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Review Article

Concept Note on Management Practices to Improve Performance of Buffalo in India

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Abstract

India is enriched in its livestock resources with a total livestock population of 512.05 million out of which buffalo alone comprises of about 22.23% (108.702 million). Among total buffalo population in our country only approximately 53 millions are the breedable females. Farmers especially in northern India un-doubtly, prefer the keeping of buffaloes as predominant milch animal since it is a triple purpose (milk, meat and draught) animal as compared to that of dual purpose cattle. They are reared mainly for milk production with meat as an adjunct. Buffalo bulls are also a important source of draught power. Buffalo meat have a good dietary value i.e. it is lean and contains less saturated fat compared to beef and pork. Buffalo plays a significant role in Indian economy because it contributed more than 56% of total milk produced in India and about 30% of total meat production in the country. However despite this potential and growth, the sector is not well integrated.

Keyword: Draught Power; Economy; GDP; Milch; Triple Purpose.

Introduction

Indian economy mostly depends on agriculture as agriculture sector alone contributes almost 18.00 % of the total GDP. Moreover, as per estimates of department of animal husbandry (2011-12), the contribution of livestock sector to total GDP was 4.11% and to total GDP from agriculture sector was 23.80 %, thus, it is obvious that livestock sector plays an important role in Indian economy. India is enriched in its livestock resources with a total livestock population of 512.05 million (19th Livestock Census, 2011-12) out of which buffalo alone comprises of about 22.23% (108.702 million), out of which only approximately 53 millions are the breedable females. Buffaloes constitute about one third of the total cattle and buffalo population but contribute more than 56% of the total milk production of the country, which is estimated to be over 131 million tons (department of animal husbandry, 2011-12). Farmers especially in northern India undoubtly, prefer the keeping of buffaloes as predominant milch animal since it is a triple purpose (milk, meat and draught) animal as compared to that of dual purpose cattle. They are reared mainly for milk production with meat as an adjunct. Buffalo bulls are important source of draught power. Buffalo meat is of good dietary value; it is lean and contains less saturated fat compared to beef and pork. In India, buffalo contributes 30.00% of total meat production (Murphy and Prince Davadaso, 2003). Presently, the buffalo contributes 1.42 million metric tons of meat to the meat pool of India, which comes out to be 45.74% of global buffalo meat (FAO, 2007). Moreover, there is a great preference for buffalo milk in consumers as compared to cattle milk, basically due to higher fat percentage. Buffalo breeds

on an average have a lactation yield of 1800 (1500-2500) liters within a lactation length of 305 days.

Though, buffaloes are considered one of the most disease resistant livestock species yet many of the diseases have been noted to affect their health, production and reproduction performance and it have been observed that on account of low fertility and poor health condition the country is suffering from an annual loss of about 20-30 million tons of milk. The buffalo is a difficult breeder because of its inherent susceptibility to environmental stress, which causes anoetrus and sub-estrus. These two conditions are responsible for a prolonged intercalving period resulting in great economic losses for the dairy industry. The productive and reproductive efficiency of animals are complementary to each other. Low reproductive efficiency in general and in the buffalo in particular remains a major economic problem globally and its incidence is higher in our country. The main interest of the animal breeder is to achieve more young ones in a lifetime, reduced mortality, and healthy and superior young ones. To achieve this goal, normal reproductive tools to augment reproductive efficiency (fertility), means to overcome reproductive constraints and remedies are needed.

Normal Reproduction in Buffaloes

The age of puberty in buffalo is 36 to 42 months in India. It is somewhat late as compared to other countries like Italy, where the age at first calving is 36 months on average. The estrus cycle length is 21 days with heat duration of 12-24 h. The ideal buffalo produces a calf every 13 to 14 months.

The factor which most strongly influences age at puberty is nutrition level. Buffalo exhibit seasonality in reproductive activity. The reproductive cycle of buffalo is as follows

Age of puberty:	36-42 months
Length of estrous cycle:	21 days.
Duration of heat:	12-24 hrs.
Time of ovulation:	10-14 hrs after end of estrous.
Period of maximum fertility:	Last 8 hrs of estrous.
Gestation period:	310 days.
Period of involution of uterus:	25-35 days.
Favourable Breeding season:	September to February.

Breeding Systems in Buffaloes

Natural Mating

Generally in dairy buffaloes, natural mating is used. In certain states, better awareness the buffalo bull and of the dam's milk yield are used in breeding. But for the most part there is no consideration of pedigree and any potent entire male available at estrous is used for breeding. This practice has caused a great deterioration in performance of the buffalo and the destruction of breed characteristics.

Artificial Insemination

Both fresh and short- duration stored extended liquid semen as well as frozen semen is being used for insemination of buffaloes. This service is provided on nominal payment by state department of animal husbandry and other agencies like BAIF and NDDB. The network project on buffalo development of ICAR arranges breeding with the use of frozen semen of known pedigree; Murrah, Nili-Ravi, Surti, Bhadwari, Pandharpuri and the swamp buffaloes of Assam.

Although the density of good breeds of dairy type river-buffaloes is higher in the hot and hot-humid parts of tropical India, the problem of low fertility in summer is also more serious. Some of the main reproductive problems of economic importance are:

Delayed Maturity

Delayed maturity in both male and female buffaloes is common throughout India. This is due to negligence of calves during their growing period. Buffaloes have potential to gain at rates of 400-800 gm daily after about 4-6 months of age and can attain 300-450 kg body weight suitable for breeding at about 24 months of age. But in the majority of dairy buffaloes calving occurs at 4-6 years of age. This is due to an inadequate supply of feed and nutrients during the growing phase.

High Incidence of Silent Estrous and Short Duration Estrous

This is more serious problem during the hot and humid-hot months. Due to these reasons, heat is often missed, and tethered females or females grazing without potent males in the herd remain unbred. It is an important factor contributing to the long intercalving period.

Non-Availability of Proven Sires and Good Quality Semen of Proven Buffalo-Bulls

It is another serious issue which becomes a cause of either missing of an estrus cycle or breeding of buffaloes with a poor quality of semen. This problem sometimes also arises because of irregular supply of quality semen or liquid nitrogen to the A.I. centers and state veterinary hospitals.

Occurrence of Venereal Diseases Causing Infertility and Sterility

These problems are encountered in both sexes, and the cause of their spread is the use of bulls for natural service. In recent years these problems have shown an increasing pattern because of increased use of artificial insemination in remote villages with the help of improperly trained inseminators. In some places, such persons present themselves as veterinary doctors though they have no education on clinical training. These persons may cause severe damage to livestock health and the wealth of the country.

Poor Heat Sign

Silent heat in the buffalo is one of the most important unsolved impediments to efficient breeding. It occurs in the hot seasons. A combination of estrus detection methods may be necessary for identification of animals in heat.

Anoestrum

Post-partum anoestrus in some buffaloes that have calved during cool season, i.e. the normal breeding season; have a shorter post-partum estrus interval than those that calve during last breeding season (February through July).

Poor Nutrition

Adequate nutrition is prerequisite for proper functioning of the reproductive system in animals. Underfeeding, overfeeding; protein and vitamin deficiency and imbalance of trace elements may also be one of the probable cause of various reproductive anomalies.

A poor body condition score at calving adversely affects fertility, characterized by prolonged post-partum intervals, reduced conception rates, and more services per conception. A very low protein diet can cause cessation of estrus.

Approaches for Improving Reproductive Efficiency

During the last two decades, farm animal reproduction has entered into the area of a new biotechnology revolution which includes artificial insemination; induction and synchronization of estrus (manipulation of breeding cycle); super ovulation embryo transfer; cryopreservation; embryo resource development; sexing; transgenesis; cloning chimera production; and early pregnancy diagnosis. Some of these technologies have immense potential to revolutionize world animal production and reproduction efficiency in the twenty-first century.

Artificial insemination is considered as one of the most effective ways of rapidly accelerating significant genetic improvement programmes, but A.I. is not successfully practiced in buffalo because of –

a. Difficulties in estrous detection.
b. Difficulties in semen preservation.
c. Lack of certified semen programmes.

Reproductive Performance of Buffaloes

Reproductive efficiency is determined by many different processes, which result from interaction among genetic and environmental factors. The processes involved singly or in concert, include age of puberty / maturity, pattern of estrous cycle and estrous behaviour, length of breeding, ovulation rate /litter size, lactational anoestrous period, post-partum anoestrus intercalving period, and reproductive life span.

The reproductive efficiency in buffalo is so alarmingly low that it poses a very serious threat of economic loss to animal husbandry professionals of India. In such a scenario, an ample scope exists for increasing the reproductive efficiency by modification in the traditional methods of breeding, feeding, management and disease control.

Reasons for Poor Reproductive Performance

Effect of Climate

Environmental attributes play an important role in production and reproduction performance of farm animals all over the world. Season affects the breeding efficiency in the case of buffaloes. There is a tendency to have better performance during the cool months; 70-80% of conceptions in buffaloes occur between July and February months. Buffaloes are sexually activated by decreased day length and temperature. A lower number of services per conception are needed during the July-February breeding season than the March-June breeding season.

Poor Thermal Tolerance

Buffaloes have poorly developed heat tolerance system. During the summer they have to be protected from the extreme heat by allowing them wallowing, bathing, mist cooling and fogging; also in winter,

they have to be protected from extreme cold, which may predispose them to many diseases.

One of greatest source of failure in A.I. is the inability to recognize estrous display, more precisely time of ovulation. The identification of accurate time of ovulation is essential for timed A. I.; as it increases the rate of conception. With frozen semen, the need to inseminate close to ovulation is even more imperative because of the limited survival of spermatozoa. It is possible to extend the life of spermatozoa and package them in such a way as to retain them in the reproductive tract in a viable state for several days. Efforts are being made for micro-encapsulation of spermatozoa, which will help in prolonged survival of spermatozoa.

There is an urgent need to start registration of all A.I. bulls by a national society or an All India Animal Breeder Association (AIABA) and to initiate a certified semen programme. Strengthening practical training in animal reproduction for veterinary students and better training of inseminators is also essential.

1. Insemination should be done during the latter half of the period of heat.
2. In heifers, the first heat should be avoided to make the animal more receptive.
3. Buffalo should be calm and quiet (stand still) at the time of insemination
4. The Best site for insemination is the mid cervix and the body of the uterus
5. Concept of twice A.I. per estrus may be followed for increased rate of conception

Induction and Synchronization of Estrous

Its main objective is to control the estrous cycle and regularizing it. It would provide a means for circumventing the problem of estrous detection for timed A.I. programme. For a satisfactory pregnancy rate in an embryo transfer programme, the embryo must be placed in an environment that simulates the one from which it was removed. So synchronization of estrous in the donor and recipient in each experiment is considered essential to obtain the best result.

Induction and synchronization of estrous can be achieved by two alternate approaches. The first is by artificially extending the luteal phase (by using progestatimal compound) and second by inducing device of the corpus luteum (by using prostaglandins and analogues.).

Progestogens with some possible adjustment in PMSG and or FSH are used for anticipated lower response. Presently PGF2 a is widely used to manipulate the early breeding of post-partum buffaloes and pubertal heifers. It is also used in a double dose schedule (10-11 days interval) for those animals, which do not have functional CL at the first injection.

Superovulation (Multiple Ovulation)

Superovulation is one of the major reproductive technologies for rapid genetic improvement of livestock.

Reduction of Unproductive Period

It may be attained by applying various methods of reducing the interval from calving to conception I.e. service period and decreasing number of services per conception.

Oral Prostagen (Chlormadinone acetate, melangestrol acetate) for a 14-day period, starting on the 21st day after calving is generally found to be effective in reducing interval between parturition and conception.

Short-term progesterone (PRID / CIDR) and progestagen (ear implant) for 7-10 days also stimulates breeding activity regardless of whether the animal is cyclic or anoestrous. FSH in conjugation with progesterone enhanced the follicular development in the post-partum period. Progesterone plus estradiol treatment resulted in synchronized wave emergence with normal luteal activity in post-partum anoestrous animals.

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Embryo Transfer Technique

The embryo transfer technique permits exploitation of superior female genotype, giving more off-spring from the same genetic donor than would arise under normal conditions of breeding. Embryo technologies are also used to resolve several reproductive enigmas, viz. uterine sufficiency; maternal reorganization of pregnancy; embryo-utero-relationship.

Heat Detection Technique

Wall charts, breeding wheels, herd monitors and individual buffalo records are estrous detection aids. These systems are the least expensive. The key to successful use of these management aids is accurate recording of every heat beginning with the first after calving and their daily use to identify those buffaloes that are due to return to estrus.

Mount Detection Involves Two Methods

1. Pressure sensitive devices.
2. Paint stick or paint on tail head.

Heat Detector Animals (Teasure Bulls)

Sexually active animals are used to detect buffalo in heat. They are fitted with chin ball markers.

Use of Dogs

Dogs can be trained to detect odour associated with estrus in buffalo.

Use of Milk Progesterone Assay

With the help of RIA, milk progesterone concentration can be determined. Progesterone level of < 200 pg / ml indicates an animal is in estrus.

Use of Pedometry

These are sensors which measure the activity of animals. It is based on the hypothesis that the activity of animals is increased during heat.

In-Vitro Fertilization

In-vitro fertilization is also most important tool to increase the reproductive performance / efficiency in buffalo. Addition of heparin and caffeine in the medium used in *in-vitro* fertilization system helps in inducing capacitation and acrosome reaction in buffalo spermatozoa.

Enzyme Immunoassay

Measurement of progesterone and to a lesser extent, of estrone sulphatehas found practical application as a method of improving reproduction in farm animals. For instance, diagnosis of (non) pregnancy and confirmation of (non) estrus is possible on the basis of progesterone concentration in body fluids. Progesterone determination in plasma or milk can serve as valuable diagnostic tools in buffaloes for accurate estrus confirmation and hence correct timing of A.I. and diagnosis of pregnancy and nonpregnancy 20-24 days post A.I. and also for identifying cystic ovarian disorders.

Use of Biostimulation

Biostimulation may be described as the effect of the male on estrus and ovulation through genital stimulation and priming pheromones. Biostimulation plays important role in reproduction such as hastening sexual maturity, induction of ovulation, and reduction of post-partum anoestrus.

Biostimulation modulates the following reproductive activities, and it has been used for augmenting the reproductive efficiency in recent years –

1. Induction and synchronization of estrus.
2. Age at onset of puberty.
3. Postpartum estrus.
4. Silent heat.
5. Ovulation rate.

Management Issues

Three main constraints important in management of buffaloes are:

1. Summer stress
2. Winter stress at high altitude
3. Inadequate quantity of non-polluted, wholesome water for drinking and wallowing.

Summer Management

- Keep buffaloes in airy, cool and comfortable place. Keep animals under shady trees and sprinkle water on their surroundings.
- Provide fresh and cold drinking water.
- Supply fresh green fodder.
- Make provision for night feeding.
- Grazing should be done only on green pasture in morning and evening hours.
- Mineral mixture and salt should be supplied daily.
- A deworming schedule should be followed with spraying for ecto-parasites.
- Avoid overcrowding.
- Sheds should be properly ventilated.

Winter Management

- Protect buffaloes from extreme cold.
- Provide proper bedding to the animals.
- Increase sources of energy for breeding stock through high-energy diets.

Maintenance of hygienic conditions on buffalo farms and in dairy buffalo stalls is less expensive. Health problems of buffalo may be widespread or

localized. Provision of a dry place for resting, timely disposal of dung and urine, daily washing/ wallowing, sprinkling of phenyl lotion on water, occasional application of flaked lime power and use of gunny bag soaked in saturated solution of washing soda at entrance particularly during the spread of viral disease like F.M.D. are considered useful in providing reasonably satisfactory protection against many diseases. Regular and timed vaccination schedule must be followed.

Managemental Practices for Better Reproductive Efficiency

- Proper heat detection.
- Maintaince of accurate record of heat.
- Routine checking of adult females for heat.
- Treatment of the females with abnormal uterine discharge during estrus.
- Checking female for pregnancy diagnosis after 45-60 days of natural service.
- Isolation of the diseased animals from the healthy herd.
- Following the vaccination programme.
- Provision of balanced nutrition.
- Good housing systems.

Conclusions

Prompt and careful managerial practices must be adopted to reduce the infertility and anoestrus problems in buffaloes. Environmental modification through provision of shade, splashing of water, misting, fogging during heat stress and proper bedding, housing and dietary manipulation during extreme winter significantly reduces the adverse effect of climatic variable and promotes survival of fundamental stock. Proper heat detection method, application of new reproductive technology, deworming, vaccination, balance ration & area specific mineral mixture supplementation to buffalo at their different stages of life also play a significant contribution in improvement of buffalo reproduction as well as in our country GDP.

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