generation and information delivery and to help farmers and buyers to interact with each other. A total of 5671.55 million messages have been sent till November 2017, out of which only 5.49% (311.50 million) messages were related to animal husbandry. Likewise, only about 16.4% farmers have been registered under this service in Uttar Pradesh (mKisan, 2017). Keeping in view the importance of this national level advisory service and low percentage of animal husbandry information available; it was felt essential to assess the existing production and reproduction

performance of cattle and buffaloes in different agro-climatic zones of Uttar Pradesh and factors affecting them.

MATERIALS AND METHODS

Present study was conducted in 5 agro-climatic zones of Uttar Pradesh. Out of the 9 agro-climatic zones in Uttar Pradesh (GOUP, 2010) 5 zones in term of their overall food grain productivity (highest and lowest productive zone with three other zones at equidistance place) were selected. One district was selected randomly from each agro-climatic zone, viz. Meerut in Western Plain zone, Bareilly in Mid-Western Plain zone, Allahabad in Central Plain zone, Gonda in North Eastern Plain zone and Hamirpur in Bundelkhand zone. From each district a total of 45 farmers (registered for the mKisan services since last 2 years and cultivating wheat besides rearing at least 2 cattle or buffalo, completed at least one lactation exclusively) were selected, randomly.

Production performance of the dairy animals was assessed through 5 parameters i.e. average daily milk yield, lactation length, lactation milk yield, peak yield and dry period and reproduction performance of the dairy animals was assessed on the basis of 4 parameters i.e. age at first calving, service period, services/conception and calving interval. Analysis of different parameters of dairy animals

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across zones were done using one way ANOVA and Tukey HSD post hoc analysis.

Performance of individual buffalo (B), crossbred cows (C) and indigenous cows (D) at household level was calculated with 9 performance parameters as:

$$B = \frac{\sum_{i=1}^9 I_j}{9} \quad C = \frac{\sum_{i=1}^9 I_j}{9} \quad D = \frac{\sum_{i=1}^9 I_j}{9}$$

I_j : Index value for j^{th} performance parameter

Index value I for each parameter was calculated as:

$$I_j = \frac{x_j - \text{Min} X_j}{\text{Max} X_j - \text{Min} X_j}$$

$j = 1, 2, 3 \dots 9$ parameters; X_j = value of j^{th} parameter

Performance of buffalo (P_B), crossbred cows (P_C) and indigenous cows (P_D) at household level was calculated as:

$$P_B = \frac{\sum B_b}{X_b} \quad P_C = \frac{\sum C_c}{X_c} \quad P_D = \frac{\sum D_d}{X_d}$$

where in B_b , C_c and D_d represent performance of b^{th} buffalo, c^{th} crossbred cows and d^{th} indigenous cows at household level, respectively. X_b , X_c and X_d represent total number of buffalo, crossbred and indigenous cows at household level, respectively.

Performance of dairy animals at household level (P) was estimated as mean of buffalo, crossbred and indigenous cows performance at household level:

$$P = \frac{P_B + P_C + P_D}{t}$$

t : type of dairy animal reared by farmers ($t=1, 2$ or 3 depends upon combination of dairy animals reared by farmers). Further, the performance of dairy animals at household level was correlated with different socio-economic and communicational variables to examine the effect of these factors on the performance.

RESULTS AND DISCUSSION

Distribution of dairy animals: Buffalo rearing was found highest among the farmers of Western zone (60.0%), followed by Mid-Western zone (55.6%), Central Plain zone (42.8%), North Eastern zone (40.0%) and Bundelkhand zone (35.6%). Crossbred cows rearing was found highest among the farmers of Western zone (60.0%), followed by Mid-Western zone (55.6%), Central Plain zone (37.8%), North Eastern zone (40.0%) and Bundelkhand zone (22.2%). Indigenous cows rearing was found highest among the farmers of Bundelkhand zone (55.6%), followed by Central Plain zone (48.9%), North Eastern zone (46.7%), Mid-Western zone (35.6%) and Western zone (31.1%).

Production performance: Average daily milk yield (DMY) for the buffaloes was 5.7 ± 0.6 L/day (Table 1). Among the different zones, no significant difference was observed in DMY of the buffaloes. Similar DMY of the buffalo in Faizabad (5.7L/day) and Unnao (5.4L/day)

district of Uttar Pradesh was reported by Meena *et al.* (2015) and Sachan *et al.* (2015). The DMY for crossbred cows was 7.2 ± 0.5 L/day. Similar finding was documented in BAH&FS, (2015). Meena *et al.* (2015) also reported that DMY of the crossbred cows in Faizabad district of Uttar Pradesh was 7.5 L/day. Among the different zones, DMY of crossbred cows reared by the farmers of Western zone was found highest (8.6 ± 0.3 L/day) followed by Mid-Western zone (7.6 ± 0.4 L/day), Central Plain zone (6.8 ± 0.5 L/day), North Eastern zone (6.6 ± 0.6 L/day) and Bundelkhand zone (6.5 ± 0.7 L/day). Similarly, DMY of the crossbred cows in Western zone was also found significantly higher than the crossbred cows of Central Plain zone. The DMY for the indigenous cows was 3.9 ± 0.4 L/day. Similar observation was recorded by Singh *et al.* (2017) for Gangatiri cattle and Meena *et al.* (2015) for indigenous cows in eastern region of Uttar Pradesh. Among the different zones, DMY of indigenous cows reared by the farmers of Western zone were found highest (4.6 ± 0.3 L/day) followed by Mid-Western zone (4.1 ± 0.3 L/day), Central Plain zone (3.7 ± 0.4 L/day), North Eastern zone (3.5 ± 0.5 L/day) and Bundelkhand zone (3.4 ± 0.5 L/day). It was also found that DMY of crossbred and indigenous cows of Mid-Western zone and Western zone were significantly higher than Bundelkhand zone and Eastern zone. However DMY of indigenous cows of Western zone were also found significantly high than Central Plain zone.

Average lactation length (LL) for the buffaloes in Uttar Pradesh was 298 ± 20 days (Table 1). Among the different zones, LL of buffaloes reared by the farmers of Western zone were found highest (318 ± 12 days) followed by Mid-Western zone (309 ± 16 days), Central Plain zone (296 ± 25 days), North Eastern zone (290 ± 21 days) and Bundelkhand zone (278 ± 28 days). The LL for buffalo of 276 days and 296 days were also reported by Meena *et al.* (2015) and Sachan *et al.* (2015) in Faizabad and Unnao district of Uttar Pradesh, respectively. The LL for the crossbred cows in Uttar Pradesh was 280 ± 21 days. Among the different zones, LL of crossbred cows reared by the farmers of Western zone were found highest (301 ± 9 days) followed by Mid-Western zone (293 ± 15 days), Central Plain zone (279 ± 21 days), North Eastern zone (272 ± 28 days) and Bundelkhand zone (258 ± 32 days). Similar LL for crossbred cows of 274 days was also reported by Meena *et al.* (2015). The LL for the indigenous cows was 193 ± 18 days. Among the different zones, LL of indigenous cows reared by the farmers of Western zone were found highest (211 ± 8 days) followed by Mid-Western zone (203 ± 12 days), Central Plain zone (192 ± 18 days), North Eastern zone (184 ± 24 days) and Bundelkhand zone (179 ± 28 days). Similarly Singh *et al.* (2017) and Meena *et al.* (2015) were also reported LL of indigenous cows as 197 and 294 days.

Average lactation milk yield (LMY) of the buffaloes in Uttar Pradesh was found to be 1746.4 ± 94 L (Table 1). The LMY of the buffaloes in Western zone were found highest (1782 ± 72 L) followed by Mid-Western zone (1756 ± 84 L), Central Plain zone (1742 ± 98 L), North Eastern zone

(1738±104L) and Bundelkhand zone (1674±113L). The results are in line with the finding of Kumar *et al.* (2013), Meena *et al.* (2015) and Sachan *et al.* (2015). The LMY of the crossbred cows in Uttar Pradesh was found to be 2200.4±108L. The LMY of the crossbred cows in Western zone was found highest (2616±81L) followed by Mid-Western zone (2314±98L), Central Plain zone (2074±104L), North Eastern zone (2006±112L) and Bundelkhand zone (1992±129L). The results are in line with the finding of Meena *et al.* (2015) and Kumar *et al.* (2013). Similarly, LMY of the crossbred cows in Mid-Western zone and Western zone were significantly higher than the LMY of crossbred cows of Bundelkhand zone. The LMY of the indigenous cows in Uttar Pradesh was found to be 1180.8±83L. The LMY of the indigenous cows in Western zone was found highest (1404±64L) followed by Mid-Western zone (1260±72L), Central Plain zone (1120±84L), North Eastern zone (1080±103L) and Bundelkhand zone (1040±95L). The results are in line with the finding of Meena *et al.* (2015) and Kumar *et al.* (2013). It was also found that LMY in Western zone was significantly higher than Central Plain zone, North Eastern zone and Bundelkhand zone.

Average peak milk yield (PY) for the buffaloes in Uttar Pradesh was found 8.7±0.5 L (Table 1). Among the different zones, no significant difference was observed in PY of buffaloes in different zones. Meena *et al.* (2015) and Sachan *et al.* (2015) also reported PY as 8.6 and 8.1 L for buffaloes in their respective study area of Uttar Pradesh. For the crossbred cows in Uttar Pradesh, PY was found 11.0±0.4L. Among the different zones, PY of crossbred cows reared by the farmers of Western zone was found highest (13.0±0.3L) followed by Mid-Western zone (11.6±0.3L), Central Plain zone (10.4±0.4L), North Eastern zone (10.0±0.5L) and Bundelkhand Zone (9.9±0.5L). Similar PY of crossbred cows were also reported by Meena *et al.* (2015) as 10.4L respectively. The PY for the indigenous cows in Uttar Pradesh was found 5.9±0.4 L. The PY for indigenous cows of 5.5 L was reported by Meena *et al.* (2015) in Faizabad district of Uttar Pradesh. Among the different zones, PY of indigenous cows reared by the farmers of Western zone was found highest (7.0±0.3L) followed by

Mid-Western zone (6.3±0.3L), Central Plain zone (5.6±0.4L), North Eastern zone (5.4±0.4L) and Bundelkhand zone (5.2±0.5L). It was also found that PY of the crossbred and indigenous cows in Mid-Western zone and Western zone were significantly higher than the crossbred and indigenous cows of North Eastern zone and Bundelkhand zone.

Average dry period (DP) of the buffaloes in Uttar Pradesh was 215±21 days (Table 1). The DP of the buffaloes in Bundelkhand zone was found highest (255±32 days) followed by North Eastern zone (231±24 days), Central Plain zone (206±22 days), Mid-Western zone (197±18 days) and Western zone (189±12 days). Sreedhar *et al.* (2017), Meena *et al.* (2015) and Sachan *et al.* (2015) also reported DP of buffaloes as 280, 226 and 156 days respectively. The DP of the crossbred cows in Uttar Pradesh was found 232±20 days. The DP of the crossbred cows in Bundelkhand zone was found highest (265±25 days) followed by North Eastern zone (241±28 days), Central Plain zone (233±21 days), Mid-Western zone (219±17 days) and Western zone (205±9 days). Meena *et al.* (2015) reported DP of the crossbred cows to be 211 days in Faizabad district of Uttar Pradesh. The DP of the indigenous cows in Uttar Pradesh was found 165±15 days. Singh *et al.* (2017) and Meena *et al.* (2015) also reported DP of indigenous cows to be 176.60 and 264 days, in their respective study area of Uttar Pradesh. The DP of the indigenous cows in Bundelkhand zone was found highest (183±23 days) followed by North Eastern zone (174±20 days), Central Plain Zone (168±19 days), Mid-Western zone (154±9 days) and Western zone (146±5 days). It was also found that DP of the buffalo, crossbred and indigenous cows in Bundelkhand zone was significantly higher than Mid-Western zone and Western zone.

Reproduction performance: The average age at first calving (AFC) was observed to be 1295±104 days for the buffaloes (Table 1). The AFC of the buffaloes in Bundelkhand zone was found highest (1342±116 days) followed by North Eastern zone (1310±108 days), Central Plain zone (1298±112 days), Mid-Western zone (1276±99 days) and Western zone (1252±87 days). The AFC of the buffaloes was reported to be 1288±122 days, 1482±162 days and 4.04 years by Meena *et al.* (2015), Sachan *et al.* (2015) and Sagar *et al.* (2013) in the Uttar Pradesh. While, AFC for buffaloes of North Eastern zone was found significantly higher than Western zone. The AFC was estimated to be 1175±111 days for the crossbred cows in study area. Similar AFC was reported to be 1170±88 days by Meena *et al.* (2015) in Faizabad district of Uttar Pradesh for the crossbred cows. The AFC of the crossbred cows in Bundelkhand zone was found highest (1222±126 days) followed by North Eastern zone (1190±119 days), Central Plain zone (1178±112 days), Mid-Western zone (1156±103 days) and Western zone (1132±98 days). While, AFC for crossbred cows of North Eastern zone was found significantly higher than Western zone. The AFC for indigenous cows was estimated as

Table 1. Production and reproduction performance of buffalo, crossbred and indigenous cows in Uttar Pradesh

Parameters	Buffalo	Crossbred cows	Indigenous cows
Average Daily Milk Yield (L)	5.7±0.6	7.2±0.5	3.9±0.4
Lactation Length (day)	298±20	280±21	193±18
Lactation Milk Yield (L)	1746.4±94	2200.4±104	1180.8±83
Peak milk yield (L)	8.7±0.5	11.0±0.4	5.9±0.4
Dry Period (day)	215±21	232±20	165±15
Age at first calving (day)	1295±104	1175±111	1548±94
Service Period (day)	174±15	179±18	261±14
Services per Conception (no.)	2.1±0.3	2.7±0.4	2.5±0.5
Calving Interval (day)	446±42	439±53	314±43

1548±94 days. It was also found that AFC of the indigenous cows in Bundelkhand zone was highest (1590±113days) followed by North Eastern zone (1569±105days), Central Plain zone (1551±98days), Mid- Western zone (1529±87days) and Western zone (1505±67days). The AFC of indigenous cows was reported to be 1517±131days and 3.78 years by Meena *et al.* (2015) and Sagar *et al.* (2013) in Faizabad and Sonbhadra districts of Uttar Pradesh, respectively. It was also found that AFC of the buffalo, crossbred and indigenous cows in Bundelkhand zone was significantly higher than the AFC in Mid- Western zone and Western zone. While, AFC for indigenous cows of North Eastern zone was found significantly higher than Western zone.

Average service period (SP) for the buffaloes was 174±15 days in Uttar Pradesh (Table 1). Among the different zones, SP of buffaloes reared by the farmers of Bundelkhand zone was found highest (210±23days) followed by North Eastern zone (193±16days), Central Plain zone (176±18days), Mid- Western zone (159±12days) and Western zone (134±9days). Dhaka *et al.* (2017) in Bundi district of Rajasthan, Meena *et al.* (2015) and Sachan *et al.* (2015) in Faizabad and Unnao district of Uttar Pradesh also reported SP of buffaloes as 240, 189 and 142 days. The SP for the crossbred cows was 179±18 days in Uttar Pradesh. Meena *et al.* (2015) also reported SP of crossbred cows as 197 days in study area. Among the different zones, SP of crossbred cows reared by the farmers of Bundelkhand zone were found highest (215±27days) followed by North Eastern zone (198±21days), Central Plain zone (181±19days), Mid- Western zone (164±15days) and Western zone (141±11days). The SP for the indigenous cows was 261±14 days. Meena *et al.* (2015) also reported SP of crossbred cows as 268 days in Faizabad district of Uttar Pradesh. Among the different zones, SP of indigenous cows reared by the farmers of Bundelkhand zone were found highest (293±23days) followed by North Eastern zone (276±18days), Central Plain zone (259±16days), Mid- Western zone (242±11days) and Western zone (239±60days). It was also found that SP of the buffalo, crossbred and indigenous cows in Bundelkhand zone was significantly higher SP than Mid- Western zone and Western zone.

Average services per conception (SPC) for the buffaloes were found 2.13±0.3. The SPC of the buffaloes was found highest in Bundelkhand zone (2.7±0.4) followed by North Eastern zone (2.1±0.4), Central Plain zone (2.0±0.4), Mid- Western zone (1.9±0.3) and Western zone (1.9±0.3). Dhaka *et al.* (2017), Sreedhar *et al.* (2017) and Sachan *et al.* (2015) estimated SPC for the buffaloes in their study area as 2.2, 2.5 and 2.6, respectively. Similarly SPC for the buffaloes of North Eastern zone was found significantly higher than the buffaloes of Western zone. The SPC for the crossbred cows were found 2.7±0.4. Vinothraj *et al.* (2016) also reported that SPC for the crossbred cows were 2.5±0.1 in Tamil Nadu. The SPC of the crossbred cows was found highest in Bundelkhand zone (3.3±0.4) followed by North

Eastern zone (2.7±0.6), Central Plain zone (2.6±0.4), Mid- Western zone (2.5±0.4) and Western zone (2.3±0.3). Similarly, SPC for the crossbred cows of North Eastern zone were found significantly higher than the crossbred cows of Western zone. The SPC for the indigenous cows were found 2.5±0.5 in study area. The SPC of the indigenous cows was found highest in Bundelkhand zone (2.9±0.6) followed by North Eastern zone (2.6±0.6), Central Plain zone (2.5±0.6), Mid- Western zone (2.3±0.4) and Western zone (2.1±0.3). It was also found that SPC for the buffalo, crossbred and indigenous cows of Bundelkhand zone were significantly higher than the indigenous cows of Mid- Western zone and Western zone.

Average calving interval (CI) of the buffaloes was 446±42days in Uttar Pradesh (Table 1). The CI of the buffaloes in Bundelkhand zone was found highest (496±61days) followed by North Eastern zone (474±54days), Central Plain zone (452±56days), Mid- Western zone (410±48days) and Western zone (402±36days). Similar CI of the buffaloes was observed by Dhaka *et al.* (2017) as 560 days in Rajasthan. Likewise, CI of the buffaloes was recorded by Meena *et al.* (2015) as 505 days in Faizabad, Sachan *et al.* (2015) as 450 days in Unnao and Sagar *et al.* (2013) as 17.15 months in Sonbhadra districts of Uttar Pradesh. The CI of crossbred cows was found 439±53 days. Similar CI of the crossbred cows (485 days) was observed by Meena *et al.* (2015) in Faizabad district of Uttar Pradesh. The CI of crossbred cows in Bundelkhand zone was found highest (492±63days) followed by North Eastern zone (462±56days), Central Plain zone (448±58days), Mid- Western zone (402±50days) and Western zone (394±38days). The CI of indigenous cows was found 314±43 days. The CI of indigenous cows was recorded by Singh *et al.* (2017) as 372.40 days for Gangatiri cattle in eastern Uttar Pradesh. Likewise, Meena *et al.* (2015), Sachan *et al.* (2015) and Sagar *et al.* (2013) also found similar results in different part of Uttar Pradesh. The CI of the indigenous cows in Bundelkhand zone was found highest (364±45days) followed by North Eastern zone (342±58days), Central Plain zone (320±42days), Mid- Western zone (278±38days) and Western zone (270±33days). It was also found that CI of the buffalo, crossbred and indigenous cows in North Eastern zone and Bundelkhand zone were significantly higher than Mid- Western zone and Western zone.

Household performance: Majority of the farmers (51.1%) were in the medium category of the household performance of dairy animals followed by low (30.7%) and high (18.2%) categories of household performance of dairy animals. Household performance of dairy animals of North Eastern zone (0.21±0.09), Bundelkhand zone (0.19±0.02) and Central Plain zone (0.24±0.12) was also found significantly lower to Western zone (0.37±0.06). Similarly household performance of dairy animals of Bundelkhand zone (0.19±0.02) was significantly lower to Mid- Western zone (0.32±0.12). This may be due farmers rearing high productive animals in Mid- Western and Western Agro-

Table 2. Household performance of dairy animals in different agro-climatic zones of Uttar Pradesh

Categories (Index)	North Eastern zone (n=45)	Bundelkhand zone (n=45)	Central Plain zone (n=45)	Mid-Western zone (n=45)	Western zone (n=45)	Pooled (N=225)
Low (0.08 to 0.23)	21 (46.7)	24 (53.3)	13 (28.9)	11 (24.4)	9 (20.0)	78 (30.7)
Medium (0.24 to 0.38)	19 (42.2)	18 (40.0)	25 (55.6)	23 (51.1)	22 (48.9)	107 (51.1)
High (0.39 to 0.54)	5 (11.1)	3 (6.7)	7 (15.6)	11 (24.4)	14 (31.1)	40 (18.2)
Mean	0.21±0.09 ^e	0.19±0.02 ^{de}	0.24±0.12 ^e	0.32±0.12 ^b	0.37±0.06 ^{abc}	0.26±0.05

Climatic zones of Uttar Pradesh (Table 2). Most of production and reproduction performance traits of dairy animals of Western and Mid- Western zone were found significantly better than Central Plain zone, North Eastern zone and Bundelkhand zone. It can be understood from the fact that most of districts of Eastern region and Bundelkhand region are considered in backward region of Uttar Pradesh (BRGF, 2014). These are low agricultural productive region in comparison to western region of the state (GOUP, 2010). Singh *et al.* (2016) also reported medium sustainability level for rearing of indigenous cattle in eastern Uttar Pradesh. Prasad, (2013) and Yadav *et al.* (2016) in their study in Eastern region of Uttar Pradesh observed poor knowledge and awareness among the farmers about improved dairy farming practices. Similarly in Bundelkhand, a drought prone region, dairy farmers also experience several constraints to cope up with drought condition like lack of knowledge about feeding practices for animals, lack of market access, high cost of feed and fodder, low water table of the area, inadequate and poor pasture land, lack of access to weather information, inadequate and irregular extension services and lack of awareness about government schemes (Singh, 2014).

Factors affecting performance at household level: Experience in livestock farming, accessibility of information sources, social relation & participation and herd size were positively and significantly correlated with performance of dairy animals at household level (0.167–0.359). Whereas knowledge about dairy farming and message utilization index were having highly significant and positive relation (0.548, 0.511) with performance of dairy animals at household level (Table 3). Thus it could be inferred that communication variables like accessibility to information sources, social relation & participation, message utilization index and knowledge about dairy farming are very important tools to manage the production and reproduction performance of dairy animals and helpful in improving milk productivity at household level. Similarly, Verma (2012) and Subhas *et al.* (2013) also observed that farmers rearing high yielding crossbred cows have better knowledge and are eager to update their knowledge through frequent contact with animal husbandry information sources and development agencies. Verma (2012) also found that farmers rearing low productive animals like indigenous cows were having poor knowledge about reproductive and productive practices of dairy animals in Faizabad district of Uttar Pradesh. Meena *et al.* (2015), Rahman and Gupta (2015)

Table 3. Correlation analysis of socio-economic and communicational variables with performance of dairy animals at household level

Variable	'r' value
Age	0.125
Education	0.077
Experience in livestock farming	0.359*
Availability of information sources	0.228
Accessibility of information sources	0.413*
Land holding	0.109
Herd size	0.167*
Social relation and participation	0.194*
Annual income	0.080
Knowledge about dairy farming	0.548**
Message utilization index	0.511**

*and ** represent significance level at 5% and 1%

also reported that communication variables like community relation, access to the resources & support services, mass media exposure, contact with personal localite and personal cosmopolite have significant and positive effect on knowledge level of dairy farmers and helpful in improving milk productivity.

Uttar Pradesh has a very large dairy animal population but there was significant variation in performance of dairy animals of different agro-climatic zones in Uttar Pradesh. Knowledge about dairy farming and higher accessibility and use of different information sources like mKisan agro-advisory services were found having positive and significant association with household performance of dairy animals. In order to exploit full genetic potential of dairy animals, there is urgent need to make deliberate efforts by the animal husbandry advisory services and other developmental agencies to make farmers more aware about different aspect for improvement in production and reproduction performance of these animals. Especially mKisan services should be more oriented toward providing customised agro-climatic zone specific information to farmers with respect to improvement in production and the reproduction related aspects. Further, the advisory agencies should also focus on promoting various other digital information tools / services for greater information access and sharing among the farmers.

ACKNOWLEDGEMENT

Authors gratefully acknowledge the ICAR-Indian Veterinary Research Institute, Izatnagar and UGC, New Delhi for their support during the course of study.

REFERENCES

- BAH&FS. 2015. Basic Animal Husbandry and Fishery Statistics. Department of Animal Husbandry Dairying and Fisheries, Ministry of Agriculture and Farmers Welfare, Government of India, New Delhi, India. Retrieved from <https://dahd.nic.in> on 25th November 2017.
- BRGF. 2014. Backward Regions Grant Fund Programme Guidelines. Ministry of Panchayati Raj. Government of India, New Delhi. Retrieved from <https://panchayat.gov.in> on 25th November 2017.
- Dhaka B L, Meena G S and Meena N L. 2017. Reproductive performance of buffaloes under field conditions in Bundi district of Rajasthan, India. *International Journal of Current Microbiology and Applied Sciences* **6**(4): 595–99.
- GOI. 2012. 19th Livestock census. Department of Animal Husbandry Dairying and Fisheries, Ministry of Agriculture & Farmers Welfare, Government of India, New Delhi, India.
- GOUNP. 2010. Annual plan, 2010–2011. Planning department, Government of Uttar Pradesh, Lucknow. Retrieved from <http://planning.up.nic.in> on 30th November 2017.
- Kumar D, Kadian K S, Jadoun Y S and Bhadauria P. 2013. Comparative analysis of the productive performance of milch animals of members of private dairy and dairy co-operatives. *Asian Journal of Dairy and Food Research* **32**(3): 191–94.
- Meena B S, Verma H C, Meena H R, Singh A and Meena D K. 2015. Field level study on productive and reproductive parameters of dairy animals in Uttar Pradesh, India. *Indian Journal of Animal Research* **49**(1): 118–22.
- mKisan. 2017. *Brief Overview of the mKisan Portal*. Department of Agriculture & Cooperation and Farmers Welfare, Government of India, New Delhi, India. Retrieved from <http://mkisan.gov.in> on 30th November 2017.
- NSSO (National Sample Survey Organisation). 2005. Situation assessment survey of farmers. NSS 59th Round (January - December 2003). NSSO, Government of India, New Delhi.
- Prasad B. 2013. 'A study on technological gap of dairy farming in Varanasi district of Uttar Pradesh.' MSc. Thesis, Banaras Hindu University, Varanasi, Uttar Pradesh.
- Rahman S and Gupta J. 2015. Knowledge and adoption level of improved dairy farming practices of SHG members and non-members in Kamrup district of Assam, India. *Indian Journal of Animal Research* **49**(2): 234–40.
- Sachan R, Sankhala G and Manjusha J. 2015. Productive and reproductive performance of buffalo. *Asian Journal of Animal Science* **10**(1): 29–36.
- Sagar V, Anand R K and Dwivedi S V. 2013. Nutritional status and reproductive performance of dairy cattle and buffaloes in Sonbhadra district of Uttar Pradesh. *International Journal of Science and Nature* **4**(3): 494–98.
- Singh M. 2014. 'Drought Coping Strategies among Dairy Farmers in Bundelkhand region of Uttar Pradesh.' M.Sc. Thesis, National Dairy Research Institute, Karnal, Haryana.
- Singh P K, Sankhala G, Singh A and Prasad K. 2016. Sustainability of Gangatiri cattle rearing. *Indian Journal of Animal Sciences* **86**(8): 936–39.
- Singh P K, Sankhala G and Singh P K. 2017. Performance of Gangatiri cattle rearing in field condition. *International Journal of Livestock Research* **7**(3): 142–48.
- Sreedhar S, Reddy A N, Sudhakar B V and Babu P R. 2017. Breeding management practices and reproductive disorders in indigenous cows and buffaloes. *Global Journal of Bio-Science and Biotechnology* **6**(3): 504–08.
- Subhash C, Meena B S, Kadian K S and Singh A. 2013. Knowledge of dairy farmers on reproductive disorders of dairy animals. *Veterinary Practitioner* **14**(1): 23–25.
- Verma H C. 2012. 'Productive and reproductive performances of dairy animals in Faizabad district of Uttar Pradesh.' M.V.Sc. Thesis, ICAR-National Dairy Research Institute, Karnal, Haryana.
- Vinothraj S, Subramaniyan A, Venkataramanan R, Joseph C and Sivaselvam S N. 2016. Genetic evaluation of reproduction performance of Jersey × Red Sindhi crossbred cows. *Veterinary World* **9**(9):1012–17.
- Yadav S P, Paswan V K, Sawant P and Bhinchhar B K. 2016. Breeding and calf rearing management practices followed in Varanasi district of Uttar Pradesh, India. *Indian Journal of Animal Research* **50**(5): 799–803.