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Factors Affecting Early Reproduction Traits of Frieswal Heifers Under Field Conditions

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ABSTRACT

The present study was carried out in U. S. Nagar district of Uttarakhand on Frieswal heifers reared by farmers under 5 AI centres, and aimed to study early reproduction traits of Frieswal heifers and factors affecting them. The study revealed that the Least-squares means for age at puberty, age at first artificial insemination and age at first conception were 485.2 ± 21.8 (n=131), 608.3 ± 27.1 (n=81) and 610.2 ± 25.2 (n=77) days. Average age at first calving was 807.0 ± 28.1 (n=18) days. The non-genetic factors like education of farmers, herd size, season, year, and artificial insemination centre had significant effect on reproductive performance traits. Significant effects of artificial insemination centre, year of birth, education level, herd size and season of birth on age at puberty; of artificial insemination centre on age at first artificial insemination; of year of birth on age at first artificial insemination; of artificial insemination centre on age at first conception were recorded.

Keywords: Age at puberty, age at first AI, Age at first conception, Frieswal heifers, non-genetic factors

Indian economy is predominantly rural economy with about 75% of its population residing in rural areas. Dairy farming is an integral system on which the entire social and economic structure of the village life anchors in India. It provides opportunity for self-employment to a substantial number of rural population, many of whom are women which play a major role in the care and management of livestock (Islam *et al.,* 2008). Livestock contributes in improving the nutritional standards by providing valuable animal protein in the form of meat, milk, egg and dairy products and by-products. Reproductive efficiency in dairy cattle is decreasing worldwide. Shifting towards more productive cows and larger herds is associated with a decrease in reproductive efficiency. Cows with the greatest milk production potential have the highest incidence of infertility (Lucy, 2001). Low reproductive efficiency due to either delayed first service, missed estrus, or multiple services per conception continues to be a major problem in dairy herds (Hammoudh *et al.,* 2010). Insufficient reproductive performance results in excessively late age at first calving and long lactations.

Early reproduction helps in achieving more number of calving per lactations in the entire life of a cow. Crossbred cattle are known for early sexual maturity in comparison to indigenous cattle and buffaloes. Crossbred cattle are known for early sexual maturity in comparison to indigenous cattle and buffaloes. This fact is not much documented with respect to the crossbred cattle reared under field conditions. The information pertaining to early reproduction traits of crossbred heifers under field condition is scanty in literature. Age at puberty is a critical trait, because success of pregnancy during the breeding season is correlated with the percentage of heifers that reach puberty before or early in the breeding season (Perry and Cushman, 2013).

Crossbred cattle are reared in good number in Uttarakhand and knowledge of reproductive traits is very important in understanding their production performance. Hence, present study was undertaken with the farmers in Udham Singh Nagar district of Uttarakhand under field progeny testing programme with the objectives to study early reproduction traits in Frieswal heifers under field conditions and factors affecting them.

MATERIALS AND METHODS

Present study is based on the data obtained from 131 animals, reared by 127 farmers of 5 AI centres viz. Pantnagar, Gadarpur, Bazpur, Kicha and Sitarganj under progeny testing programme of Frieswal cattle in Udham Singh Nagar district, Uttarakhand. The place is located in the foot hills of Himalayas at 28° 52' to 28° 25'North latitudes, 78° 58' to 79° 42' East longitude and altitude of 243.84 m above mean sea level. In the present study the experimental work were conducted on Frieswal heifers. Data were collected from the farmers by using questionnaire. The following 4 reproductive traits were analyzed: age at puberty (It is the length of time between the date of birth and the date of showing first heat in heifers), age at first artificial insemination (It is the period between date of birth and date of first AI), age at first conception (It is the period between date of birth and date of successful AI) and age at first calving (It is the age at which the heifer calved). Non genetic factors considered here include artificial insemination (AI) centre, season (spring, summer, rainy, winter), year (2010-2012), education level of farmers (Illiterate, Read and write, Matriculate, > Matriculate), herd size (3 animal unit equivalent AUE, 3-6 AUE, 6-10 AUE, >10 AUE). Units for different category of animals (cattle) are as follows:- Adult - 0.800, Immature (heifer)-0.600 and Young (calf) - 0.260 (GOI, Animal Husbandry Statistics, 2011).

The data on reproduction traits of heifers were subjected to least-squares analysis of variance as per Harvey (1987) using PC version.

RESULTS AND DISCUSSION

Age at puberty (AP)

The overall least-squares means for AP of 131 heifers was 485.2 ± 21.8 days in Frieswal (Table 1). The present value is lower than those reported by Nahar *et al*. (1992) in Holstein × deshi under field conditions, Rafique (2000) in HF × Sahiwal under farm conditions, Qureshi *et al.* (2000) in crossbreds, Sultana *et al*. (2001) and Uddin *et al*. (2008) in Friesian cross under field conditions. However, Miazi *et al.* (2007) reported higher values for AP in local cattle (25.92 ± 1.08 months) and in crosses of local cattle with Sahiwal (18.00 ± 0.00 months), Holstein-Friesian (21.60 ± 2.40 months) and Jersey (20.44 ± 1.60 months), respectively. Singh *et al.* (2002) also reported that AP was 35.6 ± 0.53 months in case of Deoni cattle under field conditions which are higher than the present value. This indicated that crossbred cattle had shorter AP than those of local or indigenous cattle.

Among AI centre, age at puberty ranged from 378.1 ± 39.2 to 572.2 ± 22.3 days, being significantly ($P<0.01$) lower in Pantnagar centre. These might be due to its close proximity to the University and farmers got immediate help whenever they are in need regarding management of animals. The highest value for AP was 572.2 ± 22.3 days which were recorded from Sitarganj centre which is most distant from Pantnagar.

Among education level AP ranged from 448.0 ± 27.1 to 509.6 ± 26.5 days being significantly ($P<0.05$) lower in illiterate and matriculate farmers and highest among farmers which are able to read and write and those of education level more than matriculate. These variations in the values for AP might be because of different management practices followed by different farmers. However, higher AP among higher education level of farmers may be because of their diversion towards some other work than the rearing of heifers.

Among herd size AP ranged from 415.2 ± 30.7 to 524.1 ± 40.9 days being significantly lower in case of farmers with 6-10 AUE and higher among farmers with more than 10 AUE. Higher AP in case of farmers with larger herd size may be because of difficulty in proper management regarding feeding and also regarding proper detection of heat at proper time.

Year of birth (YOB) was found to have significant ($P<0.01$) effect on AP with lowest value of 285.8 ± 51.3 days in the year 2012 and highest value of 620.2 ± 24.5 days in the year 2010. Bakir and Cilek (2009) reported that effects of calving year and calving season on age at first calving was

statistically significant (P<0.01).

Among season of birth (SOB) AP ranged from 416.6 ± 40.0 to 518.4 ± 24.5 days being significantly (P<0.05) lower in rainy season and highest during spring season. However, Hawk *et al*. (1954) and Schillo *et al.* (1992) reported that heifers born during the spring and autumn were found to reach puberty at earlier age than those born during the other seasons of the year.

Table 1: Least-squares means for age at puberty (AP) in Frieswal heifers

Effects	Particulars	Code	Obs.	AP (days)
AI Centre	Pantnagar	1	17	378.1 ± 39.2^{A}
	Gadarpur	2	41	444.3 ± 26.6^{A}
	Bazpur	3	29	539.5 ± 27.7^{B}
	Kicha	4	11	491.8 ± 35.0^{B}
	Sitarganj	5	33	572.2 ± 22.3^{B}
Education	Illiterate	1	34	448.0 ± 27.1^{a}
	Read and write	2	35	509.6 ± 26.5^{b}
	Matriculate	3	23	478.5 ± 27.7^{a}
	>Matriculate	4	39	504.5 ± 24.4^{b}
Herd size	Up to 3 AUE	1	66	507.9 ± 25.3^{a}
	3 to 6 AUE	2	44	493.5 ± 23.1^{a}
	6 to 10 AUE	3	14	415.2 ± 30.7^{b}
	>10 AUE	4	7	524.1 ± 40.9^{a}
Year of birth		2010	48	620.2 ± 24.5^{A}
		2011	79	549.5 ± 16.5^{B}
		2012	4	285.8 ± 51.3^{C}
Season of birth	Spring	1	27	518.4 ± 24.5^{a}
	Summer	2	26	495.0 ± 27.3^{a}
	Rainy	3	11	416.6 ± 40.0^{b}
	Winter	4	67	510.8 ± 23.3^{a}
Overall			131	485.2 ± 21.8
CV (%)				15.15

CV: Coefficient of variance

Least-squares means followed by same or no upper case letters as superscripts do not differ significantly (a, b; P<0.05), (A, B, C; P<0.01).

Age at first AI (AFAI)

The overall least-squares means for AFAI of 81 heifers was 608.3 ± 27.1 days (Table 2). The present value is lower than those reported by Madhuri *et al.* (2009) in three-breed crosses of HF, Jersey and Hariana breeds of cattle and Singh *et al.* (2011) in Vrindavani. Age at first service reported by Madhuri *et al.* (2009) and Singh *et al*. (2011) were 772.07 ± 25.12 and 746.28 ± 8.94 days. Sarder (2006) reported higher values for AFAI of 29.4 months in different genetic groups of cattle under field conditions. Similarly, Dinka (2012) also reported higher values for AFAI of 24.9 ± 3.8 months in crossbred dairy cows under farm conditions. Bakir and Cilek (2009) reported that AFAI was 523.90 ± 6.71 days in Holstein cattle in farm conditions which were lower than the present findings. Similarly, Moges (2012) also reported lower AFAI of 15.4 ± 5.1 months in Holstein × zebu cattle in farm conditions.

Table 2: Least-squares means for age at first AI (AFAI) in Frieswal heifers

Effects	Particulars	Code	Obs.	AFAI (days)
AI Centre	Pantnagar	1	17	499.9 ± 46.1^{A}
	Gadarpur	2	29	548.0 ± 32.8^{B}
	Bazpur	3	14	655.6 ± 38.3^{C}
	Kicha	4	8	642.8 ± 43.6^{C}
	Sitarganj	5	13	695.3 ± 36.4^{C}
Education	Illiterate	1	22	574.5 ± 35.7
	Read and write	2	22	634.7 ± 34.1
	Matriculate	3	16	604.9 ± 36.5
	>Matriculate	4	21	619.3 ± 29.0
Herd size	Up to 3 AUE	1	43	588.6 ± 25.8
	3 to 6 AUE	2	24	610.7 ± 27.0
	6 to 10 AUE	3	11	570.6 ± 34.1
	>10 AUE	4	3	663.4 ± 77.1
Season of birth	Spring	1	19	636.6 ± 32.9
	Summer	2	9	653.0 ± 43.6
	Rainy	3	6	508.3 ± 58.6
	Winter	4	47	635.4 ± 24.7
Year of birth		2010	36	644.5 ± 35.9^{a}
		2011	45	572.1 ± 27.0^{b}
Overall			81	608.3 ± 27.1
CV (%)				15.79

CV: Coefficient of variance.

Least-squares means followed by same or no upper case letters as superscripts do not differ Significantly (a, b; P<0.05), (A, B, C; P<0.01)

The effect of AI centre was found highly significant (P<0.01) for AFAI. Among AI centre, AFAI ranged from 499.9 ± 46.1 to 695.3 ± 36.4 days, being significantly

lower in Pantnagar and highest in Sitarganj centre. The reason behind early AFAI in Pantnagar centre may be because of proper management of heifers by farmers regarding feeding and detection of estrus. Any delay regarding detection of estrus lead to delay in AI which which may affect the reproductive efficiency of heifers. Fricke (2004) reported that age at first breeding coupled with reproductive efficiency at first subsequent breeding determines the heifer's age at first calving.

The effect of year of birth (YOB) was found significant (P<0.05) for AFAI. Khan *et al*. (1992) reported significant (P<0.01) effect of YOB on AFAI in case of Sahiwal cattle. Aral (2005) reported significant (P<0.001) effect of year on AFAI in Brown Swiss heifers. Similarly, Bakir and Cilek (2009) also reported significant (P<0.01) effect of calving year on age at first breeding in Holstein cattle. Among year of birth, AFAI was lowest in year 2011 (572.1 ± 27.0 days) and highest in year 2010 (644.5 ± 35.9 days).

Age at first conception (ACON)

The overall least-squares means for ACON of 77 heifers was 610.2 ± 25.2 days (Table 3). The present value is lower than those reported by Rafique *et al.* (2000) in different crosses of Holstein-Friesian × Sahiwal, Sattar *et al.* (2005) and Sandhu *et al.* (2011) in Holstein-Friesian under farm conditions. The average values for ACON reported by Rafique *et al*. (2000), Sattar *et al*. (2005) and Sandhu *et al*. (2011) were 679.5 ± 8.03, 714.74 ± 9.72 and 655.10 ± 10.44 days, respectively. However, lower estimates of age at conception were reported by Novakovic *et al.* (2011) with average value of 491.19 ± 9.36 days in different genotypes of Holstein-Friesian under farm conditions. These differences might be due to location and variable management practices at different farms. Feeding and breeding decisions might also have affected this trait.

The effect of AI centre on age at conception was found to be significant (P<0.05). The value for age at conception was found to be lowest in Pantnagar (489.6 ± 43.0 days) and highest in Sitarganj centre (672.2 ± 36.6 days). The reason behind the lower age at conception of heifers in case of Pantnagar centre may be because of good management practices followed by farmers which lead to better health and growth of heifers. Further this value corresponded with simultaneous lower age at puberty in case of Pantnagar centre. Timely insemination of heifers by the AI workers may be the other reason for better conception. The effect of YOB was found to be non-significant. However, Rafique *et al.* (2000) reported significant (P<0.01) effect of YOB on ACON.

Table 3: Least-squares means for age at first conception (ACON) in Frieswal heifers

Effects	Particulars	Code	Obs.	ACON (days)
AI Centre	Pantnagar	1	17	489.6 ± 43.0[a]
	Gadarpur	2	29	541.6 ± 30.3[b]
	Bazpur	3	12	669.1 ± 38.3[c]
	Kicha	4	8	678.3 ± 41.1[c]
	Sitarganj	5	11	672.2 ± 36.6[c]
Education	Illiterate	1	20	576.0 ± 36.0
	Read and write	2	22	636.4 ± 33.0
	Matriculate	3	16	612.2 ± 33.5
	>Matriculate	4	19	616.2 ± 27.8
Herd size	Up to 3 AUE	1	40	606.2 ± 26.9
	3-6 AUE	2	24	615.5 ± 26.4
	6-10 AUE	3	10	549.1 ± 38.2
	>10 AUE	4	3	669.8 ± 62.1
Land holding	Landless	1	27	666.4 ± 34.2
	Small (up to5acres)	2	29	616.3 ± 28.7
	Medium (5-10acres)	3	10	562.4 ± 44.4
	Large (>10acres)	4	11	595.6 ± 37.6
Year of birth		2010	35	639.3 ± 34.1
		2011	42	581.0 ± 25.1
Season of birth	Spring	1	19	633.6 ± 30.3
	Summer	2	7	628.1 ± 44.1
	Rainy	3	5	517.8 ± 61.2
	Winter	4	46	661.3 ± 22.0
Overall			77	610.2 ± 25.2
CV (%)				14.92

CV: Coefficient of variance.

Least-squares means followed by same or no upper case letters as superscripts do not differ Significantly (a, b; P<0.05), (A, B, C; P<0.01)

Age at first calving (AFC)

The average age at first calving for 15 Frieswal heifers was 807.0 ± 28.1 days which are in close agreement with Zaman *et al*. (1983) in Friesian × non-descript cows under field conditions. Kuralkar *et al.* (1996) in Sahiwal × Jersey, Gaur (2001) in Holstein-Friesian ×

Sahiwal, Mukherji (2005) in HF × Sahiwal, Madhuri *et al.* (2009) in three breed crosses and Singh *et al*. (2011) in Vrindavani reported higher estimates of AFC values under farm conditions. Age at first calving ranged from 711 to 1130 days in present study. Significant effect of season of calving on age at first calving was found by Sahin *et al.* (2012).

A reduction in age at first calving can be achieved through better feeding, management, disease control and efficient heat detection and timely service programme (Javed *et al*., 2000).

CONCLUSION

Overall least-squares means for AP (131 heifers), AFAI (81 heifers), ACON (77 heifers) were 485.2 ± 21.8 days, 608.3 ± 27.1 days, 610.2 ± 25.2 days. The highly significant (P<0.01) effect of AI centre and YOB and significant (P<0.05) effect of education level, herd size and season of birth on AP was observed during the study. However, effect of land holding on AP was found to be non-significant. The effect of AI centre was found highly significant (P<0.01) for AFAI. The significant (P<0.05) effect of year of birth (YOB) was also found for AFAI. However, effect of education level, herd size and land holding of farmers and season of birth was found non-significant on AFAI. Significant (P<0.05) effect of AI centre was found on ACON. The effect of education level, herd size, land holding, YOB and SOB were observed to be non-significant on ACON. The average age at first calving for 15 Frieswal heifers was 807.0 ± 28.1 days.

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