

### Research Notes.

#### Nutrition and Cattle Breeding.

IN a very interesting and useful article (*Agriculture and Livestock in India*, 3, 549, 1933) K. C. Sen has dealt with some of the nutritional factors affecting breeding operations of cattle which will prove to be of real practical value to the agriculturists and the animal husbandmen alike. Our knowledge about the dietary requirement of Indian cattle as regards their growth, reproduction and general well-being is very poor. The improvement of the breed, the fertility of the animals, the milk production and resistance to diseases can be regulated to a great extent by a careful and judicious selection of the diet. The result of an experiment carried out at Muktesar shows that by adding 4 oz. of bone flour per day from the dry period after the second lactation, and providing a well-manured grazing land for the cow, the milk production in the third lactation increased from 2,438 lbs. to 4,064 lbs. and in the fourth lactation during 293 days the yield of milk was 10,000 lbs. This is a remarkable success in increasing milk yield. The quality of milk produced is also directly related to the ration supplied. In order that the milk may be rich in all the accessory food factors essential for proper growth of calves, it is of utmost importance to see that proper nutrition is provided to the dam. Minerals also form an important constituent of milk; their deficiency in the ration may be a limiting factor in milk production. Beside the milk yield, a high birth-rate in the herd and the bearing of normal and healthy calves are very important from a farmer's point of view. Unfortunately, however, abortion in females of non-specific origin is very common in India. It has been demonstrated by American workers that deficiency of lime in the diet produces abortion or lends to the birth of weak calves. Lime deficiency occurs where grazing is not provided and is very common amongst stall-fed animals. One of the commonest symptoms of this deficiency in animals is their attempt to eat earth and mud in their pens.

It has been observed by workers in America and South Africa that phosphorus starvation in cattles leads to diminished fertility and a decrease in milk yield. In one experiment, the addition of bone meal to the ration raised the milk yield by 40 per cent. and increased the average number of

calves born in a herd by 30 per cent. This fact is particularly important for India since natural pastures in this country are highly deficient in phosphorus. Diseases like anæmia, goitre, rickets, osteoporosis, emaciation and loss of condition, etc., are associated with faulty mineral metabolism and require immediate attention. Minerals like fluorine and iodine also appear to effect breeding operations. An excess of fluorine in the diet may cause sterility while deficiency of iodine leads to endemic goitre and breeding difficulties. It is only very recently that attempts have been made to correlate sterility with vitamin deficiency. Absence of vitamin E and vitamin A in the diet causes degeneration of germinal epithelium and hence leads to sterility. Under an intensive system of dairying with stall-fed animals and in places where green pastures are not available, there is a real danger of a deficiency of vitamin A and D. The birth of blind calves, teratomatous growth on eye balls, twisted nose and other bony deformities which are very common in many parts of India are probably connected with vitamin deficiencies in the diet. A hypo or hyperfunction of some of the endocrine organs such as thyroid and pituitary, may cause sterility as a result of unbalanced ration supply to the animals.

The result of the experiments carried out in the Punjab and Pusa have shown that it is possible to improve the local breeds available in India by selective breeding and judicious feeding, provided the degeneration has not proceeded too far.

Improvement in the cattle-breeding involves therefore a number of considerations, and a knowledge of nutritional requirements of the animals will prove to be of great value to the former. Considerable research in this direction will be necessary to overcome the numerous disorders of nutritional origin and to correlate the susceptibility of animals to various types of parasitic infections and diseases in general, with nutritional deficiency.

N. C. DATTA.

#### Wood Preservatives: Their Selection and Testing.

TIMBER is one of the commodities that find a large application in every-day life for several purposes and under diverse conditions.

It is common experience that this material even when it is properly seasoned, is easily attacked by fungi and termites, unless treated with toxic chemicals. Therefore a satisfactory method of testing the various wood preservatives for their potency against such attack is a welcome addition and forms the theme of a contribution by S. Kamesam (*Forest Bulletin*, Economy Series, Bull. No. 81, 1933). The different preservatives, including the patented "Falkamesam" one, have been studied at great length. The successful employment of a preservative in practice is conditioned by its ready availability, low cost, its high toxic coefficient against the destructive agents in low concentrations, its permanent retention in the treated pieces and a few others, which have been adequately discussed in Part I of this publication.

A large part of the paper (Part II), deals with the technique of determining the toxic action of the preservatives on the wood-destroying fungi and insects. This technique which is in vogue in European countries, has been evolved by Dr. Falck with whom the author had collaborated in evolving a new preservative. The various solutions were tried on three wood-destroying fungi viz., *Coniophora cerebella*, *Lenzites thermophilla*, and *Fomes annosus*, after being impregnated in wood pieces and air dried. The arsenicals stand supreme in their destructive action, which property has been largely utilised in the latest process. In fact, Dr. Falck long ago had established the high fungicidal coefficient of arsenic, in very low concentrations. Experiments conducted with beetles particularly *Calandra* and *Dinoderus* sp. led to the same findings. In both cases, the superiority of the recently patented preparation is emphasised. Besides this, Thanalith U, Sodium fluoride, and Copper sulphate possess a destructive action on these in certain useful concentrations. Coal tar creosote, on the other hand, is not very effective.

Leachability tests show that arsenic can be fixed in wood, under conditions developed by the author. This fixation is influenced by the presence of dichromate. It is therefore interesting to investigate the mechanism of fixation of this poison in the wood and it is equally important to assess the rôle of chromium in the process. Even arsenic in the arsenious state and other non-arsenicals have proved a failure as preservatives. In the "Falkamesam" and other arsenical

preparations, no evidence of attack on mild steel has been noticed.

In Part III the author presents tentatively an ingenious method of determining the value of a preservative with the help of the several tests mentioned before. To this end, "weightage numbers" are indicated under each test, depending upon the toxicity of the chemical employed. The sum total of these numbers represent "composite value indices" which should give a clue to the potency of the solution. Thus "Falkamesam" and colloidal arsenic trisulphide mixed with sugar (Indpal Patent) have an index of 35, while arsenic trioxide has only 28 as the index. Copper sulphate and zinc chloride, on the other hand, score hardly 16.

The final part is devoted to a critical examination of the preservatives in relation to the method of utilisation of timber. Thus when wood is employed in outside location, the highly toxic chemical must be fixed permanently, a condition satisfied remarkably by the "Falkamesam" fixative. Again, timber permanently located in water does not require any treatment. In other cases, the treatment is varied according to the use to which the wood is put, for which the original paper should be consulted.

In the end, it is necessary to point out that several interesting points have been raised requiring detailed study. The simultaneous fixing of copper and arsenic in wood announced by the author, would appear to be the best treatment so far evolved for preserving timber. A publication on the same is keenly awaited.

V. I.

#### The Featherback Fish *Notopterus chitala* (Ham. Buch.)

IN the August issue of *Current Science* (2, 71, 1933) attention was directed to the valuable contributions of Dr. H. M. Smith to the ichthyology of Siam. Two further articles have now appeared in the same series (*Journ. Siam Soc. Nat. Hist. Suppl.* 9, pp. 245-260, pls. viii-ix, 1933), and of these the one dealing with "The Featherback Fish *Notopterus chitala* in Siam, with Notes on its Egg-laying and Young" is of special interest to students of Indian fishes, as the species is widely distributed in India and is of considerable economic importance.

In Siam, the egg-laying period of *N. chitala* extends from January to August, and the

eggs are attached in a single layer to piling posts, stakes, or stumps. It has been ascertained that each fully mature female lays three separate batches of eggs in the course of a single season. The eggs are comparatively numerous, and the care of them devolves on the male parent. At an average water temperature of 33°C. the incubation period is 5 to 6 days. Immediately after hatching, the young drop to the bottom and occupy a small shallow depression prepared by the parent fish before the eggs are laid. The article is full of valuable information from the point of view of pisciculture and the fisheries officers in India will find the paper of exceptional interest. Dr. Smith has to be congratulated on having produced a paper of such great merit.

#### Cytological Studies on Plant Tumors and Triploid Hybrids.

THE notable progress made during recent years in experimental biology, specially on gene mutations and chromosome aberrations caused by X-rays, violent changes in temperature, mechanical injuries, etc., and on the production by hybridisation of fertile polyploid hybrids, has led to a belief in two parallel modes of descent, *viz.*, a mutative and a synthetic descent. Dontcho Kostoff has made considerable additions to our knowledge of these phenomena. Extensive morphological, histological and cytological studies have been made by him on the tumors and polyploidy produced in various plants by bacteria and chemicals (*Arch. f. Microbiology*, 4, 1933). The tumors caused by injecting *Bacterium tumefaciens* were found to be similar to those caused by various chemicals and to the spontaneous tumors on hybrids. In *Genetica*, 15, 1933, he has described numerous abnormalities in chromosome behaviour and the sterility caused in *Nicotiana* by virus diseases. Biophysical studies have shown an increase of cytoplasmic viscosity in these tumors and the origin of polyploids is due primarily to the resistance offered by the highly viscous cytoplasm to the normal movement of chromosomes to the poles and to the formation of a nucleus before such movement is completed. Retardation of meiotic processes may also be the result of abnormal biophysical and biochemical processes created by hybridization as shown by him in pollen abortion in hybrids of *Secale* (*Cytologia*, 3, No. 4, 1932). In the production of stable

new hybrids Kostoff has been successful in breeding a triple fertile hybrid of *Nicotiana* (*Bull. Appl. Bot. Gen. and Plant Breeding*, Leningrad, 2, No. 2, 1933). Comprehensive morphological, cytological and genetical studies of this form, a triple hybrid ( $n=24$ ) of *N. tabacum* ( $n=24$ ), *N. sylvestris* ( $n=12$ ) and *N. Rusbyi* ( $n=12$ ), show that it combines the character of all these species, and is cytologically balanced and produces normal gametes. He has again described in *Cytologia*, 3, No. 2, 1932 a similar triple hybrid of *Triticum* ( $n=42$ ) possessing the characters of all the three species [*T. dicoceum* ( $n=14$ )  $\times$  *T. monococum* ( $n=7$ )  $\times$  *T. vulgare* ( $n=21$ )].

#### Courtship of Lizards.

IN *Natural History*, 34, No. 1, 1934, G. K. Noble describes a series of experiments conducted on the field by him on the American fence lizard, *Sceloporus undulatus*. The males of this species possess on their under-sides a bright blue stripe the significance of which was obscure till now. The male generally rules over a small area and makes it almost his own and exhibits great intolerance towards any male trespassers. Whenever he sights intruders, he compresses and raises his body in such a way as to show off his brilliant lower surface, which serves as a warning to the intruders to quit. Such colourful exhibitions are not manifested when he sights a female within his territory. The males are able to identify the sex of another individual even at some distance. But the recognition of sex seems to be chiefly by means of colour and in experiments where the blue stripe of the male was hidden by paint or by tying the legs of the animal in such a way as to obscure it the males were unable to distinguish the sex and mistook the intruders to be females and sometimes even began to court them. The movements of the two sexes are different and sometimes offer an additional clue to their recognition. The females are indifferent as to their habitat and reconcile themselves with any new area to which they may be introduced but the males generally find their way back to their own homes provided the distance is not too great.

#### The Kaolin Minerals.

IN a recent paper *U.S. Geol. Surv. Profess.*, Paper No. 156-E) C. S. Ross and P. F. Kerr have given a brief account of their recent investigations of the clay minerals, in the

laboratories of the United States Geological Survey. The authors have effectively supplemented the older methods of investigation by the more recent one of studying crystalline powders by X-ray diffraction patterns. They have thus been able to show that instead of one kaolin mineral, as has been commonly assumed, there are at least three which are stable at different temperatures and therefore formed probably under dissimilar conditions. Kaolinite, the most abundant of the three, is the source of most, if not all, of the kaolin and 'china clay' of commerce.

#### Nepheline Syenite from Rhodesia.

In a recent number of the *American Journal of Science* (27, No. 158, Feb. 1934) Frank D. Adams and F. Fitz Osborne have described an interesting type of nepheline syenite from Northern Rhodesia. In hand specimens, these rocks have medium granularity, and often show pitted surfaces

due to the removal of feldspathoids by weathering. The feldspars stand out and show more or less idiomorphic outline. A pale green fibrous pyroxene is common. Muscovite is found in some specimens. Of the feldspathoids some varieties show only a gray nepheline; others show a pale blue nepheline associated with a more deeply coloured sodalite and a honey yellow cancrinite. The red aggregate known as *Spreustein* or hydro-nepheline replaces part of the nepheline and sodalite of some of the rocks. Under the microscope, the feldspars are seen to be of two kinds, microcline and albite; and most of the albite appears to have replaced microcline. The muscovite, in part, appears to have replaced feldspathoids, between grains of albite. Magnetite, zircon, and perovskite are the common accessories. The authors consider these rocks as affording a particularly interesting example of the formation of minerals of unusual composition due to the abnormal composition of the magma.

#### The State of Water in Gels.

By Dr. K. Krishnamurthi, D.Sc. (London), *College of Science, Nagpur.*

THE capacity of certain colloidal solutions and gels to hold a quantity of the intermicellary liquid with great forces of attraction has been long recognised. The effect that such a binding has on the state of water has been the subject of a number of investigations. Several workers tried to find out the behaviour of this "bound water" when the colloidal solution or gel was frozen. Mölich (*Sitzungsber. Akad. Wiss. Wien.*, 105, 1896) appears to have observed that, when a 2% gelatin gel was frozen, the gelatin formed a net-work, the spaces in which were filled with ice masses and air-bubbles. Liesegang's investigations showed (*Koll. Zeit.*, 93, p. 523, 1906) that water was not separated from gelatin during freezing and subsequent thawing. Hardy's microscopic examination (*Proc. Roy. Soc.*, 112 A, pp. 47-61, 1926) revealed the fact that ice crystals were formed in the gelatin gel while freezing and that, during the subsequent thawing, the water was re-absorbed in the surrounding gel leaving only a tiny cleft.

Quantitative methods for the determination of the percentage of bound water in the gel were chiefly based on the examination

of some physical properties of water which underwent marked changes when present in the "bound" condition. In one class of methods the gel was first frozen, when a certain proportion of the water—presumably the "bound water"—remained in the unfrozen condition, and the amount of the frozen water, which corresponded to the unbound or "free" water, was determined firstly from the changes in volume produced on freezing the gel or during the subsequent thawing, or secondly from the quantity of heat required to melt the ice. Another method suggested by Newton and Gortner (*Bot. Gaz.*, 74, pp. 442-446, 1922) involves the determination of the amount of water available to dissolve a soluble material, and from this the amount of water, which cannot act as solvent, and which therefore corresponds to "bound" water, can be easily calculated.

It may be useful at this stage to consider how far the above-mentioned methods give us an accurate estimate of the amount of "bound water". In the first place, these methods are based on the assumption that the water, which is held with great forces of attraction by the gel-micells, is incapable of