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Studies on Reproductive Performance of Gaolao Cattle in the Breeding Tract of Maharashtra

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Abstract

The reproductive performance of Gaolao cattle were studied at different location in the breeding tract. The idea behind the collection of data in breeding tract of Gaolao cattle from the farmers and breeder heard of Gaolao rather than on the organized farm to obtain the real picture of reproductive performance of breed in the breeding tract. In present finding the overall least square means for age at puberty (AP) of Gaolao cattle was recorded as 1202.27 ± 13.01 days. The effect of block was found non-significant on age at puberty (AP) whereas, the effect of colour was found significant. The overall least square means for age at first calving (AFC) of Gaolao cattle was recorded as 1610.12 ± 12.68 days. The effect of block and colour was found non-significant on age at first calving (AFC) of Gaolao cattle. The overall least square mean for service period (SP) of Gaolao cattle was recorded as 145.46 ± 1.52 days. The effect of block and colour was found non-significant on service period (SP) of Gaolao cattle. The overall least square mean for gestation period (GP) of Gaolao cattle was recorded as 281.92 ± 0.60 days. The effect of block and colour was found non-significant on gestation period (GP) of Gaolao cattle. The overall least square mean for inter calving period (ICP) of Gaolao cattle was recorded as 427.17 ± 1.44 days. The effect of block and colour was found non-significant on inter calving period (ICP) of Gaolao cattle. The improvement in reproductive characteristics of indigenous breed has become essential to make economically viable dairy animal.

Keywords: Reproductive performance, age at puberty, service period, gestation period and inter calving period

1. Introduction

The important breeds are essential by the result of long-term natural selection and evolution over the centuries and the better adapted to withstand tropical disease and perform reasonably well even with low inputs in terms of feed and fodder. There are 41 recognized cattle breeds in the country. The country population of cattle accounts for 17 per cent of the total world cattle population. The best indigenous germ plasm of milch, draught and dual-purpose animals accounts for 22-25 per cent of the Indian cattle population, while, 7-10 per cent of the cross-breeds. Most of the indigenous breeds of cattle excel in draught capacity. The native livestock breed exhibit a distinct superiority in utilizing poor quality feed and adapt to withstand heat and show better resistant to tropical disease.

The total Bovine population is 299.90 million in 2012 which shows a decline of 1.57 per cent over previous census (Livestock census, 2012) [8]. Improvement in morphometric, production and reproduction characteristics of indigenous breeds has become essential to make the economically viable dairy animals.

The Gaolao is famous cattle breed of the Vidarbha region of Maharashtra state. Gaolao is average milking breed and a very popular breed for draught among farmers (Patil *et al*, 2005) [11]. Gaolao cattle fit into the group of short and stumpy horned, body is medium height narrow in frame, female are of pure white in colour and males gray over the head and hump, with a long coffin-shaped skull, face markedly long and narrow tapering towards muzzle. The Gaolao breed eyes are almond shaped and ears are medium sized, carried high giving an alert appearance to the head and forehead is slightly convex appearance. In the breeding tract, among the Gaolao population, colour varies from light to milky white. The overall performance of animals depends on morphometric, productive and reproductive characteristics, which play an important role for evaluation of animal. The morphometric characteristics like body measurements and body weights, the productive characteristics like

Lactation milk yield (LMY), Peak milk yield (PMY), Days to reach peak milk yield (DRPMY), Lactation period (LP), Dry period (DP) and reproductive characteristics like Age at puberty (AP), Age at first calving (AFC), Service period (SP), Gestation period (GP) and Inter calving period (ICP) were taken into consideration for present study. Therefore, the present study has been following objective:

1. To study the reproductive characteristics
2. To study the colour pattern effect on various characteristics
3. To study the block effect on various characteristics

2. Material and Methods

In present study the data on reproductive characteristics i.e. age at puberty (AP), age at first calving (AFC), service period (SP), gestation period (GP) and inter calving period (ICP) were collected by actual interview with the Gaolao owners with the help of model questionnaire.

The collected data on productive and reproductive characteristics under study were classified according to block and colour pattern. The collected data was classified as per colour pattern (*viz.*, White colour followed by Yellowish White and Grayish White). The data on productive traits were collected from different block of Vidarbha region of Maharashtra as mention below.

Table 1: List of villages randomly selected for collection of data

Sr. No.	Name of District	Name of Block	Name of Villages
1	Wardha	Arvi (B ₁)	Chincholi, Danapur, Kharangna, Kinhal (Bothali), Pachod, Talegaon (Raghugi)
		Karanja (B ₂)	Bhiwapur Heti, Dharti, Heti Kundi, Jaurwada, Kannamwar Gram, Selgaon
		Selu (B ₃)	Akoli, Antargaon, Jamni, Madani, Masala, Zadsi
		Wardha (B ₄)	Ashtaa, Bhankheda, Bhugaon, Jaulgaon, Selukate, Zanzapur
2	Nagpur	Katol (B ₅)	Chandanpardi, Khandala, Murti, Parsoda, Sawanga, Walni

2.1 Reproductive characteristics

The analysis of data was done by method of Least Square Technique as outlined by Harvey (1990) [4]. The following mathematical model will be employed to analyze the data.

$$Y_{ijlm} = \mu + B_i + C_j + O_l + e_{ijlm}$$

Where,

Y_{ijlm} = is the record of m^{th} Gaolao individual in i^{th} block, j^{th} colour and l^{th} off-type

μ = is the population mean common to all the observations.

B_i = is the effect of i^{th} block of individual.

C_j = is the effect of j^{th} colour of individual.

O_l = is the effect of l^{th} off-type of individual.

The significant effect was further analyzed to have all pair wise comparison by Duncan's Multiple Range Test (DMRT) as modified by Kramer (1957) [6].

3. Results and Discussion

3.1 Reproductive characteristics

3.1.1 Age at puberty (AP)

It was observed from Table 2 that the overall least square mean for age at puberty (AP) of Gaolao cattle was recorded as 1202.27 ± 13.01 days. The higher day's age at puberty than the present result has been reported by Vedpathak *et al.* (2006) [13] as 1280.50 ± 0.73 days and Bainwad *et al.* (2017) [1] as 883.16 ± 0.83 days in Red Kandhari cattle, respectively.

3.1.2 Block effect on age at puberty

The difference observed in the LSMs for AP of Gaolao cattle was significant due to block effect. The LSM for AP of Gaolao cattle in block B₁, B₂, B₃, B₄ and B₅ were 1194.60 ± 19.99 , 1197.82 ± 19.34 , 1205.49 ± 19.05 , 1209.78 ± 21.18 and 1203.63 ± 19.33 days, respectively. The LSM for AP of Gaolao cattle recorded in B₄ was higher to that of recorded in B₁, B₂, B₃ and B₅ which differed non-significant from each other.

3.1.3 Colour pattern effect on age at puberty

The differences observed in the LSMs for AP of Gaolao cattle were significant due to colour pattern effect. The LSM for AP of Gaolao cattle for colour pattern C₁, C₂ and C₃ were 1230.51 ± 8.15 , 1224.13 ± 23.10 and 1152.16 ± 30.37 days, respectively. The LSM for AP of Gaolao cattle recorded in C₁

was higher to that of recorded in C₂ and C₃, which differed significant from each other.

The DMRT revealed that Gaolao cattle maintained at C₁ had significant higher AP over other colour.

Table 2: Least squares means for Age at puberty (AP) as affected by block and colour pattern in Gaolao cows

Sources	Code	N	Mean Age at puberty (Days) + SE
Population mean	μ	370	1202.27 ± 13.01
Block			
Arvi	B ₁	68	1194.60 ± 19.99
Karanja	B ₂	80	1197.82 ± 19.34
Selu	B ₃	77	1205.49 ± 19.05
Wardha	B ₄	60	1209.78 ± 21.18
Katol	B ₅	85	1203.63 ± 19.33
Colour			
White	C ₁	310	$1230.51^a \pm 8.15$
Yellowish white	C ₂	38	$1224.13^a \pm 23.10$
Grayish white	C ₃	22	$1152.16^b \pm 30.37$

Note: Means connected by superscript do not differ significantly.

3.2.1 Age at first calving (AFC)

It was observed from Table 3 that the overall least square mean for age at first calving (AFC) of Gaolao cattle was recorded as 1610.12 ± 12.68 days. The higher days age at first calving than the present result has been reported by Mruttu (2013) [10] as 1635.77 ± 10.20 days in Deoni cattle at CCBP, Parbahi and Bhutkar (2014) as 1659.15 ± 35.77 days in Deoni cattle at CCBP, Parbahi and Kothekar *et al.* (2006) [5] as 54.74 ± 0.08 months in Gaolao cattle, respectively. The lower days age at first calving than the present result has been reported by Pundir and Singh (2008) [12] as 39.47 months in Red Kandhari cattle, Kulkarni *et al.* (2013) [7] as 53.53 ± 0.20 months in Kathani cattle of Vidarbha region in Maharashtra and Bainwad *et al.* (2017) [1] as 1529.61 ± 1.71 days in Red Kandhari cattle, respectively.

3.2.2 Block effect on age at first calving

The difference observed in the LSMs for AFC of Gaolao cattle was non-significant due to block effect. The LSM for AFC of Gaolao cattle in block B₁, B₂, B₃, B₄ and B₅ were 1607.51 ± 19.48 , 1610.21 ± 18.84 , 1613.49 ± 18.56 , 1607.32 ± 20.64 and 1612.07 ± 18.84 days, respectively. The LSM for AFC of Gaolao cattle recorded in B₃ was higher to that of recorded in B₁, B₂, B₄ and B₅ which differed non-significant from each other.

3.2.3 Colour pattern effect on age at first calving

The differences observed in the LSMs for AFC of Gaolao cattle were non-significant due to colour pattern effect. The LSM for AFC of Gaolao cattle for colour pattern C₁, C₂ and C₃ were 1632.67 ± 7.94, 1630.34 ± 22.50 and 1567.35 ± 29.59 days, respectively. The LSM for AFC of Gaolao cattle recorded in C₁ was higher to that of recorded in C₂ and C₃, which differed non-significant from each other.

Table 3: Least squares means for Age at first calving (AFC) as affected by block and colour pattern in Gaolao cows

Sources	Code	N	Mean Age at first calving (Days) ± SE
Population mean	μ	370	1628.93 ± 1.65
Block			
Arvi	B ₁	68	1625.41 ± 2.53
Karanja	B ₂	80	1629.72 ± 2.45
Selu	B ₃	77	1631.12 ± 2.41
Wardha	B ₄	60	1625.77 ± 2.69
Katol	B ₅	85	1632.63 ± 2.45
Colour			
White	C ₁	310	1628.16 ± 1.03
Yellowish white	C ₂	38	1632.11 ± 2.93
Grayish white	C ₃	22	1626.53 ± 3.85

3.3.1 Service period (SP)

It was observed from Table 4 that the overall least square mean for service period (SP) of Gaolao cattle was recorded as 145.46 ± 1.52 days. The lower days age at first calving than the present result has been reported by Bhadoria *et al.* (2002) [2] as 138.93 ± 5.53 days in Gir cattle, Kothekar *et al.* (2006) [5] as 150.94 ± 2.67 days in Gaolao cattle and Bainwad *et al.* (2017) [1] as 139.92 ± 0.66 days in Red Kandhari cattle, respectively.

3.3.2 Block effect on service period

The difference observed in the LSMs for SP of Gaolao cattle was significant due to block effect. The LSM for SP of Gaolao cattle in block B₁, B₂, B₃, B₄ and B₅ were 143.32 ± 2.34, 146.83 ± 2.26, 145.21 ± 2.23, 145.98 ± 2.48 and 145.97 ± 2.26 days, respectively. The LSM for SP of Gaolao cattle recorded in B₂ was higher to that of recorded in B₁, B₃, B₄ and B₅ which differed non-significant from each other.

3.3.3 Colour pattern effect on service period

The differences observed in the LSMs for SP of Gaolao cattle were non-significant due to colour pattern effect. The LSM for SP of Gaolao cattle for colour pattern C₁, C₂ and C₃ were 148.36 ± 0.95, 146.07 ± 2.70 and 141.96 ± 3.55 days, respectively. The LSM for SP of Gaolao cattle recorded in C₁ was higher to that of recorded in C₂ and C₃ which differed non-significant from each other.

Table 4: Least squares means for Service period (SP) as affected by block and colour pattern in Gaolao cows

Sources	Code	N	Mean Service period (Days) ± SE
Population mean	μ	370	145.46 ± 1.52
Block			
Arvi	B ₁	68	143.32 ± 2.34
Karanja	B ₂	80	146.83 ± 2.26
Selu	B ₃	77	145.21 ± 2.23
Wardha	B ₄	60	145.98 ± 2.48
Katol	B ₅	85	145.97 ± 2.26
Colour			
White	C ₁	310	148.36 ± 0.95
Yellowish white	C ₂	38	146.07 ± 2.70
Grayish white	C ₃	22	141.96 ± 3.55

3.4.1 Gestation period (GP)

It was observed from Table 5 that the overall least square mean for gestation period (GP) of Gaolao cattle was recorded as 281.92 ± 0.60 days in the present study which is in agreement with Kothekar *et al.* (2006) [5] as 281.64 ± 1.96 days in Gaolao cattle. The higher days gestation period than the present result has been reported by Bainwad *et al.* (2017) [1] as 283.49 ± 0.23 days in Red Kandhari cattle.

3.4.2 Block effect on gestation period

The difference observed in the LSMs for GP of Gaolao cattle was non-significant due to block effect. The LSM for GP of Gaolao cattle in block B₁, B₂, B₃, B₄ and B₅ were 281.54 ± 0.93, 282.40 ± 0.90, 281.73 ± 0.88, 280.76 ± 0.98 and 283.15 ± 0.90 days, respectively. The LSM for GP of Gaolao cattle recorded in B₅ was slightly higher to that of recorded in B₁, B₂, B₃ and B₄ which differed non-significant from each other.

3.4.3 Colour pattern effect on gestation period

The differences observed in the LSMs for GP of Gaolao cattle were non-significant due to colour pattern effect. The LSM for GP of Gaolao cattle for colour pattern C₁, C₂ and C₃ were 280.98 ± 0.38, 283.55 ± 1.07 and 281.22 ± 1.41 days, respectively. The LSM for GP of Gaolao cattle recorded in C₂ was slightly higher to that of recorded in C₁ and C₃ which differed non-significant from each other.

Table 5: Least squares means for Gestation period (GP) as affected by block and colour pattern in Gaolao cows

Sources	Code	N	Mean Gestation period (Days) ± SE
Population mean	μ	370	281.92 ± 0.60
Block			
Arvi	B ₁	68	281.54 ± 0.93
Karanja	B ₂	80	282.40 ± 0.90
Selu	B ₃	77	281.73 ± 0.88
Wardha	B ₄	60	280.76 ± 0.98
Katol	B ₅	85	283.15 ± 0.90
Colour			
White	C ₁	310	280.98 ± 0.38
Yellowish white	C ₂	38	283.55 ± 1.07
Grayish white	C ₃	22	281.22 ± 1.41

3.5.1 Inter calving period (ICP)

It was observed from Table 6 that the overall least square mean for inter calving period (ICP) of Gaolao cattle was recorded as 427.17 ± 1.44 days. The higher days inter calving period than the present result has been reported by Maske and Phule (2012) [9] as 450.00, 447.00, 442.20, 456.00 days in Khillar, Deoni, Red kandhari and Dangi cattle and Kothekar *et al.* (2006) [5] as 430.26 ± 6.33 days in Gaolao cattle, respectively. The lower days inter calving period than the present result has been reported by Maske and Phule (2012) [9] as 387.00 and 400.00, days in Gaolao and Gir cattle and Bainwad *et al.* (2017) [1] as 423.42 ± 0.61 days in Red Kandhari cattle, respectively.

3.5.2 Block effect on inter calving period

The difference observed in the LSMs for ICP of Gaolao cattle was non-significant due to block effect. The LSM for ICP of Gaolao cattle in block B₁, B₂, B₃, B₄ and B₅ were 423.91 ± 2.22, 428.81 ± 2.14, 427.33 ± 2.11, 426.68 ± 2.35 and 429.14 ± 2.14 days, respectively. The LSM for ICP of Gaolao cattle recorded in B₅ was higher to that of recorded in B₁, B₂, B₃ and B₄ which differed non-significant from each other.

3.5.3 Colour pattern effect on inter calving period

The differences observed in the LSMs for ICP of Gaolao cattle were non-significant due to colour pattern effect. The LSM for ICP of Gaolao cattle for colour pattern C₁, C₂ and C₃ were 428.87 ± 0.90, 429.52 ± 2.56 and 423.13 ± 3.37 days, respectively. The LSM for ICP of Gaolao cattle recorded in C₂ was higher to that of recorded in C₁ and C₃ which differed non-significant from each other.

Table 6: Least squares means for Inter calving period (ICP) as affected by block and colour pattern in Gaolao cows

Sources	Code	N	Mean Inter calving period (Days) ± SE
Population mean	μ	370	427.17 ± 1.44
Block			
Arvi	B ₁	68	423.91 ± 2.22
Karanja	B ₂	80	428.81 ± 2.14
Selu	B ₃	77	427.33 ± 2.11
Wardha	B ₄	60	426.68 ± 2.35
Katol	B ₅	85	429.14 ± 2.14
Colour			
White	C ₁	310	428.87 ± 0.90
Yellowish white	C ₂	38	429.52 ± 2.56
Grayish white	C ₃	22	423.13 ± 3.37

6. Conclusion

The effect of colour was found highly significant on age at puberty (AP) whereas the effect of block was found non-significant on all reproductive characteristics of Gaolao cattle. Hence it is concluded that indigenous cattle breeds might be due to difference in their genetic makeup coupled with differences in their management and environment to which they are exposed.

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