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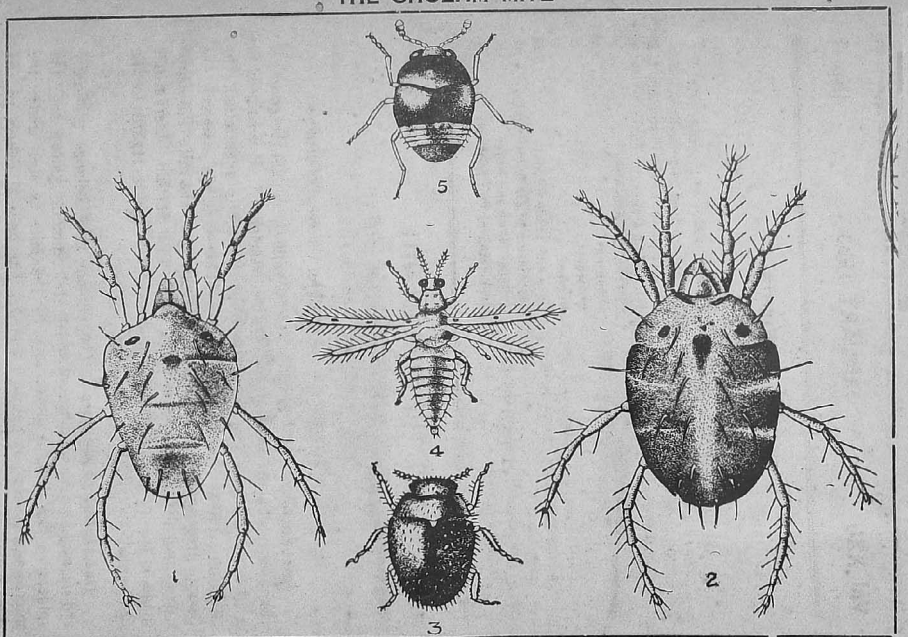
THE CHOLAM MITE



1. Male mite. 2. Female mite. 3. Scymnus beetle. 4. Scolothrips. 5. Staphylirid beetle.

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THE CHOLAM MITE†

(*Paratetranychus indicus on Sorghum*)

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Introduction. Next to paddy (*Oryza sativa*), cholam (*Sorghum*) is the most important cereal in the Madras Presidency.* It is subject to a variety of pests such as the earhead bug (*Calocoris angustatus*), the shoot bug (*Pundaluoya simplicia*), the stem borer (*Chilo simplex*), the Deccan grasshopper (*Colemania sphenarioides*) and the mite (*Paratetranychus indicus*). The present paper deals with certain observations made on the life history and remedial measures tried in regard to the last named, namely the cholam mite.

Description of the mite. The cholam mite belongs to family ** *Tetranychidae* the members of which are commonly known as "red spiders". The general appearance of the mite as seen under the microscope is shown in figures 1 and 2. The general colour of the mite is greyish green. Generally the males have also a slight tinge

† Paper read before the Indian Science Congress, 1932.

* For the year 1930—31, out of a total of 25,666,722 acres under Cereals paddy came first with 11,677,529 acres and cholam second with 4,7,209 acres.

** The classification followed is that of Nathan Banks.

of red. In addition to this difference in colour the males may also be distinguished by their smaller size. The males are about 0·3 mm. long and the females about 0·5 mm. long. Further the tip of the abdomen of the male is pointed while it is more rounded in the female. Mr. Hirst of the British Museum to whom the specimens were sent for identification described it as a new species in the *Proceedings of the Zoological Society of London*, Part IV December 1923.

Life History. There are four stages in the life history of the mite viz., the egg, the larva, the nymph and the adult.

Eggs are spherical in shape and white. The diameter of an egg is about 0·12 mm. A day before hatching the colour of the egg changes to dark-red. The egg stage lasts 3 to 4 days. One female which began egg laying on 6th February 1924 but escaped on 21st February, laid 63 eggs distributed over 16 days, the maximum being 9, the minimum 1 and the average 4 per day. The maximum number for a day in the case of another individual was 19 eggs.

Larvae. The larvae which hatch out of the eggs are pale white in colour. They have three pairs of legs only, in contrast to the nymphs and adults which have four pairs. Eyes are present and are reddish in colour. The larvae feed on plant sap and in two to four days moult into nymphs.

Nymphs. Nymphs very much resemble the adults. Both have four pairs of legs and are rusty green in colour. But in size the nymph is smaller than the adult. As soon as the nymphs emerge they begin to feed. In about two days they become quiescent, stop feeding and then moult. This is the first moult. After this they feed for two days more and moult a second time. After the second moult they are no longer nymphs but adults. When moulting, the skin is ruptured transversely and the line of rupture is the groove between the cephalo-thorax and the abdomen.

Adults. As stated above the adult stage is reached after the second nymphal moult. In a day or two the females begin egg laying either after copulation* or without copulation. The whole life cycle lasts 9 to 12 days.

Parthenogenesis. In the course of examination of a number of mite-affected plants it was found that there was a preponderance of males over females in the case of a few plants. This led the writer to suspect the phenomenon of "Parthenogenesis" i. e. reproduction without the intervention of the male. Experiments were therefore devised to test this. It was found that the usual method of introducing a cholam leaf within a glass chimney and closing both ends with cotton

* Mr. Wood-Mason describes the act of copulation in detail in the case of *Tetranychus bioculatus*. a red-spider mite on Tea in his "Report on the Tea mite and Tea bug of Assam 1884" which is applicable in this case also.

wool did not prove useful as the mites often wandered away and were lost in the wool. The following method tried by the writer gave satisfactory results.

A glass basin 6 inches in diameter was filled with water. Another smaller basin about 3 inches in diameter was filled with soil and a cholam seedling planted in it. This was then placed inside the bigger basin with water. The whole thing was then covered with a glass chimney about 2 ft. high and 1 ft. in diameter, the upper portion being tied with muslin for aeration. A mite egg (not known whether it was fertilised or not) was introduced on the cholam leaf by means of a fine brush. A female was reared from this egg. Though no male could have access to this female, due to the water in the bigger basin, she laid eggs from which both males and females were reared out parthenogenetically. One of the females of this generation again laid eggs from which both males and females were got parthenogenetically. In the next generation however all the progeny of one of the females selected happened to be males.

Nature and symptoms of damage. The injury caused to the plants by mites is quite comparable to that of the plant bugs (*Rhynchota*) since in both cases, plant sap is sucked out. As a result of their attack, the cholam leaves turn bright red in colour and ultimately dry up. The infestation starts at different centres on the leaf and gradually spreads out from these. In the field also small patches of attack are first noticeable on plants at a few centres and these gradually enlarge and the infestation spreads in all directions.

At first sight the red patches produced by mites are liable to be mistaken for patches caused by the sorghum 'rust'. But on closer examination it is seen that the mite patches are bigger in size than the rust patches and that they can be easily distinguished by the presence, on the lower surfaces of the leaves, of a delicate web under which thousands of minute creatures in all stages of development could be seen together with their white moult skins. In a few cases mites have been noticed on the upper sides of the leaves also, but this is rather the exception than the rule.

Method of spread. In the field, leaves of neighbouring sorghum plants would touch one another and it is only natural that the mites should travel from the dry leaves to the green. If the plants are not touching one another the mites descend to the soil and travel over it until they reach fresh plants. Stabler * has made the observation that mites in the case of fruit trees are distributed by the agency of wind. It is possible that in the case of the cholam mite also strong winds

* Stabler (H. P.) "Red spider spread by winds". Monthly Bull. State Comm. Hortic. Sacraments. Cal. ii, No. 12, Dec. 1913, pp. 777—784.

may be one of the means of dispersal. This will be tested in the coming season.

Amount of loss. In the Central Farm, Coimbatore, the amount of loss due to mites may roughly be estimated at 5%. In 1909 the attack was so severe in one of the fields that the whole crop had to be destroyed. There are records to show that in Vellore and Salem there was considerable damage to the cholam crop due to the mites in certain years.

The amount of loss seems to depend on the age of plants. If the attack begins when the plants are tender they may not yield any earheads at all or even if earheads are produced they will be very small in size. If the infestation appears in the later stages of the crop there may not be much damage done to the earheads, but the leaves of attacked plants do not seem to be much relished by cattle.

Distribution in the Madras Presidency. In the Coimbatore district mites are found both in the *Chitrai cholam* (irrigated) and *Periamanjal cholam* (rain-fed). The former is sown sometime in the middle of March and harvested in June and the latter is sown in August and harvested in December. It is mostly in the irrigated crop between March and June that mites are noticed in large numbers. In Bellary they are found from December to March. In Salem, Chittoor and North Arcot districts also there are reports of mite damage.

Alternate food plants. In regard to the Central Farm, Coimbatore, the question of alternate host plants does not arise at all. One field or other is sure to have the cholam crop, grown either for grain or for fodder throughout the year. It is only natural that the mites should find shelter in some of these crops ready to attack the next. Because of the continuous growing of the crop the number of generations of the mites also may be large. A search was however made for alternate host plants and as a result the writer was able to collect a few mites from *Panicum javanicum and Panicum distachyum*, two common grasses found on field bunds.

Effect of weather conditions on mites. It is found by experience that during dry hot weather mites generally thrive and that heavy rains seem to be inimical to them.

Natural enemies. Six different natural enemies have been noted till now, five being insects and one a mite. Life histories of these are briefly given below :—

1. *Scymnus gracilis*, Motsch. (Fig. 3). This Coccinellid is the most important enemy of the cholam mite. Both grubs and adults feed on mite eggs and occasionally also on larvae and nymphs.

The female beetle after mating lays eggs singly. Under laboratory conditions a female laid as many as 30 eggs. Eggs are 0·3 mm. long and 0·17 mm. broad and rounded at both ends. Generally they are

seen on the delicate silken webs of the mites. Egg period is about 3 to 4 days. The newly hatched grubs are over 1 mm. in length and pale white in colour. The head and thorax are large and the abdomen short with terminal claspers. Legs are comparatively large and stout. The body segments have rings of transparent hairs. Grubs when mature measure 2 mm. in length and 0·75 mm. in breadth and are pale yellow in colour, with stout dark hairs. The larval period is from 4 to 5 days, the number of moults being three. The grubs feed mostly on eggs piercing the egg shell and sucking the contents, but occasionally they may go in for other stages also.

The pupae are dark black in colour. The larval hairs persist on the pupae. At the hind end there is a cap-like portion which is pushed out when the adult emerges. Pupae are generally attached to the lower surface of the cholam leaves. The pupal period lasts 3 to 4 days. The adults which emerge are dark black in colour and measure 1·3 mm. long and 0·8 mm. broad. The males are slightly smaller than the females. Adult beetles also feed on mite eggs. Occasionally they may feed on mites also. If kept without food the adult beetles live only from 4 to 6 days. When given sufficient food they live for about three weeks. In one case an adult lived for 35 days.

2. *Scolothrips sexmaculatus*, Pergande.* This insect (Fig. 4) belongs to family Thripidae, (sub-order Terebrantia, order Thysanoptera). It is commonly known as the six-spotted thrips. The nymphs and adult thrips feed chiefly on the eggs but occasionally stages of mites other than eggs are also attacked. It has been found that the time taken to finish one egg is about a minute. The adult thrips can easily be spotted out, the three dark spots on each forewing being very characteristic of this species.

3. *Oligota flaviceps*, Bernh. (Fig. 5). This beetle belongs to family Staphylinidae. In this case the adults are harmless but the grubs are very active creatures destroying mite eggs. They are yellow in colour. A dark spot at the hind end of the abdomen is quite characteristic of the grub. When full fed the grubs pupate in the soil.

4. *Triphleps tantilus*, (Fam. Anthocoridae). Some of these bugs were found attacking the mite nymphs. These are not so important checks as the first three. The whole life cycle of the bug lasts about two weeks.

5. *Geocoris sp.* This bug belongs to sub-family Geocorinae, family Lygaeidae. On certain occasions these were found puncturing the adult mites and nymphs. The life cycle of the bug is about two weeks, the egg period being 4 to 5 days.

6. *Gamasid mite.* It is yellowish in colour and found moving about actively in search of mites. It attacks the larvae of the mite by puncturing their body and sucking in their contents.

* This thrips identified by Dr. T. V. Ramakrishna Ayyar is described in the Trans. of St. Louis Acad. 1894, page 542.

Insecticides tried at Coimbatore. The following insecticides were tried and results of these trials are given below in tabulated form.

Name of insecticide.	Treatment & Strength.	Results.
1. Flowers of sulphur.	Dusted 1 lb. to 4 lb. road dust.	Good against mites. Leaves not scorched.
2. Fish oil Rosin soap.	Sprayed. 1 lb.in 6 gal. of water.	do.
3. Crude oil emulsion.	do.	do.
4 Soap solution.	Sprayed 1 lb. in 4 gal. of water.	Not satisfactory.
5. Harbas.	Sprayed 1 in 40 parts of water.	Fair but leaves scorched.
6. Harola.	do.	do.
7. Vermisapon.	Sprayed 1 lb. in 10 gal.	Fair.
8. Tobacco decoction.	Sprayed 1 in 4 gal.	Not satisfactory.
9. Germicide.	Sprayed 1 lb. in 10 gal.	Fair.

Methods of control. 1. Be on the look-out for the first signs of attack. It is easy to spot them out due to the presence of red patches on the leaves. Pull out the first attacked plants and destroy them or dust flowers of sulphur on the plants by means of hand bellows. In the later stages, when the attack has already spread and injury done, it will not be of any use to have recourse to dusting.

2. Keep the bunds clean of grasses like *Panicum Javanicum* as the mites can live on them.

Acknowledgments. In conclusion, the writer wishes to thank Rao Sahib Y. Ramachandra Rao for his valuable advice in the course of this work and Mr. Hirst for kindly identifying the specimens.

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A SHORT NOTE ON CULTIVATION OF MANGOSTEENS IN THE COURTALLAM HILLS

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Mangosteen is cultivated in the Courtallam hills in the Thekkumalai Estate, Arivikkarai Estate, Udatram and at Five Falls hills.

There are on the whole in the Courtallam hills 76 Mangosteen trees i. e. 50 trees at Thekkumalai, 14 trees at Arivikkarai, 7 at Udatram and 5 at Five Falls hills. It thrives very well in elevations which are from 1,500 to 3,000 feet above sea level. It requires a cool atmosphere. Every year out of these 76 trees about 20,000 fruits are brought down and sold at Courtallam during the season from June to September.

Cultivation. Fruits which are quite ripe are picked up from well-grown trees. Immediately the seed is removed from each fruit and the seed is sown in mud pots of one foot diameter and one foot height the pots being filled with well-rotten cattle manure and fine silt. The contents in the pots are kept moist always. The pot with the seed sown in it is kept at the foot of the hills or in the hill itself where it is cool. After two years, the seedling which would have been 9 inches high by this time is removed and planted in pits of 3 feet cube and spaced 25 feet apart. The planting is generally done just at the commencement of the south west monsoon. In elevated places ranging from a height of 2,000 to 3,000 feet the pit prior to the planting of the seedling is simply filled with fine earth. No manure is applied. As soon as the seedling is planted, fencing is done all round to act as wind break and to protect the young seedling from the sun. When there is no rain, the seedling is watered once in 3 days. Brackish water is harmful to the seedling. Only good water should be used. After 30 years from the time of planting the tree begins to yield. A good tree will yield even 2,000 fruits per year but the average yield per tree is only 250 fruits. At 12 annas per dozen, the average money value of fruits per tree is Rs. 16. About 50 trees can be planted to the acre and the money value per acre from fruits collected is nearly Rs. 800.

On the Courtallam hills, Mangosteen is not cultivated solely. It is cultivated along with tea, coffee, cloves, etc. The contractor gets a profit of nearly one rupee per 100 fruit.

CULTIVATION OF CHILLIES* IN GUNTUR DISTRICT.

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Introductory. Chillies, though classified as a minor crop under condiments and spices, form one of the most valuable crops in the Madras Presidency as it is a daily necessity with both the rich and poor alike. The crop with its wide-spread cultivation and the varied uses in an Indian house-hold leads one to think that it is indigenous, but on the other hand it is an introduced one having its home in South America. It is cultivated as an irrigated crop in the south and as a rain-fed crop in the north of the presidency. Guntur

* *Capsicum fruitescens. 1. Pennisetum typhoideum 2. Panicum miliaceum.*

is one of the important chilli centres in the Circars. The present article is mainly confined to the cultivation of the chilli-crop in the Guntur District.

Soil. The crop is cultivated in black soils. They are heavy with good retentive capacity for moisture. The texture of the soil is fine with an admixture of clay, and sand with lime in small pebbles. The high retentive capacity of the soils, the fairly good rainfall after the transplanting of the chilli-crop, and the industrious nature of the ryot who conserves the soil moisture at every stage, go to the successful cultivation of the crop under rain-fed conditions.

Rotation. The time-honoured rotation of the place is to raise a grain crop of *jonna,* (sorghum) *sajja*[1] or *variga*[2] in the first year which will be followed by chillies and tobacco respectively in the succeeding two years. Chillies following *variga* is considered to be the best as it is the least exhaustive crop of the three mentioned above. The popular belief is that the chilli crop raised year after year in the same field produces gold, meaning thereby that bumper yields can be expected. In order to find out the validity of the statement a plot has been set apart last year by the farm staff of the Agricultural Research Station, Guntur to grow the crop as mentioned above. After the introduction of the groundnut, the ryots are more after that crop as it gives them money at the kist time and hence are sowing that only on a large area unmindful of the principle of rotation.

Preparatory cultivation. With the advent of the South-West Monsoon in June, the ploughing commences. This consists in ploughing the land with a heavy country plough both ways. In so doing the plough furrows are cut at regular distances so that small ridges and furrows are formed for allowing the soil to absorb as much of the rain water as possible. Indirectly the furrows also help drainage and protect the ploughed soil from being washed away in times of heavy rain. The peculiarity of the place is to work all the cultivators at least once diagonally. The principle is a sound one, in that, it ploughs all the uncultivated portions left by country plough. By about the middle of August a third ploughing is given diagonally. This will be followed by one or two more ploughings according to circumstances. In the succeeding ploughings the furrows are cut as close as possible for reducing the soil to a fine tilth. The land gets ready by about the middle of September when furrows two feet apart are run by a country plough along the length of the field. Along the breadth of the field an implement which may be called a Chilli-marker, and which consists of a beam to which blunt wooden tynes are fixed two feet apart, is worked. The seedlings are transplanted at the points of inter-section.

Manuring. Chilli crop being an exhaustive one, is manured direct in large doses. Usually the crop receives 15 to 20 cart-loads of cattle manure. In addition to this 1,500 to 2,000 sheep are penned costing

1. *Pennisetum typhoideum* 2. *Panicum miliaceum.*

Rs. 15 to 20 per acre. Sheep-penning is considered to be the best for the reason that the manure gets incorporated in the soil readily without leaving any decaying vegetable debris for the cock-chafers to lay eggs and the grubs to feed on. Chillies obtained from a sheep-penned plot are believed to get a bright colour. In the tract, the attack of cock-chafer grub is a menace and any remedy suggested to overcome it is a boon to the cultivator. When once the eggs are laid, grubs emerge and attack the transplanted chilli seedlings in the absence of decaying vegetable matter. As a preventive, facilities for laying eggs should not be created.

Nurseries. The foundation of the chilli crop is in the seed-beds and hence they are to be prepared with the utmost care for the production of healthy seedlings. A good stimulus given at the start will overcome all the intervening temporary set back and finally give a good crop. The nurseries are usually raised on a high piece of land near small ponds of water which are locally known as *kuntas*. The *kuntas* are dug generally just by the road-side so as to get the advantage of drainage water. No regular crop is raised over the seed beds but they are used as nurseries of chilli and tobacco year after year.

The portion is ploughed well three or four times and worked with a *gorru** once or twice, to produce tilth. The whole thing is finally levelled up with a *guntaka*‡. Like the main-field, nursery portions also are heavily manured with cattle manure and composted tobacco suckers. The local experience is, that tobacco compost forms an excellent manure for chilli nursery. By about the end of June or beginning of July, chilli seed at a rate of 1½ to 2 *manikas* or 4½ to 6 lbs. is broad-casted over a cent in long narrow beds and covered by working the *gorru* lengthwise and cross-wise. The beds are 20 to 25 yards long and 1 to 1½ yards broad. They are separated by one foot of walking space along the length of the beds. Seedlings from the area of one cent will be sufficient to transplant an acre. A gentle slope is also provided for giving a natural drainage. The interspace between beds come off handy for the purpose of weeding and sprinkling water. If the germination were to be poor or a good germination is followed by drought, hand watering is resorted to.

As an improvement over the local practice, raised seed beds are prepared on the Agricultural Research Station, Guntur. These facilitate good drainage especially in very young stages of the nurseries when the tender seedlings are prone to die in patches due to excess of moisture. The beds are 40 yards by 1½ yards with a gentle slope running from one end of the bed to the other. Well-rotten cattle manure made into fine powder is applied to the beds. Chilli seed at the rate of three to four lbs. per bed is sifted between fingers and covered

* An indigenous tyneharrow. ‡ An indigenous blade-harrow.

by working the *Kanki-danti* * along the length and breadth of the bed. One or two coolies walk over the bed pressing the loose surface with their feet so as to give a firm footing to the tender seedlings. After consolidating the beds, they are watered either with a rosecan or by sprinkling water. Watering the bed is continued daily once or twice till the germination is completed lest the surface should be too cracked exposing the radicles to the hot sun. The seedlings under this system come up vigorously and are healthier than those obtained by the local method.

The seeds commence to germinate on the third day after sowing by sending their radicles into the soil. On the fourth day the beads of hypocotyls are sparsely visible. A greater number of these can be seen on the fifth day. In a very few cases the plumules emerge out on the sixth day but in general the seedlings with their first pair of linear lanceolate cotyledon leaves can be seen on the seventh and eighth days. The nurseries are weeded from time to time and at times the struggling seedlings, are helped by lifting the surface crust.

In about six to seven weeks the seedlings get ready for transplanting. Usually a week or 10 days before the time of transplanting the seedlings are topped on a bright day early in the morning. The idea of topping in the morning is that the healing of the cut ends must take place as quickly as possible during the hot part of the day. The stem of the chilli plant is hollow and if even a light drizzle were to follow the topping, the stem gets rotted and becomes watery. Topping facilitates profuse side branching and the thickening of the main stem. Well-developed chilli seedlings come off easily for distribution at the time of transplanting and remain erect even when the plants are in their full bearing. The nurseries are watered the evening previous to the day on which the seedlings are removed. This saves the tender roots from being severed. The seedlings are tied into bundles and the roots are washed free of soil and kept covered in baskets till the time of planting. Chilli seedlings are transported to long distances in head-loads or by carts. Generally the seedlings are removed in the morning and transplanted in the evening.

Transplanting. This is done in the evening so as to give the seedlings the advantage of cool temperature during the night. The season for planting extends over a month and is generally done in September. In a few cases it may be done as late as the middle of October. In villages which are in the vicinity of towns, commanding good marketting facilities a few ryots transplant the seedlings very early in June. These plots are primarily intended for raising green chillies for the vegetable market.

* A small wooden rake for gathering ear-heads on threshing floor.

In the Guntur District two methods of transplanting are in vogue viz. (a) Transplanting the seedlings with the help of hand watering and (b) *Burada-natu* or planting the seedlings in a miry condition of the soil.

(a) At the time of transplanting, one man goes in advance and makes a small hole with a bamboo stake or a wooden peg at the places of intersections mentioned above. Another man following the first pours water in the holes when two or three women coolies distribute seedlings to the transplanting women. The seedlings are placed in position in the watered holes and are pressed firmly. The number of seedlings per hole varies with the quality of the seedlings. Seedlings raised under local conditions require six to eight per hole while those raised after the Agricultural Research Station fashion need only four seedlings.

(b) *Burada natu* as the name indicates is done immediately after a heavy down-pour and when the soil is very wet. This dispenses with the extra cost of hand-watering at the time of transplanting. Unless a rain is received soon after planting, the seedlings suffer badly as the soil gets hardened by this method. It is always better to wait, water and then transplant the seedlings when the soil is in a fit condition to receive them.

Transplanting and filling in gaps created by the attack of cock-chafer grubs should be done as early as possible for giving the plant sufficient time for vegetative development before they come to flower. In about six to eight days the transplanted seedlings strike new roots and get established.

After cultivation. If the weather conditions are favourable the *D intulu* is worked once or twice both ways. The operation removes weeds and forms surface mulch. The finishing of the above operations synchronises with the general commencement of flowering which will be roughly about a month from the time of planting. At about that time the field is ploughed with a country plough between rows along the length and breadth of the field. By this a sort of root pruning is given to the plants. The plants once again put forth fresh roots and grow vigorously.

Flowering and Setting. Flowering in chillies commences from October. Usually the setting of the first formed flowers is rather poor for the nights will be dewy and the Guntur District experiences heavy rain in October and November. The two phases viz. dew and heavy rain cause a lot of the flower buds and set fruits to shed in the early stages of the crop. By about the end of December or beginning of January cool sea-breeze which is popularly known as *Pairu-gali* (crop-wind) commences to blow during night time. This has a miraculous effect on all dry crops by giving them new vigour and acts as

a tonic on the standing crops. It is during this period that one more flush takes place with the maximum setting.

Harvest. The crop comes to harvest in about 3 to 3½ months from the time of planting. The early formed fruits come to harvest in December. Two more pickings are taken say one in January and the other in February. Since the harvest time comes in summer no difficulty is felt for drying the chillies.

Yield. In good years the crop yields 1 to 1½ candies‡ of dried chillies per acre costing Rs 100 to 150 per candy according to the market fluctuations.

Varieties. The varieties of the locality are 'Bellary', 'Local' and 'Nallapadu'. The fruits of the Bellary variety are broad and long, Locals are light green, medium, broad and short while the Nallapadu chillies are narrow and long with dark green colour. In the local market the Nallapadu chillies fetch Rs. 1 or 2 more per candy than the other two types for the reason that the pedicel along with the calyx adheres firmly to the fruit even after drying. The calyx is loose in the other two varieties and gets separated from the fruit either at the time of picking or drying whereby the seeds which contribute most to the pungency are lost while drying and storing.

Marketing. The dried chillies are pressed in gunnies epecially stitched for the purpose and known as *Boras*. Each *bora* holds half a candy (250 lbs) of dried chillies. These are transported to Guntur and are sold to wholesale dealers.

Export. The major part of the production in the presidency is consumed within India and the balance working roughly to 35 per cent. of the total exports from India, is exported to Ceylon, Strait Settlements, Mauritius, Aden and the United Kingdom.

Uses.* Chillies are put to several uses. They serve as a bite in the green state for the working classes at the time of taking their morning *kanji* †. The green fruits are pickled or cooked fresh with various kinds of Indian dishes. The fruits are used in all its stages of their development viz. tender, green, ripe and dried as well. The dried fruit reduced to powder forms the 'Cayenne' of commerce. Cayenne as a rule is prepared from pungent types of fruits. For all culinary purposes red chillies are preferred as they impart their red colour to the preparations.

In Bengal an extract of the consistence of treacle is regularly prepared and sold. There are various brands of pepper sauce which are produced as decoctions of the fruit in salt or vinegar. 'Tobasco' and 'Paprika' are the special European sauces.

‡ One candy = 500 lbs.

* This para has been largely drawn from the Commercial products of India by Sir George Watt.

† Rice gruel.

As a medicine, capsicum is stomachic, stimulant and astringent and an ingredient in most medicines that are intended to alleviate toothache. As a rubifacient and counter-irritant the bruised fruits, in the form of a poultice, act energetically, and added to mustard are often highly beneficial.

Deterioration. Of late the chilli crop in the district is in a state of decline due to the insecurity of reaping the fruits of the toil and the low prevailing market value for chillies. The low price offered is not only due to the trade fluctuations but also due to the inferior quality of the chillies that are being cultivated. The deterioration in the quality can be attributed to,

1. Introduction of the ground-nut crop.

2. Negligence on the part of the ryots to select and reserve their own seed for next year's sowing.

3. Admixture of superior and inferior types at the time of drying.

(1) It is nearly 10 years since ground-nut crop found its way into the tract. Since then the area under chillies is dwindling and the yields are also becoming low while the area under ground-nut is proportionately increasing. Thrips found on ground-nut leaves have developed a taste for the chilli crop. To their advantage the harvesting time of ground-nut and the transplanting time of chillies coincide. The thrips leave the drying crop of the ground-nut and pass on to the fresh crop of chillies. The damage done by the insect is considerable for their size and in cases of bad attack the whole crop fails to the utter dismay of the cultivator. People have come to realise that this is due to the introduction of ground-nut. Every one waits for the other man to stop cultivating the ground-nut but no one has taken the lead so far.

(2) One bad practice with most of the cultivators of this place is to sell their produce completely without keeping any seed for next year's sowing Especially in chillies the ryots dispose off the good stuff at the high prevailing market rate and for seed purchase the sweepings of the common drying floors at a very low price from depressed classes. Thus the quality gets deteriorated by the wanton negligence of the ryots.

3. At the time of chilli harvest one common drying floor is prepared in every village for purposes of safety. Unless one is very careful there is ample scope for the different types to get mixed while spreading daily for drying.

For some reason or other work on this useful crop was not taken up in this presidency till 1931. Considering the deterioration of the crop and the varied uses of chillies it was felt that work on this essential crop should be taken up for evolving types of chillies which are

superior in yield and quality than those commonly cultivated. With the kind permission of the Cotton Specialist and the Deputy Director of Agriculture, Second circle, the writer has started selection work at the Agricultural Research Station, Guntur, last year.

Pests and Diseases. The major pests of the place are thrips and cock-chafer grubs.

Thrips. (*Scirtothrip dorsalis* Hood). The minute insects attack the crop both in the nursery and in the advanced stages. The damage becomes all the more severe when the plants begin to flower and bear. The eggs are laid in leaf tissues. The nymphs that emerge out of the eggs cause a drain on the leaves and make them curl. The curling of the leaves is known as *Mudatha.* In cases of severe attack the curls increase greatly and the normal development of the plant is arrested. The plants become stunted, leaves get reddened and finally they succumb to the attack. The pest is virulent during dry weather and gets reduced in the rainy season. The attack in the severe form is called *Korivi.*

Cock-chafer grubs. (Melolonthrid beetle) These make their appearance in the main field where the seedlings are transplanted. They burrow into the soil and cut the growing plants just above the root system. As a result of the attack the plants dry up and drop to the ground. When once the grubs cut away the plants at a place they move on to the next and so on. The grubs can easily be spotted through the dying plants They can be removed and destroyed by digging the soil at the place of attack. They are chiefly found in singles and rarely in doubles.

Fruitrot. (*Vermicularia Capsici* Syd.) This is a fungoid disease and appears only to a small extent both in the green and ripe chillies. Fruits turn yellow, and rot and sunken spots with black dots arranged in concentric circles are found. The fruits lose their pungency and become useless.

APPENDIX

Cost of cultivation of the chilli crop under the local system. (Per acre)

		Rs.	A.	P.
Preparatory cultivation.				
Preliminary ploughings ... two (2 pairs & 2 men)	...	2	8	0
Diagonal ploughing ... one (1½ pairs & 1½ men)	...	1	14	0
Final ploughings ... two (4 pairs and 4 men)	...	5	0	0
Marking with country plough and chilli marker (1 pair & 1 man)	...	1	4	0
Manures and manuring.				
Cattle manure 15 cartloads at Re. 1 Per cart-load	...	15	0	0
Sheep penning (1500) at Re. 1 per 100	...	15	0	0
Spreading and covering with country plough (1 pair & 4 men)	...	2	3	0
Seed-bed. (1 cent).				
Ploughing, working *gorru*, covering manure levelling etc. (1½ pairs and 1½ men)	...	1	14	0

Half a cart load of cattle manure	...	0	8	0
Cost of 6 lbs. of chilli seed.	...	1	4	0
Hand watering three times. (1 man)	...	0	8	0
Transplanting.				
Pulling seedlings, washing carrying, watering and transplanting complete. Contract rate at Rs. 3 per acre.	...	3	0	0
After Cultivation.				
Working country plough (1 pair and 1 man)	...	1	4	0
Harvesting				
Collection of chillies 3 times (40 women)	...	7	8	0
Drying and Marketing.				
Charges for 1½ candies	...	1	5	0
Total.	...	60	0	0

CULTIVATION & EXTRACTION OF SUNNHEMP FIBRE

SOME ECONOMIC ASPECTS

By R. CHOCKALINGAM PILLAY, L. Ag,

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This crop is largely cultivated for fibre in Nainaragaram, Tenkasi Taluk and also in Aikudi village, 6 miles from Tenkasi (Travancore area). The area under this crop for fibre in Nainaragaram is about 25 acres. This crop is also grown in Elangi in about 10 acres for fibre.

Season. Sunnhemp for fibre extraction is sown in wet lands between the last week of May and the first week of June.

Nature of soil. It requires rich loamy soil with good drainage facility

Seed-rate. The seed-rate per acre is 56 Madras measures and it costs Rs. 12—8—0.

Preparation of the land. The land intended for sowing sunnhemp is ploughed four times. No manuring is done. After sowing the crop is irrigated once in 10 days. The water stored in tanks is used for irrigation. The crop is not irrigated here from wells. On the whole till the time of harvest, about 9 irrigations are given and it costs Rs. 3—6—0 per acre at 6 annas for each irrigation.

Sowing expenses. For forming beds and sowing one acre three men are required and it costs Rs. 1—8—0.

After cultivation. For watching the crop, Rs. 3 is spent.

Harvesting. The crop is harvested for fibre after 100 to 105 days from date of sowing For harvesting an acre 12 men are required and it costs Rs. 4—8—0 at 6 annas per man. After harvest, the crop is tied into bundles and it is stacked for which 4 coolies are required and it costs Rs. 1—8—0. Then whenever fibre is required, the bundles are

removed from the stack and steeped in water for 5 days. On the 6th day they are washed well, dried in the sun for two or three hours, then with hand they remove the fibre from the stem. The fibre is again dried, made into twists and is kept ready for sale. From steeping till the extraction of fibre, the cooly is paid at 8 annas per *thulam* (14 lbs.) of fibre so extracted and for an acre the yield of fibre is about 50 *thulams* and each *thulam* costs Rs. 2.

Cost of cultivation of Sunnhemp per acre and the money value of fibre per acre.

Preparatory cultivation.	Rs.	A.	P.
Ploughing	4	0	0
Cost of seed per acre	12	8	0
Sowing expenses	1	8	0
Cost of irrigation	3	6	0
After cultivation	3	0	0
Harvesting	4	8	0
Bundling and stacking	1	8	0
Steeping and extracting fibre at 8 annas per *thulam* for 50 *thulams*	25	0	0
	55	6	0
Yield of fibre per acre—50 *thulams* at Rs. 2 per *thulam*.	100	0	0
Profit per acre.	44	10	0

THE PRESENT POSITION OF THE LAC INDUSTRY IN INDIA

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The lac industry in India has been drawing much attention in recent years, firstly on account of the "boom" which the industry enjoyed in the post-war period, when fabulously high prices prevailed and a great demand for lac existed which exporters were unable to meet, and secondly, on account of the crisis through which the industry has been passing during the last few years, owing to trade depression and low prices. Probably, no other industry in India is in such a disorganised state, in respect of cultivation and production as well as of marketing and industrial utilisation; and this, in spite of the fact that India holds the world monopoly in this important raw material. The object of the present article is to point out the importance of encouraging the utilisation of lac within the country itself, in the manufacture of various lac products, for which more technical skill than large capital is necessary, so that a demand for lac within the country may be created and, coupled with an organisation among exporting agencies for the proper regulation and control of the lac

export market, the Indian lac industry may be placed on a stable basis, without having to depend for its outlet wholly on the export-trade, which has resulted in the past in speculation, unhealthy manipulation and violent fluctuations.

Cultivation of Lac. For the information of those not familar with the methods of lac production, it may be stated that lac is a resinous secretion formed by a species of scale insect known as *Tachardia lacca* (of which there seem to be many strains in India, e. g. indica, nagoliensis, sindica, chinensis, mysorensis, communis, cf. Beeson, 1924), which live parasitically on the young branches and twigs of host plants like *Palas* (*Butea frondosa*, Roxb.), *Kusum* (*Schleichera trijuga*, Willd.), *Pipal* (*Ficus religiosa*, L.) *Babul* (*Acacia arabica*. Willd.), *Arhar* (*Cajanus indicus*, Spreng.), *Shorea talura*, *Acacia frasenius* etc., inserting their probosces into the bark of the host plant and absorbing their nutriment from the host, during the completion of their life-cycle, which may take from 17 to 25 weeks (there being thus two or in some cases three lac seasons in the year). The insects continually exude the resinous secretion over their entire bodies, and cover themselves with a cocoon-like shell of lac, which later cohere to form a hard mass over the twigs and branches. The amount of lac secreted by a female is about 100 times that of a male, and the exudation is most active for a period of 8—10 weeks after impregnation by the male, which takes place about 10 weeks after the larval stage. At the end of its cycle, the female dies and from its ovary emerge a swarm of larvae, often amounting to about 1000 per mother insect. For more details regarding the physiology and habits of the lac insect and methods of cultivation, the reader may refer to the memoirs of Stebbing (1908), Imms and Chatterjee (1915), Misra (1923) and Glover (1931).

Even though the lac insect is widely distributed in India, it flourishes best only in certain areas, and it is in these areas that lac is produced in abundance. The lac-belt of India is concentrated in an area comprising Chota Nagpur, Orissa, Berar, the north-eastern half of the Central Provinces, the northern districts of Bengal and parts of the United Provinces, though it tails away in the west to Sind, in the north to the Punjab and in the east to Assam and Burma, the quality of lac produced in the last two areas being comparatively poorer. Small quantities of lac are produced in Mysore and the Hosur Plateau, (Salem District). Outside India, lac is produced in Indo-china, Siam and the Straits Settlements, but the quantities marketed are very small, amounting to about 5% of India's produce. The ecological relationships of the lac insect have not been so far systematically studied. Even in the areas where the lac insect flourishes, the amount of lac secreted by the insects at any given place and in any given season, is a very variable quantity, which is conditioned by a number of factors including (1) the suitability of the host plant, (2) the vitality of the

host plant as determined by conditions of soil, weather, manuring, stage of growth etc., (3) vitality and hardiness of the strain of lac insect; (4) weather conditions, excessive heat or humidity being unfavourable for lac production; (5) absence of the natural enemies of the lac-insect or lac hosts, like fungi, bacteria, parasitic insects, parasitic animals etc., (6) physiological factors like sex-ratio among the insects.

The secretion of the lac insect consists of a mixture of lac-resin, lac-wax, lac-dye and honey-dew. Puran Singh (1911) quotes analyses of crude lac as containing about 65 to 80% of lac resin, about 6 to 10% of the red colouring matter (lac-dye), 4 to 6% of lac-wax, 2 to 5% of vegetable gluten, mixed with accidental impurities such as water (up to 4%) and small quantities of wooden fibre, puparial remains, sand etc.

One interesting feature of the lac industry in India is its highly scattered nature. Even though in favourable years, as much as 743,000 cwts. (or about a million maunds) of lac were exported per annum, several hundreds and thousands of persons (mostly poor peasants and hill-tribes) were responsible for the collection, the individual quota of each producer hardly averaging more than a few seers. Naturally, middle-men play an important role, for good and bad, in the collection and marketing of the produce—a fact which has to be borne in mind in considering the economics of the trade and in devising ways and means for improving the present position.

The lac export trade of India is an old one, but in the early days (1800—1820), large quantities of lac-dye were exported and the preparation of lac-resin (shellac) was considered to be of subsidiary importance. After the advent of coal-tar dyes, however, the demand for lac-dye grew less, so that this commodity went practically off the market after 1890; but, fortunately for India, the demand for shellac showed, after the above date, a rapid and remarkable increase, which reached its height during the post-war period. Now, most of the lac exported from India is in the forms of shellac, only small quantities of inferior forms like grain-lac, garnet-lac, button-lac and stick-lac being sent out; other products like lac-wax and lac-dye do not figure in the export trade.

Manufacture of Shellac. The following gives an outline of the indigenous method of preparation of lac for the export market. The twigs containing the lac secretion (stick-lac) are crushed either by hand or by machinery, sieved and winnowed, to separate the granules from the twigs; the residual dust contains some lac with most of the wax and insect bodies. The granules of lac are washed either by machinery or more usually by treading them under feet with water in tanks, in order to remove the lac-dye, which dissolves out into the water; the highly coloured liquid is decanted off and the dye precipitated by the addition of lime or alum and sold in the form of cakes as

crude 'lac-dye'. The washed granules of lac known as "grain-lac" or "seed-lac", are next worked into shellac by transferring them into long hollow cylinders of strong calico, where they are mixed with a little orpiment (arsenious sulphide) and some low-melting resin like Colophony, and carefully heated over a fire, keeping the bag rotated. The lac oozes out through the calico and is scraped with a spatula, mixed with some water and basted into a homogeneous molten mass. The molten lac is spread on the surface of large stone-ware vessels containing hot water, till it is about a foot square and 1/8 inch thick; at this stage, a skilled workman takes it up, waves it in front of the fire to partially soften it, and at the proper moment, seizes it with his fingers, toes and teeth and stretches it into a thin sheet some 3 ft. square, of almost equal thickness through-out. These sheets broken up, constitute the shellac of commerce.

The colour of shellac varies from dark orange to pale yellow, the latter being preferred. Pure shellac is insoluble in water, but wholly soluble in methylated spirits or ethyl alcohol, besides other organic solvents. The trade requirements of good shellac are chiefly cleanness, as judged by freedom from dirt and insoluble matter or adulterants like rosin, and secondly pale-ness of colour. Shellac is usually sold under the mark "T. N.", though the origin of this mark is not definitely known. "T. N." mark may contain up to 3% of insoluble impurities.

Lac trade of India. Most of the lac exported from India is in the form of "shellac", a comparatively smaller quantity of "seed-lac" and negligible proportions of "button-lac" and "stick-lac", being sent out. The relative quantites of these forms which are exported and the important countries which show a preference to particular forms, is shown in Table I.

Table I. Showing exports of different forms of lac.
(Exports given in thousands of cwts.)

Years.	1925-26	1926-27	1927-28	1928-29	1929-30	1930-31	8 months April -Nov. 1932	Av. price in 1932 per cwt.
								Rs.
Total lac Export ...	539·9	592 0	543·6	743·4	668·9	547·2	284·0	...
Shell lac ...	416·6	424 9	404·4	530·7	498 3	366·4	167·4	33
„ to U. S. A.	226·9	239·5	170·1	237·0	225 7	117·0	46·6	
„ to U. K.	82·7	86·9	117·6	135·3	120·3	95·8	51·1	
Seed la ...	37 4	89 4	54·7	92·4	68·0	106·3	90·9	26.
„ to U. S. A.	32·8	84·0	49·2	82·8	57·0	82·0	66·5	
Button lac ...	21·7	20·6	18·0	24·7	24·2	23·7	11·6	40.
„ to U. K. ...	11·0	11·6	11·6	14·7	14·8	15·8	8·2	
Stick lac ...	22·8	7·2	9·1	26·5	6·4	4·7	3·7	19.

(U. K. = United Kingdom; U. S. A. = United States of America).

The figures show that previous to 1928, about 75% of the exports was in the form of shellac, about 10% in the form of seed-lac and about 10% in the form of button-lac, most of the seed-lac being taken by the U. S. A. and the button-lac by the United Kingdom; but in recent years, however, U. S. A. have shown an increased demand for stick-lac (probably due to its cheapness and its comparatively "raw condition" amenable for any desired treatments), at the cost of their imports of shell-lac, so that now, computed on total exports, shell-lac has fallen to about 60%, seed-lac has risen to 30% and button-lac has fallen to 5%.

Table II gives an idea of the volume of the total lac export trade of India, since 1880 onward, both in regard to quantity and value. The figures include exports of all forms of lac, like shell-lac, seed-lac, button-lac and stick-lac and the remarks noted under Table I regarding the recent preference of U. S. A to seed-lac, and the relative volume of trade in the different forms of lac, may be borne in mind while examining the figures given in the table.

Table II. Total Lac Export Trade of India.

Official year April to March.	Lac Exports in thousands of cwts.			Total value of Exports in lakhs of Rupees.	Average price per cwt. in Rs.
	Total Exports.	To United Kingdom.	To U. S. A.		
1880—81	82·1			56·5	69
1890—91	147·2			87·1	59
1900—01	219 9	73 2	70·9	103·9	47
1902—03	231·6	108·4	82·1	180·8	78
1905—06	263 4	78·5	119·1	310·2	118
1908—09	372·2	93·2	146·8	273 6	74
1910—11	421·6	105 5	161·1	214 3	51
1912—13	428·2	82·2	171·7	211 3	50
1914—15	366·7	89 4	179·7	160·6	43
1916—17	381·4	48·9	240·3	280·3	74
1917—18	322·4	59·5	204·9	377·8	118
1918—19	239 1	67·4	100 2	294·8	124
1919—20	375·7	104·3	228·8	726·4	194
1920—21	308 9	55·1	208·2	758·3	246
1921—22	434·9	86·1	245·2	791·6	182
1922—23	476·0	88·4	246·2	1026 5	216
1923—24	485·7	88.3	245·5	906·3	187
1924—25	428·2	78 9	175·1	755·1	176
1925—26	539 9	96·7	264·9	690·1	128
1926—27	592·0	101·5	327·2	547·2	93
1927—28	543·6	133·3	221·2	693·9	128
1928—29	743·4	156·9	323 3	864·3	116
1929—30	668·9	142·9	286·2	696·7	104
1930—31	547·2	121·4	200·9	313·7	57
1931—32	455·6	105·3	177·5	179·0	39
8 months April—Nov. 1932.	284·0	67·2	113 5	84·2	29

(The figures for 1900 onward are taken from the "Accounts of the Seaborne trade of India", published by the Govt. of India; those for 1880 and 1890 are taken from Stebbing (1908). On account of the wild fluctuations in price, often from month to month, average prices

have been worked out in the last column by dividing total value of exports by total weight of exports per year, as giving a better indication of the variation of prices from year to year).

The following points may be noted from the figures given in the Table:— (1) The lac trade of India showed a healthy and progressive development up to 1914, when prices were maintained constant in spite of production being quadrupled. (2) During the War period, there was a temporary fall in production due to absence of exports to Germany and other belligerent countries, and the control of the trade by the Munitions Board. (3) In the post-war period of 1919—1924, there was a great increase in demand and rush for lac, on account of increased industrial applications, but production though steadily increasing could not meet the demand, with the result that there was a good deal of speculation, attempts at 'cornering' and artificial manipulation of the market, and a soaring of prices to fabulous levels, e. g., Rs. 246 per cwt. in 1920—21, as compared with the present price of Rs. 29 per cwt. in 1932. It was during this period that attempts were made by the Government of India, as will be described later, to improve the cultivation and production of lac, but such increase could only be slow, considering the peculiar circumstances conditioning the production of lac. It was also during this period of high prices that various shellac substitutes were placed on the market by German and American chemists most of them being condensation products of aldehydes with phenols or amines. (4). To a certain extent, these synthetic products established a foot-hold in the market, and their effect is seen in the succeeding period from 1924 to 1929, when lac production increased, but there was no corresponding increase in demand, with the result that prices began gradually to climb down from Rs. 187 per cwt. in 1924 to Rs. 104 in 1929. (5) After 1929, there has been a rapid fall both in demand and prices, the fall synchronising with the general trade depression affecting all commodities. The export has decreased from 743,400 cwts. in 1928—29 to about 455,000 cwts. during 1931—32, and the figures for the current year promise to be still worse; and the price has fallen from Rs. 104 per cwt. in 1929 to below Rs. 30 per cwt. in 1932, a ridiculously low level which it never reached before, even in the earliest days. (6) Another fact that may be noticed is that our best customers are the United Kingdom and the United States of America. In former years, the U. S. A. took twice or more as much lac as the United Kingdom, but during the last few years, her demands have fallen off (probably due to her greater use of synthetic lac substitutes), while the United Kingdom has maintained hers. Germany, France and Belgium are now taking increasing quantities of Indian Lac.

Causes for the present depression. Considering the great importance of lac for the manufacture of several products, whose use is increasing day by day, and the almost monopolist position which India

holds in the marketing of this product, it may seem surprising that the lac trade should have suffered so badly during the present depression, while other less monopolist trades like the Coffee industry of Brazil, the sugar industry of Java and the oil industry of America, have borne the brunt much better. The causes for this anamolous difference are several and among them may be mentioned:— (1) The lack of organization among producers. Only about 5 per cent. or less of the total production is obtained from Government Reserve Forests, while the remaining portion is contributed by a large number of isolated farmers, peasants and hill tribes. The scattered nature of lac cultivation and the part played by middle-men in the trade, has been already referred to. For a cheaper and better method of collection, it has been suggested that co-operative societies may be organised for the purpose, and also that Government might directly purchase the lac from the cultivators at central depots. Ghosh (1929) describes a co-operative organisation backed up by the state, which has been working successfully in the Orissa Feudatory States. Similar attempts to eliminate the middle-men, as far as possible, and establish direct contact between the producer and manufacturer, will serve not merely to cheapen costs but also to improve the quality of lac produced. (2) Another factor which has brought about the deterioration of the lac market, is the wild fluctuations it has been subject to, both in respect of quantities supplied and prices. The crop available in any season cannot be predicted as accurately as in the case of staple products, and as such there is a tendency in western capitals like New York and London to stock immense quantities of lac amounting to 200,000 or 300,000 cwts. at a time, with attendant speculation and manipulation of prices. Lindsay and Harlow (1921) have shown the general inverse relationship that exists between total stocks in London and market prices of lac. This can only be solved by organising an Indian Lac Exchange, say at Calcutta, composed of the lac exporting agencies, who can purchase and stock all available supplies in India and guarantee to the world regular and adequate supplies according to demand. (3) Another adverse factor in Indian lac is the absence of proper grading and standardisation of exported material. Complaints have been received from American and European importers to the effect that even "T. N." quality of lac differs widely in respect of content of rosin and insoluble matter. A more uniform standardisation and a system of grading may help to stabilise prices in accordance with quality. For this, a scientific study of the composition of shellac and improved methods of cultivation, purification and manufacture so as to produce material of uniform quality are necessary. (4). The advent of lac substitutes prepared synthetically in Germany and America, has also played a part in dislodging lac from its natural place in world trade; but these substitutes entered the field in the post-war period when prices mounted high, and it is doubtful whether in these days of low

prices, they can successfully compete with natural lac. Moreover, they cannot be used for all purposes of natural lac, and if cultivation and production be properly organised on an economical basis, there is no doubt that natural lac will again regain its old position. (5). The absence of manufacturing enterprises in India, which could compete with foreign demand in the utilization of lac, has been a serious drawback which has thrown the Indian trade completely at the mercy of the organised markets of the west. Most of the lac now exported is utilized in the manufacture of paints, varnishes, gramaphone records and electrical appliances, and as many of these do not need large capital, though requiring specialised scientific knowledge and high technical skill, it should be possible to develop them in India rapidly in the near future. (6). Proper attention has not been paid so far, to the utilization of the bye-products of the shellac industry, like lac-dye, (useful as dye-stuff and nitrogenous fertiliser), lac-wax (as substitute for bees-wax), lac-dust (or "molemma" arising from the 'sieving' preliminary to the washing of lac and containing fine grains of lac mixed with wax, dye and insect bodies), "Kiri" (a refuse remaining in the bag used for making shellac and button lac and containing lac-resin, lac-wax and animal remains), the wash-liquors or leachings in the crushing of lac etc. A scientific study of these products should enable their economic utilization and help to cheapen the cost of production of shellac. (7). The present trade depression and dislocation of exchange are presumably temporary factors, which however have revealed the weak and unsound basis on which the industry has been developed, and the present period should be taken advantage of to re-establish the industry on a sound basis.

Lac Research in India. The Government of India, as long ago as 1920, realised the importance of safe-guarding and developing the lac industry, and in 1921, appointed the Indian Lac Cess Research Committee, whose function was to conduct a Lac Research Institute and carry on other work with a view to develop and stabilise the lac industry. The Committee has been financed by the proceeds of a small cess on lac exported from India. They established in 1925 the lac Research Institute at Namkum, near Ranchi, under the directorship of Mrs. Dorothy Norris, and the Institute has carried out much useful work by way of a scientific study of the entomological and physiological problems associated with the cultivation and production of lac.

Research on lac in India has been carried on mainly at three centres—at the Forest Institute, Dehra Dun, at the Indian Institute of Science, Bangalore, and more intensively during the last few years at the Lac Research Institute at Namkum. Most of the work done so far, has been entomological and physiological, and has dealt with subjects like the life-history and physiology of the lac insect (Stebbing,

1908; Imms and Chatterjee, 1915; Glover 1931); the suitability of hosts in relation to yield of lac (Sreenivasaya, 1924; Thakur, 1932); influence of factors like soil, climate, manuring, cultural operations etc. on lac hosts and lac yield (Norris et al, 1929), enemies and pests of the lac insect and lac hosts (Imms and Chatterjee, 1915; Glover, 1931); influence of the sex ratio in lac colonies on lac yield (Mahdihassan, 1926) etc. A certain amount of work has lately been done on the improvement of methods of production of lac and on the properties of shellac, C. G. solution and precipitation methods for the separation of shellac, bleaching of lac, regulation of temperature and moisture in the manufacture of shellac, effect of humidity and storage on button-lac, the iodine value of shellac (Aldis, 1932), the physical properties of shellac solutions, the influence of orpiment on the properties of shellac (Rangaswami, 1932) etc. But very little work has been done in India on the industrial applications of lac, though there is doubtless a wide field in India for the manufacture and sale of such lac products.

The steady lowering of the export demand and the very low prices prevailing, which render lac-production a non-paying concern, have demoralised the lac trade and have told heavily on the progress in lac cultivation. Mrs. Norris (1931), who recently made a tour of the lac area in Burma, has reported that in several areas lac cultivation has been given up on account of the present depression in trade. She remarks: "It was quite obvious that owing to the low price obtainable for lac, no interest whatsoever was being taken in its cultivation." Under these conditions, efforts at introducing improved methods of cultivation or production will prove of no immediate avail, and steps should be taken for finding outlets for the lac already being grown, if not by export to foreign countries atleast by industrial utilization in India.

That this aspect of the matter has not been over-looked by the Ranchi workers, is shown by the following extract from the Annual Report of the Indian Lac Research Institute for 1931–32:— "The state of the lac industry has not been satisfactory during the year; in spite of low prices, a steady decrease in exports has to be noted. General trade depression cannot be accepted as the only cause of this, as figures for synthetic resin production for some time past have shown a steadily increasing trade, in most cases at the expense of the natural resin industry..... In recent years, there has been a growing need for research on the technology of shellac and the problems of its marketing and industrial uses..... It was felt, therefore, that the policy of concentrating on the biochemical problems of lac should be modified. Efforts were accordingly made to round off most of the biochemical investigations and to start new problems of more immediate value to the industry. The possibilities of developing new uses for shellac have been given active consideration."

It is gratifying to note that the Imperial Council of Agricultural Research has taken up this aspect of the matter seriously, and has sanctioned funds for deputing three officers to England for training in research in the industrial applications of lac, with special reference to the manufacture of paints and varishes, plastics and electrical appliances. It is well known that America has till very recently been the main importer of Indian lac, and has been utilising most of it in the manufacture of gramaphone records and electrical appliances; and it is satisfactory to note that Government have in view the extension of the scheme to America.

Industrial applications of Lac. The wide scope for the industrial utilization of lac in India will be evident from the following list of the varied uses to which lac has been put, both in India and in the west. The lac industry is amongst the most ancient of the minor industries of India. In the Ain-i-Akbari issued by Akbar in 1590, a note is given on the proportions of lac resin employed in the varnishes used for the wood-work of public buildings. According to Sir George Watt, the Palas tree (*Butea frondosa*), which is a common lac-host in Northern India, is referred to in Atharvaveda as "laksha" and in later Sanskrit literature as "Lakshataru" (lac tree). Misra (1923) quotes other references to lac from ancient Indian literature. It has been already mentioned that before the advent of aniline dyes, the lac-dye was popular and was exported in large quantities to western countries. Among industrial applications in India, Stebbing (1907) mentions the following:—"In the village it is used either as a varnish or colour medium in the production of tables, bed posts, chairs, boxes, platters etc. The silver and copper-smiths employ it in their trades, as do the manufacturers of shields, swords etc., which are varnished over with lac. The material is employed in the manufacture of painted pottery in Bengal, Gonda, Lucknow, Oudh, Peshawar and the Punjab. It is used by jewellers and also in the manufacture of the various classes of bangles worn by the lower classes. Lastly, in the large class of toys of every description made in India, lac is extensively used for colouration purposes, whilst marbles, pens, sealing wax, ink bottles, imitation fruit and flowers are entirely made of it." But it has to be admitted that the quantity of lac at present consumed in India is very small as compared with that exported, and the main impetus for the development of the lac industry has been given by the export demand, in relation to which India has been content to be a supplier of raw material.

In the western countries, besides the large-scale application which lac finds in the manufacture of paints, varnishes, plastics, gramaphone records and electrical appliances, lac is used for the preparation of polishes, gums, cements, sealing wax, lithographic inks, as stiffening material in the manufacture of silk, felt and straw hats, mixed with

mica as insulating material etc. High grade lacs are used for aeroplanes, as inside lining for shells, pianos, furniture, boot finish manufactures, emery wheels, brushes, for lacquering metals and cables, as blinding agent for moulding compositions etc.

Among other uses for shellac, Misra (1923) mentions the following:—"Shellac is used for making milk-churns, shuttles and bobbins; for making grinding stones; for fixing hafts to swords; for the manufacture of micanite, with alternate layers of shellac and mica dust; as a substitute for leather, canvas and shellac being used for the manufacture of shoe-tips; for semaphore signalling and as a filling material for sharpnels; for silvering backs of mirrors; in confectionery as a cover to chocolates; for painting the bottom of ships to prevent the corrosive action of the water on the steel-plates; for encasing cable wires, etc. Bleached shellac is used for making imitation ivory used in the manufacture of billiard balls, backs of brushes, combs, tooth-brushes, poker-chips etc., for all white insulated goods and for the manufacture of paper and leather varnishes." Besides its value as a dye, lac-dye has been found to posses good manurial value when applied to land.

Lindsay and Harlow (1921) quote the following uses for lac in America:—"Abrasives and emery wheels, varnishes and polishes of all descriptions, billiard balls, moulding and picture frames, saws, glazed paper, photographic supplies, musical and optical instruments, watches, leather, oil-less beeswax, guns, oil-cloth, paper-board, lead pencils, paints and glass, tiles, automobiles, sealing wax, hats, rubber tires, chemicals and drugs, phonograph records, pianola rolls, composition materials, electrical apparatus of all sorts, brushes and brooms, horse shoes, buttons, lacquer, foundry supplies, bottle tops, fly-papers, hardware, toys, sports-goods, typewriters, cements and glues, cutlery, mirrors, jewellery, confectionery, engravers' supplies, mint supplies and fire-works." It is estimated that 40 to 50% of the entire demand is on account of gramaphone records that other individual industries cannot claim more than 5 to 8% each of the total consumption.

What with the low prices prevailing now, the advent of synthetic lac on the market, the disorganised condition of international trade and the gloomy prospects ahead, only a vigorous policy of development of the industrial utilization of lac within India, can hope to save the lac industry from the complete demoralisation and annihilation, such as overtook the indigo and other industries in similar situations in the past.

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THE EFFECT OF PICKING DATE OF PARENT SEED ON SOME ECONOMIC CHARACTERS OF THE COTTON PLANT

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Introduction. The variation in the characters of cotton bolls picked at different parts of the season is a phenomenon familiar to cotton breeders. A gradual and pronounced decline in the values of these characters with the advance of the season is also a common experience. It often happens that seed material obtained from a portion of the picking period is used to raise the subsequent year's crop. A knowledge, therefore, of the influence of these parental variations on the characters of the progeny will be useful, particularly in breeding work on Cotton. Some aspects of this study are presented in this paper.

Characters Investigated. Observations on the following characters of cotton bolls are included in the present study:

(1) Ovules (per lock).
(2) Seeds ,, ,,
(3) Fertility index (% of ovules maturing to seeds).
(4) Seed cotton weight, per seed (in m. gms)
(5) Seed weight, per seed ,, ,,
(6) Lint weight, per seed ,, ,,
(7) Ginning percentage.
(8) Lint length per seed (in m. ms.)

Material and Methods. Culture 54, a pure line of *G. indicum*, was grown at the Agricultural Research Station, Nandyal, Kurnool District during the seasons 1929—30 and 1930—31 for purposes of the present study. During the first year of the experiment, 150 plants in one row of the seed multiplication plot of No. 54 Cotton were marked out for purposes of 'selfing' the flowers. Picking of bolls was done at intervals of three days. The culture was 'selfed' during all generations to ensure genetic purity. Healthy material from three-locked bolls (this category being the most common in the selection) of each harvest was examined for the boll characters. All available locks of each picking date were examined in determining the average number of ovules and seeds per lock. For *Kapas*, seed and lint weights, one hundred representative seeds from each group were taken or as many as were available, if less than 100. For the study of lint length, six third position seeds from random locks were used (Ramanatha Ayyar and Jagannatha Rao, 1930) the method of fibre length determination being the one adopted by Hilson (1923). In order to study the effect of these variations on the characters of the progeny, the seeds from alternate lots of material picked at three-day intervals were sown during the

year 1930–31 and the flowers protected from foreign pollen. The seed-cotton obtained from the progeny of each lot was examined for the same set of eight characters.

Results. The appended charts show the variations in the parental characters during the year 1929-30.

The characters, Kapas, seed and lint weights exhibit a gradual fall from the beginning of the season to the end, the respective percentages of decrease being 38, 41 and 41. These observations are mostly in agreement with those of several other workers on cotton. Zaitzev and Gusteva (1928) working on short-stapled Upland cotton observe "that seed-cotton undergoes considerable changes dependent on the age of the cotton plant and that characters such as the weights of seed-cotton, seed and lint per seed decrease with the age". Patel and Mann (1928) working on *Broach deshi* cottons observe: "Generally, there seems to be a marked tendency for both the characters (seed and lint weights) to decrease in the later developed parts of the plant and in the younger parts of branches". Venkatraman (1930) concludes from a study of an *Uppam* (*G. herbaceum*) culture that there is a general tendency for the characters, seed and lint weights, to decline towards the later formed bolls The present writer (1931) has shown a similar decline in the characters, kapas, seed and lint weights, in the case of *Karunganni* cotton (*G. indicum* of Tinnevelly). A perusal of the chart shows that the decline in the case of ginning percentage is not very pronounced. In the investigations of Zaitzev and Gusteva (1928), out-turn of lint decreases with the age of the plant.

As regards lint length also, a fall (11%) is seen to occur in the cotton under study. This is in agreement with Venkatraman's (1930) finding and opposed to that of Zaitzev and Gusteva (1928).

The data pertaining to ovules and seeds per lock do not show a decline from the beginning of the flowering phase towards later stages, but a rise accompanied by a decline in value is seen. Venkatraman (1930) finds no effect on these characters with differences in the flowering period.

In Table 1 are presented the parental and the progeny averages pertaining to the several lots of seed sown during 1930-31 and Table 2 shows the parental and the progeny general means and standard deviations for each character.

As opposed to the wide variability of the parent, it is seen that the progeny characters vary only to a limited extent. Although the parental values chosen for sowing varied from 80—54, 55—37 and 26—17 m. gms. per seed in the case of *Kapas*, seed and lint weights respectively and 7·0—6·2 and 6·8—5·8 ovules and seeds per lock, the variation in the case of the progeny characters is seen to be very low. The corresponding ranges are 72—69, 52—49 and 22—20 m. gms. per seed and 6·5—6·1 ovules and 6·1—5·8 seeds per lock, respectively.

These figures together with the general means and standard deviations cited in Table 2 clearly show that the progeny averages of the characters regress towards the means of the respective parental characters irrespective of the character of the seeds sown. The seasonal influence has modified the means to a slight extent in the case of some characters such as ovules and seeds per lock and seed and lint weights. The seasonal and environmental factors affect the values of any character of the progeny of a pure line in a plus or minus direction, though during any given season some characters are affected in a positive and some in a negative direction while some are not influenced at all.

Conclusion: For purposes of the study of economic characters in breeding work on cotton, it often happens that only a portion of the plant produce usually at the time of heavy picking is gathered for the study of characters and for the subsequent sowings. The result that the picking date of parent seed has no effect on the progeny plant is in the welcome direction and this knowledge can be made use of in purification studies.

Summary. An experiment conducted at the Nandyal Agricultural Research Station during the two seasons 1929—30 and 1930—31 to see the effect of picking date of parent seed on some economic characters of the progeny plants in a pure line of *indicum* Cotton has shown that:

(1) the boll characters like *Kapas*, seed and lint weights distinctly decrease in value as the season advances, while lint length and ginning percentage show only a slight falling off;

(2) in the case of ovules and seeds per lock, the decline is preceded by a rise;

(3) the high or low parental value occuring as a seasonal variation has no influence on the progeny average, and

(4) except as modified by the seasonal and environmental influences surrounding the progeny, the average of the off-spring tends to regress to the mean value of the parent.

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Table 1.

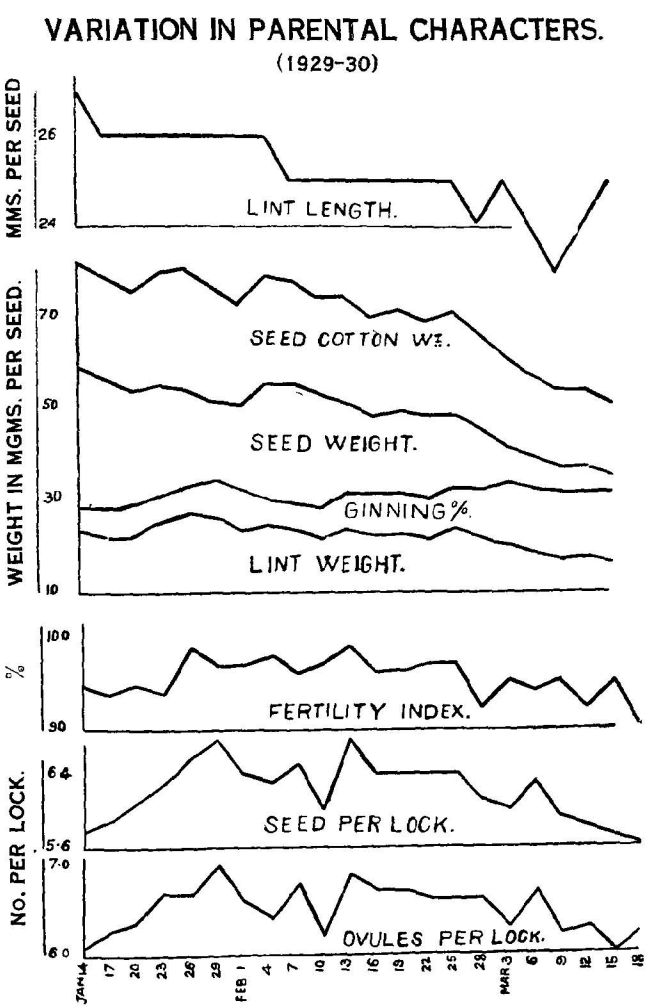
Parental & Progeny Averages.

Parental picking date	Ovules per lock		Seed per lock		Fertility index per cent.		Seed-cotton weight per seed. m. gm.		Seed weight per seed m. gm.		Lint weight per seed. m. gm.		Ginning percentage.		Lint length m. m.	
1930	Parent	Progeny	Parent	Progeny	Parent	Progeny	Parent	Progeny	Parent	Progeny	Parent	Progeny	Parent	Progeny	Parent	Progeny
23/1	6·7	6·3	6·3	5·9	94	94	80	71	55	50	25	21	31	30	26	25
29/1	7·0	6·5	6·8	6 1	97	94	77	71	51	50	26	21	34	30	26	25
4/2	6·4	6·2	6·3	6·0	98	97	79	72	55	50	24	22	30	31	26	25
10/2	6·2	6·1	6·0	5·8	97	95	74	69	53	49	21	20	28	29	25	25
16/2	6·7	6·1	6·4	5·8	96	95	70	70	48	49	22	21	31	30	25	25
22/2	6·6	6 1	6·4	5·9	97	97	69	72	48	51	21	21	31	29	25	25
28/2	6·6	6·1	6·1	5·8	92	95	66	72	45	50	21	22	32	31	24	25
6/3	6·7	6·1	6·3	5·9	94	97	57	72	39	52	18	20	32	28	24	25
12/3	6·3	6·3	5 8	5·9	92	94	54	71	37	50	17	21	31	30	24	25

Table 2.

Parental & Progeny general means & standard deviations.

Character	Parent. 1929—30.			Progeny. 1930—31.		
	Average	Standard deviation	Coeff. of variability	Average	Standard deviation	Coeff. of variability
Ovules per lock	6·50	± 29	4·4	6·24	±0·15	2·4
Seeds per lock	6·20	± ·33	5·4	5·91	±0·14	2·4
Fertility index	95·50	±2·55	2·7	95·50	±1·73	1·9
Seed-Cotton weight	70·26	±9·52	13.6	71·06	±0·90	1·3
Seed weight	48·74	±7·09	14·5	49·94	±0·90	1·8
Lint weight	21·69	±3·03	14·0	21·06	±0·90	4·3
Ginning per cent.	30·81	±1·69	5·5	29·78	±1·00	3·3
Lint length	25·26	±0·90	3·6	25·00	Nil.	Nil.


VARIATION IN PARENTAL CHARACTERS.
(1929-30)
MMS. PER SEED
26
24
LINT LENGTH.
WEIGHT IN MGMS. PER SEED.
70
50
30
10
SEED COTTON WT.
SEED WEIGHT.
GINNING %.
LINT WEIGHT.
%
100
90
FERTILITY INDEX.
NO. PER LOCK.
6·4
5·6
SEED PER LOCK.
7·0
6·0
OVULES PER LOCK.
JAN 14
17
20
23
26
29
FEB 1
4
7
10
13
16
19
22
25
28
MAR 3
6
9
12
15
18
PICKING DATES

INDIAN CANES IN SOUTH AFRICA

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On my way down the East-coast of Africa I visited the experiment station of the South African Sugar Association at Mount Edgecombe, and I thus had an opportunity of learning something about the research work being done on sugarcane in the Union In the course of my stay at Durban I also saw, in a general way, the agricultural conditions prevailing in the main sugar-cane growing area in Natal.

It will be remembered that the Uba cane, which is the only variety grown on any scale in South Africa, was imported some years ago from Northern India, and my visit was of interest in providing an opportunity of seeing the conditions under which this Indian cane has become acclimatised and grown almost to the exclusion of all others. Recently a number of Coimbatore seedlings, which are closely related to the class of cane to which Uba belongs, have been under trial, one of which has already been released for cultivation, and although it is rather early to say how far these seedlings are likely to replace Uba, there is every reason to believe that the work at Coimbatore will be of great value to the industry in South Africa.

In Natal, the hot weather extends from September to May, when the atmospheric temperature rises up to 100 degrees in the shade, but generally the maximum does not exceed 95 degrees. The annual normal mean temperature is about 67 degrees, and in July ground frosts are not uncommon. The rainfall varies from 35 to 50 inches, about 65 to 70 per cent. of which falls between the months of August and May. The rainfall therefore is well distributed, and more so than in South India.

The sugarcane belt extends approximately from Port Shepstone to Umfolosi, a distance of about 250 miles. On the South coast, in the neighbourhood of Durban, sugarcane is cultivated on undulating hills in marked contrast to South India, and such conditions may be said to be fairly typical. Many types of soil appear to be represented, but deep sandy loams preponderate. Although the surface geology of Natal generally is formed by shales, conglomerates, and sandstone, there is an almost universal distribution of volcanic rock, the disintegration of which has resulted in enriching what would otherwise be a poor soil.

To those who desire more detailed information regarding climatic conditions in the area with which we are concerned, and detailed information about the growing of sugarcane and the manufacture of sugar, the South African Sugar Industry Year Book will be found useful. But this note will be confined to a few observations which may be of interest to those who are studying the economics of sugarcane cultivation, particularly in relation to the class of cane represented by the

new Coimbatore thin seedlings. The cultivation of what may be termed "a poor man's cane" has received increasing attention in recent years in the I Circle * which has necessitated somewhat drastic changes in methods of cultivation, manuring, and irrigation. Although conditions in Natal are very different to those prevailing on the Eastcoast of the Madras Presidency, experience in South Africa, where the crop is grown generally without irrigation, may be of assistance in evolving methods of cultivation suitable for South Indian conditions where thin canes are grown.

In Natal under unirrigated conditions, except on land that recieves seepage, sugarcane takes 20 to 24 months to mature, whereas on the heavier class of soil under irrigation the period is only 8 to 12 months. In the former case the crop stands through a period of light rainfall in June, July, and August amounting on an average to about 3·5 inches, and during the latter month the mean daily temperature is about 60 degrees. These local conditions cause growth to be stationary, and a comparatively dry period at a time when atmospheric temperatures drop, does not cause flowering or any other indication of ripening.

The distance of planting is usually four and a half to five feet, and owing to the long period no difficulty is experienced in providing immature cane for seed purposes. Setts are left untrashed, and are usually nine to fifteen inches in length, and although ants are a pest, this practice does not appear to cause appreciable loss. The condition of the canes generally, as might be expected, is superior to those grown under typical wet-land conditions in S. India.

Although deep ploughing up to twelve inches is generally considered preferable to more shallow tillage, large areas are planted in less depth of tilth. Furrows are opened in the usual manner by the use of double mouldboard ploughs. There appears to be some doubt about the effect of depth of planting on germination and the vigour of the plants, and I learnt that setts are put down at a depth varying from one to six inches. The wide variation in types of soil to which I have referred is doubtless one cause of these differences. Light multiple-tined single row cultivators are in general use, and weeding by hand is done in the lines.

It is usual to take from four to six crops in succession, but no general rule appears to be recognised. On the bigger estates when the tonnage falls below a given figure, the land is ploughed up and put under a green manure crop for a period of one year, and subsequently again planted to cane.

In view of the relatively small number of live stock, supplies of manure, as in parts of S. India, are scanty. Commercial or artificial manure is in almost general use, and is applied in the form of complete

* Ganjam, Vizagapatam, East Godavari and West Godavari Districts

fertiliser at the rate of from 400 to 800 lbs. per acre. On the experiment station at Mt Edgecombe a normal dressing consists of 480 lbs. super, 120 lbs. ammonium sulphate and 60 lbs. potassium chloride, per acre.

Under estate conditions an average yield of 20 to 25 tons of stripped cane per acre is usual, although under the best conditions over 30 tons may be obtained. The juice analyses out at about 13 per cent. sucrose.

At the present time a number of Coimbatore seedlings are under comparison with Uba under unirrigated conditions In 1930-31, Co 205 and Co 210 were both found to be superior to Uba in yield of sugar, the former by 18 and the latter by 14 per cent. The thicker seedlings, however, show more promise, and a recently harvested crop of Co 281 gave a difference in yield of sugar over Uba amounting to 26·6 per cent. Co 213, up to date, has not proved superior to Uba either in tonnage of cane or yield of sugar. In a recent quantitative trial of a plant crop Co 290 gave 33 tons of stripped cane per acre, or 20 per cent over Uba and 31 per cent more sugar.

It will be seen that good yields have been obtained and that only 25 lbs. nitrogen per acre is used compared with about 100 lbs. under our conditions. It may be noted here that as a result of experience on the station at Anakapalli, the quantity of manure applied for some Coimbatore seedlings has been progressively reduced, and unirrigated crops of Co 213 on wet-land have yielded up to 30 tons of cane per acre In one case the quantity of nitrogen applied per acre was no more than 28 lbs.

I saw a number of crops of Coimbatore seedlings including Co. 290. At Anakapalli Co. 290 and Co. 281 on wet land both tend to grow tall and to develop a spreading habit even under restricted irrigation, but in Natal these canes grow to a height of about 10 feet only and show no inferior habit. This may be attributed to slow growth, absence of irrigation, light manuring, and to a less extent wide spacing.

A series of inoculation experiments to test the susceptibility of certain of the Coimbatore seedlings to mosaic disease are in progress, and although incomplete, useful information has already been obtained. The preliminary tests at the Herbarium in Durban are being continued under field conditions. Over a period of three years Co. 290 has proved to be almost entirely immune, although Co 281 and Co. 314, and particularly the latter, have been found to be susceptible.

Experience at Mount Edgecombe shows that none of the P. O. J. canes that have hitherto been tried, which include P. O. J. 2714, P. O. J. 2725, P. O. J. 2727 and P. O. J. 2878, are suitable for unirrigated conditions.

Notes and Comments.

New Year Honour to Principal Tadulingam. We have very great pleasure in offering our hearty congratulations to our College Principal Mr. C. Tadulinga Mudaliar on the title of 'Rao Bahadur' conferred on him by the Government. As the seniormost among the officers at the Institute and as one of the few who were attached to the department when it was re-organised in the early years of the century by pioneers like Dr. Barber and Mr. Benson, Mr. Mudaliar had earned a claim to such honours long ago. We are, however, glad to note that the Government has been pleased to recognise his claims and honour him now. We also extend to the "Rao Bahadur" as the President of our Union our special congratulations and good wishes and pray to God that he may be spared to live for many more years and receive further honours.

Lac Research in India. Most of our readers are, perhaps, aware, that the great bulk of the world's demand for 'shellac' (the manufactured product from 'lac' secreted by the lac insect) is supplied by India and that our country practically holds the monopoly in the production of this commodity. But for the past ten or twelve years the industry has not been thriving quite satisfactorily due to various factors. With the idea of restoring its old position and placing it on a better foundation, research work on the different aspects of the industry has been conducted in different institutes like the Forest Research Institute, Dehra Dun, the Indian Institute of Science, Bangalore, and especially in the Indian Lac Research Institute, Namkum, Ranchi (Behar and Orissa). From the latest report of the Director of the Ranchi Institute it is found that the state of the industry has not been very encouraging during the year and that as in other industries shellac is being threatened by synthetic products thus necessitating the discovery of and developing new uses for shellac and carrying on other experiments to combat this menace. In the opinion of the Director, action has to be urgently taken "if the lac industry is to regain some of its former position in the world's markets". We understand that the Indian Lac Cess Committee which took over control of the activities of the Ranchi Indian Lac Association last year is now considering ways and means to revive the industry and this is evidenced by the fact that they have recently advertised for young men with high qualifications in Physics and Chemistry to offer themselves as research scholars for special training in Europe on decent scholarships in the different aspects of the industry. We hope such activities will help to give fresh life to this ancient industry and restore the product to its original place in the world's markets. We would invite the attention of our readers to a short and interesting paper on this subject appearing elsewhere in this issue.

Agriculture at the Indian Science Congress. Out of a total of 73 papers read before the Agricultural section of the Patna Science Congress the following papers refer to subjects connected with or worked out in S. India.

1. "Determination of Nitrogen in soil" by Mr. A. Srinivasan, Bangalore. 2. "Lodging of straw and its inheritance in rice" by Messrs. K Ramiah and S. Dharmalingam, Coimbatore. 3. "Chromosome studies in some species of Crotalaria" by Messrs. S. Ramanujam, N. Parthasarathy and K. Ramiah, Coimbatore. 4. "A biochemical study of the *ragi* plant as affected by mineral treatments and seasonal factors" by Messrs. S. Rajagopal and A. V. Varadaraja Ayyangar, Bangalore. 5. "The plate method of counting soil population" by Mr. S. Rajagopal, Bangalore. 6. "Experiments on the root-gall nematode in S. India" by Mr. P. N. Krishna Ayyar, Coimbatore. 7. "Insect pests noted on oranges in Northern Circars" by Mr. V. Margabandhu, Coimbatore 8. "Some important insect problems connected with the cultivation of rice in S. India" by Dr. T. V. Ramakrishna Ayyar, Coimbatore. 9. "Kole cultivation of paddy in Cochin with special reference to insect pests" by Mr. C. S. Venkatasubban, Cochin. 10. "Hymenopterous parasites of economic importance in S. India" by Dr. T. V. Ramakrishna Ayyar and Mr. V. Margabandhu, Coimbatore. 11. "Cold storage of mangoes" by Messrs. B. N. Banerjee and G. Ramakrishna, Rao, Bangalore.

The President of the Agricultural Section is Mr. Afzal Hussain, M. A., M. Sc, Government Entomologist, Punjab.

Some New Features Proposed for our Journal. With the beginning of this—the twenty-first volume of our journal—it is the intention of the editorial board, with the co-operation of our contributors and well-wishers to add a new feature to the journal and thereby increase its usefulness to our readers, especially to those interested in agricultural matters. It is our idea to publish periodical information regarding crop and trade returns and thereby keep ourselves up-to-date on matters regarding agricultural products and their disposal. It is hoped that this addition will, in the long run, help those interested in agricultural and trade statistics and make our journal a useful reference medium. Contributions, suggestions and criticisms are invited from our readers.

Health of Dr. C. A. Barber. We are very much pained to peruse a letter written by Mrs. Barber from England to one of her correspondents at the Agricultural College giving information about the present unfortunate condition of Dr. C. A. Barber. Dr. Barber who was for several years Government Botanist in Madras Service and later Sugar Cane Expert to the Government of India and who is now 73 years old, has been in failing health for the past two years; and though

he rallied a little, he is now reported to be completely bed-ridden and helpless. To all friends of Dr. Barber and to those who have had the privilege of working with and knowing him the letter will be found very pathetic and moving. We can only convey our sincere sympathies to Mrs. Barber and her children and pray to God to give them sufficient fortitude and patience during this unfortunate period of trial and suffering.

All-India Poultry Exhibition and Conference. We understand that the 20th All-India Poultry Exhibition will be held in the Qudsia Gardens, Delhi, on the 28th, 29th and 30th January, under the patronage of His Excellency Lord Willingdon, Viceroy of India, His Excellency the Governor of Bengal, H. E. the Governor of the United Provinces and H H. the Maharajadhiraj of Patiala. The second All-India Poultry Conference will also be held in connection with this exhibition on the 27th and 28th instant. His Excellency the Viceroy will preside at the prize distribution. Lady Willingdon has accepted an invitation to visit the show. Entries will close on the 15th instant and intending exhibitors have been requested to get the particulars from the Honorary Secretary, Indian Poultry Club, 2, Peel Road, Lucknow.

Gleanings.

The Enzyme theory of Virus Disease. Evidence that the so-called "Virus diseases" of plants and animals are caused by a non-living chemical substance that can attach itself to living matter, rather than by ultra-tiny living organisms, is claimed, as the result of experiments on tobacco plants performed by Dr. Carl G. Vinson of the University of Missouri. Dr. Vinson's work apparently supports the belief, held on theoretical grounds by many physiologists and pathologists during the past 30 years, that the causes of these mysterious diseases of plants and animals are compounds analogous to enzymes, the digestive and respiratory "ferments" of normal organisms, but malefic rather than beneficient in their effects. Virus diseases afflict almost all plants. Their symptoms are such things as leaf mosaic, leaf curl and Yellows. Animals and man also have virus diseases; among them are small-pox, infantile paralysis and hog cholera. The causal agents of these diseases have never been positively identified as visible, and whatever they are, they will pass through the pores of a stone filter and come out on the other side still virulent, which is something that ordinary disease germs, visible under a microscope, could not do. Dr. Vinson's method of isolating the virus of tobacco mosaic was worked out during four years he spent at the Boyce Thompson Institute for Plant Research at Yonkers, N. Y., prior to coming to the University of Missouri. The first step was to freeze a quantity of mosaic infected tobacco plants. Then the dead plants were put under heavy pressure, squeezing out their juice. Samples of this juice, filtered free of large particles, caused leaf mosaic when injected into healthy plants. The virus was thus evidently in the juice. The next step was to separate the juice into its various components and find which of these could cause the disease and which could not. This Dr. Vinson did by adding acetone to the cold juice. This brought down a solid precipitate. The liquid left after precipitation could no longer cause the disease, but a

solution of the precipitate could do so. The virus was thus evidently in the precipitate. Dr. Vinson's further work has been in the greater refinement and purification of the precipitate, each step obtaining a more concentrated form of the virus. He states that analyses indicate the chemical make-up to be that of a protein or of some compound very similar to proteins. It is regarded as probable, however, that not the whole protein molecule is the real mischief maker, but some relatively simple group of atoms that is attached to other protein molecules *in healthy protoplasm, thus providing a mechanism of infection and* propagation. Dr. Vinson's work will of course be regarded agnostically by many of his colleagues, and all the results will be held provisional until the experiments are repeated and checked by other researchers. But if these checks confirm his theory, and extend it to apply to other virus diseases of both plants and animals, the effects of this research may well be very far reaching. They will give a new physiological picture of many diseases that have hitherto baffled understanding, and perhaps pave the way for more effectual warfare against them. (*Science News* in '*Science*', September 16, 1932).

Germany Producing Sugar From Waste Wood. A new use for waste wood from forests is reported by the Deutsche Bergin Actien Gesellscheft fur Kohle and Esdoelchemie, at Rheinan, near Mannheim. The company has departed from its former field of activity, the hydrogenation of coal and oil, and is now occupied with the producing of sugar from waste wood in forests. The technical side had been considered solved for some time, both as regards the manufacture of fodder products and fodder mixtures, and the further refining of the "wood sugar" to *grape sugar or dextro glucose. The economic success of the process* also appeared to be assured in itself, but further developments depended upon a favourable wood price, upon a successful public introduction of the new and cheap fodder, and finally the financing of extension of the Rheinan plant, or the erection of new large factories elsewhere. The "wood sugar" produced by the process of the company is regarded as a cheap basic material for the production of yeast alcohol, and other products of fermentation. (*Chemistry and Industry*, 1932, Vol. 51. P. 727)

Salt in Water–Quantities tolerated by Horses, Cattle and Sheep. (1) Horses will thrive on water containing 400 grains common salt and 550 grains total solids per gallon, and, provided they are not worked, may be sustained on water containing up to 638 grains salt and 950 grains total solids. Water containing as much as 798 grains salt and 1,022 grains total solids has been used for a period of three months without ill-effects. (2) Cattle will thrive on water containing 800 *grains common salt and 1,000 grains total solids, but when the concentration* reaches 970 grains salt and 1,300 grains total solids they are injuriously affected. (3) Sheep will thrive on water containing 800 grains common salt and 1000 grains total solids, and will do well even up to 1,197 grains salt and 1,350 grains total solids. When the concentration reaches 1,277 grains common salt and 1,868 grains total solids the sheep are injuriously affected. (R. H. F. Macindoe in the *Journal of the Dept. of Agriculture, South Australia*, November 1932).

Another Vitamin? At a meeting of the Biochemical Society on June 11th, L. W. Mapson read a paper entitled "Evidence of a Dietary Principle Stimulating General Growth and Lactation". He showed that a substance is present in fresh ox-liver which stimulates the growth of rats maintained on a full synthetic diet to approximately twice the normal rate of the control animals. The lactation of the females was also stimulated. This growth promoting principle is distinct from the Knans accessary food factors. Whether the substance active in promoting the growth rate is identical with that stimulating lactation remains to be determined. A peculiar point is that the growth response has been transmitted

from parent to offspring by the feeding of liver to the parents, the stimulation of growth being greater under such conditions than where the liver is fed directly to young animals—(*Chemistry and Industry*, 1932, Vol. 51, p. 535)

Indian Pulp and Paper Industries. (Extract from the Report of the Indian Tariff Board on the grant of Protection to the Paper and Paper Pulp Industries.)

The total consumption of paper (including pasteboard) in India increased from 111,963 tons in 1924—25 to 175,627 tons in 1929—30, but fell to 154,277 tons in 1930—31, and of these quantities the Indian mills have steadily supplied from 22 to 24 percent. The consumption of paper of protected classes increased from 43,331 tons in 1924—25 to 53,584 tons in 1929—30 but fell to 49,046 tons in 1930—31, and of this paper the Indian mills supplied from 53 to 71 percent. There are now nine paper mills working in India, the total output of which in 1930-31 amounted to nearly 40,000 tons. There has been a large increase in the use of imported wood pulp by the Indian mills and this is attributed partly to the fact that the financial aid proposed by the Tariff Board for the development of bamboo was not granted and partly to the fall in the price of wood pulp. It has led to an annual expenditure of about Rs. 20 lakhs on Indian materials and labour which would otherwise have been spent on imported paper. The additional market for paper in India which the Indian mills may expect to capture is about 20,000 tons per annum, apart from any normal increase in consumption. Bamboo is available in India and Burma in sufficient quantities not only to supply the entire Indian demand for pulp, but also to develop a large export trade. Air-dry bamboo which cost about Rs. 55 per ton in 1924—25 is now obtainable at Rs. 38—40 or even less. Considerable progress has been made regarding the mechanical treatment of the bamboos and further experiments are being undertaken. The digestion of the material is effected by the acid sulphite process at the India Paper Pulp Company's mill at Naihati and by the alkali process (usually with fractional digestion) at the other mills. The bamboo paper has proved to be of satisfactory quality for most purposes. The future of the Indian paper industry depends on the exploitation and development of bamboo and it is anticipated that paper made from it will eventually be able to dispense with protection; grass also occupies a recognised place in the industry, and should be subject to the same proposals for assistance. The withdrawal of the protective duty at the present time would lead to the disappearance of bamboo as a paper-making material and this would be a national loss; it would cripple the resources of the Indian mills and endanger their existence. Direct encouragement for the development of bamboo could most suitably be afforded by the imposition of a duty on imported pulp, which should be fixed at Rs. 45 per ton. The duty on paper should be continued at the present rate of Rs. 140 per ton or one anna per lb. These duties should remain in force for a period of seven years. The duty on paper should be applied to printing and writing papers which are now liable to the protective duty, and no alteration should be made in the existing Tariff entries regarding newsprint and packing paper. Although some progress has been made towards the Indianisation of staff and with apprenticeship schemes, the principal mills have not made sufficient effort to attract and offer employment to Indians, especially in the paper-making section of their works, and this matter should receive early attention. Steps should be taken to develop the Paper Pulp Section of the Forest Research Institute at Dehra Dun, with the object of co-ordinating the experimental work carried out by the mills. (*Bulletin of the Imperial Institute* Vol 30, page 199).

ABSTRACTS

Silage Investigations at Bangalore.—Effect of the stage of Maturity on the Ensilage of Jowar. T. S. Krishnan (*Agriculture and Live-Stock in India*. 1932, Vol. 2, Part 5, pp. 507—514). In the previous two papers (1930: *Memoirs Dept. Agr. India*, Chem. Ser. Vol. 10, No. 10 and 1931: *Ind. Jour. Vet. Sci and Animal Husb.* Vol. 1, pp 259—282) the author has reported the chemical changes occurring during the ensilage of *jowar* (*Sorghum vulgare*). In the present paper he examines the influence of the stage of maturity of *jowar* on the quality of silage obtained, and on the nature of chemical changes taking place. Jowar was ensiled at three different stages of maturity:— (1) Immature, ie, when all the leaves had appeared but the plant had just not flowered, (2) Prime, ie, when the grains in the earheads were just hardening, and (3) Straw stage, ie, the dead ripe residue left after the earheads had been removed. It was found that:— (1) Ensilage at the immature stage produced a silage of good colour and texture, but of an unpleasant acid smell, due to the butyric acid; it was "acid" or "sour" silage. A large proportion of the protein (44·2% of true protein) was lost; there was a marked decrease in the amino-acid content (from 2·86% to 0·99% on dry matter) but there was an appreciable increase in the volatile bases from 0·12% to 6·10%, and in amides, which increased by 88% on the original amount. Organic acids also show marked increase from 2·67% to 7·26%, the whole of it being volatile acids. There is marked loss in inorganic constituents (about 10% loss on the original amount), mainly phosphorus and calcium. (2) Ensilage at the prime stage yielded a silage of good colour and texture, which can be called "acid brown silage", and had a very pleasant smell and was eaten by cattle with great relish. In regard to chemical changes, the losses were the least at the "prime" stage; only 28·4% of the true proteins were lost, and the amino acid content actually showed an increase from 1·58% to 2·13%. The increase in volatile bases was from 0·24% to 1·26% and the amides increased by 77·1% on the original amount. The organic acids increased from 1·60% to 4·67%; 6·9% of the crude fibre was lost and the loss in inorganic constituents was inappreciable. (3) Ensilage at the "Straw stage' gave a material of a very fine texture and pleasant pungent acidic smell; it was readily eaten by stock and can be named "acid brown" silage. In some respects, the chemical changes at this stage resembled those at the "immature" stage, there being a slight loss in amino acids (from 1·06% to 0·78%), increase of organic acids (from 0·24% to 4·06%) and appreciable loss of inorganic constituents (about 10% on the original amount) chiefly phosphoric acid, but in other respects, this silage is superior to that obtained from "immature" jowar. There is only a small loss of true protein (12·7% on the original amount) and a slight increase in volatile bases (from 0·12% to 0·35%, while the proportion of non-volatile acids is much higher (1·70%). The author therefore concludes that the immature plant (stage I) is quite unsuitable for silage and that the prime stage (stage II) produces the best silage with the least loss. (C. N.)

2. Watering and Spacing Experiments with Egyptian Cotton. Templeton J. (*Bull No. 112 of The Ministry of Agriculture, Egypt*). The general practice in cotton cultivation in Egypt to-day is to stop watering for a period of from 6 to 8 weeks after sowing which is generally done in March—April. The explanation for this practice lies in the fact that in the early days of cotton cultivation in Egypt, water shortage was liable to occur during the hot months of June and July, i.e., before the arrival of the Nile flood, and by stopping the water supply shortly after sowing, the seedlings were forced to develop deep root systems which could draw on the sub-soil water in the succeeding dry period. The harmful effect of this practice lay in that a good percentage of the early flower buds were shed and lost. This loss was in former years to some extent

made up by allowing the fruiting season to extend up to December, but recently with the advent of the Pink boll worm, all later pickings are destroyed by the pest and thus the growing season has been curtailed. The author observes that there is no justification now for the artificial stopping of water supply in the early period, with attendant modification of the root systems, since the danger of water shortage in June and July has long ago disappeared, owing to the great developments in irrigation in Egypt by construction of dams and barrages across the Nile. As the author points out, the continuance of the old practice, long after the necessity for it has disappeared, has resulted in an artificial decrease in yields; and in view of the advent of the Pink boll-worm in November and December, efforts should be made to bring out the crop earlier. With this view the author has carried out various watering and spacing experiments, which show that by watering three weeks after sowing, combined with heavy watering at the beginning of July, the crop is earlier and increased yields are obtained. Spacing experiments show that with closer spacing the crop matured earlier and the optimum spacing was found to be 35 c. m. between the holes and 65 c. m. between the ridges as opposed to 45 × 75 c. m. in pre-bollworm days. (C. N.)

3. Production of Papain from the fruit of the Papaya Tree. *Carica Papaya.* By the Principal, Harcourt Butler Technological Institute (*Agriculture and Livestock in India*, 1932, Vol. 2, Part v. pp 47—489). As the author points out, there is good scope for increase in the area under papaya cultivation in India, especially near towns, both for sale of the fruit and for the manufacture of papain, a medicinal preparation rich in enzymes, chiefly proteolytic. Papain can be prepared in a simple manner by cutting the outer skin of the fruit before it is fully ripe when a white milky fluid exudes, which is collected and dried to a white non-crystalline powder, which is commonly sold as papain. The fruits are "lanced" at intervals till no further papain exudes, and then allowed to ripen for sale; thus the same fruits can be used both for sale as well as for the preparation of papain, though the removal of papain lowers the market value of the fruits A considerable industry in the production of papain exists in Ceylon. In 1927 and 1928, the value of this material exported from Ceylon was Rs 6,71,000 and Rs. 5,33,000 respectively; the average price of export in the years 1925—28 was in the neighbourhood of Rs. 8 per pound The cultivation of papaya on a commercial scale was tried in the grounds belonging to the Harcourt Butler Technological Institute, Cawnpore, and the author gives details regarding the laying out of a plantation, extraction and treatment of the juice, methods for grading the product and costs of production. Though the actual costs incurred were higher, due to experimental side investigations, the author estimates that on a ten acre plot devoted to papaya cultivation a net profit of Rs. 5000 can be had after the second year from date of sowing; in the first two years the total expense of bringing the plantation to bearing viz. about Rs. 7500 is recouped by an income of Rs. 8,700, leaving a net profit of Rs. 1200 for the first two years. (C. N.)

4. Ready Reckoner Tables in Animal Nutrition. By A. K. B. Cazi (*Agriculture and Livestock in India*, 1932, Vol. 2, part 5, pp 490–498). In the words of the author, "this article which embodies four tables, is intended to enable practical farmers to read off at a glance the various nutritional requirements of animals of different weights and under different states and degree of production with the exception, of course, of those that are still at the suckling age" Table I gives the starch equivalents and digestible proteins for adult dairy animals of different weights, yielding different quantities of milk; a correction for excess of fat in milk above 5% is appended. Table II gives the starch equivalents and digestible protein of working bullocks of different body weights, working for different hours per day on light or medium work (such as carting, harrowing, hoeing or interculturing, ploughing on light sandy soils etc.). Working bullocks

on heavy work (such as ploughing on medium or heavy soils or deep ploughing in the case of light soils, trotting, lifting water etc.) are recommended to be given 10% more nutrients than for light work. Table III gives the nutritional requirements of young growing animals at different ages, for maintenance plus growth at normal rates. Table IV gives the starch equivalent and digestible protein, the ratio of S. E. to D. P. and price per unit S. E. for various farm food stuffs like green fodders, straws, husks, brans, silage, grains, oil seeds, oil cakes, animal products etc. The formulae from which the figures given in tables I to III have been calculated are not given. Except for table IV, whose figures are averages of values given by Kellner, the authority for the figures given in other tables is not quoted; it is not stated whether the figures represent experimental results obtained under Indian conditions with Indian cattle, which are known to require less digestible protein than western breeds. (C. N.)

Review.

Tanjore Rice for Ceylon. A Special Report by Mr. N. S. Kolandaiswamy Pillai, Dy. Director of Agriculture, Trichinopoly:—Though a very large area, nearly a million acres, under rice is concentrated in the Tanjore district, the total output is only 6,31,791 tons of which 1,62,682 tons or nearly 25% is available for export from the district. Of this quantity, about 40% is exported to Ceylon, the rest finding a market in parts of Malabar and the Tamil districts. Although there is a general impression that Burma has captured the Ceylon rice market from Tanjore, the report mentions that it is hardly the fact in as much as the quantity of Tanjore rice exported to Ceylon is now more than double of what it was five years ago. The slump in the Tanjore rice trade is therefore due, according to the report, to three reasons: (1) general fall in prices, (2) rice from Burma and the northern districts of our own province, Godavari and Kistna, replacing Tanjore rice in the markets of the southern districts, and (3) possible extension of rice areas with a definite tendency for over-production.

Ceylon produces annually 3,63,000 tons of rice, about two-fifths of her requirements, and imports from Burma nearly as much as she produces, the balance being met by imports from Tanjore, Tinnevelly etc. There is a difference of nearly Rs. 3 in the price per bag of 160 lb. in the Ceylon market between the best Burma rice, Milchard no. 1, and the Tanjore *Sivumani* rice. Though the Tanjore rice may be better in quality than the Burma rice, on account of the trade depression in the chief commercial products of Ceylon, tea, coffee and rubber, the prosperity of the people has gone down, and the lower and middle classes of the island prefer to go in for the cheaper Burma rice. Moreover Ceylon is herself trying to increase her rice production and within the last 20 years the rice area of the island has gone up by 2)%, and the production nearly doubled. This tendency will surely affect her rice requirements from outside sources, Burma and Tanjore, and the chief problem would therefore appear to be to try and maintain the present rice trade from Tanjore rather than to extend it.

That Tanjore rice sells at Rs. 3 more per bag than Burma rice is due to several causes viz., (1) the comparatively higher cost of production in Tanjore, (2) the greater transport charges by rail from Tanjore to Ceylon, and (3) bigger profits made by the Tanjore rice merchants. As regards the first point the only possible way of reducing the cost of production in Tanjore would appear to be to increase the acre yields by growers adopting more intensified methods of growing the crop on the lines advocated by the Agricultural Department.

About the second point, which is probably the most important of the three, the attempt should be to try and get the South Indian Railway Company to

reduce their transport charges which are at present too high, even higher than the rates charged by the sister company, the M. S M. Railway Company. It is found cheaper to transport rice by rail from Cocanada to Calicut, a distance of 815 miles than from Kuttalam to Calicut a distance of only 654 miles. The Tanjore District has a number of coastal ports and all the rice trade with Ceylon was being transacted through these in earlier years. The S I R. Company has been responsible for the closure of these ports by its allowing special reduced rates from places on the line near to these ports If the trade through these ports could be revived, it would appear that there will be a saving of Rs 5-8-0 per ton of rice in the transport charges. Even if the company cannot reduce their rates sufficiently to cover the entire difference between the selling prices of Burma and Tanjore rices in Ceylon, any small reduction would be a welcome relief to the Tanjore trade. This reduction will not only enable rice growers of Tanjore to maintain their present trade with Ceylon but also successfully to compete with the rice growers of Kistna and Godavari deltas who are now able to sell their rices cheaper in Malabar and in the other Tamil Districts, due chiefly to the lower rates charged by M. S. M. Railway Company.

Lastly, the Tanjore merchants are already making a bigger profit in their business than the Burma merchants and reduction in rail freights may only increase the profits of these merchants and not bring the desired relief to the rice growers. To counteract this, the report suggests that the rice growers in Tanjore should themselves organise co-operative selling societies and dispense with the intermediary merchants.

Another useful suggestion given in the report is that Tanjore must export to Ceylon coarser varieties of rice than *Sirumani* like *Kattunsemba* which would compare favourably with the best Burma rice This variety is generally a much heavier yielder than *Sirumani* and with a possible slight reduction in railway freight, Tanjore growers would be able to sell this rice in Ceylon at the same price as the Burma rice.

In this connection attention may be drawn to the fact that there is a very big trade in raw rice in Madras and in other South Indian towns. The variety known as Nellore rice finds a ready sale at these places and the whole quantity of it is imported from Kistna. The same variety of rice, *Nellore samba*, is grown in large areas in Tanjore District also and no serious attempt has ever been made by the Tanjore people to prepare raw rice from this variety in the district and cater to the needs of these towns. Of a quarter of the total production in the district which is available for export only 40% goes to Ceylon and the district has to find suitable markets for the remaining 60% It is the successful solution of the latter question that is likely to bring about substantial relief from the present slump.

(K. R.)

Crop & Trade Reports.

Sugar refined from Gur in India. 1931.

There are at present 33 concerns in India equipped for refining *gur* or raw sugar, out of which 19 factories also manufacture sugar direct from cane and 14 work with raw sugar alone. Of the former only 3 refined *gur* during the year 1931 and of the latter 7 worked during the year, 4 were silent and returns from 3 have not been received. There were thus 10 factories refining *gur* as against 11 factories during the year 1930. Of the 10 factories that refined *gur* during the year 1931, 6 are situated in the United Provinces, 3 in Madras and 1 in the Punjab.

The figures of *gur* or raw sugar melted, sugar manufactured and molasses obtained in the whole of India during the year 1931 are given below. The figures for the concerns in the United Provinces and the Punjab are also given separately.

Total for the United Provinces.

		1931	1930
Gur or raw sugar melted	...	925,610 mds.	594,735 mds.
Sugar manufactured	...	471,737	311,931
Molasses obtained	...	363,413	222,635

Total for Madras and Punjab.

Gur or raw sugar melted	..	646,015	425,368
Sugar manufactured	...	393,627	263,778
Molasses obtained	...	193,458	128,488

Grand total for India.

Gur or raw sugar melted	...	1,571,625	1,020,103
Sugar manufactured	...	865,364	575,709
Molasses obtained	...	556,871	351,123

A note published in the Indian Trade Journal, dated the 27th August, 1931, gives the total quantity of sugar produced by factories making sugar direct from cane for the two years 1930—31 and 1929—30 as follows :—

1930—31.	...	...	3,262,574 mds., or 119,859 tons.
1929—30.	...	...	2,443,486 ,, or 89,768 ,,

If the quantity of sugar refined from *gur* or raw sugar in India by modern process during these two seasons be added to the above figures the total production in the combined seasons will amount to 4,127,938 mds. or 151,650 tons in 1930—31 as compared with 3,019,195 mds. or 110,918 tons in 1929—30. (R. C. Srivastava in *Agriculture and Livestock in India*, Sepr., 1932).

Paddy crop of Madras—1932-33—Second Report.

On an average of the five years ending 1930-31, the area under paddy in the Madras Presidency has represented 13·3 per cent of the total area under paddy in India. The figures in this report relate to the paddy crop sown between February and November 1932. (Estimates up to 25th November 1932). The area sown with paddy is estimated at 10,312,000 acres against 10,360,000 acres for the corresponding period of last year, i. e., a decrease of about 0·5 per cent. There has been a reduction in area in Ganjam, Vizagapatam, Cuddapah, Nellore, Chingleput, Chittoor, and North Arcot and partly set off by an increase in most of the other districts. The first crop has been harvested throughout the Presidency. Normal yields have been reported from all districts except Vizagapatam, Godavari (East and West), Chittoor and North Arcot. The crop was affected to some extent by insects and fungoid pests in parts of Godavari (East and West), by drought in Vizagapatam and by late planting in Chittoor and North Arcot. The seasonal factor for the Presidency works out at 99 per cent of the average against 98 per cent for the corresponding period of the previous year. The wholesale price of paddy per rupee is reported as 57 lb. in Tanjore, 29 lb. in the Deccan and 36 to 40 lb. in other districts. (*From the Board of Revenue, Madras*).

Cotton crop of Madras 1932-1933 (Third Report).

Note:— On an average of the five years ending 1930-31, the area under cotton in the Madras Presidency has represented 8·9 per cent of the total area under cotton in India. The figures in this forecast relate to the cotton crop sown between April and November 1932 (Estimates up to 25th November 1932). The area

sown with cotton is estimated at 1,727,600 acres as against 1,777,500 acres for the corresponding period of last year. There has been a reduction of 2·8 per cent. There has been a marked fall in area in the Deccan (-204,000 acres). This is due partly to want of timely rains and partly to the preference given to groundnut and cholam in parts The area under irrigated cotton, mainly Cambodia, is estimated at 156,300 acres against 117,000 acres last year, an increase of about 34 per cent. Pickings of the early sown crop in the Deccan are in progress and the yield is below normal owing to drought at the beginning. The condition of the main crop throughout the Presidency is satisfactory. But in parts of Tinnevelly. the young plants were reported to have been destroyed by stemweevils and the crop had to be resown. The seasonal factor for the Presidency works out to 99 per cent of the average against 100 per cent in last year. On this basis, the total yield is estimated at 361,300 bales of 400 lb. lint against 342,100 bales of last year, an increase of 5·6 per cent. The crop is young and it is too early to estimate the yield with any degree of accuracy. The local cotton trade is not active at this time of year. The wholesale price of cotton lint per bale of 400 lb. does not show much variation as compared with the prices prevailing in the previous month though the price of Cambodia shows a slight rise. The present prices are reported to vary from Rs. 85 to Rs. 90 for *mungari* (early crop) westerns, Rs. 88 to 92 for Northerns, Rs. 120 for Cambodia, Rs. 104 for Tinnevelly and Rs. 108 to 116 for Karunganni cotton. (*From the Board of Revenue, Madras*).

Castor Crop Report for Madras 1932. First or Final Report.

(On an average of the five years ending 1930—31, the area under castor in the Madras Presidency has represented 23·1 per cent of the total area under castor in India. The figures in this report relate to the castor crop sown between December 1931 and November 1932.) (Estimates up to the 25th November 1932.) The area under castor in the Madras Presidency is estimated at 333,600 acres as compared with 324,300 acres, estimated for the same period last year, or an increase of 2·9 per cent. The estimate for last year fell short of the actual area of 330,106 acres by 1·8 per cent.

The increase is general outside Ganjam, Vizagapatam, West Godavari, the Deccan (Anantapur excepted) and South Arcot. The yield is expected to be normal against 97 per cent in the previous year according to the season and crop report. On this basis, the yield is estimated at 34,700 tons as against 32,400 tons estimated for the corresponding period of last year, and 32,970 tons estimated in the season and crop report of last year.

The wholesale price for castor seed ranges generally from 23 to 24 lb. per rupee in Trichinopoly and the Deccan (Cuddapah excepted) and from 16 to 20 lb in the other districts. As compared with December 1931, the price has been more or less stationary in Kistna, Guntur, Nellore, Chittoor, North Arcot and Madura, has risen in Salem and fallen in the other districts. *(From the Board of Revenue, Madras).*

Gingelly Crop of 1932—33—First Forecast Report.

(*Madras Presidency.*)

On an average of the five years ending 1930—31, the area under gingelly in the Madras Presidency has represented 12·5 per cent of the total area under gingelly in India. The area sown with gingelly up to the end of July 1932 is estimated at 388,800 acres as against 332,100 acres during the corresponding period of last year. There has been an increase of 17 per cent. The increase in area is general in all important districts except Vizagapatam.

2. The yield is expected to be normal except in Ganjam, Vizagapatam Bellary, Anantapur and Chingleput where the crop was affected by drought, to some extent. 3. The wholesale price of gingelly is reported as 9 to 10¼ lb. per rupee in Ganjam, Chingleput, South Arcot, Chittoor, North Arcot, Salem and Tanjore; 14 lb. in Anantapur, and 11 to 13 in other districts. As compared with the prices reported in April 1932, the price was stationary in Vizagapatam, Kurnool, Chittoor, North Arcot, Coimbatore, and Tanjore; cheaper in South Arcot, Salem, Trichinopoly, Madura, Tinnevelly, and Malabar; and dearer in the other districts. (*From the Director of Agriculture, Madras*).

Groundnut Crop, 1932–Second Forecast Report. (*Madras Presidency.*)

The area sown with the summer of irrigated crop of groundnut in parts of the Madras Presidency during the five months January to May 1932 is estimated at 67,700 acres. The condition of the crop is satisfactory and harvest of the crop is proceeding in South Arcot. The total yield is estimated at 60,400 tons of unshelled nuts. 2. The early crop of groundnut (most unirrigated) sown up to the end of July 1932 in the districts of Salem and Coimbatore is estimated at 159,000 acres against 120,000 acres during the corresponding period of last year. The increase is due to timely sowing rains. Condition of the crop is good. The total yield is estimated at 79,500 tons of unshelled nuts against 57,000 tons during the corresponding period of last year. (*From the Director of Agriculture, Madras*).

Pepper Crop of 1932–33–First Forecast Report. (*Madras Presidency.*)

The area planted with pepper up to the end of August 1932 in the districts of Malabar and South Kanara is estimated at 87,300 acres (80,000 acres in Malabar and 7,300 acres in South Kanara) against 90,943 acres (83,409 acres in Malabar and 7,534 acres in South Kanara) in the previous year. The condition of the crop is fairly satisfactory. 2. The present price of pepper is Rs. 160 per candy of 500 lb. (*From the Director of Agriculture, Madras*).

First Forecast Report on Ginger—1932–33. (*Madras Presidency*)

The area planted with ginger up to the end of August 1932 in Malabar is estimated at 10,000 acres against 10,635 acres in 1931—32. The condition of the crop is fairly satisfactory. (*From the Director of Agriculture, Madras*).

Association of Economic Biologists.

Under the auspices of the association there were two public lectures delivered by two of the Officers of the Bombay Department of Agriculture who had come on a visit to Coimbatore

The first one was by Rao Sahib B. P Vagholkar, Special Sugarcane Research Officer, on 10th November, the subject of the lecture being 'Agricultural improvements in the famine areas of the Bombay Presidency'. The lecturer first described the general conditions obtaining in the tract. The annual rainfall was generally scanty, under 20 inches, and that badly distributed. The soils were very light and shallow and mostly undulating. They do not have more than three good seasons in a cycle of twelve years and the average outturn of these areas was only a six-anna crop.

The improvements successfully introduced by the Department were (1) the use of iron ploughs, (2) bunding of the fields to prevent soil erosion, (3) sieving of the *jowar* (sorghum) seeds used for sowing purposes and (4) the profitable dry farming practices as deep tillage, sowing the crop wider apart, frequent interculturing etc. Though the introduction of iron ploughs was very difficult in the

beginning the practice has now become so common that in two of the districts in this area there are now over 50,000 ploughs in actual use.

As regards the bunding of the fields, before the practice could be introduced, a great deal of attention had to be paid to the study of the topography of the tract, the amount and distribution of the annual rainfall etc., so that the Department could recommend the most efficient type of bund to be used for particular areas. There were three types of bunds used costing respectively Rs. 10, 50, and 300 per acre. The average yields of the bunded fields soon began to rise and the increases over the unbunded fields were often 50 to 150 per cent. The sieving of the jowar seed has been found to be very profitable and increased yields of 30 to 50 per cent. have often been obtained even with this one improved practice.

The lecturer then gave an interesting account of the attempts made by the Department to form rural co-operative societies for the benefit of the people in the tract. About the possibilities of this line of work, the example of an implement society with 700 members spread over 90 villages, and which with a capital of Rs. 8000, had made a profit of Rs. 5300 within six years by the hiring of implements, was cited. He also mentioned the possibilities of making use of the rural school teachers in helping the Department in its propaganda.

On the 21st December Mr. B. S. Kadam, Crop Botanist, gave his lecture on 'Crop improvement work in the Bombay Presidency'. The lecture was very informative on the breeding and selection work being done by the Bombay Department in the various food and industrial crops. Because of the varying climatic conditions obtaining in the different parts of the province, each tract has its own special set of varieties and the breeding work to be most successful has to be carried on at more than one centre for each of the crops handled. For *Jowar*, (sorghum) the most important food crop, work was first started at two centres, Sholapur and Satara, and this has now been extended to a third centre, Dharwar. In the *jowar* crop mere sieving of the seeds has always given an increased yield and the lecturer stated that a botanical explanation for this behaviour had recently been found. The *jowar* consisted of two types, one a fast-growing and the other a slow-growing one. The latter always suffers for want of moisture in the soil just when the grain is ripening and consequently it becomes small and shrivelled up. The sieving eliminates the poor developed grains and the sieved grains gives a crop consisting entirely of the quick growing type which with the available moisture in the soil gives better out-turns.

Work on wheat, the next important cereal grown largely in the Deccan, had been going on for over twelve years. The crop once in 3 or 4 years was subject to the attack of black rust resulting in heavy losses. By breeding and selection the Department has been able to produce two strains which were very satisfactory.

Rice, the important crop of the Konkan tract has also been tackled and several improved strains have been evolved and distributed to the people. Strain 'kolamba 79' was one of the best, a rapidly maturing, fine rice. As regards tobacco which is also one of the crops under investigation, the attempt has been to evolve a mild type suitable for cigarette manufacture, Type No. 45 which they have already got appears to be suitable for the purpose. With regard to cotton, Bombay has concentrated areas under different types of cotton and breeding work in this crop has been going on since 1897. There is a special officer in charge of this work for each of these tracts and a number of strains have been evolved suitable for the different tracts which easily give increased out-turns of 10—15 % over the local varieties. In Guzaret and Kandesh the chief trouble with this crop was the wilt problem and work was in progress to evolve wilt resistant forms. Besides the above mentioned crops the Department, the lecturer stated, was carrying on work in castor, ragi, chillies and brinjals. (K. R.)

College News and Notes.

The College reopened after the Christmas and New Year holidays on the 4th. January. On the same day evening, the students of II B. Sc. class started on an agricultural tour of the ceded districts and came back on the 14th.

Rao Bahadur C. Tadulingam. There was general satisfaction on the colony on the receipt of the news that the title of Rao Bahadur was conferred on Mr. C. Tadulingam, our Principal. The Rao Bahadur was the recipient of several congratulatory messages from far and near and was entertained at several parties held in his honour both in the colony and in Coimbatore town.

Radhakalyanam. The annual observance of *Danur masa pooja* was held this year also on the estate and culminated in the celebration of *Rhada Kalyanam* on Sunday the 8th January with the usual festive pomp. The estate Boy Scouts rendered very good service on the occasion, by erecting a pandal with raw materials, supplied to them.

Ladies' Club. After five years of gradual growth, the Agricultural College Ladies' Club has ventured on putting up a habitation for themselves. The construction of a club building has begun in right earnest on a plot of land one acre in extent which was kindly leased out by Government for the use of the club.

District Agricultural Conference. A Conference of the Agricultural Officers of the Coimbatore District was held at Coimbatore on the 9th and 10th January and was presided over by Rao Bahadur D. Ananda Rao Garu, the Headquarters Deputy Director of Agriculture.

Games. Cricket Tour. After breaking the ice with a tour to Palghaut, the College cricket team ventured out to Tellicherry and played two matches there towards the end of November. The first match was against the Brennen College whom they met within a couple of hours of their arrival at Tellicherry. For the first time during the season our colours were lowered, our opponents giving us a heavy defeat. Winning the toss our team elected to bat on what later proved to be a treacherous wicket. There was a series of batting failures, two run outs and two l. b. w. s. aggravating our misfortune. Our total was only 35 runs of whinh *Murti contributed* 10 runs. Our opponents passed our total for the fall of only 2 wickets and went on merrily till they topped 140 for 3 wickets and put us in again. Our opening batsmen made 20 runs when a sharp shower fell which prevented further play for the day. Ananda showed a spark of his usnal self in scoring four boundaries in quick succession

The next day we were pitted against the Tellicherry town club a strong local combination which included the pick of the College team Despite the injury which our wicket keeper sustained the previous day, our team contrary to expectations gave a very good account of themselves. The club was dismissed for 89 runs *Varadarajan, taking 5 wickets for* 23 runs, Narayanan 2 for 15 and Lakshmanan 3 for 45· Though we opened disastrously and lost 4 wickets before the second decade was registered, thanks to an excellent winnings played by Narayanan and an invaluable defence put up by Ramanatha Rao, we passed our opponents' total with 4 wickets and finished up with 101 runs. Narayanan made 52, Ramanatha Rao 12 and Suryanarayanamurti 16. That cricket is a great game of glorious uncertainties was again proved by our defeat by the College team and our creditable win over an exceedingly strong combination.

Agricultural Student for 'Varsity team. For the second year in succession one of our College students gained a place in the 'Varsity cricket team. It will be recalled that U Patraik played for Madras against Aligarh last year and turned-out to be the hero of the match. This year K. M. Naravanan of B. Sc. III was selected and was the recipient of the 'Varsity colours He toured with the team to North India and playing against Delhi and Aligarh rendered a good account of himself. It may be mentioned to his credit that he was one of the two *Moffusilites*

selected for the cricket team after undergoing the strenuous tests made by "Bill" Hitch and Prof. C. K. Krishnaswami Pillai at Madras.

Officers' Club. At a general body meeting of the club held on the 16th Rao Bahadur C. Tadulingam, Mr. N. L. Dutt and Mr. V. T. Subbiah Mudaliar were elected President, Vice President and Secretary respectively.

Indian Officers' Association. At a meeting of the Indian Officers' Association (Agricultural Branch) Rao Bahadur T. S. Venkatraman, Mr. G. N. Rangaswami Ayyangar and Mr. K. M. Thomas were elected President, Vice President and Secretary respectively.

Association of Economic Biologists. At the annual inaugural meeting of the Association Mr. S. Sundara Raman, Government Mycologist, gave a lecture on Professor of Mycoloigcal Research in Madras.

Departmental Notifications.

I Circle. G. Ranganadhaswamy, F. M. Samalkota, l. a. p. for 20 days from 30—11—32 to 19—12—32 both days inclusive. A. Rammohan Rao, A. D. Rajahmundry, l. a. p. on M. C. for 2 months from 21—11—32. D. Hanumantha Rao, A. D. Razole, l. a. p. for 15 days from 9th to 23rd December 1932, suffixing christmas holidays. T. Rangabrahma Rao, F. M. l. a. p. for 3 days from 3rd to 5th January '33 in continuation of Xmas holidays **II Circle.** D. Panakala Rao, A. D. Gurzala, l. a. p. for one month and 15 days from 3—1—33 with permission to avail of the christmas holidays. **III Circle.** *Transfers.* M. Jeevan Rao, F. M. Hagari, to be A. D. Giddalore. Gulam Ahmad, A. D. Giddalore to be F. M. Hagari. K V. Seshagiri Rao, transferred from the II circle, to be A. D. Allagadda. K. Hanumantha Rao, A. A. D. Rajampet. l. a. p. for 10 days from 3—1—33 with permission to prefix the christmas and New year holidays. K. Rama Rao, A. D. Cuddapah, will be in additional charge of Rajampet sub circle. **IV Circle.** K. Varadhachari, F. M. Palur, under going training in ericulture at Madras, l. a p. for 11 days from 1—12—32 to 11—12—32 **VII Circle.** E. Achuthan Nair, l. a. p. for 2 days on 20th and 21st December 1932 P. Abdulla Haji, A. D. Manantoddy. l. a. p. for 17 days from 15th to 31st January, 1933 both days inclusive. **VIII Circle.** C. S. Namasivayam Pillai, A. A. D. Omalur, l. a. p. for 6 days from 5—12—32 with permission to avail the Sunday on the 4th and 11th December 1932. B. Dasappa Malli, A. D. Coonoor, l. a p. for 21 days, from 3—1—33 to 23—1—33 with permission to prefix christmas and New year holidays. **O. S. S's Section.** T. Gopalan Nair. F. M. Nileshwar, l. a. p. for 9 days from 3rd to 11th January 1933, with permission to avail the Christmas and New year holidays and on 12th and 13th, Jannary 1933. A. P. Balakrishnan Nair, F. M. Pilicode, l. a. p for three days on 20th, 21st and 22nd December 1932 with permission to avail the christmas and New year holidays. **Paddy Section.** M. Narasimham, Asst. l. a. p. for one month from 3—1—33 to prefix christmas holidays **C. S's. Section** P. Abraham, Asst. l. a. p. for 11 days from 12—12—32 to 22—12—32 with permission to prefix Sunday 11—12—32 and to affix the Christmas and New year holidays. **G A. C's. Section.** T. Varahalu, Chemical Assistant, Anakapalle, l. a. p. for 11 days from 5—12—32. **Principal's Office.** S. R. Srinivasa Iyangar, Librarian, l a. p. for 4 days from 3—1—33 with permission to avail of the holidays on the 7th and 8th instant. **D A's. Offire Orders.** A. Chinnathambi Pillai, A. D. on return from leave is posted as F. M. Palur. K. Ramanuja Acharya, F M. Kalahasti on the expiry of his leave on the 23rd January, to Guntur to be in charge of both the Livestock Research Station and the Agricultural Research Station. Bhagirathi Padhy, A. D. Nandyal, on the expiry of his leave on the 22nd December 1932, to I circle to be employed in Ganjam or Vizagapatam Districts. K. V. Seshagiri Rao, A. A D. Vinukonda, to III circle. K. Brahmachari, Entomology Assistant, extension of l. a p. for 24 days from 23—12—32.