



Effect of COVID-19 lockdown on bovine economy in Uttar Pradesh

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ABSTRACT

A study was conducted among 570 farmers spread across 57 districts (out of 75) of Uttar Pradesh from 10 April to 10 May 2020 by telephonic contact using the pre-structured interview schedule to assess the impact of CoVID 19 lockdown on the investment and profitability of major bovines of the state namely cattle and buffalo each with 460 data points. Different indicators for research variables namely investment pattern and profitability were measured by asking direct questions to the randomly selected 10 farmers from each district during the lockdown period and their experiences during last year (2019). The collected data were subjected for descriptive analysis - average, percentage, rank, standard deviation (SD) and coefficient of variation (CV), and also to the paired t-test to see the significance of difference, if any. Findings of the study showed that all the investments indicators like feed and fodder price, treatment cost, animal handling charges and total cost of milk production of cattle and buffalo enhanced significantly during the lockdown. The magnitude varied as per the nature of the cost components. The price variation was observed across the sample respondents and district. Similarly, for profitability indicators, there was reduction in the magnitude of milk sale (13-15%), selling price of milk (4-5%) and B:C ratio (5.2 -7.3%) significantly owing to lockdown. The perceptions of KVK experts from across the selected districts were also analyzed. During this period, KVKs of the state also disseminated various advisories, instructions, crop and enterprise-specific recommendations.

Keywords: CoVID19 lockdown, Investment, Livestock and dairying, Profitability, Uttar Pradesh,

The Indian livestock sector is predominated by cattle and buffalo with their combine population i.e. total bovine population (cattle, buffalo, mithun and yak) of 302.79 million in 2019 which shows an increase of about 1% over the previous census. The total number of cattle in the country in 2019 was 192.49 million with an increase of 0.8% over previous census. Likewise, the total buffaloes in the country are 109.85 million with increased growth rate of about 1% over previous census. Thus, the total milch animals (in-milk and dry) comprising only cows and buffaloes are 125.34 million in India which has witnessed an impressive 6% growth rate over the previous census. At the national level, about 17% of the total value of output from agriculture is derived from this sector, placing Indian milk sector in first place followed by rice (14.4%) and wheat (8.7%) in 1998-99 (CSO 2001). The state of Uttar Pradesh has highest share in terms of total population of milch animal and total milk production.

Cases of COVID-19 emerged in India by the middle of March 2020 and has spread widely albeit at lesser pace as compared to other countries and relatively less damage as

compared to countries like USA, Britain, Italy, etc. (Dev 2020). Due to lockdown imposed consequently, the economic shock was much more severe for India mainly because of two reasons. Firstly, pre-COVID-19, the economy was already slowing down, compounding existing problems of unemployment, low incomes, rural distress, malnutrition, and widespread inequality. Secondly, India's large informal sector is particularly vulnerable (Rawal and Kumar 2020). The virus has taxed dairy farmers in a number of ways, the first being management of dairy animals besides the marketing and sale of milk and other by-products. Due to the lockdown, all eateries and sweet shops are closed, leading to low demand for milk and other dairy products (Vivek 2020). Both of them further argued that milk prices have fallen, putting greater stress on farmers.

More than 70% of milk is being produced by small farmers as milk provides immediate cash for their livelihood. These small farmers are worst hit due to lower demand and consequently no/partial procurement due to lockdown. The major share of milk is handled by the unorganised sector comprising milkmen, milk contractors, *halwai* shops/creameries/city-based private dairy shops etc., while only 30% is handled by the organised sector—dairy cooperatives and private milk plants (Inderpreet and Pranav 2020). Of course, during the initial phases of the lockdown

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restrictions, both milk procurement and sales of milk were impacted in several parts of the country due to supply chain disruptions. Information collected by National Dairy Development Board (NDDB) from the dairy cooperatives showed a decline in daily liquid milk sales by dairy cooperatives by about 15% in the COVID-19 lockdown period between March 1-15 and April 8-14, and a drop in the proportion of sales to procurement by about 8.8% during the same period (Dilip 2020).

The further consequence of lockdown on the dairy sector has been aptly highlighted by Shashidhar (2020), who estimated that ₹100,000 crore Indian dairy industries has suffered a 25-30% dip in demand ever since the country shut down for the COVID-19 lockdown over two weeks ago. While the first two days witnessed a 15-20% surge in demand with consumers hoarding milk, there has been consistent fall in demand from the third day onwards. A large portion of the dip in demand is due to out-of-home consumption, which contributes 15% of the milk consumption, coming to a grinding halt. In the given context, therefore, it is worth investigating the effect of lockdown on economic indicators of dairy production in Uttar Pradesh as it is the major state in livestock and dairying and also to bridge the existing knowledge gap by making empirical assessment.

MATERIALS AND METHODS

Present analysis was carried out in the Uttar Pradesh covering 57 districts (76%) out of 75, representing eastern (16 districts), western (17 districts), central (16 districts) and Bundelkhand (7 districts) zones of the state so as to have a realistic representation of the farmers. From each district, 10 farmers (randomly chosen) were interviewed telephonically by the related Krishi Vigyan Kendras of the district during 10 April to 10 May 2020. Thus total of 570 farmers were interviewed using the structured interview schedule. The post-stratification showed that there were 460 data points each for cattle and buffalo farmers. The major research variables included were the investment and the profitability parameters affected due to COVID-19 lockdown. In order to derive the effect objectively, the same respondents were asked to furnish the information during same period of last year (March–May 2019) as compared to lockdown period (March–May 2020). Thus, before-after design of research was utilized for the investigation. As it was a matter of fact that we may not have any situation wherein there was no lockdown due to COVID-19, the chance of any confounders has been nullified. Hence, whatever effect of lockdown (2020) was estimated that was with reference to same period of the last year (2019). Thus, the robustness of the research design of the study was ensured. The indicators taken under investment variables were purchase price of production inputs like feed (₹/q), fodder (₹/q), animal treatment cost (₹/animal), milk production cost (₹/lit) and labour charge (₹/head/day) during lockdown period (March–May, 2020) and their corresponding price during the same period of 2019

separately for cattle and buffalo. Likewise, for profitability variable, the indicators included were milk production (litre/animal/day), milk consumption (litre/day/households), quantity of milk sold (litre/day/household), milk selling price (₹/litre) and the B:C ratio. Besides, the data were also collected from 105 scientists including the SMS (animal sciences) of the selected 57 KVKs on their perception of effect of lockdown on the livestock keepers in their district to cross-validate the results. The data collected on the above parameters were subjected for descriptive analysis namely average, percentage, rank, standard deviation (SD) and coefficient of variation (CV) and also the inferential statistics of paired t-test to see the significance of difference, if any.

RESULTS AND DISCUSSION

Effect on investment pattern

Cattle: The results shown in Table 1 indicate that among all costs, the highest difference in cost during lockdown period was for feed cost (₹ 258.71/q) followed by fodder cost (₹ 147.57/q), animal treatment cost (₹ 78.19/animal) and animal labour charge (₹ 32.98/labour/day). All this cost increase ultimately led to increase in cost of production of cattle milk to the extent of ₹ 3.17/litre during lockdown period (₹ 30.64/litre) as compared to the same period (₹ 27.47/litre) of last year (2019). Waghmode (2020) also shared the experiences of Gokul Dairy in Maharashtra which says that during lockdown owing to restricted supply of the raw materials, the production of cattle feed was reduced by 50% which affected the purchase price of the cattle keepers. Further analysis showed that the investment made in feed, animal treatments, animal labours and overall cow milk production increased highly significantly ($P < 0.05$) whereas the purchase price of green fodder varied significantly only ($P < 0.10$). Another interesting dimension of investment in cattle rearing during lockdown period emerged was the extent of stability in their price variation which was very high for fodder cost (CV: 1.62) and milk production cost (CV: 1.08) and it implied that in many of the places in the state, the green fodders were available on the exorbitantly high price, which might have resulted in greater instability in milk production cost during lockdown period. Similarly, animal treatment cost also showed higher degree of variation (CV: 0.61) during lockdown but comparable with the last year (CV: 0.60) which indicates that animal treatment charges though varied to greater extent but had lesser effect of lockdown. Such greater variation is comprehensible on the ground that for complex treatment the charges may be more as compared to less complex treatments which resulted in the observed variation. Though the magnitude of increase in feed cost was highest (₹ 258.71/q), the CV was less (0.29) which indicate that its price increased uniformly across the districts and cattle keepers of the study area. Similar was the case with variation in the animal labour charge which also showed greater stability thereby indicating the relatively more uniform changes of animal handling charges.

Table 1. Relative status of investment in livestock rearing during lockdown period

Animal category (Data points)	Feed (concentrate) cost (₹/q)		t value	Fodder cost (₹/q)		t value	Animal treatment cost (₹/animal)		t value	Cost of production (₹/litre)		t value	Animal labour charge (₹/labour/day)	t value
	2018–19	2019–20		2018–19	2019–20		2018–19	2019–20		2018–19	2019–20			
Cattle (460)	2062.76	2321.47	-8.72 ^a	299.02	446.59	-3.16 ^a	450.32	528.51	-5.08 ^a	27.47	30.64	-8.06 ^a	233.09	266.07
	-551.39	-677.75	0.00017 ^{b*}	-192.31	-724.07	0.001 ^{b**}	-269.94	-324.03	0.00026 ^{b*}	-28.16	-33.13	0.0012 ^{b*}	-50.03	-55.28
	(0.27)	(0.29)	0.00031 ^{c*}	(0.64)	(1.62)	0.002 ^{c**}	(0.60)	(0.61)	0.00052 ^{c*}	(1.03)	(1.08)	0.0024 ^{c*}	-0.21	(0.21)
Difference value	258.71		-	147.57		-	78.19		-	3.17		-	32.98	-
Buffalo (460)	2115.74	2374.23	-8.72 ^a	286.29	418.14	-3.16 ^a	778.62	885.74	-5.08 ^a	23.79	26.3	-8.06 ^a	233.09	266.07
	-573.23	-696.24	0.00013 ^{b*}	-191.21	-222.2	0.001 ^{b*}	-1060.16	-1156.07	0.00035 ^{b**}	-6.23	-6.44	0.0013 ^{b*}	-50.03	-55.28
	(0.27)	(0.29)	0.00027 ^{c*}	(0.67)	(0.70)	0.003 ^{c*}	(1.36)	(1.31)	0.00070 ^{c*}	(0.26)	(0.24)	0.00027 ^{c*}	-0.21	(0.21)
Difference value	258.49		-	131.85		-	107.12		-	2.51		-	32.98	-

Figures in () indicate standard deviation, figures in () indicate coefficient of variation. ^aindicates t value, ^bindicates P value (one-tail) and ^cindicates P value (two-tail). 2019–20: Lockdown period (March–May, 2020); 2018–19: No Lockdown period (March–May, 2019). *P<0.05; **P<0.10.

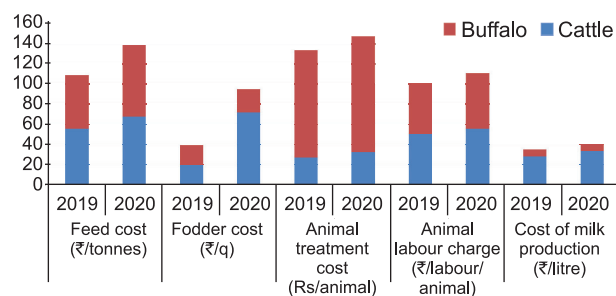


Fig. 1. Standard deviation (SD) of the investment indicators in cattle and buffalo during lockdown (2020) and non-lockdown (2019) period.

The standard deviation of the different investment indicators of cattle owners during lockdown period and non-lockdown period are shown as in Fig 1. The graph shows that for cattle keepers, the deviation was more for feed and fodder cost during lock down period and as compared to the same period of last year. For other indicators, the SD seems to be comparable over both the years.

Buffalo: Table 1 further shows that for buffalo keepers also, the magnitude of price difference was highest for feed (₹ 258.49/q) followed by fodder (₹ 131.85/q)—little lesser than cattle, and animal treatment (₹ 107.12/animal). The least price difference was found for animal labour charge (₹ 33/labour/animal) and cost of production of buffalo milk (₹ 2.51/litre) which is lesser by ₹ 0.66 for cattle milk price. It means, during the lockdown period, price of cattle milk production increased with greater magnitude than buffalo milk despite the fact the buffalo milk are higher in production and demand in the state than cows' milk. When the indicator wise price were subjected to paired t-test to see the significance of the difference, it was observed that all the indicators varied very significantly ($P<0.05$) during lockdown period as compared to the same period of last year (2019). It led to understand that lockdown had very adverse effect on the buffalo farmers' investment pattern and scale. It is a matter of fact that though the Government of Uttar Pradesh had taken several measures to protect the dairy farmers' interest, the lockdown prohibited the supply and services system including green fodder supply which might have increased the cattle owners' investment in dairying. Ila Patnaik (2020) also observed that dairying being the input intensive proposition demands higher investment than other enterprises. Unlike the variation in fodder cost for cattle which was very high (CV: 1.62), fodder price seems to be more stable for buffalo keepers (CV:0.70). This is possible on the ground that dairy farmers might have resorted more to grazing for buffalo as compared to cattle and such variation might have emerged. Likewise, there was greater stability in the feed cost (CV: 0.29), animal labour charges (CV: 0.21) and cost of buffalo milk production (CV: 0.24). However, there was again the contrast pattern in case of animal treatment cost for which there was higher variability in response (CV: 1.31) as compared to cattle (CV: 0.61). This implies that buffalo keepers might have paid higher differential price for animal

treatment during the lockdown period. The standard deviation of the different investment indicators of buffalo keepers during lockdown period and non-lockdown period are shown as in Fig 1. The graph shows that for buffalo owners, the deviation in response was highest for animal treatment cost followed by feed cost and animal labour charges. These deviations were minimum for fodder cost and overall cost of milk production. Compared to non-lockdown period of last year (2019), SDs were comparable for all the indicators, which imply that the deviations in the observations during 2020 were not because of the lockdown effect rather the other unobserved variables were responsible for it.

Effect on profitability indicators

Milk production: The results shown in Table 2 indicate that milk production level reduced nominally during lockdown period both for cattle (0.12 lt/animal/day) and buffaloes (0.23 lt/animal/day) as compared to the same period of last year (2019). For buffaloes, the reduction level was statistically significant ($P < 0.01$). However, the level of variation in the milk production was more for cattle (CV: 0.51) than buffaloes (CV: 0.34) and accordingly the standard deviation followed the same trend (Fig 2). In another words, it can be derived that even though the prices of most of the production inputs were raised due to lockdown, livestock owners preferred to rear their animals as per their normal situations and as a result, the milk production level was affected marginally.

Milk consumption: Analysis further revealed that daily milk consumption level of every sample household enhanced by about 1 litre per day per house both for cattle and buffalo (Table 2). This increased milk consumption may be because of the reduced outlets for milk disposal during lockdown and there was more availability of milk at the household level. The increased milk consumption level was significantly higher ($P < 0.01$) during lockdown as compared to the same period of previous year. However, the variation in the response was more stable for the buffalo keepers (CV: 0.51) as compared to the cattle keepers (CV: 0.71) and the standard deviation was in the similar pattern as indicated in Fig. 2.

Quantity of milk sold: As the milk consumption rate

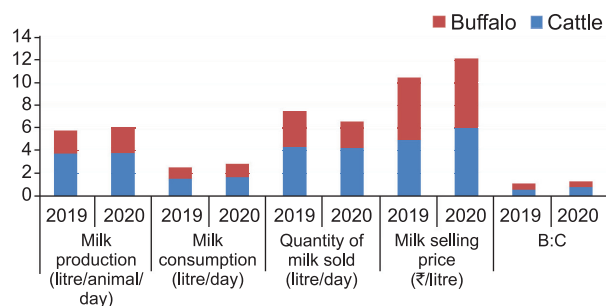


Fig. 2. Standard deviation (SD) of the profitability indicators in cattle and buffalo during lockdown (2020) and non-lockdown (2019) period.

Table 2. Relative status of economic indicators in livestock rearing during lockdown period

Animals	Milk production (lit/day/animal)		Milk consumption (lts/day)		Quantity of milk sold (lit/day)		Milk selling price (Rs/lit)		B:C ratio		t value	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
Cattle	7.14	7.26	1.34	2.19	5.8	5.07	32.65	31.32	1.65	1.53	2.44 ^a	2.48 ^a
	-3.69	-3.71	-1.48	-1.62	-4.37	-4.29	-4.94	-6.01	-0.6	-0.81	0.04 ^{b*}	0.31 ^b
	(0.52)	(0.51)	(0.73)	(0.71)	(0.74)	(0.71)	(0.16)	(0.18)	(0.36)	(0.53)	0.08 ^{c**}	0.62 ^c
Difference value	0.12	-	0.91	-	-0.73	-	-1.33	-	-0.12	-	-	-
Buffalo	6.5	6.73	1.26	2.25	5.24	4.48	41.17	39.14	1.73	1.64	0.55 ^a	2.48 ^a
	-2.01	-2.27	-1.02	-1.15	-3.03	-2.21	-5.48	-6.15	-0.44	-0.43	0.009 ^{b*}	0.008 ^{b*}
	(0.31)	(0.34)	(0.52)	(0.51)	(0.57)	(0.43)	(0.14)	(0.15)	(0.25)	(0.26)	0.018 ^{c*}	0.016 ^{c*}
Difference value	0.23	-	0.99	-	-0.76	-	-2.03	-	-0.09	-	-	-

Figures in () indicate standard deviation, figures in parenthesis indicate Coefficient of variation. ^aindicates t value, ^bindicates P value (one-tail) and ^cindicates P value (two-tail). 2019-20: Lockdown period (March-May, 2020); 2018-19: No Lockdown period (March-May, 2019). * $P < 0.05$; ** $P < 0.10$.

showed increased trends (above sub-head), it had inverse bearing on the quantity of milk sold on daily basis. Results in Table 2, therefore, shows that average quantity of milk sale per day was reduced to the extent of 0.73 lit/day for cattle and marginally more (0.76 lit/day) for buffalo milk. This reduction in milk sale was however statistically non-significant for both the animals.

Again, the extent of stability in the response of quantity of milk sold daily was better for buffalo (CV: 0.43) than cattle (CV: 0.71) and the standard deviation for both were quite high as shown in Fig. 2.

Milk selling price: The major effect of lockdown was on the selling price of the milk as owing to absence of transportations and closure of shops in city compelled the dairy farmers to sell their milk at the lesser price. As indicated in Table 2, the selling price of milk was reduced to the extent of ₹ 2.03/lit for buffalo milk and ₹ 1.33/lit for cow milk.

The reduction in selling price was experienced uniformly by the respondents, therefore, it was observed to be highly significant ($P < 0.01$) over the same period of last year (2019). Relatively very low CV both for cattle (0.18) and buffalo (0.15) milk selling price (Table 2) indicate that the reduction in selling price did not vary much between the respondents. However, the highest SD for this variable compared to other indicators gives the clue that few of the respondents might have experienced very high reduction in milk selling price than others (Fig 2) which was not the case for other indicators.

B:C ratio: As major economic indicators like quantity of milk sold and milk selling price have reduced during lockdown period, it has corresponding implication on the overall profitability level in dairying. As shown in Table 2, the BC ratio has also been declined for cattle (7.28%) and buffalo (5.20%). There was loss of 12 paisa and 9 paisa for a rupee invested in milk production of cattle and buffalo respectively. These figures may have enormous economic implications if computed in physical terms for the whole state. Results also showed that difference in the BC ratio during lockdown and non-lockdown period of the last year was highly significant ($P < 0.05$). The reduction in B:C ratio was felt so uniformly that the both CV (0.26 for buffalo and 0.50 for cow) as well as SD (0.43 and 0.81) respectively were less as compared to other indicators. The extent of

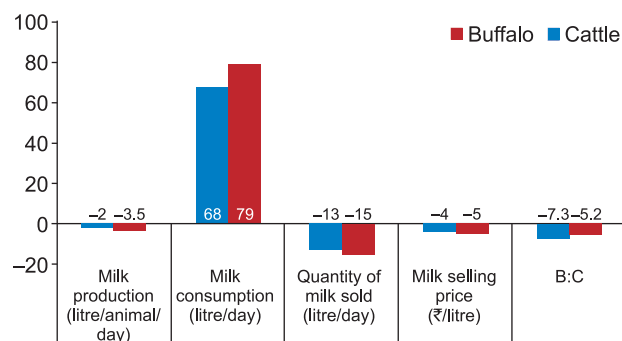


Fig. 3. Reduction in the profitability indicator (%)

reduction (%) in the various profitability indicators are shown below as in Fig. 3.

Perception of KVKs on the effect of lockdown

KVK experts unanimously agreed (90%) that there was fear prevailing among the animal handling labour to move out during CoVID lockdown (Table 3) and as a result, the dairy animal management works were getting affected. This reason was also having the highest severity index (22.56).

In general, the lockdown created closure of all veterinary-outlets despite the notification by the state government for opening the agriculturally important input stores. This fact was also confirmed by the KVK specialists (85.45%) that there was limited to nil availability of veterinary-inputs due to shutdown of such outlets and those few who use to open kept very high price of inputs especially the medicines, vaccines, etc as indicated in Table 1. The situation of lockdown further showed that the price of dairy products like milk, curd, *paneer*, etc was affected and came down because of non-availability of the transport facilities and closure of the related shops as highlighted by 80.90% of the respondents. The severity of this issue was third-ranked with an index value of (20.27). The green fodder and feed concentrates availability were restricted during the lockdown period and as a result, their prices were magnified as also indicated in Table 1. This issue was also having a considerable severity index (18.46). As a results of lockdown and closure of necessary logistics, the entire supply chain of dairy and livestock production system and the marketing systems were adversely affected

Table 3. KVKs' perception on effect of lockdown among livestock and dairy farmers (N=105)

Lockdown effects	Frequency	Percent	Severity index
Fear among agricultural labourers about COVID-19 and hence there was difficulty in getting labours for animal works	99	90.00	22.56
Non/limited availability of livestock related inputs like medicines, semens, etc and the related services like animal treatment, vaccination and insemination	94	85.45	21.42
Price of dairy products like milk, curd, <i>paneer</i> , etc was affected	89	80.90	20.27
The green fodder and feed concentrates availability were restricted	81	73.64	18.46
Adverse effect on supply chain of dairy and livestock production and marketing system	76	69.09	17.32

which expressed by 69% of the KVK experts (index: 17.32).

The fear perception among the farm labour about COVID further wooed the situations. Even the advisories issued by the Government of Uttar Pradesh and ICAR about precautions to be taken while doing the farm operations during COVID did not seem to work for livestock keepers.

Interventions of frontline extension systems i.e. KVK

Under the given circumstances, therefore, ICAR, New Delhi consistently guided, persuaded and lead the KVK network (85) of the state to intervene suitably. A three-pronged strategy was executed in the state by ICAR and KVK partnership. Firstly, to make the rural farming community aware of nature and disease spread behaviour of COVID-19, two apps namely *Arogyasetu* and *Kisan Rath* were disseminated for downloading and use; secondly, these farmers were also disseminated the state-approved and ICAR approved farm advisories including livestock related guidance which may help them to successfully perform their livestock related operations under the lockdown condition; and thirdly, under such stressed situation, farmers were also arranged to supply through the KVKs the quality seeds and planting materials. Further, to reinforce the decisions, three video-conferencing were held with the participation of KVK Heads and Directors of Extension of various SAUS, ICAR institutes, NGOs and Educational societies. As a result of these efforts, a total of 93 thousand farmers (about 48%) of the state downloaded both the apps, out of 2.46 lakh farmers who were given this information to download them. The downloading is still regularly being done by the farmers. Similarly, using various channels like WhatsApp, mKISAN, print and electronic media, radio talk, KCC and other ICT platforms, as many as 18.70 lakh farmers were disseminated the various advisories related to field and horticultural crops, livestock and poultry, low-cost sanitization, etc which have

immensely benefitted the rural farming community.

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