

Optimizing reproductive efficiency

to improve productivity in buffaloes

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Optimizing reproductive efficiency involves managing reproductive traits to achieve the goal of getting calves at regular intervals as decided by the management, and increased milk yield. In fact, losses from impaired reproductive efficiency or reproductive failures constitute the greatest cause of losses in productivity of calves and milk yield in buffaloes. Certain reproduction targets, interference levels, and management practices and protocols, useful to buffalo farmers for optimizing reproductive efficiency are discussed here briefly to improve productivity under Indian agrarian conditions. Also, importance of regular and accurate recording of reproductive events is emphasized to utilize the production potential of the buffalo farming system.

Keywords: Buffalo, Efficiency, Production, Reproduction

BUFFALO plays a significant role in food security and poverty alleviation, particularly in Asian countries. Buffaloes, often described as the black gold are favourite multipurpose animals with huge potential for social and economic changes for the agrarian community. Recent data show (DAHDF, Govt. of India, 2021-22) that India has 111.85 million buffalo accounting for approximately 57.7% of global buffalo production. About 20.5% of the total livestock population in India is contributed by buffaloes. In India, buffalo contributes more than half of the total milk production producing 105.84 million tonnes of milk in the year 2021-22. Moreover, India ranks 1st in production of buffalo meat with share of 42.60% and exports buffalo meat to more than 70 countries across the globe. Astonishingly, the population of cattle decreased from 204.5 million to 193.46 million between 1992 to 2019, whereas despite so many odds, population of buffalo increased from 84.2 million to 109.85 million during the same period. Such statistics emphasize the fact that buffalo is not a poor breeder as compared to

cow. For increasing milk production and availability in India, the contribution of buffalo towards milk needs to be increased considerably. Achievement of higher milk production from buffalo requires proper nutritional management in each stage of its life. Towards this end, feeding management during transition period is extremely important to achieve not only maximum milk but also for optimum reproduction during the subsequent lactation. Though India is first in total milk production but in terms of per animal milk productivity, it is ranked at 93rd position which is way behind in productivity not only to the developed countries but also to many developing countries.

One way to increase overall productivity of buffaloes is to optimize the reproductive efficiency in individually raised as well as in buffalo herds. To evaluate fertility status of a buffalo or herd, it is imperative that a buffalo farmer quantifies certain reproductive parameters. To achieve this first task he must maintain all records accurately. The minimum information required for such

fertility assessments is identity of the dams, last calving dates, first and subsequent services or insemination, bull and semen records, details of the technician doing AI, dates confirming pregnancy, and when dams were culled or left the herd.

Parameters of reproductive efficiency

There are several parameters (Table 1) to evaluate reproductive efficiency in dairy buffaloes, each with its own merits and demerits. Optimum reproductive efficiency in buffaloes is primarily affected by delayed puberty, seasonality of birth, prolonged postpartum anestrus, poor conception rate through artificial insemination (AI), and long inter-calving interval. Moreover, AI is not very widely adopted practice, greatly slowing genetic gains in buffaloes, mainly due to weakness of estrous symptoms, and variability of estrous cycle.

Puberty in buffalo

Compared with cattle, puberty in buffaloes is delayed with a large variation in age of puberty from one geographical location to another. Puberty is the period characterized

Table 1. Reproductive and management parameters to achieve optimum reproductive efficiency

Parameter	Mean	Range
Age at puberty (months)	30	16 – 46
Weight at puberty (kg)	275	200 – 350
Length of estrous cycle (days)	21	17 – 25
Length of estrus (hr.)	10	5 - 27
Time of ovulation		
After the onset of estrus (hr.)	34	24 – 48
After the end of estrus (hr.)	14	6 – 21
Length of gestation (days)		
River type	310	300 – 320
Swamp type	330	320 – 340
Birth weight of calves (kg)	26	22 – 36
Involution of uterus (days)	30	25 – 35

Source: Parera 2008

by functionally developed sex organs. In heifers, it is the phase in which first ovulation and plasma progesterone concentration is above 1 ng/mL. Compared with cattle, buffalo heifers usually attain puberty when they reach about 55% to 60% of their adult body weight, but the age at which they attain puberty can be highly variable, ranging from 16-24 months. Body weight has greater influence on puberty. Maturity of the heifer depends upon on the body weight rather than age. About 60-65% of body weight remains standard during the starting of breeding season. Lower growth rate occurs due to underfeeding or imbalanced feed composition. Birth weight also affects growth rate and age at puberty.

It is imperative for buffalo farmers to remember that weaning and pre-weaning system plays an important role in promoting growth at young age and thus help in achieving early puberty. Buffalo farmers must ensure proper heifer management from birth to maintain a correct weight gain. A average daily gain (ADG) of about 400 to 550 g is required to get a pubertal heifer at around 2 years of age.

Also, buffalo farmers must ensure adequate dietary energy, protein and minerals intake for optimum age of puberty in buffalo heifers. With the help of a veterinarian, buffalo farmer may opt for mimicking of endocrine changes occurring during puberty using exogenous hormonal administrations. Towards this end, progesterone releasing intra-vaginal device (PRID) along with pregnant mare serum gonadotrophin (PMSG) can be used to induce estrus in non-cyclic buffalo heifers.

Seasonality and postpartum anestrus

Buffaloes are seasonally polyestrous animal with varying reproductive efficiency throughout the year. As reported from different researchers, buffalo cows exhibit a distinct seasonal change in displaying estrus, conception rate and calving rate. Seasonality does not appear to be depended on diet, food availability or metabolic status, while climate and particularly photoperiod play a pivotal role. The proportion of buffaloes exhibiting estrus during the period of short-day length is significantly greater than during the period of long day length, indicating that decreasing daylight is a stronger determinant of the resumption of ovarian activity. It is observed that acyclicity is associated with increased prolactin concentration in blood when ambient temperature and photoperiod are at maximum during summer. Such increase in prolactin concentration influences the ovarian activity leading to sub-fertility and repeat breeding by

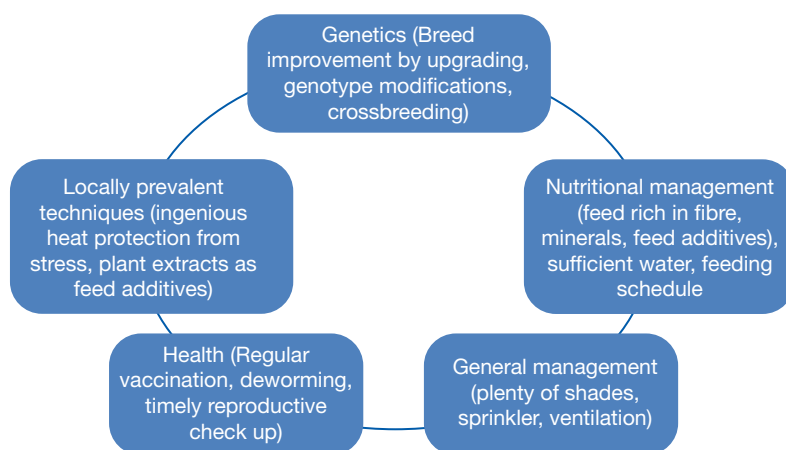
lowering progesterone secretion. In winters where buffalo are fed with a constant balanced diet and are not exposed to heat stress, a distinct seasonal reproductive pattern is also found. This has been attributed to changes in photoperiod, mediated by melatonin secretion. Moreover, buffaloes calving in winter show shorter postpartum anestrus than those calving in summer months. Providing suitable control over environmental stress such as provision of adequate shades and green fodder, water-mist systems, cooling fans, etc. may help in alleviating summer stress and help in induction of cyclicity in buffaloes. These management practices may be coupled with estrous synchronization programme under veterinary care to reduce inter-calving period.



Provision of shade tree for buffaloes during summer

Postpartum management

Buffaloes should be maintained in maternal unit in order to provide a better postpartum care. Light palatable, mixed laxative ration



Farmer friendly non-hormonal measures to tackle seasonality in buffaloes

is recommended to compensate the calving stress. Buffalo farmers must take adequate care to avoid postpartum complications such as hemorrhage, perineal injuries, edema and prolapse of genitalia. It is advisable that fetal membranes are not removed using force to avoid injuries leading to bleeding. Until dams develop hyperthermia with signs of putrifying retained fetal membranes, it is not a cause of grave concern. Flooring of the sheds should be non-slippery. Maintaining adequate sanitary precaution coupled with introduction of dry-cow therapy under guidance of a veterinarian shall help in reducing the incidences of mastitis. Daily cleaning of teats by water and 0.5% lugol's solution or potassium permanganate solution shall significantly reduce the infection of udders with opportunistic bacteria.

Herd target indicators and interference level

For farmers maintaining large herd of buffaloes, it is important that they keep an eye on targets and interference levels for various parameters for increasing productivity as discussed below. These targets and interference levels are set a bit higher than cattle and are adjusted for buffaloes under Indian conditions.

Though it is possible to estimate the estrus detection rate but remember that it is an estimate and not an accurate measurement. An interval of 36-48 days (2 × 18 - 24) indicates that an estrus has been missed, whereas an interval of 54-72 days (3 × 18 - 24) suggest that 2 estrus have been missed.

Mean calving to 1st service interval and to conception (pregnancy) interval (days)

It is important that following uneventful calving dams undergo complete involution of genitalia as quickly as possible. This ensures quick return to estrus. On an average target for 'Mean calving to 1st service interval' in days for a optimally managed buffalo herd may be set at 85 and if it were to increase to 95 days (Interference

level) then buffalo farmer must investigate the reasons for such delays. Similarly, target for 'Mean calving to conception (pregnancy) interval (days)' may be fixed at 105 days, with interference level fixed at 120 days.

In buffalo herd not meeting such targets, farmer must investigate aspects of calving and postpartum care, hygiene, supplementations of adequate nutrition especially proteins, minerals and energy rich diets, accurate detection of estrus to diminish chances of silent and missed estrus, and use of recent techniques such as in-camera monitoring. To ensure pregnancy at least by second estrus, insemination by a trained AI technician using semen from fertile bulls at right time is must. In Murrah buffaloes, ovulation occur 24-60 h (mean 42 h) after the onset of estrus or 6-21 h (mean 14 h) after end of estrus. To reduce the possibilities of unsuccessful breeding owing to variable estrus and ovulation period, assistance from a veterinarian can be availed for fixed-timed AI approach.

To establish a pregnancy successfully, buffalo farmers must ensure accurate detection of estrus, AI by a skilled technician using fertile semen, pre-ovulatory follicle development and breeding in stress free conditions, synchrony of breeding with ovulation, post breeding stress free environment for luteal sufficiency, reproductive health suitable for implantation and subsequent pregnancy. To achieve a conception rate of about 60%, service per conception should be 1.6 - 1.7, effectively meaning dams conceive in 2 inseminations. Therefore, on an average target for 'Mean interval from 1st service to conception (pregnancy) (days)' should be 20 days with interference level fixed for the herd at 25 days. To achieve this, reduction of stress by maintaining optimum body condition score, extremes of climatic changes, and incorporation of flaxseed meals may be practiced.

First service submission rate (%) and Overall pregnancy rate (%)

Improving estrus detection rate influences calving interval greatly.

A buffalo farmer must record all observed estrus during voluntary waiting period (VWP). This will help him to anticipate the date of next subsequent estrus and to improve the estrus detection rate. It is also useful in early detection of anestrus (acyclical) dams. For a buffalo herd, First service submission rate may be fixed at 80%, with interference level at 70%. Lower than expected result in this parameter could be due to poor housing conditions affecting females to exhibit overt signs of estrus, poor lighting which may hamper estrus detection, irregular estrus detection schedule, and non-recording of signs of estrus in individual animals. The submission rate is greatly influenced by the time interval to the resumption of normal cyclical activity after parturition, the detection of estrus in cows that have resumed normal cyclical activity and their presentation for AI or natural service.

High environmental temperature or very rapid and sudden fluctuation of temperature exert considerable direct effects on reproductive functions in male as well as female buffaloes. In the male, spermatogenesis and endocrine functions are affected whereas in females, great temperature fluctuation may suppress estrus, resulting in periods of acyclicity, interferes with ovulation, and disturbs early pregnancy causing death and resorption of early embryos. In certain cases, abortion in late pregnancy may also occur. The discrepancy in 'First service submission rate' is mainly due to failure to identify the correct buffalo, record and report if the cow return to estrus, culling of the cow after she has come into estrus, subsequently using natural services but not recording, and prenatal death.

Similarly, on an average for a buffalo herd, 'Overall pregnancy rate' may be fixed at 60%, and interference level at 50%. However, this may be tweaked as per the requirement of the herd and prevailing agrarian conditions. The pregnancy rate is influenced by estrus detection rate, skill of the AI technician, semen quality,

nutritional status, and overall health (disease free) of the female reproductive organs. All these aspects of buffalo farming need to be looked into to achieve optimum pregnancy rate.

Calving to first service interval and pregnancy rate are influenced by the breeding management policy of the individual farms, delayed return of cyclical activity after calving, and failure to detect estrus in buffaloes that have resumed cyclical activity. It is pertinent to ensure that dams have returned to cyclical activity. For this, regular rectal palpation in combination with milk progesterone assays and/or transrectal ultrasonography of those dams not in estrus even after prolonged post-partum period may be carried out. Efficient detection of estrus depends upon farmers knowing the true estrus signs in a buffalo, proper recording and use of tools to detect estrus.

Culling rate

On an average not more than 5% of the buffaloes should come under culling scanner for poor fertility reasons. It means for optimally producing buffalo herd, 95% of the females of the herd should be cycling and producing calves regularly as determined by the requirement of the particular buffalo herd. To achieve this, regular veterinary examination of the individual animals must be scheduled and all possible health concerns addressed

on an urgent basis.

General management practices

Regular grooming of buffaloes keeps the animal clean and helps to maintain their health. It helps to detect any illness or injuries in buffaloes. Flies menace in the sheds especially milking parlor can cause serious nuisance to buffaloes. The eyes, nostrils and face, should be cleaned in morning with a clean cloth and body should be brushed gently with dandy brush and curry comb. The angular parts of body like inguinal region, thigh, udder and grooves should be cleaned thoroughly. If possible, sufficient clean water may be made available for wallowing. All these practices of grooming, feeding, watering, washing and exercise should be scheduled for regular follow up. The management practices to protect buffaloes from direct solar radiation and extreme climatic conditions may be introduced. Remember that buffaloes are intelligent animals, gentle handling, and avoiding shouting and beating of lactating buffaloes may help in increasing the milk production and reduces economic loss. To get better average productivity from the herd, uneconomical and surplus buffaloes should be identified and disposed off. Estrus detection programs are hall mark of optimum breeding buffalo herd, hence regular scrutinizing of female buffaloes ensures curtailing high incidence of

silent estrus. Fortunately, common vices of kicking, self-suckling of teats or of other cows, licking and naval suckling commonly observed in cattle are rare in buffaloes. During transportation of buffaloes, exercise patience and gentle handling especially during loading and unloading.

SUMMARY

Though numerous method have been used to measure fertility, not all of these can be adopted well by a rural buffalo farmers. To increase productivity, a buffalo farmer must optimize the reproductive efficiency to the maximum extent possible. Buffaloes are considered 'black gold' because of their greater feed conversion efficiency and multifarious uses but has associated problems of poor estrus signs, late maturity and seasonality in their reproduction, particularly under summer stress. To achieve the goal of optimum reproductive performance, a system of proper and accurate recording of reproductive events needs to be developed and maintained. From such records, farmer can fairly accurately predict the aspects where attention needs to be paid, thus tackling such problem-points at an early stage. This will surely go in a long way to boost buffalo productivity and his income.

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TECHNICAL SPECIFICATIONS

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