

reduced at each stage till the laying hen has a cage of her own. The eggs as soon as laid roll out of reach, are recorded and collected, and when the egg production falls below a standard, the birds are sold, and the places occupied by better workers. The arrangements are perfected so that no litter is scattered and no food or water is wasted. The lack of sunlight resulted in rickets and this was overcome by feeding with cod-liver-oil. The problem of cannibalism was overcome by a trick. Ruby coloured glass windows and coloured light bulbs solved the trouble. The cannibalism was suspected to be due to the sight of blood where the pin feathers came through the skin and the red light neutralised the effect. The freedom of the birds from soil and litter results in a disease-free condition. A controlled ventilating system is designed to give a plentiful oxygen supply to each bird. Prolonged tests have shown that under these controlled conditions of temperature, light and humidity, the seasonal fluctuations of a neutralised bird are eliminated. There is no scattering of rations and hence feed-cost is reduced. Under natural conditions 100 birds is the limit of bird density per acre and beyond which, it will breed diseases due to crowding. As an example of the efficiency of battery brooding, M. H. Arndt experimental plant houses 16,000 birds on less than one acre and all labour is performed by two men only. The revenue from the droppings amounts to roughly the cost spent on labour. The freshness of products and lower breakage losses due to reduction in the distance transported, are other points in their favour. Breeding for confinement-minded birds are being done and among other incentives tried music has been found to induce better laying. Attempts to make better use of the dropping as fertiliser are being made. The volatile products like ammonia of the litter are being captured by placing chemicals on the belts, and if successful will result in a better utilisation of the waste and by-products. The factory idea will be unprofitable, if new structures are to be erected, but the establishment chiefly depends upon the ability to rent or purchase obsolete structures which do not possess any economical value for other enterprises.

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Agricultural Fottings

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Cattle Breeding. A Dairyman or ryot who owns a herd of cows and supplies milk all the year round to his customers has to regulate the calving of his cows throughout the year to fulfil his orders and keep up a uniform supply. It is therefore important that he should know something about the "Oestrus" in cows or "the period of heat." This is the time when the cow calls for the bull.

A heifer will come on 'heat' for the first time any time from the age of 2 to 4 years according to the state of her maturity, condition, environment and feeding, i.e., an early matured heifer reared under good conditions will take the bull much earlier than one which is underfed and undersized. In temperate climates, cows come on heat about 3 weeks after calving and every 3 weeks after that until they conceive; but in India, the indigenous cows vary from 3 weeks to a year or more after calving and their periods are very irregular. On the average the Indian cow in good condition will conceive about 3 to 4 months after calving. Some people are under the impression that a cow will conceive at any time if covered by the bull. This is not so, a cow must be properly "on heat" if she is to conceive. It is therefore waste of time taking her to the bull unless she shows the signs of "Oestrus."

It is very easy to see how a heat period in a cow might easily be missed. There are often no apparent preliminary symptoms of approaching heat, such

as are observable in the bitch, which bleeds extensively for several days (pre-oestrus). External haemorrhage in the cow or heifer, if it occurs at all, does so 2 or 3 days after the beginning of the heat. This is far more common in heifers than cows; in the latter it is rare, but in heifers the appearance of blood-stained mucus at the vulva is quite frequent; it forms a useful indication as to when the animal may be again on heat. On the average, heat lasts about 16 hours in heifers and 19 hours in cows. In the cold season a heat period may only last 6 hours as against 16 or more hours in hot season. It is easy to see therefore, that a period occurring in the night is overlooked. Again it is more difficult to detect the heat when the cow is tied in the stall than when she is allowed to run about.

In some cases ryots will not allow their cows to be taken to the bull whilst they are in milk and suckling their calves in the belief that if the cow is served by the bull, the cow will immediately go dry. This is not so; the cow will continue to yield milk if properly fed.

The following signs of "Oestrus" in cows will benefit cow owners in discovering the proper time to send their cows to the bull.

(i) The cow will be restless and will switch its tail frequently from side to side and will turn her head towards its hind quarters.

(ii) It will go off its feed for a day or so.

(iii) The external genital organ (vulva) will be slightly swollen and there will be a slight discharge of a white slimy mucus.

(iv) It will stand with its tail raised and ears erect and will stare at individuals.

(v) Frequent passing of urine.

(vi) Milk yield will decrease for 2 or 3 days and does not allow calf to suckle properly.

(vii) If tied in a stall, will be restless and will bellow frequently.

(viii) If allowed to graze or exercise with other cows, she will be seen to jump on them or allow others to hump her.

All cows should be taken to the bull immediately these signs appear. It is no use waiting until the next day as this may be too late.

The above symptoms become more pronounced in an adult cow than in a heifer or first calving cow.

Breeding Bulls and their Management. There are occasional complaints that some breeding bulls are slow servers and others refuse to serve at all. It is therefore necessary that the agriculturists should be informed of some of the reasons why this happens.

1. Slowness of service is not necessarily an indication of infertility. It is true, however, that they are often associated and notably so in animals which are too fat or alternatively, in those which are going back in condition. The best condition for breeding in males is a hard one produced by sufficient exercise to work off a surplus of fat, but favouring the retention of nitrogenous substances and vitamins. However it cannot be sufficiently stressed that with the male, as well as with the female, a rising condition is always more conducive to the proper discharge of the reproductive functions than a falling one. A breeding bull can be worked for half a day in a single bullock cart or can be used as a work animal in agricultural operations. The bull should be well fed and given green fodder whenever available, its muscles should be fairly hard and there should be very little fat on its body; but do not allow it to lose condition and become too lean. Groom it daily and pick off all ticks as these reduce its vitality and irritate it.

2. Slowness in service is sometimes psychical in nature due to strange surroundings or to the nature of the control to which the animal is subjected. Hesitation in service is also sometimes the result of sores or warts on the prepuce, penis or feet and males are in best condition for service a few hours after they have been fed when they are more active than directly after a meal. It is sometimes noticed that stud animals which have travelled long distances and are introduced into fresh surroundings are temporarily infertile, especially when the new conditions are less favourable than those to which the animals have been accustomed. This, however, is usually only a temporary result and full fertility can generally be restored by favourable treatment in the way of diet and surroundings. When a new bull is purchased and brought to the homestead, feed it on the same ration, if possible, as it was formerly fed on, allow it time to become accustomed to its new surroundings and do not ill-treat it. House it in a comfortable shed, give plenty of exercise as stated above and allow it to rest for two or three weeks before it begins its service.

3. It is of great importance that a male animal should be used regularly. It should not be used too much at one time and too little at another. It should be remembered also that prolonged periods of disuse may be as injurious to the bull as over-use since undue accumulation of semen in the generative passages may result in back pressure and deleteriously affect the spermatogenic capacity of the testes and possibly also interfere with the functional activity of the accessory sexual glands. In India this is difficult as a large number of cows come on heat after the rains and when good grazing is available and breeders are apt to permit the bull to perform too many services in a short period. This is undesirable; the number of services in a month should be limited to 10 or 12 at the most in these heavy seasons. If possible the services should be spread out evenly throughout the year.

4. With any young males it is inadvisable to allow service to occur too often, even though the service may be fertile, as frequent service, when performed too early, is likely to result in undergrowth of the sire and to impair its breeding capacity in later life. Young males are most liable to suffer from underfeeding and over-use, whereas old males suffer from overfeeding and under-use. Many young early matured bulls are ready for work at $2\frac{1}{2}$ years old but as the bull is not fully grown until about 4 years old, its services from $2\frac{1}{2}$ to 3 years should be limited to 3 per month, from 3 to 4 years to 4 per month or 50 in the year. If a young bull is allowed to serve a great number of cows in its early life, the length of its breeding life will be considerably reduced. See that a young bull is well-fed and kept growing. In the case of matured bulls, the rations can be decreased if it is seen that they are becoming fat.

5. In general, the males of the lighter breeds are able to serve more females successfully than those of the heavier breeds. Kangayam and Hallikar bulls are much quicker at service than the bulls of the heavier breeds such as the Ongoles and Sinds.

6. Onanism or sexual abuse is sometimes a source of trouble, more especially in young animals that are given little service. This is often seen in India and to avoid it as far as possible, give the bull some hard work to do if there are no services to perform.

A bull will refuse to serve a cow which is not properly in heat and will not stand. This is a very common complaint unnecessarily made against the bull. It must be remembered that the period of heat (Oestrus) in cows only lasts for about 16 hours and it is essential that the cow should be taken to the bull at once before the heat subsides; otherwise the cow will not stand and the bull will not serve it.