Production and reproduction performance of Gangatiri cattle in middle Gangetic plains of Bihar

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ABSTRACT

The characteristics, production and reproduction performance of Gangatiri cattle was investigated by visiting 142 farmer families in 37 villages under Buxar and Itahri blocks of Buxar district of Bihar. The study revealed that the coat colour of Gangatiri cattle were milky white and light grey, and the face was long and narrow. The estimated body weight of cattle in the breeding tract were 83.02±0.20, 132.06±0.71, 172.24±0.31, 326.45±0.70 and 261.63±0.26 kg, at various stages, viz. calves less than one year, 1–3 year males, 1–3 year females, adult males and adult females, respectively. The body length and height at withers of Gangatiri cattle were nearly equal to each other whereas the chest girth was prominent in all stages of age. The mean lactation length, peak yield, age at first calving, service period and dry period were 230.24±7.44 days, 4.52±0.31 kg, 56.63±0.63 months, 129.45±3.63 days and 169.26±10.18 days under farmers’ management. Among the kinds of different farming systems adopted by the farmers, the practice of agriculture along with rearing of Gangatiri cattle was prominent followed by other farming systems in the breeding tract. Regression of different dependent variables such as number of cattle, quantity of concentrate fed and the occurrence of diseases on the income generated from Gangatiri cattle (independent variable) were 2.66, 4.15 and –5.91, respectively.

Key words: Characterization, Gangatiri, Indigenous, Production, Regression

Agricultural economy in India depends invariably on animal husbandry for its stability with different species of livestock playing varying roles. Cattle and buffaloes are the part of income generators in many households and the income from these species acts as a buffer for the household economy. However, organized rearing of cattle and buffaloes is sporadic in the country as small scale production system with the management involving more of traditional knowledge rather than the scientific principles is more prevalent. Besides, large scale haphazard execution of artificial insemination has so far resulted in increase in the number of crossbred cattle but the genetic gain achieved in term of increase in milk production has almost reached the selection limit. With the focus being back on conservation and development of native animals, it would be ideal to characterize, select and breed indigenous cattle towards higher milk productivity. Though the task may be very much demanding in the prevailing situation of sparse and scattered resources, it is still possible to gather breed-wise pool of indigenous cattle for further improvement. Identification of indigenous populations and distinguishing their performance are the primary assignments before undertaking the job of breeding them for further improvement. With these importance, it was decided to study the characteristics and performance of one of the indigenous populations of Bihar, Gangatiri breed and the role of the cattle in the farming systems practiced by the farmers in the breeding tract.

MATERIALS AND METHODS

Characteristics and performance of Gangatiri cattle under farmers’ management system were studied by visiting 37 villages in Buxar and Itahri blocks of Buxar district from January 2017 to December 2017. The characterization of the breed was carried out based on the guidelines suggested in Breed Descriptors for Cattle and Buffaloes (FAO 1986). Information pertaining to land utilization and livestock populations in the breeding tract were collected from Directorate of Statistics and Evaluation, and Directorate Economics & Statistics, Govt. of Bihar, respectively. Weather information was compiled from the data obtained from ICAR Research Complex for Eastern Region, Patna for the year from 1960 to 2008. A total of 142 farmer families rearing Gangatiri cattle were interacted for collecting data on cattle management interventions. Further, a total of 368 Gangatiri cattle of different age groups were subjected into morphometric evaluation as a part of phenotypic characterization. Age of the cattle was decided
by dentition and the information from the farmers. The body weight characteristics of Gangatiri cattle was estimated using Shaeffer’s formula for different age groups. Production and reproduction characteristics of the cattle were assessed based on observation and the information from the farmers. Prevalence of various farming systems in the breeding tract with Gangatiri as one of the component was also studied. Regression of dependent variables such as number of cattle, quantity of concentrates fed and occurrence of diseases on the independent variable, viz. income generated by the farmers from Gangatiri cattle was studied using standard statistical procedures as suggested by Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

Environmental factors in the breeding tract: Gangatiri breed of cattle are medium sized dual purpose cattle which are reared in the bordering districts of Bihar and eastern Uttar Pradesh and are mainly reared for draught and milk purpose. The breeding tract of this cattle falls under Bihar agro climatic zone IIIb, which is a southwest alluvial plain of the state and adjacent to southern bank of river Ganges. Bachaur cattle, one of the recognized cattle breed of Bihar, distributed in Sitamarhi, Darbanga, Sheohar and Madhubani districts of Bihar (Chandran et al. 2014b) could be considered as geographically most closely reared cattle breed to Gangatiri cattle. Though both are reared in the terrain of middle Gangetic plains, Bachaur is a draught cattle whereas the Gangatiri is a dual purpose in nature.

The general climate of the region is hot and humid. The average maximum and minimum temperature and the rainfall data collected from ICAR Research Complex for Eastern Region, which is located close to the breeding tract (Table 1). The maximum temperature recorded was as high as 47.0°C as against the minimum temperature of 1.9°C. The tract received maximum rainfall during Southwest monsoon from June to September with the annual rainfall ranged from 618.5 to 1734.4 mm in the last 49 years. Though water recedes generally after rainfall in the breeding tract, certain regions especially in Rohtas district, experience severe flood during the rainy season vowing to low land and seepage of water from river.

Land utilization pattern: Land utilization pattern in the breeding tract of Gangatiri cattle in Bihar was studied for 26 years from 1987 to 2013 and the summary is given in Table 2. The study revealed that the proportion of cultivable waste land and the land under permanent pastures and grazing, which are the major nourishing factors, have reduced by 16.1% and 63.5%, respectively. There are no other major changes in the land utilization except that the land under trees and groves has witnessed constant rise over the years. In the absence of breed-wise census in the breeding tract, the authors could not make any authentic estimate on Gangatiri population statistics except assuming that the population of Gangatiri might have shrunk over the years due to its scattered presence and the shrinkage of adequate grazing land.

Livestock population dynamics: Growth of livestock population in the breeding tract of Bihar was studied from livestock census 2003 to 2012 (Table 3). The study revealed that the proportion of different species of livestock population in Gangatiri breeding tract to the total livestock

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**Table 1. Summary of meteorological data of the breeding tract**

| Weather particulars | From 1960 to 2008 (49 years) | From 1994 to 2008 (15 years) |
|---------------------|-------------------------------|-------------------------------|
| Average maximum temperature | 38.5°C | 37.7°C |
| Maximum temperature range | 10.0°C–47.0°C | 10.0°C–43.9°C |
| Average minimum temperature | 19.3°C | 19.8°C |
| Minimum temperature range | 1.9°C–32.2°C | 4°C–31.8°C |
| Average annual rainfall | 1136.8 mm | 1168.1 mm |
| Annual rainfall range | 618.5–1734.4 mm | 704.4–1734.4 mm |

**Table 2. Changes in land utilization over a period of time in Gangatiri breeding tract**

| Land divisions | 1987–92 | 1992–97 | 1997–02 | 2002–07 | 2007–12 | 2012–13 | % shift |
|----------------|---------|---------|---------|---------|---------|---------|---------|
| Geographical area | 1137507 | 1137507 | 1137507 | 1137507 | 1137507 | 1137507 | 0       |
| Forest area      | 179762  | 179762  | 179762  | 179762  | 179762  | 179762  | 0       |
| Barren uncultivable area | 45424    | 45484    | 45424    | 45377    | 45001    | 44969    | -1.002  |
| Land put to non-agricultural use | 121092   | 124837   | 128126   | 130428   | 133230   | 135146   | 11.606  |
| Cultivable waste land | 5021     | 8706     | 4247     | 3722     | 4153     | 4215     | -16.05  |
| Permanent pastures and grazing land | 880      | 606      | 400      | 357      | 331      | 321      | -63.52  |
| Land under trees and groves | 1965     | 3107     | 4951     | 5952     | 6296     | 6422     | 226.89  |
| Current fallow    | 12164   | 13009   | 11091   | 9941     | 5098     | 3979     | -67.29  |
| Other fallsow     | 53788   | 51199   | 32831   | 28483    | 42890    | 34215    | -36.39  |
| Total uncultivable land | 420094   | 426711   | 406832   | 404022   | 416761   | 409029   | -2.634  |
| Net sown area     | 717413  | 710796  | 730675  | 733485   | 720746   | 728478   | 1.5424  |
population of the state were 9.70, 40.87, 4.12 and 7.45 for bovines, sheep, goats and pigs, respectively. This indicates that the farmers in the breeding tract prefers to rear sheep and cattle in comparison to other species of livestock. Further, the population density of more than 15000 bovine and 4000 goats per square km. found in study is also the phenomenon in major parts of Gangetic plains and Gangatiri cattle tract is no exception to it. When compared the density of Gangatiri cattle in the breeding tract with the density of livestock population in different countries, density in this locality is much higher. Hence, this is the right time to strike a balance in maintaining a livestock population between the number essential to improve the livelihood status of farmers and the number necessary to minimize greenhouse gas production.

**Housing:** The study revealed that the 92% of Gangatiri farmers in the breeding tract provided housing to their cattle. Among the houses, 64% were _pucca_ houses whereas the remaining were _kachcha_ houses built with thatched roof with the support of bamboo sticks in most of the cases. Even though the sheds were _pucca_ in many places, provision for water and slopes for drainage were invariably absent. Floor in the shed had undulating surface with stagnation of water and slopes for drainage were invariably absent. For water mixed with urine in many places. Feed manger, though provided, did not have proper dimensions. The intention of rearing Gangatiri cattle with minimum capital might be one of the reasons for the disorderly conditions of cattle sheds.

**Breeding:** Study revealed that 31% of Gangatiri cows were mated with bulls of the same breed through natural service. The remaining cows were artificially inseminated with the semen of exotic germplasm with the intention of improving the milk production. Unavailability of Gangatiri semen in the breeding tract was due to lack of animal breeding infrastructure in the breeding tract and the delay in policy implementation. On all accounts, the absence of semen of Gangatiri germplasm in the tract leads to genetic dilution posing the danger of diminishing the population size. In addition, there were no breed registration societies in the breeding tract for taking up either rearing of genetically potent Gangatiri bulls or establishing infrastructure for collection and storage of semen doses. The situation reveals that the sense of maintaining the genetic integrity of Gangatiri cattle is invariably absent among the farmers rearing Gangatiri cattle. Genetic upgradation of Gangatiri cattle and creation of strong extension mechanism to make farmers realize the importance of the cattle may encourage the farmers to shift the focus towards this indigenous cattle.

**Feeding:** System of feeding and feeding pattern varied widely in the breeding tract. A total of 54.6% farmers in the surveyed breeding tract adopted intensive system of feeding practices where as 45.4% farmers followed extensive rearing of Gangatiri cattle. Under intensive feeding practices, the cattle were maintained on dry fodders including paddy and wheat straw to a greater extent, and green fodders such as sorghum, berseem and oat to a smaller extent. Concentrate feeds such as grain, bran and cakes were provided to lactating animals under intensive and extensive management systems. Mixing of feed ingredients was a common feeding practice adopted by majority of the farmers (90.5%) in Gangatiri breeding tract.

**Morphological features of Gangatiri cattle:** The study reported two coat colours of Gangatiri cattle in milky white (Fig. 1) and light grey (Fig. 2) with the former genetic group comprised 73% while the remaining were the latter genetic group. The head was medium in size and the face was long and narrow. The ears were invariably erect. Horns were generally black in colour, grew lateral, upwards and then inwards. Muzzle and eyelashes were black in colour. Cows had medium sized hump whereas bulls and bullocks had large sized one (Fig. 3). Body was long and cylindrical with the straight back. Tail was thin with black switch and extended beyond knee joint. Udder was medium sized with visible milk vein in some cases. Based on the characteristics, it could be seen that these cattle phenotypically resemble closer to Bachaur cattle of Bihar.

Study revealed that the average herd size of Gangatiri cattle was 4.8 which included 2.1 cows, 0.8 bullocks and 1.9 calves. A total of 43% of surveyed herds had only one

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Table 3. Livestock population dynamics in the breeding tract of Gangatiri cattle

| Livestock species | Year | 2003 | 2007 | 2012 |
|-------------------|------|------|------|------|
| Bovine           |      | 1.72 | 1.79 | 1.62 |
| Sheep            |      | 0.12 | 0.10 | 0.10 |
| Goat             |      | 0.50 | 0.41 | 0.45 |
| Pig              |      | 0.04 | 0.04 | 0.05 |

*In million. Source: (Directorate of Economics and Statistics, 2012); (Directorate of Economics and Statistics, 2014)
animal with the rest having more than one. The findings on herd size of Gangatiri cattle revealed that the breed was mostly reared in small scale extensive system with strong interaction with other agricultural components. However, Sharma et al. (2012) reported relatively larger herd size of 2 to 30 animals in Shahabadi (Gangatiri) herd in the breeding tract, which may be due to varying study area owing to substantially larger breeding tract of Gangatiri breed.

Morphometry and body weight: The morphological characteristics of male and female Gangatiri cattle belonging to various age groups are given in Table 4. Results showed that the body length and height at withers of Gangatiri cattle were almost equal to each other whereas the chest girth was prominent at all stages. The height, body length and girth increased by 37, 39 and 52%, respectively, from one year stage to adult stage. Females were heavier than males during one to three years of age and this might be due to the varying level of feeding among different sexes by the farmers. However, during the adult stage, males were found to be heavier than their female counterparts for all morphometric traits. Sharma et al. (2012) reported the body length, chest girth and height at withers of Shahabadi cattle (Gangatiri) to be 123.80±0.39 cm, 155.96±0.58 cm and 122.40±0.58 cm, respectively, which are almost similar to the findings of the present study.

Face in Gangatiri cattle was relatively longer (42.78 cm) whereas the horns were medium in size with 19.80 cm. Tail was very long with 85.43 cm in length which extended up to switch. However, still longer face (47.48±0.15 cm) and shorter horn (6.43±0.21 cm) and tail (72.98±0.29 cm) were reported in Bachaur cattle, another breed found in Bihar (Chandran et al. 2014a).

The body weight of Gangatiri cattle in the breeding tract were estimated to be 83.02±0.20 kg, 132.06±0.71 kg, 172.24±0.31 kg, 326.45±0.70 kg and 261.63±0.26 kg, for calves less than one year, 1–3 year males, 1–3 year females, adult males and adult females, respectively. The estimated body weight show that the Gangatiri cattle are medium sized and within the range of body weight of most of the cattle breeds of India.

Production and reproduction: The production and reproduction traits of Gangatiri cattle found in the breeding tract are summarized in Table 5. The production characteristics of Gangatiri cattle observed from the study indicates that these cows were capable of substantial milk production. Peak yield of the cattle ranged from 2 to 9 l of milk with an average being 4.52 l/day. The breed showed great variations in production characteristics which could efficiently be utilized in the selection and breeding programs. Singh et al. (2016) reported that the average lactation length and the average dry period of Gangatiri cattle were 187.80±14 days and 176.60±14.7 days, respectively, in which duration of dry period corroborates

| Attribute            | Adult female (>3 years) | Adult male (>3 years) | Growing females (1–3 years) | Growing males (1–3 years) | Calves (< 1 year old) |
|----------------------|-------------------------|-----------------------|------------------------------|---------------------------|----------------------|
| Height at withers (cm) | 122.93±0.35 (136) [3.29] | 136.64±1.71 (14) [4.70] | 109.94±0.74 (78) [5.98] | 101.78±2.11 (23) [9.96] | 90.53±0.69 (117) [8.29] |
| Body length (cm)         | 120.71±0.38 (136) [3.64] | 125.21±1.67 (14) [4.98] | 107.15±0.65 (78) [5.36] | 100.22±1.69 (23) [8.10] | 86.99±0.49 (117) [6.03] |
| Chest girth (cm)          | 152.84±0.60 (136) [4.55] | 168.00±1.54 (14) [3.43] | 131.41±0.81 (78) [5.45] | 119.13±1.90 (23) [7.65] | 101.28±0.50 (117) [5.38] |
| Face length (cm)          | 42.03±0.17 (136) [4.70]  | 50.07±0.61 (14) [4.53]  | 37.22±0.29 (78) [6.84]  | 39.39±0.62 (23) [7.61]  | 30.57±0.30 (117) [10.50] |
| Ear length (cm)           | 29.15±0.16 (136) [6.02]  | 29.79±0.66 (14) [8.24]  | 24.90±0.27 (78) [9.55]  | 26.91±0.44 (23) [7.84]  | 20.74±0.26 (117) [13.38] |
| Horn length (cm)          | 19.21±0.53 (136) [32.30] | 25.50±1.61 (14) [23.57] | 4.82±0.37 (78) [68.58]  | 5.91±0.67 (23) [54.66]  | 2.14±0.13 (117) [64.13] |
| Tail length (cm)          | 85.04±1.18 (136) [16.15] | 89.21±1.60 (14) [6.71]  | 73.29±1.09 (78) [13.09] | 73.09±1.84 (23) [12.07] | 54.85±0.91 (117) [17.94] |
Table 5. Production and reproduction characteristics of Gangatiri cattle

| Traits                        | Mean        | Range   |
|-------------------------------|-------------|---------|
| Lactation length (Days)       | 230.2±4.74  | 167 to 315 |
| Peak yield (Lit.)             | 4.52±0.31   | 02 to 09  |
| Age at sexual maturity in males (years) | 3.07±0.10  | 2.5 to 3.5  |
| Age at sexual maturity in females (years) | 3.97±0.04   | 3.5 to 4.5  |
| Age at 1st calving (months)   | 56.6±3.63   | 51 to 63  |
| Service period (Days)         | 129.45±3.63 | 92 to 170 |
| Dry period (Days)             | 169.26±10.18 | 90 to 270   |
| Lifetime number of calvings   | 6.45±0.71   | 3 to 10   |

Table 6. Kinds of farming system adopted by the farmers of Gangatiri cattle

| Kinds of farming systems                  | Number |
|------------------------------------------|--------|
| Gangatiri cattle + Agriculture           | 47 (33.1) |
| Gangatiri cattle + Agriculture + Buffalo | 22 (15.5) |
| Gangatiri cattle + Agriculture + Buffalo + Goat | 14 (9.9) |
| Gangatiri cattle + Agriculture + Buffalo + Goat + Poultry | 8 (5.6) |
| Gangatiri cattle + Agriculture + Goat + Poultry | 15 (10.6) |
| Gangatiri cattle + Agriculture + Goat | 15 (10.6) |
| Gangatiri cattle + Buffalo               | 17 (12.0) |
| Gangatiri cattle + Goat                  | 4 (2.8)   |

Figures in the parentheses are percentages.

with the present study.

Though possessing substantial production characteristics, the breed attained late sexual maturity with an average of 3.07 years for males and 3.97 years for females. Service period in Gangatiri cattle ranged from 92 to 170 days with an average being 129.45 days. Dry period was quite extensive which indicates that a calf a year was not a regular phenomenon in majority of the animals. Singh et al. (2008) reported the age at first calving of Hallikar cattle ranged from 2.5 to 4 years with a mean of 3.02±0.07 years which is lesser than the age at first calving found in the present study. Pundir et al. (2013) found the lactation length, dry period and service period of Uttara cattle to be 275 days, 147 days and 124 days, respectively, which agree more or less with the findings of the present study. Marginal differences in the reproductive performances might be due to variations in genotype, environment or genotype environment interactions. However, detailed study is required to analyze the reproductive health of Gangatiri cattle and to diagnose disorders prevailing in the tract.

Gangatiri in farming system: The breeding tract of Gangatiri cattle is vastly agrarian and is fed by river Ganges on both sides. Different types of farming systems adopted by the farmers in the breeding tract of Gangatiri cattle (Table 6). Cultivated crops in the breeding tract included rice, maize, sorghum, wheat, lentil and different vegetables and other horticulture crops. The tract was also thickly populated by selecting superior males for breeding purposes and making the semen available to the Gangatiri farmers. This would pave the way for the improvement of Gangatiri cattle vis-à-vis enhancement of livelihood status of Gangatiri farmers. Alternatively, assisting Gangatiri farmers to establish self-sustainable breed societies may also cause significant benefits to the breed and to the farmers holding them.
the effect of breed improvement.

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