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CONTENTS

BIONOMICS OF THE TASAR SILK WORM (*Antheroea pathia.* LINN)* IN SOUTH INDIA

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Among the several species of wild silk insects actually utilised in India for the production of Silk, the Tasar (variously spelt as Tussore, Tusser, Tusseh, Tussa, Tussah, from Sanskrit *Trasarah* = A shuttle) is certainly the most important not merely because of its extreme aboundance but also of its great commercial value. It is said to be a native of India, China and Ceylon. In India it occurs in a wild state in forest and jungle tracts throughout the continent and feeds on a variety of plants. It is a multivoltine worm but very little exact information is available as to the number of generations it passes through in the course of one year. The apparent lack of accurate knowledge on this point may be partly due to the variability in the number of broods in adaptation to the striking climatic differences prevailing in the different parts of this vast continent and partly also perhaps to the fact that attention has been directed not so much to the study of the lifecycle of the insect as to that of its commercial exploitation.

* A paper read before the Science Congress, 1929.

Occurring as it does throughout the hill tracts of India from Burma to Bombay and Travancore to the Himalayas it has a very wide distribution; and it has been cultivated for the silk fibre though in a partial state of domestication in many districts of northern and Central India, specially in Bengal and Central Provinces. It may be useful briefly to review the methods of semi-domestication in vogue in these districts. Broadly speaking, it mainly consists in collecting the seed cocoons of the insect from jungles and rearing the insects by tying the cocoons on selected trees which are grown specially for this purpose. In some places the females that emerge are kept as prisoners in such a state of confinement as to allow of the nocturnal visits of wild males for fertilisation purposes and the cages or other receptacles in which the eggs are laid by the female are tied on to the branches of trees where the developing worms are guarded so as to ward off insectivorous birds and other enemies which are likely to harm the growing stages of the insect. In Western India also definite attempts have been made to see if its cultivation could be carried on, on a commercial scale, which showed that under the conditions prevailing in that part of the country the worm could not be profitably reared, not being sufficiently remunerative.

In South India though the insect is commonly met with throughout, very little attention appears to have been paid to utilise it as a silk-spinner. It is due perhaps to various reports of attempts elsewhere to rear them in captivity having invariably failed. It is said that the moths will not mate in captivity and lay fertilised eggs in confinement as it is believed that the Tasar female will not permit the attentions of a male of the same family and that feeding at any rate will have to be done in the open air as they seldom feed properly in captivity. Whatever may be the real cause, the fact remains that in Madras nothing substantial seems to have been done, so far as the writer's knowledge goes, to note their habits, food or produce so as to ascertain the economy of this insect under South Indian conditions. In this short paper therefore, the writer proposes to present in as concise a manner as possible, the results of certain attempts made to rear these worms experimentally in the laboratory during the latter part of 1927 and the beginning of the year 1928 and thereby endeavour to draw the attention of those interested in Tasar culture to the importance of the subject. It is needless to observe that in all operations connected with wild insects much more than in the case of domesticated ones, a careful study of the life history, habits and other factors is of paramount importance so as to ensure success. In the following paragraphs, therefore, an imperfect attempt is made to record some points regarding the bionomics, distribution, host plants, natural enemies etc. of the insect in relation to the conditions obtaining in this part of the country which have come to the writer's notice in the course of his experiment

with the worms and it makes no pretensions to have either completely solved the problem of their domestication or to have thrown new light on their productive or commercial aspects.

In December 1927 a few Tasar cocoons procured from the country Almond trees (*Terminalia catappa*) of the locality were kept under cover with a view to ascertain if the moths that emerged would pair and lay fertilised eggs. Early in January 1928 the moths emerged and laid fertilised eggs which formed the basis of the first-generation. The caterpillars that hatched out within ten days were successfully bred by feeding them on the leaves of *Terminalia catappa*. They went on vigorously eating the leaves both during day and night and after getting full-grown went into pupation. The larval period varied from 37 to 72 days and the pupal period from 22 to 51 days for a total number of 27 individuals reared. The proportion of males to females was 59 : 41. From these moths a second generation was raised. Some of the females that emerged were kept isolated with one male each in separate cages, and in other cages one female was kept with a number of males (always more than one, generally two or three). The eggs in the former cages were not fertilised but in the latter they were invariably fertile.

Life History—Adult. The moths are large and handsome with the body short and thickset and densely clothed in downy hairs. They are nocturnal and short lived. A pinkish wavy line (white edged on the outer side) marks off the marginal lightly coloured area of the wings. The anterior margin of the forewings has a dark grey band running across the dorsal side of prothorax. Each wing possesses a circular transparent eye-like area surrounded by three concentric circles, the innermost pale yellow, the middle grey, and the outer most dark.

Varieties. Three varieties of Tasar have been collected from South India and they differ only in the shades of colouration.

1. Form *paphia*—pinkish brown in colour varying between light brown and dark brown. Wing expanse of the largest sized + moth in the collection. 155 m. m.
   Thickness of abdomen. 27 m. m.
   Wing expanse of the largest sized female moth in the collection. 154 m. m.
   Thickness of abdomen. 12 m. m.
2. Form *mylitta*—bright yellow throughout except the abdomen which is light yellow wing expanse of the largest sized female moth in the collection. 162 m. m.
3. Form *nebulosa*—dirty grey or greenish brown in colour with the abdomen light grey colour. Wing expanse of larget sized female moth in the collection. 144 m. m.

The male moth has a more pronounced hue, slender abdomen and broadly bipectinated antennae. The hyaline ocellus-like area is bigger in the female. The angle made by the interior margin of the forewing with lateral margin in the male is narrower and more acute than is the case with the female.

In captivity the moths have not been observed to pair during day time. Soon after emergence the females are fertilised by the male at night (provided more than one male specimen is left with a female) and it begins to lay eggs the day after emergence. Each moth continues to lay eggs in varying numbers at intervals from day to day for about four to eight days. While about to lay eggs it goes on continually shaking the abdomen as also the wings, the abdomen gets stretched out and the eggs are forced out with a coating of a gummy yellowish exudation. This gummy fluid gets hardened soon so that the eggs are glued on to the surface of the object such as leaf, branch, sides of glass cage or wire gauze on their flat surfaces. Eggs are laid sometimes quickly and about eight eggs were seen laid in two minutes.

Egg. When freshly laid the egg is soft and yellowish white in colour but soon changes into a creamy white colour and gets hardened. The eggs are slightly oval in shape (not exactly circular in most cases) flattened and approximately biconvex having two concentric brownish lines along the oval border or thickness of the egg. These lines are (·2) mm apart and become visible only in a few minutes after the egg is laid.

Length along long axis. 3·2 mm to 3·4 mm.
,, ,, short axis. 2·6 mm to 2·9 mm.
Thickness. 1·5 mm to 1·7 mm.

The total number of eggs laid varied from 121 to 190 the average for eight individuals whose egglaying capacity was noted being 144 eggs. The life of the female moth after emergence is very short and varied from 6 days to 12 days averaging about 8 days for eight individuals; whereas the life of the male varied from 5 to 11 days averaging about 7 days. The eggs hatched in about seven to nine days on an average into small caterpillars.

I Instar. When the eggs are about to hatch i. e. about the sixth day they exhibit a slight change in colour in that they become paler and the fully developed larva inside the egg shell slowly gnaws its way out. For a time it remains on the empty egg shell feeding thereon. The caterpillar is very small and not being active moves about slowly.

Length. 7·0 to 7·5 m. m.
Thickness. 1·0 to 1·5 m. m.

In colour it appears golden yellow but appears superficially to be composed of yellow and dark bands or rings across the body. It has a comparatively large head with a dark brown shield. Examined under a lens these are seen to possess twelve visible segments. Each segment has two darkish warts or tubercles dorsally one on either side of the median line and two warts laterally on either side, the upper row of which is quite clear. From these warts project out stiff black spiny hairs while smaller hairs are scattered sparsely over the body. The first and the third segments possess one dark blotch

each dorsally and the rest of the body has a dark spot in between the segments so that along the dorsal median line there appears to be an interrupted dark streak or line. The instar lasts from 5 to 8 days averaging about 7 days for 7 individuals. After that the larva moults for the first time and enters upon.

II Instar:— The colour of the larva alters as it progresses. The general colour is yellowish green. Those which appeared in the previous instar as dark cross bands can now be distinguished as six distinct warts on each of the twelve segments of the body.

Length. 19 to 22 m. m.
Thickness across the broadest part of the body. 3 to 4 m. m.

All warts are reddish in colour except the two dorsal pairs of warts on 3rd and 4th segments from the anterior end which are dark at their tips. There are four distinct dark dots on the first segments behind the head. The larva is fairly active and feeds well on *Badam* leaves. This instar lasts for four days after which the larva moults for the second time and enters on.

III Instar:— The general colour is bright yellowish green and the larva is elegant and beautiful to look at with its variegated colours.

Length 26 to 27 m. m.
Thickness 4 to 5 m. m.

Head capsule is reddish brown. All warts are reddish in colour with dark spiny hairs. About nine dark spots are seen ventro-laterally which are the spiracles. The caterpillar is active and feeds voraciously. This instar lasts from 4 to 6 days averaging about 5 days. Then it moults for the third time and enters on.

IV Instar:—The general colour is still greenish. Head brownish (pale brown soon after moulting but becoming deep brown gradually).

Length 38 to 39 m. m.
Thickness 7 to 8 m. m.

The dorsal series of warts are sparkling red with a dark rather bluish dark cap giving off dark hairs. The lateral rows of warts are brownish. The upper series of lateral warts on either side are connected together by a faint yellowish streak just above the spiracl confined to the region corresponding to the posterior half of the abdomen, legs pinkish brown, the spiracles are clearer, larger and more conspicuous. The instar lasts from 5 to 7 days averaging about 6 days. After which the larva moults for the fourth time and enters on.

V Instar:—

Length 47 to 57 m. m.
Thickness 10 to 15 m. m.

The colours of the worm at this stage are the most brilliant and varied in shades. Head is reddish brown still. Body yellowish green. Dorsal warts red with black caps giving off greyish hairs. The prolegs are of

a green colour with small hairs. The lateral warts are also reddish with distinctly blue caps and dark hairs. The brownish longitudinal stripe connecting upper lateral row of warts is more pronounced and extended covering three quarters of the length of the body posteriorly. The instar lasts the longest from 9 to 13 days averaging 11 days. It grows in size considerably before it enters the pupal instar. But at the time of spinning the cocoon, the worm becomes contracted antero-posteriorly and consequently thickened appreciably and seeks a good mid rib of a stripped leaf for attachment.

Rearing, feeding, moulting. The worms feed night and day having had to be supplied with food both morning and evening. They feed voraciously during the last three instars. After the second moult they have to be kept in flat trays separately with plenty of leaves because of their increasing size. It is easy to distinguish when the worm is about to moult, for at this stage it is inactive and refuses to feed. It fastens itself firmly by means of its prolegs to a thick mid rib of a leaf which has been already eaten up including its succulent parts. The attachment of the prolegs is so firm that it is extremely difficult to shake them from that position without causing injury. The head is raised, bent in a characteristic manner and is held in that attitude for hours just before moulting actually sets in, the head appears to be much larger than usual and the head capsule in the process severs off easily but the moult skin in the region corresponding to the abdomen is not shed with as much ease. In one or two cases a ring or band of the old skin which seems hard to cast off was seen to remain encircling the abdomen which gets constricted as by a belt round the growing worm for a long time after the moulting is over. The worm may have to be helped in such cases to cast off this belt for its healthy growth. As the worm grows and progresses the colour alters until it becomes, before spinning commences, very brilliant with diverse colours.

Pupal instar :— When the worm has attained its full growth it ceases to feed and begins to spin its silken cocoon. In the natural state (usually in confinement also) it secretes, to begin with, a resinous silky fluid and slowly constructs a thick cord, encircling in the form of a ring a small branch of the plant or twig or a naked mid rib of a leaf which is prolonged into an inch or two so as to form a peduncle or stalk by means of which the future cocoon is to be suspended. This silken cord, which is of singular strength and neatness with its ring, is undoubtedly a necessary provision of nature. In the cage in the laboratory the silken ring is often dispensed with, although the cord is almost always present. The peduncle is short and is strengthened by adherence to a midrib. It is from the end of this cord that the construction of the cocoon commences. Often a few leaves from the

vicinity are drawn together to line externally the forming cocoon, to mask it from observation. After forming the cord the worm can be observed to produce short sweeps of the head from one side to another depositing the silk in loops, which issues in the form of fine threads. The threads take a zig-zag course with leaves or midribs or sides of the cage in the laboratory for temporary attachment. As the silk is drawn out, it becomes slightly yellowish in colour being coated with a gum. After it has spun sufficiently to conceal itself, a cementing fluid is discharged at intervals which is thick like plaster of paris. This exudation or cement is then pressed by the expanding muscular motions of the body through the silken cocoon so as to consolidate and harden it. In this manner it is seen to spin the cocoon layer after layer until the whole of the stock of silk is exhausted. Before it transforms itself into a pupa inside this, it moults for the last and fifth time as is evidenced by the presence of the head capsule and moult skin compressed between the pupa and the inner wall of the cocoon. The cocoon so constructed is compact and hard like a shell presenting a rough outer surface independently of the impress of leaves or other objects. It is oval in form with rounded ends. Thought it possess an irregularly reticulated parchment like outer surface not easily pierced through by a penknife or needle, the inner surface is surprisingly smooth, soft and varnished. The colour of the cocoon is greenish brown or yellowish brown. Imprisoned within such a cocoon the larva transforms itself into a pupa and rests on this stage for a period very varying from 23 to 51 days, averaging 26 days. The cocoons may vary much in size but the female cocoons are always much larger than male ones.

Length of the largest sized cocoon in the collection.	60 m. m.
Breadth.	30 m. m.
Length of the peduncle.	40 m. m.
Thickness of peduncle.	1 to 1·5 m. m.

Mode of exit from the cocoon. When the metamorphosis is completed and prior to the emergence of the moth, one end of the cocoon (generally near the peduncle) is moistened by a liquid which is said to be secreted in the alimentary tract so as to dissolve the cement, and the moth slowly creeps out by separating and breaking the weakened fibres with its head, antennae and anterior legs appearing first. Very soon the wings become extended and dried. The adult is short-lived owing to the absence of proboscis which renders feeding impossible and its longevity varies from 6 to 12 days averaging 8 days.

The pierced cocoon though not of any real value for its fibre is reported to be used for various purposes, such as for keeping tobacco or lime for chewing betel-leaves. In this Province it is cut in a continuous spiral of uniform width to produce one long band which is used for tying objects like walking sticks.

Food plants and distribution. The Tasar worms have been said to feed on a variety of plants, such as *Zizyphus jujuba, Terminalia tomentosa, T. arjuna, T alata, T. catappa, Shorea robusta, Ficus elastica, F. religiosa, Bombax malabaricum, Eugenia jambolana, Bauhenia variegata, Bassia latifolia, Tectona grandis, Ricinus communis* etc. etc. In south India it has been noted to feed mostly on *Terminalia catappa* (the country almond tree) and *Feronia elephantum* (Wood apple tree). It also feeds on *Zizyphus jujuba* (Yellande tree), *Dalbergia lanceolaria* (Erigei) and occasionally on *Moringa pterygosperma* (Drum stick plant). It is widely distributed in the province being either collected from or noted to occur in places like Madura, Tinnevelly, Pondicherry, Bellary, Ganjam, Northern Circars, Saidapet, Coimbatore, Walayar forests and Mysore.

Natural Enemies. The business of rearing these worms in the open air is attended with difficulties of various kinds, such as adverse weather and natural enemies like predators or parasites. In their natural habitat they are liable to the attack of numerous foes in all their stages. Even the moths are not free from the attacks of such animals as rats, bats and ants. The caterpillars may be eaten by crows, owls and other insectivorous birds, snakes, lizards, toads, wasps and ants. These may be also destroyed by Mantids and predaceous bugs like *Canthecona furcellata*. They are also parasitised by Ichneumonids and Tachnids. Cocoons collected from forest areas often display small holes being the exit holes of hymenopterous parasites. Diseases of an unknown nature, perhaps of the nature of Pebrine, are also said to be prevalent in certain regions which might sometimes cause the mortality of a whole brood.

Conclusion. Without actual experiments on a very large scale it is not possible to venture any remarks regarding the possibility of rearing these worms on a commercial scale. But the following facts are evident from a study of the bionomics of the insect. The cocoons can be had from food plants for the trouble of collection and the moths can be made to mate in captivity and lay fertile eggs provided a number of males is left with the females in confinement. A proportion of these eggs hatch out into larvae. The larvae can be reared under cover on *Terminalia catappa* leaves though the problem of getting a continuous supply of good fresh leaves is not easy of solution. If necessary, the phenomenon known as "assembling" can also be practised, for, it has been noted that one or two males were attracted to the glass doors and windows of the room in which the females were kept confined. Probably these were attracted by sense of smell. But nothing definite regarding the lines to be pursued for breeding them on a commercial scale can be said without further experiments both in the laboratory and outside on a large scale for a sufficiently long period.

and if these meagre notes on the bionomics of the insect serve the purpose of stimulating interest on the subject, the object of the paper is more than gained.

Synopsis of Data regarding Life cycle, Egg-laying capacity, Longevity etc.

Egg-laying capacity varied from 121 to 190 eggs averaging 144 for a lot of individuals.

Egg period varied from 7 to 9 days averaging 8 days.

First Instar	„	„	5 to 8	„	„ 7 „
Second „	„	„	3 to 5	„	„ 4 „
Third „	„	„	4 to 6	„	„ 6 „
Fourth „	„	„	5 to 7	„	„ 6 „
Fifth „	„	„	9 to 13	„	„ 11 „
Pupal stage	„	„	23 to 51	„	„ 26 „
Longevity of female moth.	„	„	6 to 12	„	„ 8 „
„ „ of male moth.	„	„	5 to 11	„	„ 7 „

In a lot of 27 individuals the proportion of males to females was 11:16, the percentage being 41: 59.

A NOTE ON CUCUMBER CULTIVATION IN THE GANJAM DISTRICT

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Introduction :— The cultivation of cucumber (*Cucumis sativus*) is done mostly in the wet lands during the summer months, a period when the ryots are at leisure and a crop of moderate expenditure but of decent return could be raised. The crop is cultivated mostly in Berhampore and its neighbouring villages and the produce from these places is mostly marketed in Berhampore, which is a big town with a population of more than 50,000 and as such the demand for vegetables is ever on the increase there.

Varieties :— There are many local varieties, which differ in colour and size. But the two common varieties that are grown are (1) *Dosakaya* which produces stout and long fruits and (2) *Mundosakaya*, which produces short fruits. The second named variety is generally grown on a small scale during the South West Monsoon period in the backyards of houses and in the garden lands. The first named variety is the one that is commonly grown during the summer as described below.

Soil and rotations:— Light and well drained soils of wet lands are generally selected for this crop. A long duration paddy crop from August to December is followed by this cucumber crop from April to July, which in turn is followed again by a long duration paddy crop.

Preparatory cultivation, sowing, and manuring. Soon after the receipt of the summer showers the fields intended for cucumber cultivation, which are kept fallow after the harvest of paddy in December, are ploughed once. Then shallow pits 9″ × 9″ × 3″ about four feet apart are dug with *mammoties*. After finishing the above operations, a handful of cattle manure is put in each pit and then 4 to 6 cucumber seeds are dibbled in these pits and the pits watered. Altogether the crop receives three manurings, the first being a dose of cattle manure before sowing, the second another dose of cattle manure or ashes when the plants are about a fortnight old and the third a dose of powered groundnut cake applied when the crop is a month and a half old.

After-cultivation:— When the plants are about a fortnight old, each pit is hoed with a small crowbar and it is at this time they receive a handful of either cattle manure or ashes Again when the plants form tendrils, that is when they are one and half months old, the pits are hoed and it is at this stage that powdered groundnut is applied at 2 to 3 tolas to each pit. After this operation the whole field is hoed with *mammoties* with the object of clearing the weeds and facilitating the spread of the plants. If the surface remains very hard, the tendrils will not have firm hold in the soil and by even a slight wind the shoots will be disturbed with the result that the plants do not spread properly and bear fruit satisfactorily.

Irrigation:— In this case the whole field is not irrigated unlike the case of the other crops. Water is brought from a tank or a well nearby and the pits are hand watered till the end of May. After that, *i. e.*, in the month of June there will ordinarily be enough of rain and so there is no need for hand watering.

Harvesting and marketing of fruits:— When the crop is about two and half months old, it begins to bear fruit and by the end of July *i.e.*, by the time the land is prepared for transplanting paddy, the fruiting of the crop will be over.

The harvest of these fruits is done daily. Every day the ryots themselves collect headloads of these fruits as they become sufficiently grown up, and take them to the Berhampore market which is nearby. Each fruit fetches from 3 pies to 9 pies according to the size of the fruit. From an acre of the crop an yield of about 8000 fruits is obtained. Thus the farmers by growing this crop realize a gross income of about rupees 100 to 140 per acre.

Conclusion:— The ryots who live in towns and the surrounding villages may easily take up the cultivation of crops like this in their wet lands, during the second crop season instead of depending always on paddy and realizing after all not an appreciable return.

Cost of cultivation of the cucumber crop per acre:—

Items of expenditure	Cost of the operations	Actual cash expenditure
1) One ploughing, one pair of animals and a man.	1—8—0	...
2) Digging pits, 4 men per acre at 6 annas a man.	1—8—0	1—8—0
3) Cost of four pounds of the seed at 8 annas a pound.	2—0—0	...
4) Manuring and dibbling seed, two men and one woman, men at 6 annas each and women at 4 annas each.	1—0—0	...
5) Cost of cattle manure applied to the crop twice i.e. 10 cartloads at Rs. 1—8—0 a cartload.	15—0—0	...
6) Cost of groundnut cake applied to the crop.	4—0—0	4—0—0
7) Watering the pits once in 5 days during April and May i.e for one and half months (9 waterings). For each watering 1 man and 10 women are necessary, i.e. 9 men and 90 women are needed for all the 9 waterings, men at 6 annas each and women at 4 annas each.	25-14—0	25-14—0
8) After cultivation :—		
a) Hoeing the pits with small crowbars, 5 women at 4 as. each.	1—4—0	...
b) Hoeing the whole field with mammoties, 5 men at 6 annas each.	1-14—0	1-14—0
9) Harvesting and marketing the fruits, 20 men and 20 women, men at 6 annas each and women 4 annas each.	12-8—0	...
10) Lease on land.	17-8—0	17-8—0
Total ...	84—0—0	50—12—0

* The lease amount per acre is Rs. 35 of which half the amount is charged to cucumber and half to paddy.

The average gross income from the crop per acre = Rs. 120—0—0.
The cost of cultivation of the crop per acre ... = Rs. 84—0—0.

Net income per acre = Rs. 36—0—0.

A profit of rupees 36 per acre is realised by a ryot by growing this cucumber crop, besides finding work for himself and his family.

A SHORT NOTE ON ARECA NUT PALM AND ITS DISEASES IN PUTTUR TALUK (S. Kanara).

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In South India the areca palm or betelnut palm (*Areca catechu*) is commercially grown in S. Kanara, Malabar, Cochin, Travancore, Mysore and in portions of the Coimbatore District. It can be grown in any place where there is a good supply of water and a loamy or laterite soil. Its importance lies in its being used for chewing with betel leaves (*Piper betel*) and also for medicinal purposes. *Areca catechu* is a wormicide but the popular saying goes that it will produce anaemia. In North India, areca nut is very important and on ceremonial occasions is used for such purposes as the coconut is used in S. India.

In South Kanara it is chiefly produced in the taluks of Kasargod, Puttur and Karakal. The ryots who cultivate this palm in Puttur are mostly Brahmins belonging to Chitpavan and Harik communities. Naturally the trade in arecanuts in the taluk is mainly controlled by them. They prepare the nuts chiefly for North Indian consumption.

Seed and Nursery : The seeds that are to be planted in the nursery should be good and ripe ones, taken from trees that are bearing well, middle-aged and healthy. Such seeds are taken during the second harvest period (December). An open space without shade is usually selected for the nursery. The soil is not ordinarily, specially ploughed or manured. A rough digging with an ordinary *mammotty* is quite ample. The nuts are planted in small pits dug 1½ ft. apart both ways. They are to be only just deep enough to hold the nuts and be fully covered in. Generally, a single nut is sown in each pit. The nuts are planted directly they are picked from the trees. In portions of Mysore, the shell is artificially rotted to facilitate germination. If they become dry, the nuts do not germinate. In this way, the nursery is planted about December or January. It requires constant watering as the months that follow are generally quite dry. The usual practice is to water the nursery twice a week. The soil in these places being light laterite, liberal watering does not do any harm.

Germination takes place about 2 months after sowing. In some places the nuts are planted very close, removed farther apart after germination before final transplantation. No manure is applied to the nursery. The young seedlings are allowed to grow in open sunlight without any sort of shade. It is believed that such seedlings that have become hardy by exposure to the severe sunlight and heat fare well afterwards. It usually happens that ripe nuts which fall in the garden germinate of their own accord. Though such seeds sprout quickly and become trees sooner, it is said, they do not bear well

owing to their having grown in the shade and are unable to withstand the heavy monsoon winds.

Transplanting: After 3 years in the nursery, the young plants are carefully lifted by a special kind of tool resembling an ordinary *mammotty*. Before lifting, the place where the areca garden is wanted is dug up to receive these plants. Pits are dug 3′ x 3′ x 3′ and 8′ to 10′ apart either way. Seedlings are planted one in each pit. A year before this, the proposed place is planted with plantains to create a temporary artificial shade for the areca seedlings. In the beginning about 500 seedlings are planted per acre. After the plants are well established, the same area is inter-planted with another 500 plants. The interval between two such plantings is generally a year or two. In this way an acre may be planted with 2000 trees. Those that are planted later on will grow very quick owing to the shade created by the trees planted before them. This kind of planting is also resorted to in old gardens to replace trees that have ceased to bear or are destroyed by the wind. Thus when the garden is looked at, it appears in tiers, i. e., the old trees forming the top-most surface, the younger ones occupying slightly lower portions and the youngest, the lowest of them all. This system allows of a perennial supply of nuts, irrespective of the age of the garden.

The seedlings are planted just after the monsoon has exhausted itself (i. e., in the months of August and September) and the water table is high enough. One man can easily plant about 20 to 25 seedlings a day. Proper mulch and drainage are to be given in the early stages, else the soil round the roots gets water-logged and the plants do not thrive well. They are manured with ashes alone at the time of planting. The plant is also supported by a wooden pole to keep it in position until it establishes itself. It is advisable to cover the trunks with dried leaves before the summer sets in as they are liable to be split by the heat.

Manuring: By about 6 months after planting a basketful (30 lbs. nearly) of cattle manure is applied to each tree individually—a sort of trench having been dug out around and the manure put into but rarely covered. Later this is done once in 2 years after the trees begin to bear. The yield can be increased if the manuring is done every year, especially if bone meal and other phosphatic manures are applied.

Irrigation: During summer the garden is irrigated twice a week till the monsoon sets in. In Puttur taluk the water is not generally got from wells or tanks, but only directed from streams near which almost all gardens are situated. Improvised bunds are put across the stream and the water level raised to the desired extent and directed into the garden by means of channels. Naturally the bunds (or anicuts) have to be renewed every year, as the old ones will be washed away by

the freshes during the monsoon. There are also places where irrigation is done from tank water or natural springs from where water is directed to the gardens situated in the lower levels.

When the water supply is plentiful, irrigation is done by flooding the garden. Later in the hot months, when the supply becomes limited, the water is led into the channels and splashed over to the beds.

Pests and diseases of areca palm: '*Mahali* 'or '*Koleroga*' *Phytophthora arecae*. This is the most serious of all diseases that the fruits suffer from. The annual loss caused by this fungus disease is very heavy in Malabar and other places where it occurs. The fungus attacks the young fruits and is at its worst during the monsoon. Very many fruits fall away, and the yield at harvest time may be almost nil. Once it begins to attack a tree in a garden the whole area will be very soon infested with the help of the rain and wind and the constant swaying of trees.

The method of treatment recommended is spraying the bunches with 2% Bordeaux mixture (10-10-50) with resin adhesive. One per cent. Casein Bordeaux and Alum Bordeaux may be applied and they are under trial by the Government Mycologist. Alum Bordeaux mixture appears to have given good results in Mysore (the preparation of the latter is given at the end of the article). In places where the disease is very severe, it is better to give a second spraying (2 months later) to act as a further preventive. A fuller description of the disease with remedial measures is found in Madras Agl. Dept. leaflet No. 7 of 1914.

'*Anaberoga*' *or* '*foot rot*' *of arecanuts*. This is caused by a fungus *Fomes lucidus* and it attacks the roots and base of the stem. In the end it kills the tree outright. This is not a very common disease but appears here and there. Firstly the leaves become yellow and gradually drop as if for want of water. In course of time, they dry up and fall off easily by any natural causes. The fructification of the fungus which causes the disease, appears on the trunk or stump after some time. These are called *anabe* in Kanarese and hence the Kanarese name of the disease. No remedial measures are possible in case of a tree which has once been attacked. But if it is found that a plant has been infected it should be isolated by digging trenches round it (1' x 2') and the tree cut and burnt. The trench may be filled in with a good quantity of lime. This may prevent further infection. (For further information please refer to the Villagers' Calendar of 1928—pages 91 to 94).

Stem bleeding disease (Theilaviopsis paradoxa von Hon): This disease was known to attack areca palm only recently (barely half a decade old) in parts of Malabar. The loss due to this is as yet not

ascertained, as a complete survey of the disease has not been made so far. But it is always better to take note of its existence and prevent it from spreading.

The symptoms are almost the same as in the case of stem bleeding disease of coconuts, except in the formation of hollows which occurs in the areca palm. The disease generally begins at the base and gradually spreads upwards. Discoloured depressions appear, then the stem splits, and with the progress of the disease, the internal tissues disintegrate. In some instances, there is an exudation of a dark brown liquid from the split stem. Its existence has been noted only in S. Malabar and Coimbatore. The control measures lie in the removal of all the diseased tissues and the application of hot tar to the cut surfaces after scorching them with a lighted torch. (Pusa Bulletin No. 169 of 1928).

Insect and other pests: This palm seems to be more or less free from insect pests so far, except for the depredation caused by white ants and occasionally by a few species of scale insects which sap the juice from the tender leaves of both young and old plants. In this taluk monkeys are also a serious pest on this crop. They spoil the ripe or half ripe fruits.

Harvesting: The trees begin to flower from between 5 to 10 years after planting. The governing factors that contribute to early maturity are (1) soil condition and (2) availability of a plentiful supply of water. Given a good soil and a large supply of water the trees will begin to put forth flowers in about 5 years, which in comparatively poor soils take a longer time. It is only 3 or 4 years after the first flowering that the real harvesting begins to appear by November or December and goes on till the end of April. The fruits begin to mature from February which goes on for a whole year. Different bunches of flowers borne by the tree at different times will naturally be maturing at different periods. But the bulk of trees flower by about April and fruits set by May or June. The actual harvest, however, begins by about October-November and lasts till February. In Malabar the harvest begins as early as July-August, the reason for this early harvest primarily being that there is a demand for the produce prepared from tender or half ripe nuts. There is also a demand for ripe nuts (special to Malabar) for people who keep them in water (the outer rind rotting the whole while). There is a demand for ripe and dry nuts, the shavings of which many people use for chewing. Then again the tender nuts are cut, boiled and dried. Many people use this kind of preparation. Therefore, to supply the various demands the nuts are harvested at different times in Malabar. The above solely applies to South Indian markets. The garden owners in Puttur taluk, as already mentioned, cater mainly to North Indian

markets, where they require only dried ripe nuts (without the outer rind). Hence the harvest begins only when the nuts are ripe, which will be about November and goes on till February. One man can harvest 150 to 200 bunches a day. Each tree can yield about 2—3 bunches yielding 500—600 nuts per harvest. An acre of new garden will yield about 1 to 2 candies of dried nuts (1 candy = 500 lbs). The maximum yield per acre will be about 4 candies. The average yield in these places may be computed at 3 candies. About 2000 green nuts go to form one maund of prepared product.

Curing: The process is very simple in this area. The ripe nuts as soon as harvested are dried in the sunshine for about a month. For this purpose the ryots have special open places. The dried nuts are shelled (the outer rind removed) and directly sent to the market. There are various other methods of curing, such as cutting the half ripe nuts, boiling and drying them before final marketting. But as these methods are not in vogue in the particular tract referred to they are not dealt with here. The price of shelled nuts at the time (May 1930) was between Rs. 80—100 per candy. The price during some years was as high as Rs. 150—200 when the cultivation of this crop was very profitable.

Uses of areca products: The spathes which cover the flowering axis are used for a variety of purposes. Many poor people use the spathe as plates for eating purposes, covering for the head as protection against sun and rain, containers for domestic articles, buckets for drawing water, cups for drinking purposes, for packing and for making sundry small articles of personal use.

As medicine the tender nuts are said to be astringent. It contains a large proportion of tannic acid and gallic acid and hence its astringent property. The nuts when burnt and powdered make a good tooth powder (dentifrice). The powdered nut in doses of 10 to 15 grains is useful in stopping diarrhoea arising from debility. It is reported to possess approdisiac properties and when chewed produce stimulating and exhilarant effects on the system. It is supposed to be anthelmentic for dogs and also regarded as a nervine tonic to human beings.

For chewing betel leaf the nut is an indispensable adjunct, so much so it is considered discourteous to offer betel leaves without nuts. Small pieces of these nuts are sold all over the bazaar.

Acknowledgement. Before I conclude I wish to express my deep indebtedness to the Government Mycologist under whose instructions I had been to S. Kanara to conduct spraying trials and during the course of which most of the information contained herein was collected. I must also express my gratefulness to Mr. M. N. Bhide, a garden owner, in Belthangadi, Puttur taluk, for supplying varied information

on the subject. I must not omit to express my thanks to various officers of this Department who were kind enough to go through the paper and correct it from their different stand-points.

A note on the preparation of Alum Bordeaux Mixture.

I. Dissolve 4 lbs of copper sulphate in 24 gallons of water. Add to this 4 lbs of potash alum.

II. Dissolve 5 lbs of lime in 24 gallons of water. Mix I and II.

To this mixture add casein adhesive, which is prepared as follows and stir well.

To one pound of casein soaked for some time in 1 gallon of water add 1 lb. of lime dissolved in 1 gallon of water. Stir the mixture well till all the casein is dissolved This takes about 15 minutes.

Literature cited.

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2. *Sundararaman S.* Stem bleeding disease of arecanut (*Areca catechu*) caused by *Thielaviopsis paradoxa* von. Hon. Pusa Bulletin No. 169 of 1928.

A SHORT NOTE ON THE CULTIVATION OF GARLIC * IN SIRUGAPPA (BELLARY DISTRICT)

BY M. JEEVAN RAO B. Sc. (Ag.),

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Sirugappa is the headquarters of the taluk of the same name in Bellary District, bordering on the dominions of H. E. H. the Nizam of Hyderabad and separated from it by the river Tungabhadra. The town is situated on the banks of the river and as such, is essentially a wet tract commanding unfailing water supply. An anicut is built across the river higher up and from there runs a channel taking water to the fields for irrigation. Sirugappa town is 26 miles from Adoni and 36 miles from Bellary by road. The average annual rainfall recorded at the station is about 20 inches, more than half this fall being received during the months of September and October.

Garlic is an important money crop which used to be grown at Sirugappa in large areas in previous years, but now the area has gone down considerably due to poor yields. The main reason in the opinion of the local ryots, for the decreased acre yields, appears to be the damage done to the crop by insects and by fungus disease.

Soils, rotation and varieties. Garlic is grown in paddy lands with good drainage facilities. It comes in rotation with paddy and

* *Allium sativum.* Linn.

sugarcane and is also sometimes grown between rows of plantains in young plantain gardens. As a pure crop, it is raised round about Desanur, an island village about four miles from Sirugappa; there are two varieties of garlic, *Javari-gaddi* a four-months crop, and *Rajalle-gaddi* a five-month variety with big sized bulbs.

Cultivation. In the case of a pure crop of garlic, the land is prepared by ploughing with the country plough four times, during summer, after the harvest of the previous crop of either paddy or sugarcane at intervals of fifteen days to a month. The bulbs are then sown broadcast, in October-November, using a seed rate of 10 to 12 maunds per acre. The Guntaka is worked to cover the seed-bulbs, beds are formed immediately, irrigation channels opened and the field irrigated. During the next irrigation given about a week or ten days later, brinjal seedlings are invariably transplanted along the irrigation channels. The crop during its period of growth receives about eight irrigations, the last one being given twenty days before harvesting. Where garlic is grown as a mixed crop, the land after a similar preparation by ploughing is generally manured with cattle manure at 30-35 cartloads per acre and the manure covered by means of a country plough. Pits are then dug in rows and plantain suckers planted therein, in the months of *Srayana-Bhadrapadam* (August-September) and hand watered until fresh shoots are put forth. Beds are then formed between the rows and garlic bulblets are either sown broadcast or in lines marked by a pick-axe or a rake, and then covered, the seed rate as before, ranging from 10-15 maunds per acre. The field is then irrigated.

Harvest, Storing and Yield : The indication for ripeness is the complete drying up of top leaves. Harvest is done by digging out the bulbs. For harvesting an acre, 30 men and 15 women are usually required. The bulbs harvested in the field are dried with the outer leaves sticking on to them and tied together in bundles, which are either hung up or piled until disposed of. Until about eight years back the crop was yielding as much as 180 maunds (1 maund equals 26 lbs.) per acre. At any rate the average yield might be taken as 150 maunds and the cultivator was getting a net income of Rs. 250—300 per acre from such a crop. But now the yields have gone down to a very low figure and this is attributed chiefly to the attack by *thrips*.

Thrips appear when the crop is about a month and a half old and multiply enormously in about a fortnight. These gather in large numbers at the central shoot and drain away the plant sap. The plants consequently wither, producing only small sized bulbs and finally even die. The disease is known locally as *majjiga roga* (Butter milk disease), owing perhaps to the whitening of the leaves and the formation of white streaks thereon. In some years the damage

is so severe that there is complete loss of the crop when it is merely ploughed in.

Market: Usually Garlic from Sirugappa is marketed at Bellary and Adoni. At times they go as far as Hubli, Dharwar, Gadag and Raichur.

BEE-KEEPING NOTES *

By H. H. COOTE

The Bee is generally known as an insect with a sting and its only good quality is that of gathering honey. It is hated for the former and merely tolerated for the latter, but those who have studied their lives have discovered some most interesting principles which, applied to the human race, would make the world not worse off for it.

Just a few sketches by way of examples:

Sanitation: A bee on its return from the field getting in contact with some dirt, so soon as it alights at the entrance of the hive, will submit itself to being cleaned and it is a pleasure to see the other bees tidying her up before she is permited to pass in. Should a bee die in the Colony, it is immediately removed, not merely thrown out, but carried, and deposited outside of the Apiary.

Roaches, Beetles, Lizards, etc., sometimes invade the Colony, and should they die there from any causes, —stung to death or otherwise - being too big to be removed, what do we find—the bees will bury them with a gum called propolis (a gum gathered by the bees, to seal cracks or joints of the hive so as to conserve temperature etc.) This is so well done that you could not detect the slightest stench in the Colony, even though the invader might be a lizard.

The Queen would not on principle lay an egg in a dirty cell, it would have to be first thoroughly cleaned up by the workers. There are thousands of bees in a Colony, and to keep up this strength there must be a birth rate and in proportion also a death rate, yet none of these dead bees are found in the Colony from natural causes. With these thousands of little creatures compact in a hive a little more than eighteen inches square, consuming a certain proportion of food daily, one would expect some deposit, yet never is a sign of such a thing discernible.

Devotion to Duty: To begin with the young bees, as soon as they are hatched, with their first thought, give their most devoted consideration to the younger bees; they immediately take up the nursing

* From the Journal of the Jamaica Agricultural Society Vol. xxxvi, No 4, April 1932 pp. 177—179.

profession, and turn their attention to helping the weaker ones in an embryo or worm stage. They realise that suffioient food must be stored in each cell on which the young bees may live for at least 12 days while they are sealed up—and cannot be got at for more food. If a Queen should be reared, the young bees are the ones to whom is relegated the task of seeing her well matured, and when hatched, they act as body-guard and attendants. A bee would not hesitate to sacrifice its life in defence of its home against any foe, from an Ant to an Elephant. It often wears its wings out, flying miles away visiting over a thousand flowers, to get one drop of nectar or a load of pollen for the subsistence of the Colony.

Laws and Ethics: The basic Law of the bees is— "The survival of the fittest "— If a bee should lose its sting the Colony would not have it back; if maimed or sick they take no chances ; a strong bee would take either of these bodily and dump her out of the Apiary, and if she resists or persists in returning, a sting would do the trick.

It is thought by many that once a bee stings, it cannot live again; this is wrong (except in a few instances) but the trouble is, that the Colony will not have it back like a soldier ; without a gun, it is useless to the army; but suppose all the workers of a Colony should lose their stings, they could carry on gathering honey etc.

Should the "Queen", which should be really termed the "Mother", for any reasons fail in her duty (laying eggs), the workers would not hesitate to replace her, by starting to rear another, and very often this daughter becomes her executioner; while she is in the Colony, she realises all that is going on, and although a sting from her will do away with the young queen while she is in the baby stage, and though she knows what she must expect when this young one comes to perfection, she willingly accepts her fate, for the benefit of the Colony. Sometimes, she is even permitted to remain in the Colony until there is a certainty that the young queen is mated, and capable of carrying on, then in most such cases the workers take the duty of execution.

During the swarming season the mother queen leaves the hive, with a portion of workers and even a few drones, to set up a new home, the old home is left to the daughter to carry on, where all provisions such as honey etc., are left for her comfort; while the mother with her attendants seeks a new field facing all the odds, attendant to her venture, and I can assure you, there are manifold disadvantages, yet she prefers to take all the risks rather than allowing her daughter to do so.

Sportsmanship:—The queen has a sting and this is generally employed in self-defence against another queen; all workers have stings. They use it against another worker, a queen or all comers. A drone has no sting. During a certain period of the year these drones increase

abundantly and there is a time they must be got rid of, and although they are of wonderful importance to the Colony, at a certain juncture when food is scarce, the bees must conserve their little savings to tide them over the days of dearth, and as these good old chaps cannot gather honey, but live off the labour of the workers, and at the expense of others, they are coolly told to leave; sometimes they repudiate the insult and would transfer their abode to another Colony that has a little more honey; sooner or later this stock is getting down and the same request is again repeated. The drone can go from Colony to Colony and get a little food, while a worker would not for one moment dare to do this—Why?—because in the case of the former nature did not provide him with the necessary equipment for the gathering of honey and the bees know it, and hence they accomodate him with a sip whenever they can. This, however, must have an end and he must be got rid of at any cost. To get rid of a drone would be a simple matter, each worker getting hold of one and stinging him to death would not take many minutes, but like the little sportsmen they are, they could not sting a defenceless brother; they can't support him any longer, but they certainly would like to give him a chance with another Colony or Apiary. They would take him although unwillingly and fly away with him some distance, giving him a chance if he can; although just a sting would get rid of him and save all the efforts of such a transportation, they refrain from taking such an advantage.

Co-operation: Let us assume that a weak Colony has around a thousand bees, and a strong one, a million or more. Those who have just a casual knowledge of beekeeping, believe that the Queen rules and dictates to this great household; nothing of the kind; if anything, it is just the contrary. The Queen has a great duty to perform, and when you think she can lay up to two thousand eggs a day, what time would she have at her disposal for dictating terms to these numerous workers as to how they should carry on. Not a single cell is built by one bee alone and unassisted—that shows conclusively that every individual bee knows his job, and he is not waiting on any leader or boss to show him what to do. There is a certain unity and understanding between them that when a job is started it takes more than one to complete it, and there is no shirking of duty. Each has its part to perform for the benefit of the Colony. Every single bee is an Architect, the comb they build has been a marvel to man. One of the most outstanding features is that they never seem to quarrel, but live happily together.

Notes and Comments.

1. **The Imperial Council of Agricultural Research.** At a meeting of the Advisory Board of the Council held in Simla from the 18th to the 22nd of July a number of important and interesting schemes put up for grants from the Council appear to have been discussed and definite conclusions arrived at with regard to some of them ; of which we may note the following (i) the proposal of the Bombay Government for the importation of a prickly pear destroying caterpillar from Australia; the Board appears to have disapproved of this proposal ; (ii) application from the Madras University for a grant of Rs. 26,000 spread over three years for a scheme of research in the cytological study of the Indian crop plants ; this proposal was favourably viewed and it is likely that work may be started soon ; and (iii) application from the Madras Government for a grant of about one and a half lakhs for a period of five years for a dry farming scheme for the Ceded Districts ; this too appears to have been approved.

2. **" Current Science ", A new journal.** We have great pleasure in welcoming into our ranks this new journal, the first number of which has just been issued. The periodical is a monthly devoted to science in India and 'its chief object' in the words of the promoters "is among others, to provide a suitable medium for the early publication of short notes of original work done, to provide a forum for the exchange of scientific thought and to further in all possible ways the advancement of science and industry in the country". The main idea, as far as we are aware, is to run an Indian journal on the model of the British *Nature* and the American *Science.* It is published with the editorial co-operation of a number of scientists in India of whom many are well known in the country. The journal is published at Bangalore and the annual subscription is fixed at Rs. 6. The first number is very promising and well got up. We wish this new venture our very best wishes and a bright and prosperous future.

3. **Madras University M. Sc. Degree for a Departmental Officer.** We offer our hearty congratulations to Mr. C Narasimhachari, Assistant Lecturer in Chemistry at the Agricultural College for the Master of Science Degree conferred on him by the Madras University for his thesis on " studies on the hydrolysis of starch by the enzymes in cholam malt ". Some of our readers are, perhaps, aware that Mr. Narasimhachari is a distinguished graduate of the Madras University, having taken a first class in Chemistry in the B. A. Examination and obtained the first rank among the successful candidates of the year 1927. This distinction gained for him the Jagirdar of Arni gold medal from the University and the Father Billard medal from the St. Joseph's College, Trichinopoly. He joined the Agricultural College teaching staff in August 1927. In 1930 he also won the Ramasastrulu

Munagala medal for a prize essay on an agricultural subject. We understand that his M. Sc. thesis was reported upon as a very good piece of original research by some German specialists who examined the same. Mr. Narasimhachari happens to be the first officer in the department to obtain the newly instituted M. Sc. degree of the Madras University and as such it is not only creditable to him but also to the department of which he is a member. We have no doubt that Mr. Narasimhachari will continue with enthusiasm his researches and hope they would earn him further honours in the future.

4. Tanjore Rice in Ceylon. Mr. N. S. Kulandaiswami Pillai, Deputy Director of Agriculture, V Circle, had been deputed by the Madras Government on the recommendation of the Director of Agriculture to Ceylon to study the market conditions of rice and to investigate into the possibilities of increasing the export of rice from the Tanjore delta to Ceylon. It appears that 25% of the rice imported by Ceylon goes from S. India while the rest is got from Burma, Siam and Indo-China. The difference in price at the Ceylon market between the Tanjore and Burma rice comes to Rs. 2—12—0 per bag, Burmah rice selling cheaper. The question is whether Tanjore can successfully compete with Burmah in capturing the Ceylon rice market. Steps and measures should be taken by the exporters here and the consumers in Ceylon to get transport charges etc., reduced by the railways and to provide adequate port facilities in India and thus maintain and, if possible, improve the present trade of Tanjore rice in Ceylon. We hope Mr. Pillai's investigations might help us in this direction.

5. In search of natural enemies. That some foreign administrations have great faith in the biological control of pests is shown by the fact that at present there is in India a State Officer from California who is in search of the natural enemies of the citrus red scale which is a very serious pest in orchards in California. This officer, Mr. H. Compere, visited Coimbatore recently and took with him a few parasitic insects supplied to him by the Entomological section. It appears that this is Mr. Compere's third trip to Asia, he having visited China and Japan during the earlier expeditions. Twenty five years ago, Mr. Compere's father, the well-known parasite collector, George Compere, visited Bangalore and after a few months' stay took with him 15000 live parasites of the guava fruit fly for use in Australia against the fruit fly pests there.

6. The Indian Institute of Science, Bangalore. We understand that Sir C. V. Raman, N. L., LL. D,, F. R. S. etc., has been appointed by the Managing Council as Director of the Institute from April 1933 when the present incumbent Dr. M. O. Forster, D. Sc., F. R. S., is due to retire, and it is announced that the appointment is for a period of fifteen years. We congratulate the Institute on its good luck in securing the

services of such an eminent scientist like Sir C. V. Raman. The Council has also to be thanked for recognising Indian talent and placing the control of this well-known Institute in the hands of an Indian scientist with an international reputation. We shall have thus a Science Institute under an Indian Director and it behoves all concerned to endeavour through their exertions to deserve and justify the trust and confidence so placed.

ABSTRACTS

Notes on Indian Scorpions.—Rev. Father J. F. Caius and K. S. Mhaskar (*Indian Medical Research Memoir No. 24, 1932*). The present publication comprises results of investigations extending over 20 years in regard to the toxic properties of the venom of Indian scorpions, of which the authors were able to get 680 individuals belonging to 20 different species. The authors report that (1). The scorpions more commonly met with in India belong to either genus *Buthus* or genus *Palamnoeus*. (2). The amount of venom a scorpion can inject in any animal larger than its prey never exceeds a few drops, even if the glands are full; not infrequently, the glands are partly if not entirely empty. (3). The maximum amount of venom found in the glands of *Buthus tamulus* was 5. 2 mg. If the toxicity of the venom in relation to body weight was the same for man as for the very susceptible English rabbit, the total above quantity would not be lethal for a greater body weight than 2·6 Kilograms. Scorpion venom should then not be lethal to man, children not excepted (though there have been actually several recorded cases of fatality among children). (4). As a result of poisoning, the nervous system becomes highly irritable; shivering tremors and muscular twitchings occur; the convulsions are similar to those induced by strychnine. Through its local irritant action, the venom stimulates the terminations of the sensory nerves and produces excessive pain and a burning sensation. (5). After entering the circulation, the venom acts on various centres in the bulb including the vasomotor centre. The venom stimulates the heart which continues to beat after failure of the respiratory centre. and finally stops in mid-systole or complete systole. There is also rise of blood pressure. Death is entirely due to paralysis of the respiratory centre through the direct action of the venom, and is not dependent on the vagus centre or the vagal nerve or its endings. (6). Scorpion venoms are very complex liquids which consist of the following active principles: (I) neuro-toxins acting principally (a) on the respiratory centre and partly on (b) the vaso-motor centre, (c) on the nerve end plates in striated muscle, and (d) on the responsive mechanism of the parasympathetic and sympathetic in the secretory glands; (II) haemolysins, agglutenins haemorrhagins, leucocytolysins, coagulants, ferments, lecithin and cholestrin; (III) a cardiac tonic; and (IV) a vascular tonic. Scorpion venom closely resembles snake venom. (7). The anti-venom prepared at Kasauli against cobra and daboia venoms imparts a certain amount of protection to rabbits and dogs which have received lethal doses of the venoms of *Buthus tamulus* and *Palamnoeus swammerdami*. (8). None of the Indian plant remedies popularly used in the treatment of scorpion sting has been found to have any preventive, anti-dotal or therapeutic effect. (C. N.)

Anatomy and Micro-chemistry of the Cotton Seed. Reeves, R. G. and Valle, C. C (*Bot. Gazette, vol. 93, 1932, No. 3*). Though there have been many publications on the anatomy and micro-chemistry of the cotton seed, the authors think that none of the workers have given a thorough discussion of the subject.

Further, investigators are in disagreement as to the structure of the several tissues and localisation of certain of the chemical components. The present work was therefore undertaken with a view to acquire precise information on the debatable points. For anatomical studies of seeds material was fixed in chromo-acetic-osmic acid, and sections cut 8—16 nicroms thick. The mature seed coat was very tough, but satisfactory results were obtained by macerating with nitric acid and potassium chlorate or by soaking the seeds in water for a few hours and then making free-hand sections. Micro-chemical studies were made with free-hand sections. The following conclusions were arrived at :— The cotton seed is composed of embryo, endosperm, perisperm, inner pigment layer, palisade (Malpighian) layer, colourless layer, outer pigment layer and epidermis, including lint hairs. Traces of starch, in addition to oil and protein sometimes occur in the cells of the embryo. Pentosans in hulled seeds are located in the resin glands. The cell walls of the embryo are composed mainly of cellulose. Starch, oil and protein occur within the cells of the endosperm. Large quantities of starch are found in the two integuments of the developing ovule, but disappear before maturity. The pigmentation occurring in the cells of the two pigment layers, is associated with the hardening of the protoplast. The palisade layer is a part of the inner rather than of the outer integument. The cell walls of the epidermis are composed chiefly of cellulose. Those of the perisperm and colorless layer of the seed coat become lignified before maturity. The palisade layer of the seed coat contains cellulose and lignocellulose. (R. S.)

Nitrate Assimilation in Soils. By F. B. Smith and P. E. Brown (*Iowa Agr. Expt. Stn. Research Bull. No. 135.*) The authors find that the nitrate assimlating power of the soil (the decrease in the nitrate content due to microbiological action), was influenced by a number of factors, e. g, the nature of the soil, additions of organic matter, addition of nitrogenous fertilisers etc. The addition of a readily available energy source, especially one poor in nitrogen, e. g. straw, tends to rapid disappearance of nitarte. There was a rough parallelism between the nitrifying power and nitrate assimilating power of different soils. In an endeavour to trace the major groups of organisms which brought about nitrate assimilation, five cultures of nitrate-assimilating and nine cultures of denitrifying bacteria were isolated and studied in pure culture. Nitrate assimilation was found to be common to a large number of micro-organisms of which the moulds and certain bacteria were prominent. (C N.)

Lodging in Oats and Wheat. Welton F. A. and V. H. Morris (*Bull No. 471 of the Ohio Agrl. Expt. Station*). Lodging may be brought about by two sets of causes. (1) the interaction of those hereditary and environmental factors which make for the development of weak stems, and (2) external forces which exert no influence whatever on the structure of the stems, but which cause lodging through mechanical impact such as violent wind, rain or hailstorms. The present publication from the Ohio Agrl. Expt. Station examines the first set of causes, to ascertain the situation within the plants which results in the development of relatively soft, pliable stems and to determine to what environmental factors this internal situation is responsive.

The authors conclude (1) that lodging is brought about by the development of certain internodes having a relatively low content of dry matter per unit length of culm. Such low dry matter per unit length of culm results from the development of stems relatively small in diameter in proportion to their length, brought about either by a low carbohydrate-nitrogen relation within the plant or directly from a thick stand. (2) A low carbohydrate-nitrogen relation results from such factors as hyper-nuitrition, shading and relatively high temperature, and it is accompanied by a relatively high proportion of vegetative or straw growth. (3) A thick stand may result directly from a thick seeding of normal sized seeds, from a normal rate of seeding of small sized seeds, from a normal rate of seeding of a

prolifically tillering variety, or from a combination of two or more of these factors. On rich ground, lodging may occur on account of heavy tillering due to high nitrate content and accompanying low carbo-hydrate-nitrogen ratio as well as increased shading due to the thick stand. (4) On rich ground to which lodging is chiefly confined the chain of sequence appears to be hyper-nutrition, low carbohydrate—nitrogen relation, a preponderance of vegetative growth, and straw weakness. On poor soil, the reverse is true: a high carbo-hydrate relation, a reduction in proportion of vegetative growth, and straw strength. Lodging in rich lands is more prevalent in warm, rainy, cloudy seasons. (5) Relief from lodging may be obtained where the situation is amenable to control, by reducing the seed rate and selecting bigger sized seed. In size-of-seed tests, the difference being such as can be obtained by passing the grain repeatedly through a good fanning mill, the plants grown from the small seeds often lodge, while those grown from the large seeds remain erect. (6) Among varieties there is much difference in stiffness of straw. The stiff strawed varieties usually tiller sparingly and, consequently establish a relatively thin stand of comparatively strong coarse culms. (7) Clipping tends to reduce the number and height of culms and hence to militate against lodging, but it is not a highly successful practice, for so much depends on the character of the subsequent season that it is impossible to determine the most appropriate time at which to make the clipping. (8) So far as the soil is concerned, the most helpful practices are those which tend to reduce temporarily the available fertility, particularly the nitrates. A straw mulch can be usefully applied. (9) Ploughing rather than disking or no preparation of seedbeds often results in an increase of soil nitrates and frequently causes lodging. (10) A rotation in which the small grain crop is preceded by gross feeding crops, like corn and soybeans, is preferable to one in which a legume like alfalfa lucerne predominates. (C. N.)

"The Measurement of the Degree of Saturation of Soils with Bases" by R. H. Walker, B. J. Firkins and P. E. Brown. (*Research Bull. No. 139 of the Iowa Agr. Expt. Station.*) As the writers point out, when the degree of saturation of a soil with bases is to be determined, data must be secured showing the amount of replaceable basic ions, the replaceable Hydrogen ions and the total absorptive capacity of the soil for bases. Most methods involve the direct determination of two of these quantities and the calculation of the third by difference In the present paper the writers have compared the important methods in use for making the above determinations, principally the electrodialysis methods of Mattson and Bradfield; and the Hissink and Parker methods for measuring the exchangeable hydrogen in soils.

Experiments for the determination of exchangeable bases by the use of Mattson and Bradfield cells showed that dialysis methods showed no clear end point and the amount of bases removed from soils varied with the size of the sample used, the voltage of the current and the length of time electrodialysis continued. In Hissink's method the exchangeable Hydrogen is determined by conductometric titration against a base, *e.g.* Barium hydroxide, but it was found that the method did not give a true measure of the amount of exchangeable hydrogen in soils.

The authors finally recommend Parker's Method. "According to this method, the exchangeable hydrogen is determined in the leachings after passing 250 c. c. of neutral normal Barium acetate through 10 gm. of soil in a good crucible. After the exchange capacity of the soil is saturated with Barium, the Barium ions are completely replaced with Ammonium ions by leaching the soil with 250 c. c. of normal Ammonium Chloride solution. The excess ammonium chloride is removed by leaching with ethyl alcohol, and the absorbed ammonia is determined by distillation. Thus the total exchange capacity of the soil is determined. From the data showing the amount of exchangeable hydrogen and the total exchange capacity, the degree of saturation with bases is calculated." (C. N.)

Gleanings.

Leaves of Plants are best Gas detectives:— Potted tomato plants can give warning of gas leaks, long before even the most sensitive of animal detectives, could detect them. This is one of the possible uses for the peculiar behaviour of plants in the presence of Ethylene gas that was suggested by Dr. William Crocker of the Boyce Thompson Institute for Plant Research, speaking at one of the closing sessions of the American Philosophical Society's meeting in Philadelphia. Plants could also be used to detect dangerous gases in garages and other closed spaces where men are at work.

The value of many plants, and especially the tomato plant, for this purpose depends on the curious behaviour of their petioles or leaf stems in the presence of very dilute quantities of ethylene gas, which is a common ingredient of illuminating gas and is also almost invariably present when the poisonous carbon monoxide is being generated. Dilutions of ethylene as low as one part in ten millions of air will cause tomato leaf stems to begin growing on the upper side where they did not grow before, thus causing them to bend downward instead of up. Curiously enough, if a potted plant is turned upside down and then exposed to ethylene it does not react. It behaves as though it were confused, not knowing which way to turn. The secret of this lies in the fact that the growth direction of the leaves is really a response to the pull of gravity, and the ethylene, by anesthetizing the plant, destroys its ability to respond normally to this stimulus.

Not all plants are sensitive to ethylene, however. Dr. Crocker mentioned the common Boston fern, which remains unaffected by the gas in atmospheres containing 90 % of it. (*Science Supplement*, April 29, 1932).

An Artificial Humus.— The detailed study of the chemical composition of organic matter in soils has brought out the fact that humus consists largely of two chemical complexes, namely lignin (40—45 %) and proteins (30—35 %) with smaller quantities of other substances, especially hemicelluloses, and to a less extent fats and waxes. In spite of the high protein content of humus, its nitrogen is not readily available to the growth of the higher plants, and it has accordingly been suggested that the formation of humus complexes involves the chemical interaction of the protein with carbohydrate. Arguing that a combination of protein with lignin is especially probable, Waksman and Iyer (*Jour. Washington Acad. Sci.*, vol. 22, p. 41, 1932) have found that solutions of protein and of lignin in alkali give, on mixing and neutralising, a precipitate which, when dried and tested, undergoes no more bacterial decomposition than 'humic acid' prepared from peat by alkali extraction and subsequent acid precipitation. In the presence of bases, such as calcium, magnesium and iron, the preparations become still more similar to 'humic acid' in their physical and biochemical properties and particularly in their high base-exchange capacity The authors, therefore, conclude that the complexes they have synthesised can be considered as the humus-nucleus (*Nature*, May 28, 1932).

Units of Heredity.— Genes, the ultimate units in heridity, have been seen and photographed, according to Dr. John Belling, biologist on the staff of the Carnegie Institution of Washington. This information has been made public by the institution at its headquarters in Washington. Genes have hitherto been dealt with as hypothetical entities by biologists, because no one has ever actually seen them. They were like atoms and electrons that make up matter; physicists treat them as actually existing things, though it is impossible to give them visual demonstration. But now Dr. Belling believes that he has brought the genes out of their invisibility.

All living cells contain structures that presumably contain genes—the chromosomes within the nucleus. But to get clear-cut pictures of chromosomes, not all cells will do equally well. In the cells of some organisms, chromosomes are too numerous or too small to work with conveniently; in others, their outlines are not clear-cut. Dr. Bellies found lilies suitable for his purpose. By exceedingly fine and skilful microscopic technique, he got the contents of the pollen "mother-cells," each only one-hundredth of an inch in diameter, emptied out on glass slides. By suitable chemical treatment he made the small divisions of the chromosomes, known as chromomeres, sharply visible. By further manipulation, he was able to detect, within each chromomere, an exceedingly minute object which he takes to be the gene itself. A typical cell of the type Dr. Beliing has been working with contains about 4,400 genes, arranged in 2,200 pairs. (*Science News*, May 20, 1932).

Chromosomes of Sorghum :— In a study of the somatic chromosomes of the genus *Sorghum*, Prof. C. L. Huskins and Mr. Stanley G. Smith (J. Genetics, vol. 25, No. 2, find that the wild species and cultivated varieties examined all have twenty chromosomes, except the Johnson Grass, S. *halepense*, which has forty. All, without exception, have a single pair of A chromosomes of peculiar character. The cultivated sorghums came from tropical Africa, while *S. halepense* is Mediterranean. Since it has but one pair of A chromosomes, it is probably an allotetra-ploid, having arisen from a cross between a diploid sorghum and some other genus without an A chromosome. The evidence indicates that all the diploid wild and cultivated species of sorghum will cross readily, while there is great difficulty in crossing Johnson Grass with the diploid forms, and the progeny from such crosses are almost sterile. In the root tips examined, a number of tetraploid segments and one octoploid segment were found in diploid roots. The general results are in accordance with and confirm the views already held by systematists regarding the relationships of these forms. (*Nature*, June 4, 1932).

University Science Teaching:— University teachers are, however, of three types. First there is the research worker, for whom the University is essentially the only place where research work may be carried out without any thought of its industrial application, and where the teaching duties must be merely tolerated. For the second type, a university differs essentially from a school only in that the students are older pupils who have to be spoon-fed for fewer teaching hours with fewer but more difficult subjects than at school. This type usually does no research whatever. In the lecture room, his courses admirably cover the field on which the student will later be examined. In the laboratory, no sooner is a student in difficulty than the demonstrator is by his side, ensuring no 'waste' of the student's time, by at once pointing out the errors. This type would, by his professor, be described as a good teacher—the adjective being used, dare we venture to suggest, as a reward for the *smooth* running of the teaching laboratories. From neither of these types would one naturally expect the new teaching. The most likely source is the third type, who at heart believes and practices that research and teaching are equally prime functions of a University. As there would be a danger of this type being sadly over-worked, we will consider how far extensive lecture and laboratory courses are now-a-days necessary in teaching science subjects in universities.....

As we see it, then, present needs would best be served if extensive spoon-feeding lecture and laboratory courses were abolished in universities, and if into all science teaching, instruction in scientific method were incorporated (*W. H. G. in 'Nature'*, May 28, 1932).

Research and Industry. In a recent article in the *Journal of the Textile Institute* on "Cotton Research and Academic Physics", Dr, F. T. Peirce points out that

the tendency of men of science to get into ruts of thought is partly responsible for the tardiness of the academic mind to appreciate and interpret the problems of technology in a way that is essential for the interpenetration of science and industry. On the other hand, while as one consequence of specialisation every research worker is accustomed in his reading to slur over matter which he cannot or need not understand, the industralist is apt to be offended if he encounters matter which is incomprehensible to him even though the practical conclusions are clear. Without claiming that scientific research is a complete cure for all the troubles of industry, Dr. Peirce urges that it is a method of securing the most effective use of available resources, and shows how, within the experience of cotton industry, impersonal scientific methods have succeeded in saving efforts and resolving difficulties in the relations of firms or branches of the industry with employees and between service departments. Co-operation may ultimately lead the ideal of team work to merge in that of 'group work' groups having only their own ignorance or inefficiency as enemy, and in organisation by technical processes rather than by sciences.

The matter of publication is not without concern to the relations of science and industry, as pointed out by Dr. Peirce, and a general policy of publication for lines of pure scientific interest has a stimulating effect on the research staff from which the industry itself is the first to benefit. Publication assists in securing the recognition and interest from the Universities, which are essential for open discussion, for combating the natural secretiveness of industry, and for creating a technical literature in which systematic cross reference becomes possible. These and other problems relating to the scientific reputation of the individual, the place of individual initiative and originality in co-operative research, are aspects of the relation between science and industry which are a modern phase of the conflict between authority and liberty. Much also remains to be done in redressing the present neglect of the borderland sciences, and cotton itself is of special interest in the borderland of physics. Finally, Dr. Peirce suggests that by overcoming the technical difficulties of industry the scientific worker may remove obstacles to the development of beauty, and thus contribute to the artistic as well as to the humane aspect of industry.

The Transport Problem in the United States:— In the century and a half which has elapsed since the American steam-boat pioneers, Fitch and Rumsey, began their experiments on the Delaware and Potomac rivers, transport in the United States has undergone many remarkable changes. From the work of those pioneers, in the course of years, came a magnificient fleet of river steamers; her engineers next gave the country the most extensive railway system in the world; while to-day the automobiles are so numerous that there is one for every five of the population, and transport by air is making rapid progress.

America is what it is largely because of its transport, without which its prairies would still be uncultivated and its mines unexploited. One of the landmarks in the history of that transport was May 10, 1869, when the last spike—a golden one—was driven in the railway which connected the Atlantic coast with the shores of the Pacific. On that occasion Philadelphia rang the old Liberty Bell, New York fired a hundred guns, Buffalo sang "The Star Spangled Banner," and there was even a thanksgiving ceremony in Trinity. There then seemed no end to the benefits to be gained from the railways, which to-day, by the irony of fate, are faced almost with bankruptcy.

Like our own railway system, that of the United States was built up entirely by private enterprise, and the present position of the railways is much the same as our own; some think it is somewhat more complex. What that position is, and

what remedies are suggested so that the railways can continue to fulfil their part in the national economy, are well stated in three contributions printed in the first issue for the current year of the *Proceedings of the American Philosophical Society*. The three papers are entitled: (1) "The Railroad Situation: Some Suggestions as to the Way Out"; (2) "A Way for the Railways to Keep Out After They Are Out"; and (3) "Co ordination as a 'Way Out' of the Transportation Crisis"—the respective authors of which are Dr. E. R. Johnson, Mr. A B. Johnson, and Mr. G. L. Wilson. Of the three papers, the first is much the longest and gives a record of all the factors of the problem.

The United States railway system has some 250,000 miles of track, and the rolling stock includes about 67,000 locomotives, 57,000 passenger cars, and 2,500,000 freight cars, the results of the development of a hundred years. The public roads include 3,000 000 miles of highways, of which some 700,000 miles are surfaced and about 128,000 miles are mainly of concrete. About 50,000 miles of streets are constructed or rebuilt annually, the expenditure on which reaches 2,000,000 dollars.

The number of automobiles of all kinds registered in the United States at the end of 1931 reached the astonishing figure of 23,042,840, the result of thirty years' development; and the number of companies engaged in freight traffic services runs into thousands. There are no complete statistics of the freight carried by motor vehicles, but not only are fruit, vegetables, and live stock now conveyed by road, but also such things as coal and cotton. Of the 4,000,000 bales of cotton grown in Texas in 1930, 1,200,000 reached the ports by motor vehicles. But severe as is the inroad made on the freight traffic of the railroads by motor wagons, still more severe is that due to the private motor car and the motor buses. In 1920 the passenger earnings of the American railroads were nearly 21 per cent. of their total operating revenues, but in 1930 this figure had fallen to 13·8 percent, and the showing for 1931 was even worse.

Added to the competition from the roads is that due to the carriers by water, for inland and coast-wise traffic. At the time Panama Canal Act of 1912 was passed, several railroad companies had steamship lines on the Great Lakes and on the Pacific and Atlantic seaboards. By that Act, however, the companies were prohibited the use of the Canal for vessels owned by them, and other restrictions were placed on their maritime activities. At the close of the War, too, the United States possessed a large surplus of ships. Many of these were sold at a low figure and placed in service, while the Government itself entered the business of inland water transportation. The schemes have never paid their way, and, says Dr. Johnson, "it is hard to justify the continuance of business operation on this basis by the Government in competition with private enterprise."

The traffic has not only been leaving the rails for the roads and waterways, but also for underground pipelines for distributing oil, natural gas, and gasoline. Formerly nearly all petroleum was sent by freight cars, and it involved a large tonnage. In 1929 only 4·5 per cent. of the production was transported by rail. There are now 100,000 miles of Crude oil pipelines in the United States. 65,000 miles of pipelines for the distribution of natural gas, and in 1931 there were also 3800 miles of gasoline pipelines. The rapid increase in the use of oil and gas has had a marked effect on the coal output of the country, and it has been estimated that in 1929 natural gas was substituted for about 77,500,000 tons of bituminous coal. As to civil aviation in the United States, a recent return shows that American transport companies now operate over routes with a total mileage of 51,000 miles, every twenty four hours.

The problem of co-ordinating the great and varied transportation services of the United States, it will thus be seen, is a very complex one. It is one dealt

with by Dr. Johnson and Mr. Wilson in their respective papers, both of which are worthy of the attentjon of the authorities in Great Britain. In reviewing the constructive and corrective measures required, Dr. Johnson mentions the reduction of unprofitable train services, the operation by railways of both passenger and freight motor services, a reduction in the competition among the railways themselves, the consolidation or the grouping of the railways into a limited number of systems, the co-ordination of railroad, water, and air services and the regulation of all transport agencies by the Government, according to a sound and equitable national policy. What co-ordination means and how it can be effected is dealt with fully by Mr. Wilson, who says : " The trend towards co-cordination has proceeded to the point that we can predict that the great railroads, steamship companies, electric railways and other specialised carriers will tend to become *transportation* companies..... offering a variety of transportation services to shippers and travellers that will supply the needs and fit the pocket-books of their patrons."—*Nature* No. 3266. Vol. 129. June 4, 1932. pp. 819—820.

New South Wales Rice Marketing Board. Within less than a decade, the rice industry in New South Wales has been put on a commercial footing and Australia, until a few years ago a rice importer, is now a seller in the international market. Progressive marketing organisation has paralleled a vigorous development of production.

In order to enable this industry to develop on sound lines, the rice growers of New South Wales, following a period of co-operative organisation, applied the Marketing of Primary Products Act to rice in November, 1928. The Statutory Board set up under the scheme, with control over the purchase and sale of rice in N. S. Wales, has now completed three years of successful operation.

The general method of the Board has been to assemble the rice at its own depots, to make advance payments to suppliers at the time of delivery, and to co-operate with well-established millers in the processing and disposal of the product. By these means, the Board has rationalized the assembly and the distribution of the crop.

The good relations which it had established with the millers, and its statutory backing, served the Board well in 1930, when it was faced with a crop which exceeded home needs by 10,000 tons. To avoid a carry-over, the Board, in conjunction with millers, entered the export trade and succeeded in establishing a market for its rice in several countries. The Board has also turned its attention to the home market, and has concluded that the *per capita* consumption of rice in Australia can be greatly increased by publicity. As a part of its activities in this direction, the Board has published a booklet of recipes of rice dishes.

The Board has appreciated the intimate connection between production and marketing problems. By co-operation with the Department of Agriculture and the Irrigation Commission, it has brought to producers the most up-to-date knowledge on varieties, preparation of the land and crop rotation.

Although, as stated by the Board's Chairman, organization in the rice industry was greatly facilitated by a tariff, and by the small numbers and territorial concentration of growers. "it is extremely doubtful whether the growers working through the agency of purely co-operative organizations and marketing their products on an uncontrolled market could have achieved anything like the same results as has been done by the Marketing Board with its statutory powers.' (*Jour. of Ministry of Agriculture*, May 1932).

Correspondence.

SEX REVERSAL IN A BULLOCK

Mr. S. Krishnamurthi Rao, B.Sc., Ag., writes from Dharmavaram :—A strange phenomenon of development of udder in a bullock has happened of late in a neighbouring village of this town. The bullock owned by a private ryot belongs to the Mysore breed of cattle. The animal was purchased by the person in Kothacheruvu cattle fair eight years back and was broken for work at the time of purchase. The animal is strong and well built and is now thirteen years old. Till very recently, it was put to agricultural work and was very serviceable to the owner; but after the development of udder it is given complete rest and is now being worshipped by the villagers one and all!

History of development of udder : About three months back, the owner noticed an abnormal swelling in the region of the scrotum and the native medical aid proving a failure, the animal was taken to the Veterinary Sub-Assistant Surgeon at Dharmavaram. The Veterinary doctor, after examining the case, advised the ryot to take the animal to the District Veterinary hospital at Anantapur for proper treatment. The owner realising later that there was no necessity for medical aid gave complete rest to the animal. The swelling was found to increase enormously in size after some time, though the animal was quite healthy and it suffered no pain even when the portion was pressed by hand.

The abnormal growth increased in size. Along with the development of udder, the rudimentary teats also increased in size and they were well formed. It was plain then, that the animal was developing its udder. One day the ryot, as a matter of curiosity, milked the well formed teats and he was surprised to see milk coming out in a fine jet from the milk ducts. This news spread soon far and wide like wild fire, when the people gathered in great numbers at the place to see the animal.

I visited the place a few days back. The animal was tied in an open space and to my surprise it appeared exactly like a cow from a distance. But when I went near it was clear that the animal was a bullock with a well developed udder. The udder is as big as a pine-apple and the teats are quite conspicuous. The animal is very docile. The development of the milk vein is also prominent. On manipulation over the part with my hand the animal exhibited no pain. I milked the four teats and the milk was coming out of them quite normally as in the case of an ordinary cow. The colour, odour and taste of the milk exactly resembles the milk of an ordinary cow. Then I examined its hind portion and found that the portion below the anus is wrinkled and there is the formation of a reddish mucosa in that portion and I am not sure whether a slit would not develop later corresponding to the vaginal hole. The animal is now giving 2 lbs. of milk per day and the owner out of superstition is afraid to use the milk for household consumption and it is now being wasted. It may be worthwhile to analyse the milk chemically.

Review.

(The Italian Rice Industry by H. A. Tempany, Director of Agriculture, S. S. and F. M. S, Malayan Agricultural Journal Vol. XX. No. 6). The methods of rice cultivation in Italy which produces the second largest acre yields in the world have been attracting the attention of scientific investigators in recent years. Rao Bahadur Mr. D. Ananda Rao, Headquarters Deputy Director of Agriculture, Madras, had paid a special visit to the tract in 1926 and described the methods in an article in *The Modern Review*. Mr. Galletti. I. C. S. has also written about it in *The Statesman* which was reproduced in the Madras dailies. The present article is written by the Director of Agriculture, S. S. & F. M. S. who had made a special visit to the tract to study the conditions while on home leave. The information given in this article supplements those already observed by the two previous writers.

Rice cultivation in Italy extends over a period of six months March to October, and the standard of cultivation and the yield per acre have steadily increased since the beginning of the present century from 20·65 quintals per hectare in 1870 (1843 lb. per acre) to 46·0 quintals (4106 lb. per acre) in 1929—30. The climatic conditions obtaining in the tract where rice is grown and the physical and chemical analysis of the soils have been described. The irrigation system adopted is very perfect and efficient and this, in no small degree, is responsible for the heavy yields. The water rate charged is 120 liras per hectare or roughly Rs. 7 per acre. The consumption of water per hectare varies from 2 to 4 litres per second or (·074 to ·15 c. ft. per second). The cultivation methods and rotation practiced are described in great detail. The first ploughing, harrowing of the land and sowing are all apparently done dry, with occasional irrigations, water being allowed to stand continually only after the crop is established. Generally the seed is sown broadcast by hand or in drills by means of a machine according to the size of the holdings. The advantage of raising a seed bed and transplanting the crop has been realised and it is said that about 10 % of the total rice area is now transplanted. The bigger yields obtained by transplanting the crop more than makes up the extra labour charges involved in transplanting. Recently transplanting machines have also been constructed and put on the market and it is stated that the best of these are fully satisfactory.

The chief varieties of rice grown in the tract, the cultivation of the crop after planting, layout and equipment of the farms are dealt with next. The economics of rice growing in Italy taking into consideration the cost of cultivation, the average outturn and the prevailing prices of the grain, show that the industry is being carried on at a considerabe loss. This is entirely due to the present market for rice being very much below the normal level as a result of the world depression. At the normal level of prices which is more than twice the present rate and with an yield of 50 quintals per hectare (4463 lb. per acre) the cultivation of the crop yields a profit of 1,000 to 2,000 liras per hectare (58 Rs. per acre).

Fish culture which forms an adjunct to the rice industry consists of raising of carp which is carried out to some extent in the rice fields similar to what is being done in Java.

An experimental Station of the Rice Industry at Varcelli has been organised and is being run partly by interest on a central fund and partly by contributions from the rice growing districts—from the farmers, syndicates etc. The work of the station concerns itself with breeding, selection, acclimatisation and trial of varieties of rice in addition to conducting manurial experiments and experiments on agricultural engineering problems including irrigation, farm machinery and the like. It is considered that this experimental station has played a very

important part in bringing about the very marked improvements in rice cultivation which have occurred during the last 23 years.

The author concludes that the chief conditions that have contributed to the high returns are (1) the provision of an effective system of water control, (2) the working out of a rotation system which allows of the lands being rested from rice cultivation periodically, (3) the provision of deep and thorough cultivation. (4) the working of a system of regular and heavy manuring, (5) the evolution of heavy-yielding varieties suited to the condition obtaining and (6) the availability of adequate scientific advice and guidance through the experimental station. (K. R.)

The use of Lime in Agriculture. (Bulletin No. 35 of the Ministry of Argi. and Fisheries, London 1932)—A common draw-back in most schemes of intensive cultivation with the help of artificial fertilizers, is the failure to make suitable provision for the maintenance of the calcium reserve of the soil, which results in a rapid depletion of this essential constituent in the soil, as shown by certain Rothamsted soils whose lime reserves have fallen from about 100 tons per acre at the beginning of the 19th century to about half the amount at the present day. The important role played by lime in maintaining soil fertility is stressed upon in a recent Bulletin of the Ministry of Agriculture and Fisheries, England (Bulletin No. 35), which though written with an eye to English conditions, still carries a wider interest as it deals with the fundamentals of the lime problem.

Lime is known to exert several beneficial effects on the soil, both of a physical and of a chemical nature—eg. (1) It improves the texture, effects a marked reduction in the draught of the plough and renders heavy clay soils open and friable. (2) It improves the drainage conditions and renders the land warmer, (3) It increases bacterial action and the rate of decomposition of organic matter, and indirectly increases the availability of the phosphoric acid and potash of the soil. (4) Lime is an essential plant food and in insufficient quantities easily becomes the limiting factor for plant growth; it is specially absorbed in large quantities by leguminous crops like lucerne, clover, vetch, sunflower etc. (5) Lime serves as a preventive against certain diseases like clover-sickness, "finger-and-toe" disease of turnips etc. (6) Lime finds large scale application in improving soil-acidity, and in rendering the soil a suitable medium for bacterial development and plant growth.

Serious losses of lime take place (1) by removal of successive crops from the land, (2) by the dissolving action of natural agencies like rain, soil-water etc. (3) by the use of "physiologically" acid manures like sulphate of ammonia, and (4) in industrial areas, by the deposition and subsequent washing in of the acid constituents of smoke. In regard to the effect of fertilizers on the loss of lime already taking place due to natural agencies, the Rothamsted experiments show that (a) sulphate of ammonia increased the loss; (b) super-phosphate, sulphate of potash, kainit and kindred manures do not increase the loss to any appreciable extent; (c) farm-yard manure and probably other organic manures diminish the loss of carbonate of lime; (d) basic slag reduces the total loss of lime from the soil, and may even to a certain extent serve the purpose of lime in the soil, (e) nitrate of lime, nitro-chalk, cyanamide and nitrate of soda tend to diminish slightly the loss of lime and so are preferable to sulphate of ammonia for use as nitrogenous top dressings on light soils deficient in lime.

The pamphlet describes the indications of a sour or acid soil as shown by the type of plant growth in grass and arrable lands, and also deals with the comparative values of different forms of lime for improving soil acidity. Of the four types of calcium compounds available, viz. (1) free lime (eg. quick lime, ground lime), (2) lime combined with water (eg. slaked lime, hydrated lime etc.), (3) calcium

carbonate (eg. chalk, limestone etc.) and (4) other calcium compounds (eg. bones, super-phosphate mineral or rock phosphate, sulphate of lime etc.), the writers recommend the first three forms, as the fourth group has no power of neutralising soil acidity. Lime stone rich in magnesium salts. render some harm than good. For ordinary soils, dressings of about 10 cwt. to 1 ton per acre of ground lime or 1 to 2 tons per acre of ground carbonate of lime once in 4 or 5 years, would serve to maintain soil fertility and preserve it from deteriorating into a sour and badly working condition. For sour soils, greater quantities are necessary and the amount can be gauged either by field observation or by the chemical methods of determining "lime requirement". (C. N.)

Association of Economic Biologists, Coimbatore.

A meeting of the Association was held on Friday. 15th July 1932, when two papers were contributed: (1) Delayed germination in cotton by R. Balasubramanyan and V. Ramasawamy Mudaliar and (2) Inheritance of length of grain in rice by K. Ramiah and N. Parthasarathy.

(1). The authors having noticed some delay in germination in a second generation cross of cotton when the seeds were planted under ideal field conditions, conducted certain laboratory experiments to determine the factors that contributed to this defect. The experiments were mainly directed towards finding the rates of moisture intake up to the point of germination in both the normal and treated seeds of the parents and the cross. The rapid initial absorption of water and rise to the saturation point were associated with quick and good germinations and in cases where the germination was delayed the rate of water intake was slow, due mainly to the closed micropyle, thick and tough seed coat and poor embryo development. Any treatment adopted to reduce the thickness of the seed coat or to increase the permeability of the seed coat quickened the rate of absorption and improved the germination. Light seeds had poor embryos, while heavy seeds possessed thick seed coat and both these drawbacks could account for the low germination.

Microchemical studies on the seed coat did not reveal the presence of cutin, suberin or pectic compounds, but the modified cellulose of the pallisade layer resisted to a large measure the action of cuperammonia and concentrated sulphuric acid.

The delay in germination was akin to late planting in its effects and data were presented from one of the parents to show the extent to which the final yields might be pulled down when an interval of even one week was allowed between one sowing and another.

The paper was illustrated with a number of specially prepared charts and tables. It was followed by an interesting discussion in which several members took part. It was pointed out in the discussions that the percentage of germination under laboratory conditions might be quite different from that obtained under field conditions and the reason for some of the seeds having poor embryos might be genetical, they being the progenies of crosses. It was also pointed out that in addition to rapid germination the depth to which the seeds were sown in the field was also an important factor in as much as a beating rain soon after the sowings could cake the surface soil and prevent the germinating embryo from breaking through the soil.

(2). In the second paper the authors explained the results of a cross in rice where the inheritance of grain length was concerned. Previous studies had shown that the short length of grain was a simple dominant to the long length, but in such studies the short length of grain was always associated with a round shape also. It was surmised that the factors concerned with the inheritance of grain length might be different from those concerned with grain shape. In the particular cross under study both the parents had narrow grains and differed only in length by nearly 0·5 m·m. The progenies of the cross had been followed up to F 4 generation and the results were found to fit in admirably with a three factor hypothesis.

The studies have also shown the existence of definite positive correlations between the length of grain and length by breadth ratio, an index of the shape.

In the discussion that followed it was pointed out that the studies on the inheritance of grain sizes was of great importance as it was probably the only reliable character that could be used in the classification of types in certain crops like groundnut. (K. R).

College News and Notes.

Students' Club. The annual day of the Students' Club was held on July 26th, when the Rt. Hon'ble V. S. Sreenivasa Sastry gave an extremely interesting informal Talk on "The Indian Problem in South Africa". On the eve of the transfer of Mr. P. S. Kuppusamy Ayyar, Lecturer in Animal Hygiene, from the College, the students entertained him with a dinner at the hostel. In connection with the Abraham Memorial Foot-ball Tournament, our College met the London Mission High School and lost the match to them by 3 goals to one.

College-Estate Committee. Messrs. P. D. Karunakar and M. R. Balakrishnan, the two elected representatives on the Estate Committee having finished their term, fresh elections were held on 8th August. Six candidates had been nominated of which Messrs. Ramasubramaniya Sarma, Head-clerk of the Cotton Specialist's Section and M. A. Sankarier, Assistant to Millets Specialist, got the largest number of votes and were declared duly elected.

Weather Review (JULY—1932)

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st	Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars	Gopalpore	4·8	−1·3	7·5	South	Negapatam	1·1	−0·8	9 3
	Berhampore *	6·9	−0·3	12·8		Aduthurai *	1·9	+0·4	11·0
	Calingapatam	5·3	+0·4	1·7		Madura	0·5	−1·4	8·5
	Vizagapatam	5·8	+1·5	10·1		Pamban	0	−0·5	4·1
	Anakapalli *	8·0	+2·8	17 1		Koilpatti *	0·1	−0·6	9·1
	Maruteru *	10·3	+3·6	18·1		Palamkottah	0	−0·3	6·1
	Samalkota *	10·5	+2·1	14·7					
	Cocanada	9·3	+3·3	13·5					
	Masulipatam	7·3	+1·1	14·7	West Coast	Trivandrum	6·7	−0·7	34·9
Ceded Dists.	Kurnool	3·4	−1·4	7·7		Cochin	20·7	−1·7	65·4
	Nandyal *	1·6	−4 3	8·4		Pattambi *	28·8	+4·9	68·6
	Bellary	0·7	−1·0	3·7		Calicut	30·0	+1·1	91·0
	Hagari *	0·9	+0·1	5·4		Taliparamba *	45·8	+2·0	100·6
	Cuddapah	1·8	−2·2	4·3		Mangalore	22·7	−15·3	71·0
						Kasargode *	26·2	−11·2	74·7
Carnatic	Nellore	2·4	−0·2	8·1					
	Madras.	0·9	−2·9	3·8	Mysore and Coorg	Bangalore	4·0	+0·1	15·2
	Palur *	...	...	...		Mysore	2.6	+0·6	14·9
	Palakuppam *	1·8	+0·4	8 8		Mercara	46·8	+5·1	83·2
	Cuddalore	0·3	−2·8	6·2					
Central	Vellore	2·1	−2·3	10·2	Hills.	Kodaikanal	5·4	+1·1	21·8
	Salem	1·9	−1·6	16·6		Nanjanad *	13·1	+0·2	29·1
	Hosur Cattle Farm *	2·0	+1·8	17·5		Ootacamund *	8·9	+3·3	21·3
	Coimbatore Town	1·5	+0·1	12·7		Coonoor	2·0	−1·7	12·9
						Kallar *	1·2	−1·4	17·6
	Coimbatore Res. Inst. *	1·3	−1·1	13·4					
	Trichinopoly	0·5	−1·1	13·5					

* Meteorological Stations of the Agricultural Department.

Summary of general weather conditions: The monsoon at the beginning of the month was weak on the west coast, but revived about the 3rd and continued active for the rest of the month, and rainfall was general there. The weather in the Bay was dominated by four depressions, which gave general rain in the north of the presidency. The first depression was centred about 18° N and 87° E on the 9th and moving in a northwesterly direction crossed the Orissa coast on the 13th and filled up in Upper India on the 17th. It caused moderately heavy rainfall on the Circars coast and very heavy rainfall in the adjoining regions of Orissa and Central Provinces. The second depression formed at the head of the Bay on the 17th and lay centred at about 20° N and 89° E on the 18th and moving slowly crossed at the north-west corner of the Bay on the 21st disappeared over the Central Provinces by the 24th. The third depression originated at about 20° N and 88° E on the 24th and moved rapidly and crossed the Orissa coast on the 25th and filled up by the 26th. The last depression formed over south Bengal on the 30th and moved to over Chota Nagpore on the 31st. The second and third depressions caused some general rain on the Circars coast and in the interior, and stimulated a flow of the monsoon over the peninsula.

Rainfall was in excess in the south of the Circars, Coorg, locally on the Hills and in the central districts, and was in defect elsewhere, especially in Malabar and the Coromandel coast.

Other climatic elements were about normal.

Weather Report for the Research Institute Observatory:

Report No 7.32.

Absolute Maximum in shade	91·2°
Absolute Minimum in shade	68·5°
Mean Maximum in shade	86·3°
Mean Minimum in shade	73·0°
Total rainfall in month	1·33″
Mean rainfall for July	2·42″
Departure from normal	−1·09″
Heaviest fall in 24 hours	0·37″
Number of Rainy days	4
Mean daily wind velocity	7·1 M. P. H.
Mean 8 hours wind velocity	10.0 M. P. H.
Mean Humidity at 8 hours	71.1 %
Total hours of bright sunshine	148·9
Mean daily hours of bright sunshine	4·8

General weather conditions:

The weather during the month was typical of the south-west monsoon period with frequent showers and a vigorous wind movement. The monsoon was active on the west coast during the greater part of the month, and though the total rainfall was low the monsoon penetrated freely inland and caused cloudy skies and strong winds. The total rainfall was about 40 % in defect, and no fall exceeded 0·37 inch. Temperature was generally low except towards the end of the month when the monsoon weakened and skies cleared to some extent. P. V. R.

Departmental Notifications.

I Circle: B. P. Papiah A. A. D., extension of l. a. p, for 15 days. A. Gulam Ahmed, F. M., Anakapalli, l. a. p. on m. c. for 1½ months from 26-6-32. A. Gopalakrishnayya, A. D., extension of l. a. p. on m. c. for 2 months from 1-7-32. A. Rammohan Rao, A. D., Dowleswaram, l. a. p. for one month and 15 days from 12-7-32. V. Tirumala Rao, Asst. to G. E., l. a. p. for 1 month from 1-9-32. N. M. Bhukta, A. A. D., l. a. p. for 1 month from 18-7-32. T. Seshachalam Naidu, F. M. Chintaldevi posted to Tuni division. M. V. Kondala Rao transferred to Vizagapatam Sub Circle, to report for duty to the A. D. A., Vizag. on the expiry of his leave. **II Circle:** S. Sitapati Rao, A. A. D., l. a. p. for 24 days from date of relief. **III Circle:** N. Annaswami, A. D., Kadiri l. a. p. for 1 month from 25-7-32 K. Balaji Rao, A. A. D. will join duty at Tadpatri after the expiry of leave granted to him. K. Sanjeeva Shetty A. D., Bellary, l. a. p. for 18 days from 5-7-32. **IV Circle:** L. a. p. granted to S. Ramachandran, A. D., Tiruppur, from 16-5-32 cancelled and the period of absence for 7 days treated as casual leave. K. B. Vaideeswara Iyer, F.M. Palur, l. a. p. for 1 month from 11-7-32. M. K. Swaminatha Iyer, A. D. Gudiyattam. l. a. p. on m. c. for 15 days from date of relief. P. S. Venkatasubramanian, A. D., Tindivanam to be in additional charge of Villupuram sub-circle. A. Ramaswami Iyer A. D., Villupurram to be A. D. Van Duty until further orders. K. Varadachary, A. D., Vellore to be in additional charge of Tirupattur sub-circle and Gudiyattam. S. Muthuswami Iyer, F M, Kalahasti to Palur. P. Janakirama Iyer to be A. D., Tirukoilur and relieve N. V. Kalyanasundaram to join duty at Coimbatore. K. E. Viswam Iyer to relieve A. Ramaswami Iyer at Tirukoilur and

A. Ramaswami to Villupuram. R. Narasimha Iyer, A. A. D. Mycology, l. a. p. for 17 days from 15-8-32. **V Circle:** P.V. Samu Iyer, A.A.D., Kulitalai, l. a. p. for one month from 6-7-32. T. G. Muthuswami Iyer, l. a. p. for 1 month from date of relief. The period of 11 days' casual leave granted to P. V. Samu Iyer from 13-6-32 to 23-6-'32 was converted as l. a. p. S. Mahadeva Iyer, A. D., Ariyalur, l. a. p. for 1 month from 1-7-32. P. V. Samu Iyer, A. A. D., Kulitalai, extension of l. a. p. for one month from 5-8-32 **VI Circle:** A. K. Ganesa Iyer, A. D., Sholavandan, l. a. p. for 10 days from 1-7-32. C. A. S. Ramalingam Pillai, A. A. D., Manamadurai, l. a. p. for 7 days in continuation. N. C. Tirumalacharai, A. D., l. a. p. for 2 months on m. c. from date of relief. **VII Circle:** B. Narasimha Pattathan, A. A. D., Coondapur, l. a. p. for 21 days from 29-6-32. C. S. Madiah, extension of l. a. p. for 6 months and 18 days in continuation of leave without allowance for 5 months and 12 days. **Live Stock Section:** P. M. Appaswami Pillai, A. F. M. l. a. p. for one month from 7-8-32. **P. S's. Section:** M. K. Venkatasubramaniam, Asst. extension of l. a. p. for one month from 15-7-32. **G. A. C.'s Section:** C. V. Ramaswami Iyer, Asst. extension of l. a. p. till 12-8-32 **M S's. Section:** K. Narayanan Nair, Asst. l. a. p. for 13 days from 19-7-32.

O. S's Section: K. W. Chakrapani Marar, to be F. M., Kasargod. K. P. Sankunni Menon, F. M. Nileshwar Station is temporarily transferred as F. M., Palakuppam. He will join duty as F. M. on 14th August. F. M. Palakuppam to proceed to Madras, to attend the sericulture classes from 15th August for a month. Gopalan Nair, F. M., Kasargod, will hand over charge to A. F. M., Kasargod and take over the charge from F. M., Nileshwar. **G. E.'s Section:** T. A. Subrahmaniam appointed as Artist vice M. Singaroyan granted l. a. p. for 1 month from 20-7-32.

D. A's Office Orders: T. R. Narayanan, Asst. in Millets extension of leave for 1 year without pay in continuation of leave already granted. T. S. Ramasubrahmania Ayyar, Asst. in Chemistry l. a. p. for 1 month and 23 days from 10—7—32. S. Rajarathnam Chetty will continue to work until further orders. U. B. Muhammad Abbas, Offg. Upper Subordinate is appointed to officiate vice S. Mahadeva Ayyar, A. D. V. Circle. He will continue to work in the IV Circle. C. V. Seshacharya to Central Farm from 6—7—32. R. Anantapadmanabha Pillai will continue to officiate vice M. Narayana Iyer, A. D. on leave. D. Shanmugasundaram to officiate vice K. B. Vaideeswara Iyer, A. D, on leave. M. Muhammad Ali to officiate in the IV Circle vice M. Narayana Iyer till 6—7—32 and then vice P. Janakirama Iyer, A. D. on leave. R. Govindaramayya, F. M., C. B. S. Coimbatore, to V Circle. N C. Tirumalacharya, to be F. M. C. B, S., Coimbatore. K. W. Chakrapani Marar l. a. p. for 1 month from 15—7—32. N. V. Kalyanasundaram, A. D., Tirukoilur to be offg. Asst. in the Chemistry Section vice M. Suryanarayana. N. K. Thomas, F. M., Central Farm, to be Offg. Asst. in the Paddy Section in the temporary post sanctioned for the R. R. S., Berhampore till January 1934, vice K. Kumaraswami Chetty. N. K. Thomas will, however, work in the Cotton Section until further orders. T. S. Lakshmanan, F. M. to be Offg. Asst. in the Chemistry Section vice M. Sanyasi Raju. U. B. Muhammad Abbas, F. M. Palur, will be considered to be offg. as Asst. in the Chemistry Section vice. T. S. Ramasubramaniam. D. Sitaramaswami, Sub-Assistant has been discharged from service as a measure of retrenchment from 10—8—32 and re-appointed as a fieldman from the same date. Muhammad Moinuddin, Asst. Entomology Section, discharged from the service from 25—7—32. T. Seshachalam Naidu, F. M., Lives Section, to I Circle. M. V. Narasimha Sastry, A. F. M. to II Circle, M. Alagiriswami, A. F. M., to Central Farm, Coimbatore. K. Ramanuja Acharya, F. M., in charge of Dairy herd at Central Farm, to IV Circle as Headmaster Agricultural Middle School, Kalahasti. A. Muhammad Ali, Upper Subordinate discharged from service from 28—7—32. K. L. Ramakrishna Rao, A. D., Giddalur, transferred to

Hagari, as Assistant to the C. S., vice temporarily V. K. Subramania Mudaliar on other duty. M. Venkoba Rao, Asst. to C. S., Hagari transferred to Coimbatore, as Asst. to the G. A. C. displacing K. Veerabadhra Rao, discharged from 24-8-32. A. Gulam Ahamed, from Samalkota, transferred to III Circle, for district work, to report himself to the A. D. A., Kurnool. N. V. Kalyanasundaram, Offg. Upper Subordinate Agrl Section, whose offg. appot. terminates on 24—8—32, will continue vice K. L. Ramakrishna Rao on other duty—to continue to work in the IV Circle. P. Kunhi Raman Menon and S. Rajarathnam Chetty, Assts. Chemistry Section and K. Kumaraswami Chetty, Assistant, cotton section discharged from service from 1—8—32.

The officers of the Agricultural Department now known as "District Agricultural Officers" will in future be designated "Assistant Directors of Agriculture."

ADDITIONS TO THE LIBRARY—APRIL & MAY 1932

A. Books:

H. C. Powell—*The culture of the orange and allied fruits*; H. L. Kaji—*Co-operation in India* B. R. Misra—*Economic Survey of a village in Cawnpore District* and T. S. Sabnis *Report on Hemp Marketing in India.* Davidson H. C. *Fruit Culture*; Baker D. M. and Conkling H. *Water Supply and Utilisation*; Rothamstead Conferences No. 6— *Power for cultivation and Haulage on the Farm*; Conference No. 13 (1931)—*Technique of field experiments*; Basu S.—*Winds weather and currents on the coasts of India and the laws of storms*; Golver P. M.—*A practical manual of Lac cultivation*; Jones H. P.— *An account of Hemiptera Heteroptera of Hampshire and the Isle of Wight*; Donisthorpe H.— *The Ants and Guests (Myrmecophiles) of Windsor Forest and District*; Butler E. J. & Bilby G. R.— *The Fungi of India*; *Prospectus of the Punjab Agricultural College, Lyalpur*; Heath H. F.—*The Year Book of the universities of the Empire*; Agra *University Calendar for 1931-32*; *The Imperial Gazetteer of India*, Vol. 26 —*Atlas*—*Revised Edition.*

B. Reports:

(1) Madras Agricultural Stations Reports—1930—31; (2) Annual Report on Experimental Farms, Bihar and Orissa. (3) *Triennial Reviews*: of irrigation in India; of the Society of Chemical Industry; on the progress of applied Chemistry; on the progress of Chemistry; of East African—Amami Agricultural Research Station; of the Departments of Agriculture and Forests, Palestine, of the Agricultural Experiment Stations, Arkansas, West Virginia and Colorado; of the Agricultural Department, Canada Been Division. Second report showing the Progress made in giving effect to Recommendations of the Royal Commission on Agriculture in India—Part I—Central Government—1929—30; Part II—Local Governments and Administrations; Reports of the Biological Chemists in India, 1930; Do. 1931; Annual report for 1930 of the East Malling Research Station, Part I—General; Part II—Supplement; Report of the Imperial Bureau of Soil Science for 1931—2; Annual Report of the Department of Agriculture, Mauritius for 1930; of the Co-operative Credit Societies for the year ending 30—6—31; of the Department of Agriculture, Ontario for 1930; of the Experiment Station Swift Current Sask (Canada for 1927) of Experiment Station, Rosthern for 1928; of Expt. Station, Swift Current, Sask, for 1929; Do. for 1930; of the Public Instruction in the Madras Presidency for 1930—31—Vol. I; of the Madras Fisheries Department for 1930—31.

C. Bulletins and Memoirs.

(14) *Madras Agri. Dept.* Bull No. 25—insects affecting the paddy plant in South India; (15) *U. P. Agri Dept.* Bull. No. 60—The Papaya or Pappeeta; (16) *B. M. B.*

Pub. 48—Further changes in the demand for butter; (17) *I. B. A.* Parasitology Notes and Memo No. 5—Different Diagnosis of plant parasitic Ecloworms; (18) *Union of South Africa Agri. Dept.* Bull. 106—Agricultural Grasses of South Africa and management of their pastures. (19) *Canada Agri. Dept.* Bee. Div. Bull. No. 33—Bees and How to Keep them; Bull No. 74—Wintering bees in Canada (20) *U. S. Agri. Dept.* Bull No. 471—Grape Propagation, Pruning and Training (21); Bull. 1057—Cattle fever attacks and methods of eradication (22); Bull. No. 1214—Farm Dairy Houses (23); Bull. No. 1330—Parasites and parasitic diseases of sheeps (24); Bull. No. 1423—Preparation of cabbage for market (25); Bull. No. 1443—Dairy cattle breeds (26); Bull. No. 1686—Common Errors in Cotton Production (27). (28) *Arkansas A. E. S.* Bull. No 247—Beef producing qualities of pure bred Aberdeen Angus Cattle compared with Arkansas Native Cattle; Bull No. 248—The Biology of the Bean Leaf-Beetle (29); Bull. No. 249—Factors influencing the flavour of butter (30); Bull No. 250—Dietary requirements for fertility and lactation (i) the role of fat soluble vitamins in fertility and lactation; (31); Bull No. 251—(ii) the role of vitamin B in Lactation and vitamin requirements of nursing young (32); Bull. No. 252—(iii) Pathological changes in nursing young of the Albino rat suffering from vitamin B deficiency, and the role of vitamin B in infant nuitrition. (33); Bull. No 253—Cotton spacing—(ii) Effect of Blooming on Earliness, fruit set and yield (34); (35) Bull. No. 254—A study of the effect of certain fertiliser and cultural, treatments upon the vigor of young stayman apple trees; (37) Bull. No. 256—Preliminary studies on Arkansas Horse flies; (38) Bull. No. 259—Organisation and Management of Agricultural credit corporations in Arkansas; (39) Bull No. 260—Rice Farming in Arkansas with Financial results for 1927; (40) Bull. No. 261—Cost of pumping and duty of water for rice on the grand of Prairie of Arkansas; (41) Bull. No. 262—Three-year study of farm management and incomes in a typical upland section of Arkansas; (42) Bull. No. 263—The Peanut crop in Arkansas; (43) Bull. No. 264—Preliminary report on cultural and fertilizer experiments with rice in Arkansas; (44) Bull. No. 265—The rate of absorption of Potassium by plants and its possible effect upon the amount of potassium remaining in soils from applications of potassium fertilisers (45) Bull. No 266—Cost of producing rice in Arkansas in 1927; [46] Bull. No. 267—Some factors which influence growth and fruiting of Tomato. [47] Colorado A. E. B. Bull. 369—The date to plant corn in Colorado. [48] Bull. No. 370—Oat varieties in Colorado. [49] Bull No. 371—Barley in Colorado. [50] Bull No. 330—Silage and trench soils in Colorado; [51] Bull. No. 383—Poroso or Hog Millet in Colorado. [52] Missouri A. E. S. Bull. No. 8—The killing of plant tissue by Low temperature. [53] Bull. No. 152—A study on the influence of climate upon the nitrogen and organic matter content of the soil. (54) Bull. No 297—Influence of yield on costs and income in Agricultural production. (55) Bull. No. 299—Cotton production in Missouri. (56) Ohio A. E. S. Bull. 475—Manual of Ohio weeds. (57) Bull. No. 487—The Propagation of flowers by cuttings and seeds. (58) Cornell A. E. S. Memoir 136—Studies on the fire blight organism (Bacillus Amylovorus). (59) Memoir 137—Some nitrogen relationships in Mirck soils (60) Memoir 138—The effect of Pruning apple trees at planting time. (61) Memoir No. 530. A study of phosphatic lime stone as a mineral supplement. (62) Northa Dakota A. E. S. Bull. 243—North Dakota weeds; (63) Nebraska A. E. S. Bull. 232—Tillage practices in relation to corn production; (64) Mississipi A. E. S. Bull. 290—Making cotton cheaper. Madras Agri. Bull. 27—Annotated list of the Insects Affecting the Important Cultivated Plants in South India; Min. Agri. and Fish. Econ Ser. No 34—Report on the Organisation of Potato Marketing; Imp. Bur. Palant Gentics, Herbage Bull' 6 — Research on Forage Crops in Soviet Central Asia with special reference to Turkestan Lucerne; Imy. Bur. Soil Sci. Tech. Com. 23—; Reclamation of Alkali Soils in Hungary; E. M. B. Pub. 44 — Dairy Research Pnb. No. 45 — Transport and Storage of Bananas with Special reference to

Chilling; Pub. No. 46, — Australian and New Zealand Fruit Shipments; Pub, No. 47 — Banana Breeding at the Imperial College of Tropical Agriculture; Pub. No, 48 — Further Changes in the Demand for Butter; Union of S. Africa Agri. Bull. No. 105 — Foods and Cookery — Part I; U. S. A. Tech. Bull. No. 273—The Bacterial Spot Disease of the Peach and other Stone fruits; Bull No. 275—Biology and Control of Blueberry Maggot in Washington Country, Maine; Bull. No. 231 — Experiments with Insecticides for Codling Moth Control Bull, 287 — Farm Mangement Problems in Shifting from Sack to Bulk handling of grain in the Pacific Northwest—Bull. 239—Land Utilisation in Laurel County, Ky.; Bull. 290—Investigations on Harvesting and Handling Fall and Winter Pears; Bull. No. 293—Factors affecting the Development of Loose Smut in Barley and its control by Dust Fungicides; Bull. 299—Repellency to the Japanese Beetle of Extracts made from Plants Immune to Attack; Bull. 302—Cotton improvement through type selection with special reference to Acala Variety; U. S. A. Farmers. Bull. 1186—Pork on the Farm, Killing, Curing, and Canning; No. 1234—Gullies, How to Control and Reclaim them; No. 1437. Swine Production; No. 1514—Control of Sugar Beet Nematode by Crop rotation, No. 1547—Rose Diseases—their causes and control; No. 1678—Safe use and storage of Gasoline and Kerosene on the Farm; No. 1681—Adjusting Corn Belt Farming to meet Corn borer conditions; Oklahoma Bull. 174—Farmer's part in Co-operative Marketing; Bull 178—Attitudes of Oklahama Farmers toward the Oklahoma Cotton Growers' Association; Bull. 181—Types of Farming in Oklahama; Bull. No. 185—The Relations of Economic, Social and Educational Advancement of Farmers to their Membership in Organisations; Bull. No. 191—Sorghum Crops on the High Plains of Oklahoma; Bull. 202—Growing Turkeys in Confinement; Virginia Pol. Tech. Bull. 282—The Receipts and Expenditures of Virginia Counties; Bull. 283—Leaf Hoppers Injurious to Apple Trees; Alberta Bull. No. 21—Wooded Soils and Their Management.

D. Leaflets, Miscellaneous Publications, Circulars, etc.

(65) Madras Agrl. Dept. B. H. No. 1—Broad Hints for every day use—A. Bullocks; B. Keep Good Bullocks; (66) Canada Agri. Dept. Bee Division Pam. No. 107—Package bees and how to install them; (67) U. S. Agri. Dept. Misc. Pub. 117—Bibliography of Ethylene Dichloride (68)—U. S. Agri. Dept. Misc. Pub. 129—Directory of Field activities of the Bureau of Plant Industry. (69) Misc. Pub. 131—The common Barberry—A dangerous neighbour for wheat, oats, barley and rye. (70)—Misc, Pub, 136—Conservation of fertilizer materials from minor sources. (71) Misc, Pub' 139—Some facts about the cotton outlook for 1932, (72) U. S. Agri. Dept. Leaflet 83—More turpentin; Less Scar: Better Pine; (73) West Virginia Cir. 58—Save black walnut from canker, (74) J. A. R. Reprint Vol. 43/11—The fasting metabolism of cattle as a base value of heat production in the determination of the net energy of feeding stuffs. Supplement to the "Indian Trade Journal' 12-5-32— Review of the Sugar Industry of India during 1930-31; Imp. Bur. Soil, Sc. April 1932—Publications of Soil Science issued from the *Empire Overseas during* 1931; U. S. A. Mis. Pub. No. 66—Economic Benefits of Eradicating Tuberculosis from Livestock; Pub. 120—A Digest of Literature of Derris (Deguelia) Species used as Insecticides, 1747—1931; Pub. 135—Research in Farm Structures; Pub. 134—Works in Subjects Pertaining to Agriculture in State Agricultural Colleges and Experiment Stations—1931-32; Pub. 142—Construction of Sled type Corn stalk Shavers; Pub. 144—The Agricultural Outlook for 1932; U. S. A, Food and Drug Administration Pub. 18451-18500—Notices of Judgment under the Food Drugs Act; Pub. 18501-18550-Notices of Judgment under the Food and Drugs Act; Fibre Board Pub.-The Vazcane Process; Ural Provinc Pub.-The Soils and Vegetation of the district Troitzk; Do. Pub.—Some materials on the study of Ural Region soils in connection with the stating of land areas standing in need of lime.

E. Reprints:

Extrct from "Science" Vol. LIV No. 1396—Reprint and Circular Series of the Nationai Research Council; Extract from "Astrophysical Journal" Vol, 54—Indexing of Scientfic Articles; from "Journal of Chemical Education" Vo. 7 No 4—A survey of Chemistry as Taught to Agricultural Students; from "Journal of Agricultural Research" Vo. 43 No. 11—Hardiness studies with 2 year old Alfalfa Plants; from "Journal of Agricultural Research, Vol. 44 No. 1—Dehiscence of the Boll of Linum rigidum and related species; Do Do. —Effect of temperature on rate of decay of sugar beets by strains of Phoma betae; A study of the Physiologic forms of kernel smut (Sphacelotheca Sorghi) of Sorghum; Inheritance of Height in Broomcorn; Root construction of cotton plants in San Josquin Valley of California; Heterothallism and Hybridisation in Trelletia Tritici and T. Levis; Factors influencing the changes in Oxidation, Reduction, Potential on the reduction of Methylene Blue in milk; Effect of light on the reduction of Methylene Blue ia milk; from Vol. 44 No. 2—Inheritance of Resistance of Bunt Tilletia Tritici in Crosses of White Federation with Turkey wheats; Effect of Hydrogen-ion concentration of the soil on the growth of the bean and its susceptibility to dry root rot; The decomposition of Vetch Green Manure in relation to the surrounding soil.

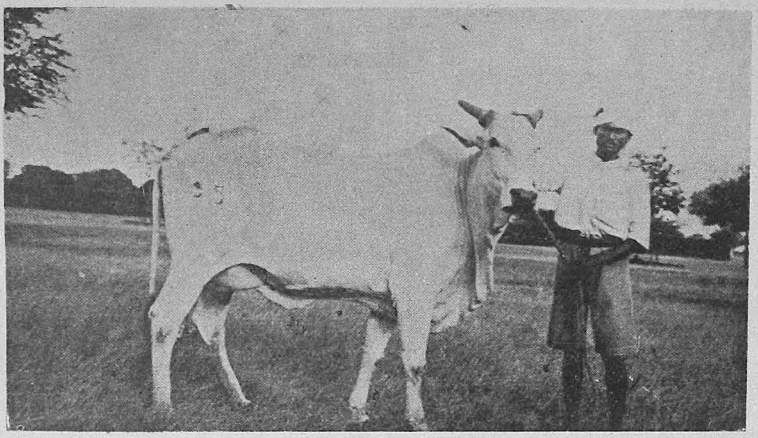
F. Circulars, Leaflets, Etc.

Mad. Agri. Leaflet No. 36 — Bud rot of Palmyra and Coconut palms; Broad Hint 7 — Feed and work your cow; Broad Hint No. 8 — Dedication of Breeding Bulls of Ongole Breed; Min. Agri. & Fish. Advisory Leaflet 2— Destruction of Charlock; No. 15— Common Lung Worms of cattle, sheep and goats; No. 75— The Hen Flea; No. 76— Poultry Mites; No. 77— Bird Lice; No. 78— The Gape Worm of Poultry; No. 79— Round Worms in poultry; No. 80— Tape Worms in Poultry; No. 83— The Brown Scale; No. 94— The Cultivation of Maize for fooder; No. 91— The Mangold Fly; No. 95— Foot rot of sheep; No. 96— the Apple sacker; No. 97— The Breeding of Table Pigeons: Ottawa Pub. No. 55— Seasonable Hints from the Dominion Experimental Farms— Eastern and B. C. Adition; Pub. No. 55— Prairie Edition; The Press Bulletin Vol. XVII No. 5— The University of Alberta Broadcasting Station CKUA.; Agricultural Supplement No. 46— Maize— A crop which provides additional food during the dry summer months for animals. —U. S. A. Agricultural Leaflet No. 88 Poisoning of Livestock by Plants that Produce Hydrocyanic acid; Leaflet No. 89— Controlling Stomach Worms in Sheep and Lambs; U. S. A. Circular No. 200— Irrigation and Related Cultural Practices with Cotton in the Salt River Valley of Arizona; Cir. 210—Field Tests of Imported Red Clover Seed; No. 211—Verticillium Wilt (Hadrycosis) of Cotton in San Joaquin Valley of California; Cir. No. 212— Bud variation in peaches; Cir. 213—Dummer fallow at Ardmore, S. Dak; Cir. 214—Small plants for pasteurizing milk; Cir. 217—Cronartium Compotniae, The Sweetfern Blister Rust of Pitch pines; Cir. 221—The Brainerd Blackberry.

G. Translations:

Nilsson N. Heribert—A Mandelian Explanation of the lossmutants; Brieger Friedrich—The self sterility of flowering plants and significance for breeding.

1. YOUNG ONGOLE BULLS AT CHINTALADEVI LIVESTOCK RESEARCH STATION

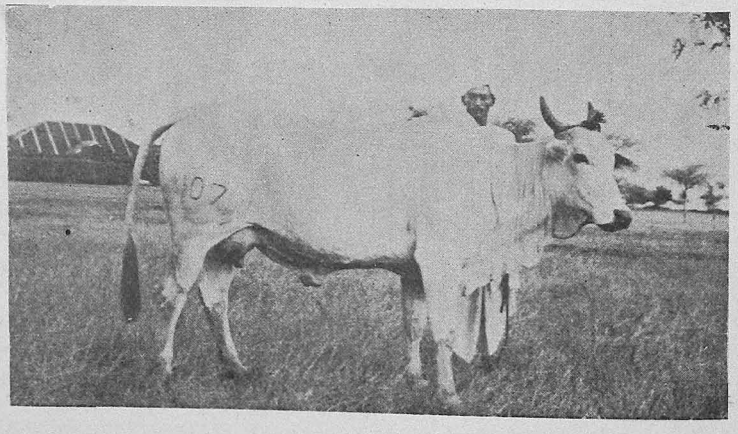


2. ONGOLE COW 95

This cow is the best known milker in the breed.

Milk yields:- 4260 lbs. Daily average 12·5 lbs.
5510 „ „ „ 17·6 „
* 6224 „ „ „ 25·6 „

* Still in milk, average for last month 21·3 lbs. per day.



3. ONGOLE COW 107

Milk yields:- 4965 lbs. Daily average 13·5 lbs.
5126 „ „ „ 17·4 lbs.