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MANAGEMENT AND POTENTIALITY OF DAIRY CATTLE IN THE THAR DESERT

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As crop fields are low in desertic land, because of recurrent drought the farmers of the region rely heavily on livestock enterprises for their sustenance. Animal husbandry under such degraded lands can be successful only if the livestock are basically a stable protective resource having long-term viability employment absorbing capability and income generating capacity. The livestock should be compatible with crop cultivation instead of competing with it for land and water resources. Dairy cattle rearing fits well with such requirements. India is a highly populated country with 32 states/UT's with 81 regions having their varying regional perspective. The total population that nears 1000 million with 50% females among them, with 46% people are between the age group of 19 years and 60 years i.e. they are eligible to be an employment but the opportunities of organized employment (salaried jobs) are limited to less than 3% and about 70% of country's population is dependent on agriculture or animal husbandry (Singh, 2000).

The socio-economic status of farmers as well as communication and transport infrastructure are very poor. In these Thar desert land is dune and soils are low in nitrogen and organic matter content. It is naturally eroded by winds during summer and the crop fields are low and unstable. Some of the farmers follow a trans migratory system of animal management. Animal husbandry in this region depends not only on the economic and social aspects of the migrating farmers but also on the ecological and agrostological aspects of land use management.

Bhakat and Sahani (2001) reported that the average family size of farmers ranges from 5.25 ± 1.33 to 8.54 ± 2.66 with overall average of 6.70 ± 0.59 individuals. The overall number of female members were 3.49 ± 0.26 where as male members were 3.21 ± 0.36 . The literacy percentage varies from 26.22 to 32.11%. Most of the farmers were having maximum non-irrigated land. The overall average land holding was 29.90 ± 1.01 ha/farmer (Non-irrigated) and 15.22 ± 1.02 ha/farmer (Irrigated). Among the different categories of farmer marginal farmer formed the major group (92.50 to 96.14%) and very few progressive farmers 3.86 to 7.50% were also there. It was observed that under village condition the female members of farmer's family devoted maximum time (81.85%) as compared to male members (18.15%) with day to day management of livestock. The ratio between different livestock species in different villages of Thar districts were also reported by Bhakat and Sahani (2001). The camel to sheep and goat ratio was highest (1:12.45). The second highest was camel to cattle ratio (1:8.56) followed by buffalo

ratio (1:0.31). The overall ratio between camel and herbivore was 1:21.36. Rama *et al.*, 1997 reported that the livestock farming has more or less been steady in spite of several severe drought that the region experienced in recent years. There is a need for capital generation and raw material production for the industry to survive. An increase in demand for animal products in the urban consumer market is expected. Singh (2000) suggested that the only source that is sustainable would be the small holder who generates products at moderate cost, without draining natural resource and depending on import.

Bharat Singh *et al.*, 1999 worked out a economics of dairy enterprise under farmer's condition in arid village. The gross cost for maintenance of milch cow per annum was about Rs. 5057/- under farmer's condition in the villages. The milk production per annum for a milch cow was estimated around 714 liters in the villages. Thus the cost of milk production came around Rs. 7.08/litre milk. The gross returns and net returns/animal were Rs. 6970/- and Rs. 1912/- per annum. The family labour income was observed as Rs. 3368/animal. Finally, the cost of milk production/litre (when family labour excluded) came around Rs. 4.71/litre, where as crop residues used as fodder for animals by crop cultivation is excluded, the cost of milk will be less than Rs. 4.0/litre. Yedukondalu *et al.*, 2000 reported that in spite of many dairy development programmes organized by different agencies, the many farmers perceived a number of constraints with regard to dairy farming. In their views, these are hampering them in increasing the milk production. Non-remunerative price for the milk was perceived by 90 percent of the respondents as a major constraint. This appeared to be genuine in view of the increased inputs cost and overall increase in the price for all food commodities.

POTENTIALITY

Animal husbandry and Dairy development plays a prominent role in the rural economy in supplementing the income of rural households particularly, the landless and small and marginal farmers. It also provides subsidiary occupation in semi-urban areas and more so for people living in hilly, tribal and drought-prone areas where crop output may not sustain the family.

The six breeds of indigenous cattle are available in the arid Rajasthan. In the northern part (Ganganagar and Bikaner) Rathi breed, in eastern (Alwar, Jaipur, Jhunjhun, Sikar, Bharatpur) ND breed, in western area Tharparker and Kankrej are available. In central part Nagauri breed and in southern part Malvi breed are also found.

All livestock improvement programme should be viewed in terms of improving the productivity per unit animal through planned breeding, increasing feed and fodder resources and providing the optimal management levels. Any efforts made towards improving the livestock productivity in arid region will greatly benefit the socio-economic conditions of the rural people. The breed of cattle in this Rajasthan is of better quality in comparison to those found in other parts of the country. This state possesses 4.84 crore of livestock of various species (Bannerjee and Sharma, 1999). The livestock resources contribute to over 18% of the net domestic income of the state. It contributes to over 10% of milk, 30% of meat, 40% of wool and around 35% of draft power produced in the country although the state has only 7% of the total cattle population of India.

A.H. output constitutes about 24 per cent of the country's agricultural output. According to estimates of national accounts, the gross value of output for livestock sector during, 1998-99 was about Rs. 1,23,077 crore as against the total value of output of Rs. 5,07,297 crore for the

agriculture sector. The production statistics of the country as well as of the state clearly indicate that the development of livestock has been undertaken, thereby augmentation of potential animals has been achieved.

POPULATION DYNAMICS

India is endowed with the largest livestock population in the world. It accounts for 57 per cent of the world's buffalo population and 15 per cent of the cattle population. The country has about 20.5 crore cattle and 8.4 crore buffaloes as compared to 15.5 crore cattle and 4.3 crore buffalo in 1951 (India, 2001). Cattle population in the state shows a non-linear growth from 1951-1988. However, the production data show a linearity. This indicates that even in famine and drought conditions the farmers tried to save the good animals (the estimated annual growth of cattle is about 4%). On the contrary the total livestock population of the state shows a steady increase from 1951-1983 and thereafter a sharp decline. In fact the population of sheep and goat is increasing at higher rate than large animals and these species are less affected by adverse climatic conditions. However the continuous famine during 1985-1987 also affected the growth of sheep and goat. The number of buffaloes is increasing, 30 lac to 63 lac from 1951 to 1988. This is because of their higher production potential which favours their management even in adverse conditions. The population of cross-breed animals also progresses well.

NUTRITION AND FEEDING MANAGEMENT

The natural grazing land is the natural feed of cattle. Raising them on pasture is the cheapest because no cost of growing, cutting, transporting or preserving is normally involved. In hot dry region of Thar desert these are only very limited number of species that are suited for use as grazing legumes. Decline in the productivity of pastures can be attributed mainly to overgrazing, bad drainage and depletion of plant nutrients in the soils.

Improvement of Pasture

The measures that can be employed to prevent this and improve pastures are

1. Soil and water conservation.
2. Selection of improved fodder species and varieties.
3. Fertilizer input.
4. Control of grazing through stocking rate and system of grazing.
5. Weed control.
6. Burning.
7. Temporary closure reseeding and fertilizer application.

Feeding schedule for dairy cattle

The orthodox method of computation of ration for dairy cattle has given by many workers. Although the method described is founded on scientific and rational basis, the common farmer of our country, may at times, be confounded with a labyrinth of calculation. While considering the feeding schedule of an adult dairy cattle, proper considerations should first be made for the purpose for which the animal has to be fed. These are (i) Maintenance ration (ii) Gestation ration and (iii) Production ration (G.C. Banerjee, 1993).

Maintenance Ration

The amount of concentrate mixture and straw that will provide optimum maintenance requirement for an adult dairy cattle without any computation whatsoever are given below:

Table-1 : Maintenance Requirement

Feed	Zebu cattle	Cross-breed-pure breed Indian cows/buffaloes
Straw	4 kg	4-6 kg
Concentrate mixture (with straw only or with little greens)	1-1.25 kg	2.00 kg

Gestation Ration

In the case of pregnancy, further allowance from the fifth month of pregnancy onwards must be made for proper growth of the foetus and to keep the mother fit for optimum milk production on calving. For this, in addition to maintenance ration, a further amount of 1.25 kg and 1.75 kg concentrate mixture is recommended for zebu and cross breed cows/buffaloes, respectively. For high yielder, it is desirable to go for liberal feeding of pregnant dams particularly cross bred cows/buffaloes from 8th month of pregnancy of 6 weeks before calving with the object of securing full development of mammary glands for optimum production. For this 2.0 or 3.0 kg of concentrate for zebu and between 4.0 to 5.0 kg for cross-bred Indian cattle/buffaloes over and above maintenance requirements are recommended.

Production Ration

Production ration is the additional allowance of ration for milk production over and above the maintenance requirement. For zebu 1kg additional amount of concentrate is required for every 2.5 kg of milk over and above the maintenance requirement while the same amount of concentrate is required for every 2.0 kg of milk for cross bred/Indian milch breed/buffaloes.

Table-2 : Average rates of feeding concentrates green and dry fodder (in kg) assumed for different categories of Cattle

Age group of cattle	Rates of feeding per day		
	Concentrates	Green fodder	Dry fodder
Crossbred (milch)	2.75	20.00	6.00
Females over 3 years of age :			
i) Improved cows (milch)	1.20	10.00	6.00
ii) Other milch cows and not calved even once	0.125	3.5	3.16
Males over 3 years of age	0.17	4.96	5.65
Males less than 3 years of age :			
i) Crossbred (young stock)	1.50	10.00	2.00
ii) Other young stock	0.016	1.58	1.47

Guidelines to feed High Milk Yielder Cattle are as follows (Thomas and Sastry, 1991) :

1. Ration of dairy cow should contain a minimum of 20-25 per cent dry matter forages.

2. In the case of high yielders the forages given should be of superior quality. It should be cut at the proper stage of maturity. Thirty to fifty per cent of the roughages should be of leguminous crops.
3. Processing and reducing the forage to smaller bits may be avoided except in the case of very coarse fodder.
4. For high yielders when large quantities of concentrates are to be fed, it should be either fed immediately after feeding roughages or preferably, it may be fed mixed with the roughages.
5. To ensure proper nutrient intake and roughage concentrate ratio, a density X digestibility value of 35 may be maintained.
6. The feeding schedule should be such that it maintains a continuous fermentation in the rumen. The cow should be fed a minimum of 4 times a day, each feeding comprising of both concentrate and roughage.

PHYSIOLOGICAL MANAGEMENT

The effect of the climatic environment on the input-output ratio and economic optimisation of shelters and other environmental control systems are areas of vital importance to dairy production in the hot arid region of Thar desert. While planning dairy animal management it will be necessary to consider both micro and macro climate. The evaluation of the direct and indirect effects of climatic independent of each other is very necessary.

Environmental temperature

The most important single climatic component that is concerned in thermal comfort of dairy cattle is environmental temperature. Faulty enclosed housing in hot arid regions instead of doing good, imparts continuous thermal stress on dairy cattle. Even though the direct solar radiation is cut off and the average air temperature reduced, the increased minimum temperature keeping it above the comfort zone throughout, the increased humidity, radiation from the walls and reduced air movement make such a housing extremely uncomfortable for dairy cattle. In hot dry climates, in spite of a much higher daily mean temperature, at night the mercury falls sufficiently to within comfortable range of dairy cattle. A diurnal variation of 20-22°C in air temperature allows animal to restore thermal balance during the latter half of night before encountering the hazards of high environmental temperature in the next day.

Solar Radiation

Radiant energy is transmitted by the Sun in the form of electro-magnetic waves. This falls on animal directly or indirectly and has the following three components.

1. Direct solar radiation.
2. Solar radiation reflected from other sources (cloud, dust particles) etc.
3. Radiation emitted by hot ground, walls, roofs etc.

A white coat of hair can reflect most of the incidence of visible light radiation and therefore was considered superior by some.

Wind

In general dry regions of the earth have windy and gusty climatic. In hot dry regions, this

may cause dehydration and heat gain through reverse convection. In such regions the ideal wind velocity during day time is 8 kmph or less. But generally such regions have much higher wind speed. At night a wind velocity of 8-16 kmph would be beneficial to facilitate heat loss and attain thermal balance. Air movement over the body surfaces of animals facilitates heat dissipation through evaporative as well as non-evaporative channels. The latter involving heat transfer from the animal's body surface into air is a typical example of thermal convection.

Physiological Regulation

Stress represents the totality of discomfort felt by the animal in a hot environment. When subjected to thermal stress, animal system reacts through a series of physiological compensations which act in the form of a chain reaction. When a stress is applied, the animal system activates some of the physiological or behavioural reactions to neutralize that effect. If this fails, another group of reactions are initiated which attempt to maintain homeothermy and so on until heat balance is restored. If all the systems fail then the heat balance is disturbed. The first line of defence against thermal stress is by making changes in the circulation i.e. by increasing cutaneous blood flow and increasing blood volume with an aim to bring the heat to the periphery and facilitate evaporative heat loss. This is followed by activation of sweating and increased respiratory activity. Both aim at increasing evaporative cooling. If these systems fail to bring about the desired compensation they will feel discomfort forcing them to make behavioural adjustments. If the thermal stress is sustained hormonal mechanisms would be triggered into action soon with changes in metabolic rate and heat production. The animal will reduce feed intake and increase water consumption. The body temperature will rise often stabilising at a higher level. There will be shifts in body water from intracellular to extracellular and from extracellular to vascular space which will be ultimately mobilised to effective evaporative thermal cooling from the skin and the respiratory tract. Increased respiratory activity leads to excessive 'blowing out' of carbon dioxide through the expired air thus upsetting the carbonic acid-bicarbonate buffer system.

In order to maintain acid base balance, bicarbonates mainly in the form of sodium bicarbonate or potassium bicarbonate are excreted through urine. Excessive loss of sodium from the body triggers cortico-steroid hormones like aldosterone. Ultimately, the acid-base and mineral balances are disturbed. Excessive loss of moisture through evaporative channels can cause dehydration under hot-arid conditions if they are subjected to water scarcity also. Sustained exposure to hot condition an upset not only thermal balance, but also water balance, acid base balance and electrolyte balance. In a bid to reduce heat production (under the influence of neurohumoral orders) animals reduce feed intake and as a result milk yield and growth are reduced. There is also a 35 per cent decrease in the efficiency of utilization of energy for productive purposes making many enterprises uneconomic. In addition, reproductive efficiency is progressively affected by thermal stress. Under prolonged heat stress, the vitality of the animal breaks down making it susceptible to many diseases.

HOUSING MANAGEMENT

Based on deliberations among experienced animal husbandry specialists, rather than on empirical findings the Indian Standards Institution has brought out standards on space requirements of animals.

Types of Housing

Conventional Housing

These are also called stanchion barns or tie barns. These refer to housing in which the cows are confined together on a platform and secured at neck by stanchions or neck-chains. The cows are fed as well as milked in this barn. The barns are completely roofed and the walls are also complete with windows and/or ventilators located at suitable places.

Loose Housing

This comprises of keeping animals loose in an open paddock or pasture throughout the day and night except at milking time. The open paddock is provided with shelter along one side under which the animals can retire when it is very hot or cold during rains. A common watering tank is provided and fodder is fed in common mangers. Concentrates are fed at the time of milking, which is done in a separate milking barn. Under loose housing system a milking barn is always constructed in which the cows are secured at milking time and are milked. It is ideal to store dry fodder in the sheltered area where animals are allowed a limited access through movable fences. This is known as self-feeding. The open paddock is enclosed by means of half walls or wooden or plain-wire fences of convenient height. Loose house system is also recommended by Sastry *et al.*, (1985), who gave guidelines on the layout, design and space requirement in loose house. In all the major organized farms in the area presently, the loose house is largely in vogue. The study in India (Verma and Tripathi, 1980) revealed that in loose houses provisions of 1.76 square meter paddock area per two year old heifer as against 3.86 square meter does in no way hamper this growth and health.

The ISI recommendations generally agree with the figures suggested by several other worker for cattle in warmer regions. Cattle and buffaloes in warm regions mostly lie down during night time (Gerewal *et al.*, 1982 and Barua *et al.*, 1982). Hence the need to provide adequately large open or paddock area per animal in loose houses, as it is in the open area rather than under the shelter. For this very reason feed manger must be provided in the paddock area also so that animals can feed at night.

Table-3 : Floor Space Requirement of Dairy Cattle and Buffaloes (ISI 1970)

Type of animal	Floor space requirement (Sq. Meter)		Maximum No. of animals/pen	Height of shed (Cm)
	Covered area	Open paddock		
Bulls	12.0	24.0	1	220 cm in dry areas 175 cm in medium and heavy rainfall
Cows	3.5	7.0	50	
Buffaloes	4.0	8.0	50	
Down-calvers	12.0	12.0	1	
Young-calvers	1.0	2.0	30	
Old heifers	2.0	4.0	30	

MILKING MANAGEMENT

Milking a dairy cattle is an important operation of dairy farm having a direct effect on the income from the enterprise. It is an art requiring experience and skill. It should be conducted at regular intervals, quickly, cleanly, gently, quietly and completely. Cows remain in comfortable position yield more milk. Maintenance of clean conditions in the milking parlour and while milking will ensure under health and production of clean milk that remains wholesome for longer time. The withdrawal of milk should be completed within 5 to 7 minutes so that the milk is removed completely when the effect of oxytocin is present. Complete milking should be practised least the residual milk may cause regression of the secretory tissue thus reducing milk yield and also serve as a nidus for mastitis causing organisms.

Milking is a labour intensive operation requiring 50-60 per cent of the total man-hours on the dairy farm. One milker, depending on his skill may milk 10 to 15 cows including activities connected with milking like cleaning the cows, udder and feeding concentrates etc. Machine milking and automatic udder washing equipments may make the chores associated with milking easier and less time consuming. But, in a developing country like Indian where providing labour is a major social objective for any enterprise and where labour is relatively cheap, hand milking is encouraged.

Preparation of Milking

The milking barn should be thoroughly washed and scrubbed after each milking so that the barn will be clean and dry before the next milking is commenced. Dusty feed and silage should be avoided in the milking barn. The hind quarters, thighs and udders of cows should be brushed or washed before milking. If there is more hair growth in the udder region, it should be clipped periodically. Just before milking (after suckling by calf if early weaning is not practised), the udder should be wiped with a cloth dipped and squeezed in some weak antiseptic solution. In cold weather, warm antiseptic solution should be used for the purpose. Apart from the cows and udders, the milkers, their hands especially and the milking pails and cans should be clean. The milkers should wear clean dress and cover their heads with suitable caps, least loose hair may fall in milk. Their nails should be periodically trimmed and hands cleaned and disinfected between each milking by dipping in an antiseptic solution.

Hand Milking

Cows are generally milked from the left side. There is no hard and fast order of teats while milking, the engorgement of teats due to letdown should be the guideline.

Machine Milking

Milking machines popularly used now a days. It use alternating negative and atmospheric pressures with the help of a double chambered teat-cup assembly. A number of factors influence the efficiency of machine milking like vacuum level, pulsation rate (the number of cycles of alternating vacuum and normal atmospheric pressure per minute) and the pulsation ratio (the proportion of time of vacuum and atmospheric pressure applied). Milking machines vary widely in their pulsation rate, as high as 120 or as low as 40 cycles per minute. Pulsation ratio or the ratio of expansion time and collapse time is kept within the limits of 1:1 and 2.5:1.

A continuous partial vacuum is maintained inside an inflatable rubber tube, the teat-cup liner, into which the teat is inserted. A partial vacuum and normal atmospheric pressure are alternated in the space between the rubber liner and the metal shell of the teat-cup by means of a device known 'pulsator'. When the negative pressure is applied between the liner and the shell milk flows from the teat. When atmospheric pressure enters the chamber, the rubber inflation (liner) collapses with the result that the teat is compressed and massaged. This forces the lymph and blood to flow out of the teat. A continuous vacuum alone would have caused congestion and irritation of the teats.

Ideal practices in Machine Milking

1. Get the cow ready by wiping and massaging the udder and teats for $\frac{1}{2}$ to 1 minute. Use a cloth dipped and squeezed out of warm mild antiseptic lotion.
2. Use the strip cup and draw out the foremilk into it from each quarter.
3. Put on the teat-cups promptly.
4. It is a good practice to use a timer to avoid overuse of the machine. Remove teat cups promptly braking vacuum first.
5. Strip by machine for a few seconds. At the end of the time period pull down on the teat cups with one hand and massage the udder with the other.
6. Apply teat dips.
7. Record the milk weights.
8. Screen window and doors to avoid flies.
9. After every milking, milking machines should be properly cleaned.
10. The manufacturers direction may be followed to maintain, operate and service the milking machine.

HEALTH MANAGEMENT

The objective of herd health programme is to minimize non-genetic culling and mortality and economic losses due to diseases. This should be achieved through a herd health programme, which is centered around systematic prevention of diseases and other health problems, rather than the sporadic treatment of various conditions.

The spread of diseases can be prevented by following steps:

1. Quick accurate diagnosis and prompt treatment.
2. Isolation of sick and in contact animals.
3. Elimination of carriers.
4. Proper disposal of carcasses.
5. Control of vectors.

Quarantine

It means the segregation of apparently healthy animals which have been exposed to the risk of infections from those animals which are healthy and unexposed to such risk. In practice a period of 30 days has been generally accepted as a reasonable period. But in the case of certain disease this period is more.

Deworming

During quarantine, animal should be screened for internal parasites by faecal examination and deworming carried out on 23rd to 24th day, if need be. They should be dipped or sprayed on 25th to 26th day to remove ectoparasites.

Isolation

It means segregation of affected and in-contact animals in the event of out break of a contagious diseases from the apparently healthy ones.

Vaccination

Table-4 : Vaccination schedule for Dairy cattle

S. No.	Name of the disease	Type of vaccine	Time of vaccination	Duration of immunity imparted
1	Foot and mouth disease	Polyvalent tissue culture vaccine	At about 6 months of age with booster dose of 4 months later, thereafter yearly once (September-October) once in 3 years	One season
2	Rinderpest	Tissue culture vaccine or lapinised avianised vaccine for exotic and crossbred cattle. Caprinised vaccine for zebu	-	3-4 years
3	Anthrax	Spore vaccine	Once in a year (Premonsoon period)	One season
4	Haemorrhagic septicaemia	Oil adjuvant vaccine	Once in a year (Premonsoon period)	One season
5	Black quarter	Polyvalent vaccine	Once in a year (Premonsoon)	One season
6	Tuberculosis	B.C.G. vaccine	At about 6 month of age, to be repeated every 2-3 year	1 to 2 years
7	Brucellosis	Cotton-19 strain live vaccine 5 ml S/C	4 to 8 months	

Source : Radostits and Blood, 1985).

Disposal of Carcass

Prompt disposal of carcasses of animals died by contagious diseases is of great importance in controlling them. In city the carcass utilization plants are available. After removal

of skins they are usually disinfected by immersion in a disinfecting solution. The remainder of the carcass is fire out its fact, which, is used in soap industry. Farmers can inform these plants so that the carcass can be collected by these utilization plants.

REPRODUCTIVE MANAGEMENT

Management is a major factor that determines success of reproduction. Many decisions taken and actions carried out at the proper time go a long way in ensuring adequate fertility rate on a dairy farm. Failure in one or many may have ruinous effects on reproduction and profits.

Artificial Insemination (AI)

AI through preserved semen is an indispensable tool for the rapid improvement in the milk production. However, preservation technique employed will also preserve most of micro organism which will be subsequently deposited in the female reproductive tract along with semen. The bacteriocidal agent may either be not fully effective or may have detrimental effect on the preservability of spermatozoa. Bhakat *et al.* (1999) reported that streptomycin + benzyl penicillin + gentamicin was the most efficient antibiotic combination for checking bacterial load followed by streptomycin + Benzyl penicillin + Ampicillin and Streptomycin + Benzyl Pencillin in the semen samples before and after deep freezing without affecting the quality and preservability of bovine semen. Ampicillin combination being cheaper can also be recommended for controlling the bacterial load of semen without affecting its livability in the process of cryopreservation.

Factors affecting Fertility of Dairy Cattle

General management will affect reproduction, but here more specific aspects of management which have a direct effect on it are given below:

1. Improper heat detection

The most important managerial cause of lowered fertility is improper detection of heat. Some cows have silent heat or highly subdued heat. In some cases cows may have heat of very short duration. Under hot summer conditions cattle come into heat during the night. Such nocturnal heat may be of shorter duration and of less intensity that no tell-tale are left for the morning. Detection of heat becomes more difficult when they are tied and stall-fed throughout.

2. Improper time of Insemination

Another managerial failure is due to improper time of insemination. Ovulation take place 12 to 14 hours after the end of heat period. But then the egg has to travel down the oviduct before it meets the sperms, which may take roughly 6 hours. Thus, if a cow is served when she first displays signs of heat, the sperms may have to remain in the reproductive tract of the cow for 30 hours or more before they encounter the descending ovum. Though many may survive this length of time, their activity tends to fall fairly quickly, and there is a risk that conception may fail to take place. Insemination very near to or after ovulation is also not conducive to high fertility rate. The sperms must be exposed to the female reproductive tract for about 6 hours for attaining the capacity to fertilize. The ova are viable for only about 10 hours after ovulation. The maximum fertility period, therefore, is that between mid-estrus to about 6 hours after the end of estrus. Any deviation in terms of early service or late service can affect success of the breeding

operation.

3. Sexual Rest

Breeding cows in the first heat after freshening reduces conception rate. In addition, the cows do not get enough time to recoup the body reserves depleted during lactation. It is a better management procedure to let the cow pass through two estrus cycles after calving before breeding her again. A healthy cow may be bred in the third heat period. But, if the cow has history of metritis or retained placenta it will be advisable to give her sexual rest until she is completely recovered.

4. Delaying Rebreeding

Keeping a cow open too long after calving or delaying breeding of a heifer beyond a certain level results in lowering of fertility. Many owners due to ignorance or carelessness miss heats in early lactation and think of getting the cow bred only towards the end of lactation. Every time a cow undergoes a sexual cycle additional chance is given for some abnormal conditions to develop that may lower breeding efficiency. Therefore, the sooner a cow is rebred after she becomes normal after calving the better is the chance for conception.

5. Record Keeping

The reproductive efficiency of the herd is bound to be affected because it will be difficult to plan and organise the management to (i) show the approximate date on which the cow is expected to come in heat, (ii) show whether the heat period is regular, (iii) identify cows which have previous history of breeding trouble so that special attention can be given to them, (iv) locate cows that may need to be treated before breeding because of reproductive disorders, (v) aid the veterinarians in making a proper diagnosis of the breeding trouble. Breeding records are very useful management aids for ensuring efficiency in reproduction. Failure to keep proper records with respect to (a) dates the cow has come in heat (b) date of service (c) sire used (d) result of pregnancy diagnosis (e) expected date of calving (f) actual date of calving (g) health history of cow at and after calving such as dystokia. Prolapse, retained placenta, metritis may lead to confusion.

RECENT ADVANCES

The various cattle and buffalo development programmes, lay emphasis on genetic improvement of productivity, since augmentation of high milk producing animals is necessary to provide milk to the fast growing human population of our country. The Rajasthan state is advocating cross breeding of non-descript cattle with frozen semen of Jersey and Holstein exotic breeds. The exotic blood level will be kept between 50 to 62.5 per cent. The state is famous for many recognised indigenous breed, hence in such tracts the policy of selection and upgradation of the indigenous breeds has been adopted. India's cattle are resistant to diseases especially to tropical animal diseases like tick-borne and protozoan infections. Various Central and Centrally-sponsored schemes are being implemented for genetic improvement of cattle with a view to increasing the per capita availability of consumption of milk through increased milk production. Efforts are also made to protect and preserve the indigenous cattle in their native tract, which are facing threat of extinction. The elite animals are selected and registered on the basis of their performance for production of superior pedigree bulls, bull-mothers, frozen semen and frozen

embryos for future breeding improvements. To achieve this the advanced embryo transfer technology is also applied in breeding operations. During 1999-2000, 6103 artificial insemination centres, 17 semen stations, 40 frozen semen banks, 66 LN2 delivery and distribution system and 10 training centres were established/ strengthened in various states with central assistance. A Central sector scheme for production of proven bulls by progeny testing under field conditions has been in operation in Andhra Pradesh, Kerala, Maharashtra, Orissa and Tamil Nadu. So far 45 number of bulls have been put under test-mating in the progeny testing centres.

Under the National bull Production Programme 914 persons have been trained, 16 farms have been strengthened, five gaushalas were assisted, four bull stations for associated herd progeny testing programme were strengthened and two Embryo Transfer Training Centres were established. In 1999-2000, 2870 castrators were purchased by various States for castration of the scrup bulls under mass castration programme. The following schemes are implemented through the State Governments with 100 per cent Central assistance : (a) Extension of frozen semen technology and progeny testing programme and (b) National bull production programme.

The crossbreeding programme in the country has led to the development of new strains of cattles namely Karan Swiss, Karan Fries and Frieswal. The National Dairy Research Institute, Karnal has achieved distinction of possessing a Karan Fries Cow, "KAMDHENU" which produced 44.2 kg milk per day at peak lactation.

In the field of animal nutrition technologies for improvement of cereal straws through alkali and urea treatment were developed. Biodegradable waste has been used as feed ingredient. Database was developed on Animal nutrition at NIANP, Bangalore. Embryo transfer technology was successfully used among buffalo, cattle, sheep and goat. In-vitro buffalo calves were successfully produced. 32 cell cloned embryo in buffaloes was produced.

ELISA based diagnostic kits for infectious bovine rhinotracheitis (IBR) and Brucella, ELISA Kit for FMD, a liquid phase blocking ELISA test, DOT-ELISA for quick diagnosis of hydroperiardium syndrome etc. were developed. A high Security Animal Disease Laboratory (P4 Biosafety) has been established at Bhopal.

FUTURE STRATEGIES

Rapid change in agro-ecological condition and industrialisation in the recent past has its impact on dairy cattle management practices. The future strategies are given below:

1. For improvement of production, genetic upgradation by cross breeding of ND cattle and also by selective breeding by good indigeous breed.
2. Strengthen AI facility to interior village area by providing good semen quality.
3. Effective transfer of technology to grass root level.
4. Better facilities for animal health care at farmer's door of hot arid village.
5. Promote the production of fodder, seeds and adopt mixed farming system with suitable rotation.
6. Make a meticulous data base related to dairy cattle management in hot arid Thar desert.
7. Create opportunities for self employment through dairy farming within village itself by awareness programmes.
8. Encourage milk producer/farmers to sale milk through co-operative and prevent their exploitation by middle man.

CONCLUSION

In view of many natural impediments mainly the climatic conditions and poor soil moisture regime the Thar desert appears to be more suitable for livestock farming than crop farming. Therefore, to ensure a regular income and sufficient food for farmers and better living standards it is necessary to go for some other alternate land use based farming system or subsidiary enterprises, which will provide more income and employment to the farmers. Such enterprises include dairy cattle rearing or other species. It holds practical values for cost effectiveness, sustainable environmentally friendly and socio culturally acceptable. The farmer of this region gets scope of higher production from dairy cattle, if they adopt improved technologies and scientific management practices, thereby ensuring good income and better living standard. The arid region of our country is better placed in terms of animal production and there is scope for further improvement. The idea of sustainability of agriculture and livestock production revolves around better utilisation of time, money, resource and family labour of the farmers. So, there is sign of hope to explore the income through dairy cattle rearing that exists for turning the farmer's economy viable in the hot arid Thar desert region.

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