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Prevalence, risk factors and constraints in control of repeat breeding in dairy animals of Punjab

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ABSTRACT

The present study investigated the occurrence of repeat breeding (RB) and constraints in controlling this disease in cattle and buffalo in Punjab. Livestock owners/households (720) constituted the ultimate sampling units for the study. The dairy farmers were categorized into small (5–10 animals), medium (11–50) and large (>50) farmers. The overall prevalence of repeat breeding in the study area was 27.6%. It varied significantly with respect to herd size and categories of animals except in buffaloes. The highest prevalence was observed in crossbred cattle (41.8%), followed by indigenous cattle (32.0%) and buffaloes (17.6%). Repeat breeder animals were mostly high yielders (with >15 kg milk yield), calved mostly in winter season, having below average body condition score (BCS). No significant correlation was observed between parity (lactation number) and type of calving and prevalence of repeat breeding. The major constraint (rank I) perceived by farmers was culling of affected problematic cows, and lack of effective and accurate estrus detection in buffaloes. The other major constraints perceived in the study area were high cost of veterinary medicine, poor conception rate following artificial insemination and inaccessibility of qualified veterinarian. The lack of knowledge regarding animal nutrition and higher cost of branded feed available in the market were responsible for low body condition score of affected animals. Thus, a comprehensive policy and programmes involving various stakeholders are required for effective control of repeat breeding in Punjab.

Key words: Buffalo, Cattle, Constraints, Prevalence, Punjab, Repeat breeding, Risk factors

Reproductive performance is a crucial factor for the dairying sector because of vast impact of reproductive performance on dairy production system (De Vries 2006, Giordano *et al.* 2012). It has a long-term effect on animal's lifetime production including length of calving interval and lactational milk production. Poor reproductive performance, results in economic losses due to late maturity, extended dry period, decreased calving percentage, less lactations per animal, less number of calves born and reduced lifetime productivity of the animal, increased cost of management and intense culling of the animals (Agarwal 2005, Meadows *et al.* 2005, Mulligan *et al.* 2006, Inchaisri *et al.* 2010). It is estimated that about 30.4% of cattle and buffalo are culled mainly due to various infertility conditions (Gupta *et al.* 2015). Among the reproductive disorders, repeat breeding and anestrus cause most devastating losses to livestock owners in India.

Repeat breeding (RB) is one of the important reproductive disorders of domestic animals and causes great economic loss to dairy industry in India. Repeat breeder is a cyclic non-breeder dairy animal that failed to conceive after three or more inseminations and exhibit normal signs of estrus every 18 to 24 days (Parkinson 2001). The incidence of repeat breeding appears to be low in buffaloes as compared to cattle (8.68% vs. 18.79%) (Patel *et al.* 2007). The incidence varies with breed, farm, agro-climatic and management conditions. In Punjab, the incidence of repeat breeding in cattle and buffalo is slightly higher than national average due to higher propensity towards rearing of high yielding cows and buffaloes. The annual incidence of repeat breeding in Punjab has been reported to be 11–16% in buffaloes and 12–20% in cattle (Sharma and Karwani 2003, Singh *et al.* 2003, Kaur *et al.* 2011).

The etiology of repeat breeding appears to be multifactorial and include uterine infections, hormonal dysfunctions and nutritional inadequacies, and poor breeding and health management. The significant risk factors for repeat breeding in cattle and buffalo are breed, age, season of calving, parity, high milk yield, early embryonic deaths, poor semen quality, improper insemination, peri-parturient disease and lactation stage (Saraswat and Purohit 2016). This study was conducted to investigate the occurrence of repeat breeding in cattle and buffalo at herd and individual level, constraints in controlling this disease at field level and define the priorities of the control procedures in terms of the cost-benefit .

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MATERIALS AND METHODS

The data was collected through pre-tested schedule by personally visiting the individual farms. The respondents were selected by multistage stratified random sampling technique across six agro climatic zones of Punjab (Mahi and Kingra 2013), viz. Sub-mountainous undulating region (Zone I), Undulating plain region (Zone II), Central plain region (Zone III), Western plain region (Zone IV), Western region (Zone V) and Flood plain region (Zone VI). From each zone, two districts were selected randomly, and then from each selected district, two tehsils were selected. From each selected tehsil, 3 villages were selected. Thus, the sample for the study comprised 12 districts, 24 blocks and 72 villages. On the basis of a pre-survey, a list of farmers having at least 5 adult cattle or buffaloes, were prepared from each selected village. This list served as the following frame. Then, simple random sampling without replacement was followed to select 10 livestock owners/households from that list. Thus, 720 livestock owners/households constituted the ultimate sampling units for the study. Out of 720 farmers, 112 reared cattle, 472 reared buffalo, and the remaining 136 farmers reared both cattle and buffalo.

On the basis of herd size, the dairy farmers were categorized into small (5–10 animals), medium (11–50) and large farmer (>50 animals). The respondents were interviewed for data collection using interview schedule specially prepared for the purpose. The prevalence of repeat breeding in 2016–17 was studied with the help of a structured interview schedule. The information regarding major risk factors and the various constraints in controlling repeat breeding in the region was also collected. The data so collected also included clinical features of repeat breeding at species level, herd level and zone level. The responses provided by dairy farmers were confirmed with the local veterinarian and matched with the existing data registers at the local dispensary. The animal level incidence of repeat breeding was determined as the number of animals affected divided by the total number of animals at species level and herd level.

Garrett's ranking technique was used to analyze the constraints of controlling repeat breeding in dairy animals as perceived by the affected dairy farmers. To find out the most significant constraint perceived based on its seriousness by dairy farmers, respondents were asked to assign the rank for all constraints and the outcome of such ranking was converted into score value with the help of the following formula:

$$\text{Per cent position} = \frac{100\ (R_{ij} - 50)}{N_j}$$

where R_{ij}, rank given for the i^{th} factor by the j^{th} individual; N_j, number of factor ranked by the j^{th} individual.

With the help of Garrett's Table, the per cent position estimated was converted into scores. Then for each factor, the score of each individual was added and then total value of scores and mean value of scores were calculated. The factors having highest mean value was considered to be the most important factor.

RESULTS AND DISCUSSION

Prevalence: The overall prevalence of repeat breeding was 27.6%. It varied significantly among farms of different herd size (P<0.01) and different categories of animal species (P<0.01). Among the different agro climatic zones of Punjab, repeat breeding varied significantly among different herds (P<0.01). Repeat breeding also varied significantly (P<0.05) in different categories of animals except in buffaloes (P>0.05).

Prevalence of repeat breeding among crossbred cattle in different agro climatic zones of Punjab varied significantly (χ^2=20.2; P<0.01) and ranged between 34.5% (Zone II) to 45.4% (Zone VI). Similarly, among indigenous cattle, it varied significantly (χ^2=11.8; P<0.05) and ranged between 20.7% (Zone V) to 38.9% (Zone IV). However, the prevalence of repeat breeding in buffaloes did not vary significantly (χ^2=9.83; P>0.05). Among small herd groups, the prevalence was 39.4% and varied significantly (χ^2=17.9; P<0.05) among different agro climatic zones. It ranged from 34.7% (Zone I) to 52.2% (Zone VI). Among medium herd size farms, the prevalence of repeat breeding was 28.97%. It also varied significantly (χ^2=93.4; P<0.01) among different agro climatic zones, ranging from 21.2% (Zone I) to 44.9% (Zone VI). In case of large herd size farms, the prevalence was 21.78% varying significantly (χ^2= 32.8;

Table 1. Prevalence of repeat breeding on species basis and herd basis of dairy animals in different agro climatic zones of Punjab

	Category	Agro-climatic zones of Punjab						
		I	II	III	IV	V	VI	χ2 value
Species basis	Crossbred cattle	33.9	34.5	41.2	40.8	44.7	45.4	20.2**
	Indigenous cattle	23.3	19.4	38.4	31.9	38.8	25.7	11.8*
	Buffalo	15.5	17.3	18.2	12.5	19.9	12.7	9.83^{ns}
Herd size basis	Small	34.7	35.7	42	36.7	41.3	52.2	17.9*
	Medium	21.2	22.3	26.4	26.8	29.1	44.9	93.4**
	Large	16.8	14.4	30.7	20.9	20.8	23.1	32.8**
Overall		24.2	23.7	32.6	28.4	34.5	27.9	40.1**

*(P<0.05) and **(P<0.01) indicate significant difference; ^{ns}(P>0.05) indicate no significant difference.

P<0.01) in different agro climatic zones.

Prevalence of repeat breeding (Table 2) among all the categories of animals was highest in later stages of lactation followed by middle and early lactation. It varied significantly (P<0.01) among different parity groups and among different categories of animals.

The most affected zones due to repeat breeding were Zone V and Zone III because the animals reared were mainly

Table 2. Prevalence of repeat breeding at parity levels of different categories of animals

	Lactation (1–2)	Lactation (3–4)	Lactation (>5)	Overall
CB cattle	750	1490	750	2990
Affected	238	650	361	1249
(%)	(31.73)	(43.62)	(48.13)	(41.77)
Indigenous cattle	192	330	183	705
Affected	44	105	78	226
(%)	(22.91)	(31.81)	(42.62)	(32.05)
Buffalo	1200	2421	903	4524
Affected	139	421	236	796
(%)	(11.58)	(17.38)	(26.13)	(17.59)
Total animals	2142	4241	1836	8219
Affected	421	1176	675	2271
(%)	(19.65)	(27.72)	(36.76)	27.63

χ^2=144.73 and 533.80 (significant at P<0.01 between the different parity groups and between the different categories of animals respectively).

Table 3. Risk factors associated with the occurrence of repeat breeding in dairy animals (n=8219)

		Normal	Repeat breeder (%)	Significance
Category of animals	Crossbred cattle	1741	1249 (41.8)	$\chi^2 = 533.8^{**}$
	Indigenous cattle	479	226 (32.1)	
	Buffalo	3728	796 (17.6)	
Herd size	Small	1028	667 (39.4)	$\chi^2 = 186.8^{**}$
	Medium	1807	737 (29.0)	
	Large	3113	867 (21.8)	
Lactation No.	1	1735	648 (37.3)	$\chi^2 = 0.7^{ns}$
	2	1894	726 (38.3)	
	3	823	329 (40.0)	
	>4	1496	568 (38.0)	
Nature of delivery	Eutocia	3986	1549 (38.9)	$\chi^2 = 1.1^{ns}$
	Dystocia	1962	722 (36.8)	
Calving season	Winter	1311	873 (51.8)	$\chi^2 = 228.2^{**}$
	Summer	1833	581 (24.1)	
	Monsoon	2804	817 (19.8)	
Milk yield	< 15 kg	2423	491 (16.8)	$\chi^2 = 262.4^{**}$
	> 15 kg	3525	1780 (33.6)	
Body condition score (BCS)	1–2	1225	638 (52.1)	$\chi^2 = 51.2^{**}$
	2–3	2849	995 (33.5)	
	4–5	1874	648 (36.2)	

**(P<0.01) indicate significant difference; ^{ns}(P>0.05) indicate no significant difference.

crossbred animals within small herd units with little awareness about animal's health and breeding management. Zone II was mainly inhabited by buffaloes that have lower comparatively prevalence of repeat breeding. Animals raised in small herds were affected highest followed by those of medium and large herd groups. Compared to cattle, buffalo showed lower incidence of repeat breeding because buffaloes are well adopted to their natural habitat and have lower production capacity compared to crossbred animals. Buffaloes, however, showed poor reproductive inefficacy due to seasonality and silent heat during summer season (Das and Khan 2010). The results of the study were partly in agreement with those of Sharma and Karwani (2003), who reported incidence of repeat breeding in buffaloes to be 19.61%. They reported much lower incidence of repeat breeding in cattle (15.63%).

Risk factors: Prevalence of repeat breeding among different categories of animals, viz. crossbred cattle, indigenous cattle and buffaloes varied significantly (χ^2=533.8; P<0.01). The highest prevalence was observed in crossbred cattle (41.8%), followed by indigenous cattle (32.0%) and buffaloes (17.6%) (Table 3). Repeat breeder animals were mostly high yielders (>15 kg milk yield), calved mostly in winter season, having below average body condition score (BCS). Parity (lactation number) and type of calving had no significant effect on prevalence of repeat breeding.

The results clearly indicate that high yielder crossbred animals had highest prevalence of repeat breeding syndrome. This is due to intensive selection for high milk yield in exotic and crossbred cows that has a negative impact on fertility (Butler 2000, Dobson *et al.* 2007, Roy and Prakash 2007). Dairy farmers in the present study perceived cross breeding as a major constraint in controlling repeat breeding in cattle (Table 4). High producing animals mostly suffer from negative energy balance and metabolic diseases due to drainage of nutrients in milk. The negative energy balance affects hypothalamo-pituitary-ovarian axis at multiple levels and ultimately prevent dominant follicle from ovulating (Garcia-Garcia 2012). Body condition score is also associated with repeat breeding (Asaduzzaman *et al.* 2016). Marai *et al.* (1992) reported that lactating buffaloes with high milk production required higher number of services per conception than non-lactating and low producing buffaloes. In Punjab, it was previously revealed that buffaloes producing more than 3,000 kg in lactation had the highest calving to conception period and those producing 1,000 kg in lactation had the lowest (Abayawansa *et al.* 2011). Similar observations have been recorded in cattle (Gustafsson and Emanuelson 2002). The results of lower incidence of repeat breeding in buffaloes as compared to cattle have also been reported in earlier studies (Patel *et al.* 2007, Purohit *et al.* 2008), however, Sharma and Karwani (2003) found higher incidence of repeat breeding in indigenous Sahiwal cattle (21.67%) as compared to crossbred HF cattle (14.28%). This could be due to use of

frozen semen from Sahiwal bulls having low post-thaw motility. No effect of parity on occurrence of repeat breeding has been recorded previously (Kumar *et al.* 2011).

Constraints for controlling repeat breeding in cattle and buffalo using Garrets Ranking Technique in different agro climatic zones of Punjab: Various causes of repeat breeding and constraints faced by dairy farmers to control this disease were ranked using Garrett's ranking technique (Tables 4 and 5). The first major constraint perceived by farmers was the problem of culling infertile cattle. It is the major impediment in control of this disease in cattle. This constraint arises due to government regulation in trade and slaughter of unproductive cattle. Lack of effective and accurate estrous detection was the major constraint in buffaloes. Standing estrus is less likely to be observed in buffaloes, resulting an inaccurate timing of insemination and conception failure. This condition is exaggerated during summer due to increased incidence of summer anestrus, silent estrus or estrus during night hours. The problem of repeat breeding in buffaloes is being solved partly by culling the affected animals. It has been reported that 37.5% buffaloes are culled due to various reproductive problems (Sharma *et al.* 1993). This practice has been prohibited legally in cattle.

The other major constraints perceived in the study area were high cost of veterinary medicine, poor conception rate following AI and inaccessibility of qualified veterinarian. The nutritional imbalances due to poor knowledge of balanced nutrition and higher cost of branded feed available in the market result in low body condition score of affected animals.

Malik *et al.* (2017) also reported similar findings as major constraints in dairy farming in Punjab. Imakawa *et al.* (1986) reported that poor nutrition or underfeeding occurs most frequently and results in weak estrus expression and reduced ovulation, extended periods of anestrus following calving, low conception and fertilization rates. Royal *et al.* (2000) reported that large negative energy balance during post-partum period was associated with reduced BCS and subfertility. Lack of AI and PD services at door step by expert inseminators was also perceived as a constraint in controlling this disease. This constraint was due to improper storage and thawing of semen, poor post thaw handling, incorrect and inappropriate insemination technique that too by the quacks (Malik *et al.* 2017). Correctness and precision of the above mentioned steps were mandatory in achieving high success rate with AI (Salisburry *et al.* 1985).

Heat stress, although not so important for cattle, was recognized as major constraint (rank V) by buffalo dairy farmers in the study area. Since the temperature and humidity remain on higher side during summer and rainy season, buffaloes were unable to cope with heat stress due to poor heat dissipation mechanism thereby affecting their fertility.

It is, therefore, concluded that a comprehensive, ongoing reproductive management program, involving a team effort by the dairy farmers, inseminators and veterinarians is the

Table 4. Constraints for controlling repeat breeding in cattle from different agro climatic zones of Punjab

	Perceived Rank										Total score	Mean score	Overall Rank
	I	II	III	IV	V	VI	VII	VIII	IX	X			
Garrett's value constraint	82	70	63	58	52	48	42	36	29	18			
High input cost for managing heat stress	164	980	3843	2494	3640	624	756	792	87	36	13416	54.10	V
High cost of veterinary medicines	1476	2310	1701	4872	1768	1008	672	144	232	54	14237	57.41	II
Poor results of AI	1640	3010	1890	1218	2236	2880	546	180	145	144	13889	56.00	III
Increased incidence due to cross breeding	2624	1610	2457	1276	780	1248	2478	864	145	54	13536	54.58	IV
Inaccessibility of veterinarians	984	980	315	754	260	1440	1092	1872	1798	522	10017	40.39	IX
Lack of AI and PD services at door step	1640	490	882	870	936	1296	1218	1656	1711	234	10933	44.08	VIII
Lack of effective and accurate estrous detection	2624	1750	1071	1450	1352	1776	1218	936	464	270	12911	52.06	VII
Problem of culling unproductive animals	6396	1750	2835	986	520	1056	1512	180	232	36	15503	62.51	I
Inadequate knowledge of AI timing	2050	4480	315	464	1404	576	714	1692	1218	18	12931	52.14	VI
Inadequate knowledge of balanced nutrition	738	0	315	0	0	0	210	612	1160	3096	6131	24.72	X

Table 5. Constraints for controlling repeat breeding in buffaloes from different agro climatic zones of Punjab

	Perceived Rank										Total score	Mean score	Overall Rank
	I	II	III	IV	V	VI	VII	VIII	IX	X			
Garrett's value constraint	82	70	63	58	52	48	42	36	29	18			
High input cost for managing heat stress	4018	3570	5166	3596	8996	3024	1554	1044	493	441	31902	54.63	V
High cost of veterinary medicines	3116	2730	2898	2842	2808	7152	3066	3204	203	840	28859	49.42	VI
Poor results of AI	7052	13300	4347	3074	2548	2016	1596	1080	464	231	35708	61.14	II
Poor semen quality	410	350	378	174	832	1152	2646	1044	406	8799	16191	27.72	X
Inaccessibility of veterinarians	5412	3710	3213	11484	2236	768	1932	1368	1276	609	32008	54.81	IV
Lack of AI and PD services at door step	6068	5740	11466	3770	2860	1776	1260	900	551	315	34706	59.43	III
Lack of effective and accurate estrous detection	15826	7770	5670	4582	2236	1584	1092	252	58	0	39070	66.90	I
Problem of culling unproductive animals	1558	560	1197	696	1404	2976	2058	4428	7569	84	22530	38.58	IX
Inadequate knowledge of AI timing	2706	1820	1134	870	2756	4128	5292	3312	2987	672	25677	43.97	VIII
Inadequate knowledge of balanced nutrition	1738	1330	1323	2784	3692	3456	4032	4392	2929	273	25948.87	44.43	VII

key to success in diagnosing, treating and preventing the problem of repeat breeding. This can be achieved by increasing the intensity of veterinary institutions which will improve accessibility and veterinary health of dairy animals. Overcoming the problem of nutritional deficiency among high yielding cows and buffaloes will alone reduce economic losses to the dairy farmers.

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