STATUS OF INBREEDING IN SAHIWAL CATTLE OF PAKISTAN

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ABSTRACT

Mating between closely related (than the average of population) individuals is termed as inbreeding and is unavoidable in commercial breeding programmes in dairy cattle. Consequences of inbreeding include genetic drift, loss of hetrozygosity, and decrease in genetic variance. In breeding coefficients were estimated through using a total of 7345 pedigree records of Sahiwal cattle maintained at 6 institutional herds viz. LES, Jahangirabad (Khanewal), Khizerabad (Sargodha), Bahadurnagar (Okara), Kalurkot (Bhakar), Fazilpur (Rajanpur) and Shergarh (Okara) of Punjab province of Pakistan from year of birth 1973 to 2007. The overall inbreeding coefficient of all animals was 0.56%. Total 766 (10 sires and 756 cows) animals (10.43%) were found inbred. The average inbreeding coefficient amongst inbred animals was 5.33%. Maximum average inbreeding coefficient (25%) was observed in the herds maintained at Kalurkot, Fazilpur and Shergarh having relative small population size. It was followed by Jahangirabad and Khizerabad, while the lowest value of IBC was at Bahadurnagar with the highest number of animals inbred. Minimum (2.48%)IBC was found in the cows born during 1996 with 34 number of cows. The maximum 68 inbred cows were observed in the birth year, 2001.

Key words: Inbreeding Coefficient, Sahiwal cattle.

INTRODUCTION

Inbreeding occurs when animals mated to each other have common ancestors and is unavoidable in commercial breeding programmes in dairy cattle. Consequences of inbreeding include genetic drift, loss of hetrozygosity, and decrease in genetic variance (Hinrichs and Thaller, 2011). The knowledge of genetic variability within populations has received increasing attention over recent years (Wooliams *et al.*, 2002). In populations under selection pressure, the inbreeding within the progeny of reproducing individuals can be higher than that expected under pure genetic drift. On the other hand, the goal in conservation programmes for endangered breeds is to restrain the rate of inbreeding. Considering both selection and conservation, some simple demographic parameters have a large impact on the evolution of the genetic variability and largely depend on the management of the population (Gutiérrez *et al.*, 2003; Goyache *et al.*, 2003). Zebu cattle flourish well under tropical environments where as Sahiwal dairy cattle breed is known to be the best amongst Zebu cattle breeds due to relatively high milk producing ability, resistance against tropical diseases like ticks and heat tolerant and more than 29 countries use Sahiwal as purebred and for crossbreeding. So Sahiwal cattle can be considered as is a global animal genetic resource (Anonymous, 2009). Limited data on inbreeding and its effect on performance of Sahiwal are available. The present study was thus undertaken to find out present status of inbreeding in Sahiwal cattle of Pakistan.

MATERIALS AND METHODS

Natural & unknown Pedigreed bulls=	44
eAllah Dad Cattle Farm Jahanian =	15
LES, Bahadurnagar, Okara	52
LES, Jahangirabad, Khanewal =	60
LES, Khizerabad, Sargodha =	15
Private Purchase =	20
	206

A total of 7345 pedigree records of Sahiwal cattle (7139 cows and 206 bulls) maintained at 6 institutional herds viz. LES, Jahangirabad Khanewal (1843 cows), Khizerabad Sargodha (1251 cows), Bahadurnagar Okara (2363 cows), Kalurkot Bhakar (1171 cows), Fazilpur Rajanpur (422 cows) and Shergarh Okara (89 cows) of Punjab province of Pakistan from year of birth 1973 to 2007 were used in the present study. Inbreeding coefficients were calculated for all breeding animals of six herds according to Quass (1976) using computer software WOMBAT (Mayer, 2010) considering all known relationships. Farm wise and annual trend of inbreeding was estimated by averaging inbreeding coefficients of animals within each year.

The summary of data structure is given below;

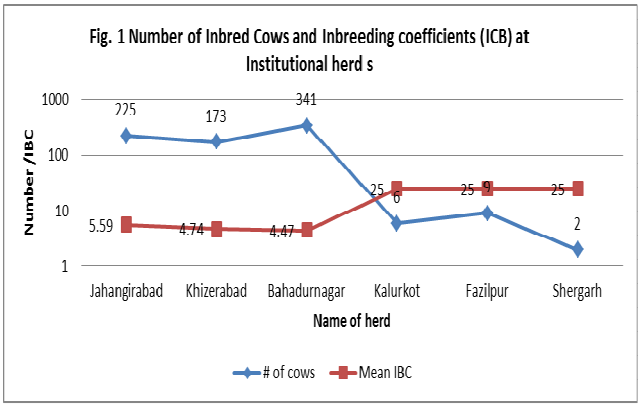
Total Number of Pedigree records	=	7345
Total Number of sires	=	206

Total number of dams	=	3074
Dams with progeny in the data	=	3047
Dams with records & progeny in data	=	2769
Number of animals with paternal grandsire	=	3334
Number of animals with paternal grand dam	=	2570
Number of animals with maternal grandsire	=	3607
Number of animals with maternal grand dam	=	2965
Total Number of Inbred Animals	=	766
Total number of inbred cows	=	756
Total number of inbred bulls	=	10
Total Number non-inbred animals	=	6579

RESULTS AND DISCUSSION

Out of total 7345 animals 766 (10.43%) were found inbred (756 females and 10 sires) with average inbreeding coefficient 5.33% whereas overall inbreeding coefficient was 0.56%. Dahlin *et al.* (1995) reported average inbreeding coefficient in 1224 cows and 49 bulls were 0.043 and 0.046, respectively. Most of the inbred animals were a result of matings between animals with their parents or grandparents. Javed *et al.* (2001) observed the average inbreeding coefficient (3.25 %) among 503 inbred animals as in a pure bred Sahiwal herd in Pakistan and only two bulls had inbreeding coefficient 25% or more. The higher inbreeding coefficient observed in the present study may be due the fact that the herds with smaller population size where more intense inbreeding has been practiced in past were also included in the present study whereas the previous studies (Dahlin *et al.*, 1995 and Javed *et al.*, 2001) were based on the herds excludings the herds of small size. The differences may be due the total number of pedigree records used for analysis and change of herd structure. A decrease in number of inbred cows has been recorded in the present study, while the average inbreeding coefficient showed an increasing trend which is inevitable in small populations and close breeding schemes. Cehan *et al.* (2011) has also observed an increasing trend of inbreeding coefficient in a close bred flock of Sakiz sheep in Turkey.

Maximum inbred animals were found at LES, Bahadurnagar, followed by Jahangirabad, Khizerabad, Fazilpur, Kalurkot and minimum inbred animals were calculated at Shergarh (Fig. 1). This variation may be due to the herd size and records available at different herds. The maximum (25%) average inbreeding coefficient (IBC) was observed in herds at Kalurkot, Fazilpur and Shergarh due to smaller size of population. However, the minimum average inbreeding coefficient was at Bahadurnagar, the reason may be somewhat better breeding strategy.



Lowest inbred animal number (only 1) was observed among the animals born during the year 1973 to 1975 and 1981 (Fig. 2), whereas the minimum IBC (2.48%) was in the cows born during 1996 (N =34). The maximum inbred cows (68) were observed among the animals born during the year 2001. The highest IBC (25%) was recorded among the cows born during the years 1974, 1977, 1978 and 1981. The level of inbreeding continuously increased after the year 1989. The reason seems to be the widely use of closely related proven bulls through artificial insemination at all the herds. Interestingly the bulls of high genetic merit (proven) were born as a result of closely related cows and sires resulting in comparatively higher inbreeding coefficients.

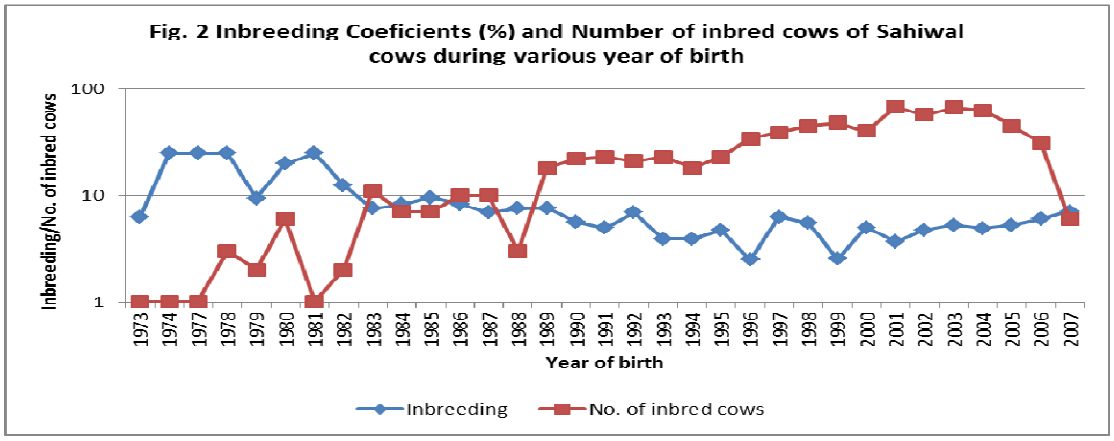


Fig. 2 above illustrates the increased levels of inbreeding and a decline in inbred population size during the years 1999 to 2007. Which lime lights the needs of measures to develop a breeding program which integrates management of genetic variability and selection.

It appears from the above list that co-efficient of inbreeding among inbred sires ranged from 0.78% to 25%. Bull number S-325 the most highly inbred sire was born at LES, Jahangirabad, during 2000. Inbreeding coefficient was 25% for this particular animal. It was the progeny of the most eminent cow number K4/2.2=Queen of Sahiwal cattle. Inbred sire of Sahiwal cattle number S=328, is the son of National Champion=J-4/1.4 Shareefan. Similarly, it is evident from the bull pedigree file, that all inbred sires them selves are of high genetic merit and are also from the progeny of Elite Sires and Dams. Breeding within an Elite class remains ever close due to selection drift. Any close breeding program results in a reduction in genetic variability and faces risks of increased inbreeding levels. Hence, it creates need to find an optimal balance between inbreeding and genetic diversity.

Table 1. List of inbred sires of Sahiwal cattle

Brand # of Sire	Year of birth	ICB %
328	2001	0.78
325	2000	25.00
296	1999	1.56
308	1999	0.78
295	1998	1.17
273	1997	4.30
266	1996	1.56
142	1987	3.13
108	1985	3.13
28	1982	12.50

Table 2.

Sr. No.	Bull code	Brand no.	DOB	Source of receipt	Sire no.	Dam no.	Paternal Grand sire no.	Paternal Grand dam no.	Maternal Grand sire no.	Maternal Grand dam no.
1	S-28	B43/2.2	04.12.82	Bahadurnagar	B221/4.3	B190/4.1	B14/1.0	B139/3.6	A2/1.5	B186/4.5
2	S-108	B9/1.5	23.01.85	Bahadurnagar	S-9	15/1.0	J14/1.9	B173/3.1	B34/1.8	B74/1.4
3	S-142	B7/1.7	15.01.87	Bahadurnagar	S-100	B151/4.8	B88/3.9	B190/4.1	J14/1.9	B171/3.1
4	S-266	P95/96	30.08.96	Purchased	S-142	J13/1.0	S-100	B151/4.8	J22/1.4	J127/4.6
5	S-273	B77/97	10.02.97	Bahadurnagar	S-219	B89/4.7	S-110	J112/4.0		B42/2.2
6	S-295	B85/9.8	22.11.98	Bahadurnagar	S-219	B87/4.5	S-110	J112/4.0	B3/1.6	B66/2.2
7	S-296	J25/9.9	21.02.99	Jahangirabad	S-219	J94/4.6	S-110	J112/4.0	J88/3.7	J104/3.9
8	S-308	B31/0.0	30.07.99	Bahadurnagar	S-158	J128/4.7	S-51	B151/4.8	S-101	J7/1.9
9	S-325	J83/2000	04.11.00	Jahangirabad	S-100	J89/2.7	S-15	B190/4.1	S-100	J9/1.0
10	S-328	J2/01	20.01.01	Jahangirabad	S-110	J89/9.4	S-7	B53/1.8	S-124	J30/1.8

The present results are partially in line with Javed et al, 2001, who reported the inbreeding coefficients of Sahiwal cattle of Jahangirabad herd, among the 503 inbred animals was 3.25 percent, the highest level being 26.78 percent. The number of sires used was 213 out of which 27 were inbred with average inbreeding coefficient 3.125 percent. Only 2 sires were having coefficient of inbreeding 25 percent or more. They also suggested that planned mating strategies be adopted to avoid adverse inbreeding effects.

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