A benchmark study on reproductive management assessment of dairy animals under rural smallholder conditions

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Citation

S Ghuman, J Singh. *A benchmark study on reproductive management assessment of dairy animals under rural smallholder conditions*. The Internet Journal of Veterinary Medicine. 2009 Volume 8 Number 1.

Abstract

About 200 rural smallholder dairy farmers completed a questionnaire that was designed to assess the practices adopted by them for the reproductive management of cattle and buffaloes. Repeat breeding, retention of placenta and anestrus were the commonly encountered problems in cattle and buffaloes, whereas silent estrus was an additional reproductive issue in buffaloes. Estrus detection procedures were faulty. The frequency of estrous detection was twice a day and the duration was <5 min. Moreover, 73% persons engaged in estrous detection were 'multitasking' during the period of estrous detection. For taking a decision regarding breeding of animal, 'Doka' (partial let down of milk without any stimulation about 2 days prior onset of estrus) was ranked as the most prominent estrus sign in buffaloes, whereas 'standing to be mounted' was ranked as the least important estrus sign in cattle. The techniques of semen tank management, handling of semen within the tank, thawing of semen and semen motility check were not carried out appropriately ($p<.05$). In summary, the present survey provided a benchmark of commonly used reproductive management practices in cattle and buffaloes under rural smallholder conditions.

INTRODUCTION

More than 70% Indian rural households own livestock and a majority of them are smallholders with less than 5 dairy animals (Birthal and Jha 2005, Misra et al 2007). The reproductive performance of smallholder dairy farms remains inefficient besides the fact that they may have a key role in the success of various dairy developmental schemes (Thammi Raju et al 2006). Moreover, in the current smallholder scenario, the holistic growth of dairy animals appears difficult, if not impossible, because of the non-availability of systematic fertility records (Caraviello et al 2006). The smallholder farmers must account for various factors affecting fertility viz., reproductive disorders, estrous detection and breeding activities (Grohn et al 2000). Once the in-depth data on management practices being used in smallholder farms is available, strategies can be chalked out for optimizing their fertility. Hence, using an extensive questionnaire based-survey, the objective of present study was to scrutinize the existing practices in rural smallholder dairy farms that could alter the reproductive performance of cattle and buffaloes.

MATERIALS AND METHODS

The present survey was conducted on rural smallholder dairy farms in Poadh region (30.79°N, 76.5°E) of Punjab, India. A total of 200 dairy farms with 1101 cattle and 864 buffaloes were visited during a 6 month period beginning September, 2008. Each farm housed 2.4±0.2 cattle and 1.7±0.0 buffaloes that can be further categorized as calves, heifers, and adults between 1st to 3rd parity and above 3rd parity. The respective average of these categories at each farm with respect to cattle and buffaloes was 2.6±0.3 and 1.8±0.1 (calves), 1.9±0.3 and 1.4±0.1 (heifers), 3.0±0.5 and 1.8±0.1 (1-3 parity), and 1.9±0.3 and 1.5±0.1 (>3 parity).

A comprehensive questionnaire was designed and a personal interview was conducted at each farm. Questions were answered by head of the household or family member or labor, whosoever was mainly responsible for the animals. The main categories for which information was obtained were herd management (Table 1), reproductive disorders (Table 1), estrous detection (Table 2), breeding activities (Table 3) and artificial insemination (AI) procedures (Table 4).

The frequencies were tabulated for various variables and data was analyzed. Microsoft Excel was used to input data and concatenate different combinations of response. Frequency percentage for all the categories was calculated

individually. Whenever there was more than one response per informant the total exceeded 100%. Statistical significance (P<0.05) for a select categorical variable compared with other categorical variable (in response to a categorized question) was generated using chi-square (2) test (Dytham 1999). The statistical procedures were performed using MINITAB release 14.2 statistical software.

RESULTS AND DISCUSSION

It is established that poor record keeping is one of the major factors limiting the successful reproductive management of dairy animals (Chagunda et al 2006). In the present survey, a major proportion (66%; P<0.05) of dairy farmers kept records (Table 1), however, the records being kept appeared incomplete and not systematic because most of the farmers were unable to mention the details about conception rate, numbers of services per conception, day's open and calving intervals.

In the majority of farms (95%; P<0.05), animals were identified by their name (Table 1). This appears justified as the present survey was conducted on farms which had not more than 5 animals. Usually, smaller farms facilitate a good farmer-animal relationship (Waiblinger and Menke 1999), thus the farmers may not need to use animal identification aids such as tags.

Keeping in view the economically backward condition of smallholders, it appears reasonable that 66% farms were managed by the family members only and most of them were working full-time (59.6%, P<0.05, Table 1). About 3.6% farms were managed only by labor without the involvement of family members. Furthermore, about half of the dairy farmers were satisfied with existing herd size, and 38.7% farmers anticipated continued expansion of the herd. A comparatively less proportion (11%, p<0.05; Table 1) of farmers were not satisfied with dairy farming and were in favor of reducing the number of animals.

Figure 1

Table 1. Responses (frequency %) of rural smallholder dairy farmers to the questions related to herd management and reproductive issues.

Question	Response		
Whether record of various reproductive events is kept?	Yes (66%)[a] No (34%)[b]		
How the animals are identified?	Name (95%)[a] Tag (4%)[b], Number (1%)[b]		
How many persons are involved in managing dairy animals?	Whole family full-time (59.6%)[a] Whole family some-time (6.2%)[b] Labor full-time (3.6%)[b] Whole family full-time, labor full-time (7.8%)[b] Whole family full-time, labor some-time (4.7%)[b] Whole family some-time, labor full-time (18.1%)[b]		
What is the goal for dairy herd size?	Keep existing (50.5%)[a] Expansion (38.7%)[a], Contraction (10.8%)[b]		
What system is used to lessen the stress of elevated temperature on animals during summer?	Shade (37%)[a], Shade and fan (51%)[a] Shade, fan and sprinklers (2%)[b] Shade and pond / Shade and sprinkler/ Shade, fan and pond / Fan (0.5% each)[b], Nothing (8%)[b]		
Indicate the important reproductive issues among dairy animals.		**Cattle**	**Buffalo**
	Anestrus	21.3%[a]	14.8%[a]
	Repeat breeding	30.2%[a]	14.3%[a]
	Silent estrus	3.6%[b]	13.7%[a]
	Abortion	4.1%[b]	1.1%[b]
	Retention of placenta	21.9%[a]	9.9%[a]
	Dystocia	4.7%[b]	1.6%[b]
[a,b] p<0.05 (between responses of a categorized question)			

The environmental conditions in Poadh region of Punjab are adverse between April to September, when maximum ambient temperature and relative humidity is 36-45ºC and 30-80%, respectively. This period warrants heat abatement practices for the dairy animals to decrease the impact of heat stress on their fertility rates (De Rensis and Scaramuzzi 2003). In the present survey, a major proportion (88%, P<0.05) of farmers relied on the shade of trees with or without fans (Table 1). A very little proportion of farms also used heat abatement devices such as sprinklers (Table 1).

Out of various reproductive disorders observed by the dairy farmers, the major (P<0.05) causes for concern were repeat breeding, retention of placenta and anestrus compared to disorders such as abortions and dystocia (Table 1). The observed prevalence of reproductive disorders is similar to previously reported studies in bovines; however, the proportion of animals with retention of placenta is much higher (Agarwal et al 2005). In fact, a proportion of the repeat breeder animals (Table 1) could be the consequence of retained placenta as endometritis and pyometra may develop following retention of placenta thus increasing services per conception (Bekena et al 1997). Silent estrus was one of the major issues in buffalo farming (Table 1). Although the prevalence of dystocia was too little in the present survey (Table 1), only 63.6% cattle and 43.4%

buffaloes calved on their own and calving in the remaining (except those with dystocia) required mild assistance by the farmer.

At most of the dairy farms surveyed, head of family was responsible for the detection of estrus (P<0.05, Table 2). Almost all the farmers admitted that estrous detection is important and they are keeping records of animals detected in estrus (P<0.05, Table 2). In fact, 88% farmers believed that they are aware of accurate estrous detection procedures (P<0.05, Table 2). This was essential because bulls for estrous detection were used only at 3% dairy farms and estrus was mainly detected by the farmer through external estrus signs (P<0.05, Table 2).

On the contrary, after analyzing the other responses of farmers with respect to estrous detection, it was concluded that farmers of the surveyed area were not aware of accurate estrous detection method (Table 2). Only 27% farmers admitted that detection of estrus is the farmer's sole responsibility during the period of estrous detection (P<0.05, Table 2). In addition, estrous detection period lasts for not more than 5 min at 77% farms (P<0.05, Table 2) and at 80% farms estrous detection is done only during morning and evening (P<0.05, Table 2). Therefore, twice a day observation, short period of observation, and 'multitasking' appears to be the major factors limiting the estrous detection efficiency of rural farmers. 'Multitasking' can increase missed estruses because the duration of mounting in dairy animals is only 4-8 seconds (Diskin and Sreenan 2000). Ideally, animals should be detected for estrus thrice a day for a minimum duration of 30 minutes and estrous detection should be the sole responsibility of person engaged for the detection of estrus (Diskin and Sreenan 2000).

Moreover, ignorance of farmer about importance of various estrus signs in relation to taking the animal for breeding was also clear from the present survey. The major estrus sign based on which buffaloes were taken for breeding was 'doka' (retention of milk at the time of milking), followed by bellowing, vaginal discharge and frequent urination (P<0.05, Table 2). Nevertheless, about 80% farmers detected 3 to 4 estrus signs in buffaloes suspected in estrus (P<0.05, Table 2). Established reports on buffalo estrous behavior suggest that acceptance of male is considered as the most reliable estrus indicator in buffalo followed by bellowing (Singh et al 1984). In contrast to present survey (Table 2), homosexual behavior is not reported in buffaloes in estrus (Perera 2008).

In cattle, 'standing to be mounted' (18.9%, P<0.05, Table 2) was ranked among the least important sign of estrus suitable for breeding, yet the converse is true (Diskin and Sreenan 2000). For taking cattle for breeding, most of the farmers relied on vaginal discharge (98.2%, P<0.05, Table 2), which is a supplementary estrus sign. This shows that those responsible for checking of estrus were not aware of the importance of various estrus signs. Moreover, in cattle, around 80% farmers relied on 2 to 3 estrus signs (P<0.05) for detection of estrus which are mainly the supplementary estrus signs (Table 2). Relying on supplementary estrus signs can give rise to poor estrous detection accuracy and the animal may be bred at the wrong time (Diskin and Sreenan 2000). The ideal goal for estrus detection error rate should not be more than 2% in a herd (Senger 2003). In present survey, with more than 80% farmers failing to observe standing estrus, it is clear that poor estrous detection is the major reproductive management problem in the surveyed dairy farms. This survey highlights a need to raise awareness about primary and supplementary signs of estrus and their relative importance, and thus, encourage the farmers to act accordingly

Figure 2

Table 2. Responses (frequency %) of rural smallholder dairy farmers to the questions related to detection of estrus

Question	Response		
Who is responsible for the detection of estrus?	Head of family (94.1%)[a] Family members (4.4%)[b], Labor (1%)[b]		
Whether the detection of estrus and keeping record of detected estruses is important for the dairy farm?	Yes (99.5%)[a] No (0.5%)[b]		
Whether the head of the family / family members / labor are aware of the accurate estrous detection procedures?	Yes (88.3%)[a] No (11.7%)[b]		
How estrus is detected?	Estrus signs (97%)[a], Bull (3%)[b]		
Is detection of estrus sole responsibility of a person at a time?	Yes (27.2%)[a] No (72.8%)[b]		
How much time is spent on detection of estrus each time?	<5 min (77.5%)[a] 5-10 min (11.5%)[b] Never recorded time (11%)[b]		
At what time of the day animals are detected for estrus?	Morning and evening (80%)[a] Morning, evening and noon (10%)[b] Noon and morning or evening (2% each)[b] Morning or noon (1% each)[b] No time fixed (4%)[b]		
Which estrus signs shown by an animal are reliable indicators for taking the animal for breeding?	**Sign**	**Cattle**	**Buffalo**
	Vaginal discharge	98.2%[a]	67.6%[a]
	Bellowing	45.6%[a]	78.0%[a]
	Vulval swelling	12.4%[b]	10.4%[b]
	Frequent urination	30.8%[a]	54.4%[a]
	Mounting other animals	54.4%[a]	1.1%[b]
	Allowing other to mount	18.9%[b]	3.3%[b]
	Doka	3.0%[b]	95.1%[a]
Number of estrus signs observed by the farmer in an animal in estrus	**Number of signs**	**Cattle**	**Buffalo**
	1	8.4%[b]	1.7%[b]
	2	38.6%[a]	15.1%[b]
	3	38.6%[a]	52.5%[a]
	4	10.8%[b]	27.9%[a]
	5-6	3.6%[b]	2.8%[b]
[a,b] $p<0.05$ (between responses of a categorized question)			

Majority of the dairy farmers (95.9%, P<0.05, Table 3) were not aware about the estrous synchronization and fixed-timed breeding programs that can be used in dairy animals. A general unawareness of dairy farmers about these protocols might limit their estrous detection problems. Percentage of farmers adopting either ‘artificial insemination’ (AI), 'AI and natural service' or 'natural service' was highest (P<0.05) for 'AI' in case of cattle and was highest (P<0.05) for 'natural service with or without AI' in case of buffaloes. The major reasons for farmers not adopting AI in case of buffaloes are poor estrous detection in buffaloes along with no persuasion and advice (Sinniah and Pollott 2006). In present survey, the majority of herds used rectal palpation for pregnancy diagnosis within three months after breeding (P<0.05), however pregnancy was not re-confirmed in those animals at later stages (P<0.05, Table 3).

Figure 3

Table 3. Responses (frequency %) of rural smallholder dairy farmers to the questions related to breeding of animals

Questions	Response		
Are you aware about estrous synchronization and fixed-time breeding protocols?	Yes (4.1%)[a] No (95.9%)[b]		
Which breeding methods are used in herd?	**Breeding method**	**Cattle**	**Buffalo**
	AI	95.0%[a]	27.9%[a]
	AI and natural service	39.8%[a]	81.0%[b]
	Natural service	5.0%[b]	80.4%[b]
Whether pregnancies are diagnosed with in three months after AI?	Yes (97.9%)[a] No (2.1%)[b]		
What method is used for pregnancy diagnosis?	Rectal palpation (96.5%)[a] External signs (3.5%)[b]		
Whether the pregnant animals are re-confirmed?	Yes (2.8%)[a] No (97.2%)[b]		
[a,b] $p<0.05$ (between responses of a categorized question)			

Attempts to improve the efficiency of AI should be based upon the understanding of most important causes for failure. The present survey indicated that one of the factors responsible for the failure of AI could be improper semen tank management (Table 4). The proper handling tank filled with semen straws is important for maintaining the fertilizing capacity of the spermatozoa (O’Connor 2004). It was recorded that quite a high proportion (35%, P<0.05) of the semen tanks lacked semen inventory, in 75% cases (P<0.05) semen straws were counted near the neck of the semen tank in liquid nitrogen fumes and in a very less proportion of cases (40%) liquid nitrogen level in the semen tanks is checked by an appropriate wooden stick (Table 4). The practice of shaking the straw, as it is taken out from the tank, to remove any liquid nitrogen that may be retained in the cotton plug end of the straw is not strictly followed (Table 4). Most inseminators were using water thawing of the semen; however survey pointed out that thawing procedures were carried out with approximation. There was no use of a time watch or a thermometer to observe the duration and temperature of thawing (P<0.05, Table 4). Appropriate semen thawing practices are important to minimize thermal damage to spermatozoa (O’Connor 2004). Most of the inseminators repeatedly use the same towel cloth for drying the semen straws (90%, P<0.05, Table 4), which is not a hygienic practice. About 60-70% (P<0.05, Table 4) inseminators had no idea about semen motility checking procedures and hence never checked the motility of thawed semen before carrying out the insemination. The observed flaws in relation to AI procedures can cause a significant economic loss to the individual farmer in terms of repeated failure of conception (O’Connor 2004).

Figure 4

Table 4. Responses (frequency %) to questions related to the artificial insemination (AI) technique.

Questions	Response
Whether inseminator sanitizes perineal area prior to insemination?	Yes (100%)[a] No (0%)[b]
Semen tank management and handling semen within the tank	
Is semen inventory / locator list available on the outside of semen tank?	Yes (65%)[a] No (35%)[b]
Is goblet present inside the canister?	Yes (85%)[a], No (15%)[b]
How semen straws are transferred between semen tanks?	After counting straws in gas fumes (75%)[a] Transferring whole goblet (25%)[b]
What is the method of checking gas level in the semen tank?	Inserting a wooden stick in tank (40%) Swinging the tank (20%), With eyes (35%) Weighing semen tank (5%)
Whether straws once taken out of semen tank are again placed back?	Yes (20%)[a] No (80%)[b]
Thawing semen	
Whether inseminator shakes the straw, to be used for AI, after removing from tank?	Yes (55%) No (45%)
What is the method of semen thawing?	Water (95%)[a] ; Pocket (0%)[b] Rubbing between hands (5%)[b]
Maximum time allowed for semen thawing.	<5 min (100%)[a] >5 min (0%)[b]
Maximum number of straws thawed at once.	One (85%)[a] Two (15%)[b]
What is the method of method of checking time during thawing?	Watch (55%) Estimate (45%)
What is the method of checking temperature of water used for thawing?	Thermometer (15%)[a] Hand (85%)[a]
What is the temperature of water used for thawing.	37-40° (20%)[a]; Warm water (70%)[b] Normal water (10%)[a]
How inseminators cut the straw?	Scissors (100%)[a], Cutter / Knife (0%)[b]
How inseminators dry the straw?	Cotton (5%)[a]; Cloth towel (90%)[b] Don't dry (5%)[a]
Semen motility check	
Whether the inseminators occasionally check motility of the semen?	Yes (40%) No (60%)
Whether the inseminators know how to check semen?	Yes (35%)[a] No (65%)[b]
What is usually the motility of thawed semen?	<40% (5%)[a]; ~40% (25%)[a] Don't know (70%)[b]
At which site semen is deposited during insemination?	Mid-cervix (15%)[b]; Uterus (80%)[a] Uterine horns (5%)[b]
[a,b] $p<0.05$ (between responses of a categorized question)	

In summary, several key challenges under the rural smallholder conditions were identified with regard to dairy farm reproductive management viz., disorganized record keeping, less use of heat abatement devices during summer season, high prevalence of reproductive issues like retention of placenta and repeat breeding, estrous detection errors and faulty practices related to AI.

ACKNOWLEDGEMENT

We would like to thank all of the dairy farmers who participated in this survey. We acknowledge financial support from SIR RATAN TATA TRUST (Reviving Green Revolution Cell, Punjab Agricultural University, Ludhiana).

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