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CASHEW NUT: ITS CULTIVATION & MARKETING ON THE MALABAR COAST

By A. H. SUBRAHMANYA SARMA, B.Sc., (Agri.),

Farm Manager, Central Farm, Coimbatore.

The cashew nut (*Anacardium occidentale*) has been cultivated in South India for a very long time. Till recently this tree was grown mainly for the firewood obtained from it. The tree supplied a good fuel with excellent burning qualities. Hence, when the trees grew to their full size, the owner used to sell them to the fuel contractor. The fruits of the cashew nut tree which the owner got from the plantation were only a bye-product. But in recent years the cashew nut is attracting the attention of the people in South India in the districts of Malabar and South Canara and the Native States of Cochin and Travancore, because the cashew kernels fetch at present a good price in the overseas markets *e.g.* the United States of America and France.

A good loamy soil is suitable for its cultivation, but on the Malabar coast any *paramba* is used for planting cashew nut. But now because of the good money return the crop gives for a number of years from its fruits, the systematic planting of cashew nut has begun to be adopted. The hill slopes and jungle areas are cleared of all the trees and utilised for the planting of cashew.

Pitting. After the land is cleared of all jungle vegetation, pits 3 feet by 3 feet by 2½ feet are dug in lines. The distance between

the plants is 12 feet in the lines and 21 feet between the lines. This is the usual distance adopted in planting rubber and gives about 150 trees per acre. This gives excellent results, especially on hill slopes, for when planting is done along the slope 12 feet apart, the tree next to the one below is at a higher level and so gets its required exposure to sunlight, combining at the same time economy of space. Some suggest more trees per acre but more trees only decrease the yield when the trees grow bigger and have not sufficient space to grow. Even with 150 trees per acre it will be found that thinning has to be done, in later stages, to keep up the yields. The return from a plantation depends upon the fruits, which again depend upon the number of branches in a tree, and so it is always better to have a good spacing between trees. One particular noteworthy feature in pitting is that the dug out earth from the pit is always put on the side of the downward slope, which helps to a great extent in checking erosion. After pitting the pit is filled up by scraping round the surface earth from the other three sides of the pit. This is done because the surface earth in cleared forests and jungles is always rich in humus, and by filling the pit to a depth of 2½ feet with that earth the young plants are able to get a good start when planted. A small dose of farm yard manure is also added in the pits when they are filled.

Planting. Usually a nursery is raised before planting. Long nursery beds are prepared and over each bed well matured heavy cashew nut seeds are spread and covered with a layer of straw and watered twice daily. The necessity for watering does not arise always as the nurseries are raised in June or July which is the period of S. W. Monsoon on the West Coast. When the seeds begin to sprout, which will be in the course of a week or ten days, they are removed in baskets to the prepared pits. Usually three to five sprouted seeds are planted in each pit. The object of planting more seeds is to select the best of the seedlings and remove the rest after one or two years thus making a general selection of a sturdy plant. Again this helps in preventing any gap arising in the plantation, for even if one or two plants die out owing to some unforeseen causes there will be still one or two left at the end of the first or the second year when the plants get permanently established.

After Cultivation — This consists of hoeing round the plants every three months to a radius of three feet from the plant. This helps in creating a mulch and at the same time protects the young plant from being drowned by weeds. It is advisable to cultivate the rest of the area with some annual catch crop which may pay for the cultivation charges of the plantation. If no inter-crop is raised the land is kept free from weeds by weeding at least three or four times in a year. Inter-cropping is only possible for the first two or

three years. After that the trees grow in size and shade round them, and hence it is not possible to grow any crop with success. If no catch crop is raised it is usual to grow interspaces with some green manure crops like *Tephrosia candida* or *Cowpea*, which after a good growth are cut and forked in. Another essential requirement in planting on hill sides is the necessity for preventing soil erosion. This is done by digging trenches across the slope and putting the earth by the side of the lower slope. Trenches are usually 16 to 20 feet long 1½ feet broad and 1½ feet deep. These trenches arrest considerably much of the wash-outs, thus conserving the huge loss of fertile surface soil and humus.

The advantages of systematic planting as detailed above over the old way of ploughing and dibbling seeds are two-fold. Firstly a complete number of required plants is obtained per acre. Usually it happens that the ryot may not be aware of any losses of plants by death or by accident, and if at all he comes to know of any loss it may be too late to plant in the same year, which means a loss of one valuable year's growth of the plant. Secondly, by having good pits the soil is being loosened to a depth of 2½ feet, the young plants are able to develop a good root system. They get a good start and have a good bushy growth unlike the stunted plants which result from indiscriminate planting. As the plants grow well the ryots are able to get fruits at least one year earlier than by the other method, and again in subsequent years more yield is obtained which means more money return.

The cost of planting one acre of land as detailed above and bringing up to the stage of bearing varies from Rs. 200 to Rs. 300, varying with the place and availability of labour excluding cost of land. A general outline of cost is worked out below:—

First Year.	Rs.	A.	P
Clearing jungle and lining on one acre	25	0	0.
Pitting— 150 pits at Rs. 4 per 100.	6	0	0.
Filling at Rs. 2 per 100 pits	3	0	0.
Cost of raising nursery including seed	5	0	0.
Planting at Rs. 2 per 100 pits	3	0	0.
Hoeing round plants twice during the year	9	0	0.
Weeding between lines 3 times ,,	15	0	0.
Contingencies	4	0	0.
	Rs. 70	0	0.

Second Year.	Rs.	A.	P.
Weeding three times in the year between lines	15	0	0
Hoeing round plants three times in the year	13	8	0
Contingencies	1	8	0
	30	0	0

Third Year.			
Same as 2nd. year and removing extra plants	30	0	0
Fourth Year.			
Same as 2nd year	30	0	0
Fifth Year.			
Two weedings between lines in the year.	10	0	0
Total Rs.	170	0	0
Other expenses as watch &c., per acre	30	0	0
Grand Total Rs.	200	0	0

Note :—Cost of land and fencing is not included. It is ordinarily done with five lines of barbed wire.

Yields and Returns :—Cashew nut systematically planted begins to bear fruit from the fifth year of planting. During the first year a tree will give from 2 to 4 pounds of nuts. This means from an acre of 150 trees, allowing for a margin of ten per cent. of the trees not bearing any fruit, the yield will be about 400 pounds at three pounds of nuts per tree. The price of raw cashew nut of late has varied from Rs. 35 to Rs. 47 per candy. (1 candy = 700 lbs.). This fluctuation is due to the depreciation of the rupee owing to the suspension of gold standard in England. As the United States of America is still on the gold standard basis the same dollar price paid for the kernels in America means more rupees in India, and hence the price of the raw nuts also increases. Taking the price at an average of Rs. 40 per candy of 700 pounds the return from an acre of cashew nut trees is Rs. 23 during the first year of bearing, which in consideration of the low prices of other agricultural produce is not bad. The yield from an acre gradually increases as the tree grows in size. By the tenth year a tree gives more than 20 pounds of raw nuts, and there are trees on the West Coast which have given much more. Therefore by the tenth year a ryot gets more than Rs. 100 from every acre of cashew nut, and he spends only about Rs. 200 or 300 on jungle land. The cost of collecting the nut is not much as there will be many who will collect and give the nuts in exchange for the pear (fleshy pedicel) which is very delicious to eat. The fleshy fruit (pedicel portion) contains a good quantity of sugar and this is usually wasted. The juice extracted if fermented produces on distillation a spirit which is said to be useful for medicinal purposes and has industrial possiblities. The raw nuts thus obtained are sold by the ryot to big factory owners who remove the shell and export the kernels to foreign countries. On the West Coast there are several factories which deal in cashew nut and export

the kernels. These are situated in Mangalore, Trichur and Quilon. Quilon factories are the pioneers in this trade. Originally this trade was monopolised by the Europeans, but some shrewd people among Indians have learnt the secrets of the trade and have begun the preparation of these kernels. The preparation of the cashew nut kernels from the raw nuts is a difficult operation and requires much skill in order to get a first class marketable product which will fetch a good price in foreign markets.

The first process in the manufacture is the roasting of the raw nut in order to enable the rind of the cashew nut being removed easily. This is done by roasting the nuts in open iron pans kept over a fire, and small quantities of the nuts are roasted at a time. The rinds of the previously shelled nuts serve as fuel for the subsequent day's charge. It is very important to have the raw nuts roasted very carefully, for over-roasting leads to a brown colour being imparted to the kernels in which state it has no demand in foreign countries. By this method of roasting the oil that is contained in the rind is allowed to burn off owing to higher temperature of roasting. The rind of the cashew nut contains 35 per cent. of oil, which has very high disinfecting qualities. This oil if extracted without being wasted fetches a good price in the foreign markets, ranging from Rs. 1-8-0 to Rs. 2-8-0 per gallon. Hence the introduction of some improved method of roasting of cashew nuts without wasting the oil would save a very important and valuable bye-product of the industry from being lost.

The next operation after roasting is the shelling of the rinds This is done by hand. Women and boys are usually engaged for this operation. The shelling has to be very carefully done. Any indiscriminate or careless handling of the nuts leads to breakages which considerably reduce the price of the final product. Hence skilled labour is very essential to do this shelling operation. It has been found that the erection of factories in new places where skilled labour for this purpose is not available has met with failure if not with loss owing to inferior quality of the kernels obtained by breakage. Considerable patience is required on the part of labourers to get the kernels as wholes, and hence the employers always stipulate that breakages should not go beyond a very small percentage depending on the quality of the nuts.

Having removed the outer rind it is necessary to remove the inner coat. In order to facilitate this operation the kernels are spread in the trays in hot air rooms under controlled temperatures. Here again considerable care has to be bestowed as high temperatures some times impart a brown tinge to the kernels which contribute to an inferior stuff being obtained. The temperature of the hot air chamber has to be very carefully controlled depending upon the climatic condition of the place as well as the nature of the inner coat. Experience

has shown that the best temperature lies at about 120° F. This drying of the kernels also removes any excess of the moisture that may be contained in the kernel itself as in packing and exporting the kernels a high percentage of moisture contents leads to the kernels becoming mouldy. A very low moisture content is also not advisable as the brittle kernels get broken in transit over long distances. Hence the control of the moisture content is another important factor for the successful marketing of the cashew nut kernels. The thin coat of the kernel is removed soon after the kernels are dried in the oven. This also is done by hand.

Grading. This is the most important operation in the marketing of all produce and in the case of the cashew nut it is specially so. The usual grades in the cashew nut kernels are (1) The *wholes* which are complete kernels as they occur within the nut, (2) The *halves* which consist of one cotyledon only, and (3) The *brokens*. It is only the wholes that fetch good prices in the foreign markets. The prices for halves are much lower than those for wholes, sometimes even half. The brokens are not exported and are utilised for local consumption. Usually from a bag of 168 pounds of raw cashew nuts 38 to 45 lbs. of kernels are obtained depending upon the quality of the cashew nut and the efficiency of the labourers in shelling the roasted nuts. The graded kernels are filled in tins and the air being exhausted are packed in a medium of carbon-di-oxide which prevents any decay setting up in the kernels.

The chief market for cashew kernels at present is the United States of America, where it is consumed after salting. It is also used in the manufacture of chocolate confectionery. Its use is mostly as a substitute for almonds. Cashew kernels are said to be very nutritious, being rich in proteins and fat.

The Trade. The trade in cashew nut on the Malabar Coast is conducted in Mangalore, Goa, Quilon and Trichur. Mangalore is the chief centre for the preparation of cashew kernels from the nuts. Here there are six major factories employing more than 6000 hands daily. About one hundred thousand bags of raw nuts are dealt with in these factories annually and exported. The supply of the raw nuts for the Mangalore factories is mostly from South Canara and Malabar and a portion is also met by import from Africa. Quilon, which is the next important centre, prepares kernels from about 60,000 bags of raw nuts annually The sources of raw nuts are mainly Travancore and Cochin. In Goa also there are some factories and during six months they work with locally obtained nuts and during the rest of the year with nuts imported from Africa.

At present about 75,000 bags of raw nuts are said to be imported every year from Africa. As the cultivation of cashew nuts is not

systematically carried out in Africa there are no signs of African competition at present. Moreover, the African cashew nuts are said to be inferior to those produced on the West Coast.

The Future. The cultivation of cashew nuts has a good future as it brings more money returns than any other dry land crop on the West Coast, owing to the fall in prices of rubber, coconuts, pepper, ginger, etc., At present the export is mostly limited to the United States of America, and gradually it is possible to create a demand for this product in the United Kingdom and the Continent as well. Thus cashew nut growers have a bright future if they do not *over-produce*.

PIG KEEPING AS A SIDE LINE

By T. MURARI, B.Sc., (*Oxon*), F.L.S.,

Superintendent in Charge, Livestock Research Station, Hosur.

It is to be regretted that the pig is regarded as a very unclean animal Mohemedanism and Judaism prohibit eating pork because the pig is thought to be a dirty animal. In the East and tropics generally, the pig is ordinarily bred in such a way that it cannot help being what it is. In the Indian villages the pig is very often the only scavenger and as such it is no wonder that the pig is looked down as a dirty animal.

In Europe, however, the pig enjoys greater respect. The breeding and fattening of pigs, have become extremely scientific and as a matter of fact pig keeping is a very paying industry both in England and Denmark. If one does see how wonderfully clean the piggery can be kept and how the pigs can be reared on skimmed milk, potatoes, beans, wheat-bran and other agricultural products, it will be realised that the pig is not after all to be blamed.

Experience at Hosur and Coimbatore indicates that the Berkshires thrive quite well under local conditions. The Large Black is likely to thrive just as well. It has been noticed that Berkshire boars put on local sows produce a useful cross and it would be interesting to see what further grading up would produce.

In this country, despite religions, there are a good number of people both Indians and Europeans, who do eat pork. In and near places where there is demand, pig keeping as an industry in addition to market gardening and poultrying would be very paying. In big cities or towns particularly those in which there is a Cantonment there is likely to be sufficient demand for pig keeping.

Under Indian conditions it is quite easy to fatten the pigs. At Hosur and Coimbatore the pigs get skim milk but even when this is

not available they do not seem to lose condition. The pigs generally get 1 lb. groundnut cake, 1 lb. rice bran and 1 lb. wheat bran with skim milk from the dairy and vegetable refuse from the vegetable gardens as they become available, and grazing. As the purpose of the Department is not to fatten pigs no effort is made to fatten them, but it is interesting to find them thriving very well on a small ration as mentioned above. If the above ration is gradually increased they are sure to put on weight very quickly and they ought to make a useful porker in a short time, say, six months. It must be mentioned that about 5% of fishmeal in the ration is very good for quick fattening but it must be discontinued for a fortnight before killing, else the fat is likely to be tainted. Half oz. of lime and bone flour may be given per animal per day.

While the feeds are expensive in Europe, in India pigs could be raised economically. Cashew nuts, tamarind seeds, *Korukkapuli* (*Pithecolobium dulce*) seeds, jack seeds and bananas could be used in the ration with advantage.

The housing need not be elaborate ; a small shed with good flooring would be essential. All drainage collected from the piggery can be mixed with farm yard manure. No bedding is essential in the plains ; but in the hills some straw may be useful. If the sheds have walls it would be a good thing to keep a frame work with poles standing about 6″ from the ground so that the sides are about 6 inches from the walls. This kind of frame work saves young pigs or suckling piglings being crushed to death by the sows. If the piggery is fenced properly there need be no fear of the pigs going astray. When grazing in the pastures, vegetable gardens or orchards a boy can look after them and see that they do not root up plants.

Pigs are very fond of wallowing in the mud. If there is no tank near by a small bath about 1′ deep in the piggery would be sufficient. If the piggery is kept thoroughly clean, and the paddocks limed to keep them sweet one can be sure of making pig-keeping a success.

Sometimes due to the heat the skin begins to crack and application of *neem* oil is a good remedy. If any of the animals do get ill it would be a good thing for the amateur to segregate the animal and call in a veterinarian.

Killing of pigs is a painful process in most countries. The best and most humane method of killing is to use a " humane killer." Salting and curing for bacon can be done according to the requirements of the market. It would be best for the beginner to sell the pigs on foot and as he gains experience he can do the killing and curing himself.

COST OF RAISING PIGS AT THE LIVE-STOCK RESEARCH STATION, HOSUR

By T. MURARI, B. Sc. (*Oxon*). F. L. S.

Superintendent, Livestock Research Station, Hosur.

As there have been several enquiries with regard to the economics of pig keeping in India the author has ventured to communicate the cost of rearing pigs with a special reference to the conditions at the Livestock Research Station. Hosur. The object of pig keeping at this station is to supply the public with a pure bred improved pig and the breed that has been thriving here is the Berkshire. In addition to this, another object has been to utilise skim milk, a waste product under prevailing conditions at this Station.

Before going into details of costings it would be of interest to understand the pigs and the type of market the breeder has to cater for. The Berkshire is quite a suitable pig for crossing with the indigenous type of pig. The author has come across a number of first-crosses which are a great improvement over the indigenous type. The Berkshire is capable of being fed as a porker and as a baconer. If there is a useful market I have no doubt it can be fed up to the heavy lard type. Usually any weight between 120 to 140 lbs. live-weight is known as a porker, 180 to 210 lbs. live-weight a baconer and anything between 250 to 350 lbs. live weight a true lard type. It must be remembered that the ration varies with the type of finished products required. Again it is not possible for all breeds to be useful for all the types. For instance, the large white with a splendid even side makes the best baconer. In England, Sweden and Denmark in particular the breeder is anxious to get the best baconer. There is a good trade for pork as well, but it cannot be compared with that in the rest of the continent. In India most of the demand is for pork. Bacon trade is restricted generally to the European community which often prefers the bacon from England and Denmark to the local. The prevailing financial stringency, however, is likely to create a market for a good local made bacon.

At the Livestock Research Stations at Hosur and Coimbatore no forced feeding is done. The animals are just maintained on a ration that would make them grow and keep condition. The skim milk supply is not always regular because the quantity would vary with the amount of butter manufactured. In working out the costings, the cost of stys have been taken into account. This item may seem rather high, but it cannot be avoided as the buildings were taken over from the Remount Depot. Moreover it must be remembered that good housing is necessary for successful pig keeping. The pay of the Manager has not been charged to the pigs as he is in charge of more than one type of work and it is not possible to decide what proportion

of his salary should be debited to the cost of pig keeping. If pig keeping is done on a large scale so as to require a full time manager the whole of his pay would naturally be taken into account. Cost of manure is again an arbitrary figure. When we know more about the digestibility of local foodstuffs it would be easier to assess the value of farm yard manure more accurately. In Europe it is usual to charge the service fee to the maintenance of a breeding sow. Under prevailing conditions in India it would be essential to maintain at least 1 boar to 10 sows and the cost of maintaining the boar should be borne by the 10 sows. Skim milk is an expensive food, but when it is not available butter-milk can be given with advantage.

The cost of maintaining an adult pig is given below. At first the cost of maintaining all the pigs in the Farm is taken into account and the cost for one is worked out at the end.

Cost of maintaining an adult pig for one month.

Cost of ration for 19 pigs :—

Wheat-bran 434 lbs. at Rs. 3—14—0 per 100 lbs.	...	Rs.	16—13—1
Groundnut cake 434 lbs. at Rs. 3—2—0 per 100 lbs.	...	,,	13—9—0
Rice-bran 434 lbs. at Rs. 3—4—0 per 100 lbs.	...	,,	14—1—3
Ragi 84 lbs. at Rs. 2—8—0 per 100 lbs.	...	,	2—1—7
Skim milk 1644 lbs. at 6 pies per lb.	...	,,	51—6—0
Lime and bone mixture 11 lbs. 10 oz. at 5 ps. a lb.	...	,,	0—4—10
Cost of carting 1 barrel of water to piggery at 2 annas per barrel per day		,,	3—14—0
Wages of cooly ...	...	,,	7—9—7
Housing charges ...	...	,,	0—15—9
Interest at 5 % on the value of animals	...	,	0—14—3
Veterinary charges ...	...	,,	1—0—0
Sundry charges such as buckets, feeding troughs, locks, brooms, winnows, etc.		,,	1—0—0
Grazing charges ...	...	,,	3—2—7
Cost of maintaining 19 animals ...	...	,	116—11—11
Therefore cost of maintaining 1 animal	...	,,	6—2—4
Deduct the value of manure at Rs. 1—8—0 per pig	...	,,	0—2—8
∴ Net cost of maintaining 1 adult pig	...	,,	5—15—8
	or	,,	6—0—0

Having seen how much it costs to maintain an adult pig it would be interesting to work out the cost of raising a baconer weighing 180 lbs. At Hosur this weight is attained within 9 months from birth without any forcing ration. It will be seen that in the case of porkers it would take very much less time, but the ration should contain greater proportion of starchy foods like rice, sugarcane, maize meal, sweet potatoes, etc. This changed ration is for the purpose of keeping up growth and putting on large layers of fat.

The cost of raising a gilt up to 180 lbs. liveweight at Hosur is given below.

Cost of raising a gilt up to 180 lbs. liveweight for 9 months.

		Rs.	
Cost of pigling at birth	... ...	Rs.	2—0—0
Cost of dam's milk for the first month. ⅛ of cost of maintaining an adult		,,	0—12—0
Cost of 151¾ lbs. groundnut cake at Rs. 3—2—0 per 100 lbs.		,,	4—12—0
Cost of 151¾ lbs. ricebran at Rs 3—4—0 per 100 lbs.	...	,,	4—15—0
,, 151¾ lbs. wheatbran at Rs. 3—14—0 per 100 lbs.		,,	5—14—2
,, 425 lb. skim milk at 6 ps. per lb.	...	,,	13—4—6
3½ lbs. lime and bone mixture at 5 ps. per lb.	...	,,	0—1—6
Labour charges at Rs. 12 for a man for 30 pigs	...	,,	3—10—9
Housing 1½ % on the value of piggery	...	,,	0—4—9
Water 2 barrels at 4 as. a day for 30 pigs	...	,,	2—4—0
Veterinary charges	... ...	,,	0—8—0
Grazing charges	... ...	,,	1—8—0
Sundry charges	... ...	,,	0—[illegible]—0
		,,	40—6—8
Deduct cost of manure received from one pig during 9 months		,,	1—8—0
Net cost	... ...	,,	38—14—8
		or ,,	39—0—0

It is seen that it costs about Rs. 39 to raise a gilt weighing 180 lbs. liveweight. The sale price of the pig here is 4 annas per lb. liveweight and this works out to Rs. 45. The net profit works out to Rs. 6 that is about 15·3 per cent. This is no doubt a very good business proposition. It must, however, be borne in mind that if the purpose was purely for bacon it would have been possible to force the pigs to attain the weight sooner, which means a quick turn-over.

So much has been said on raising the Berkshire at Hosur. It will be interesting to have some idea of pig raising in the villages. To begin with, the conformation of the Indian pig is not of the bacon type nor is it conducive for putting on fat economically. It is very narrow in the back and not as well set as the Berkshire. The indigenous pig is not easily handled because it is often wild and bellicose. Moreover as it is far too agile it is not capable of putting on weight easily. It is said that the pork of the indigenous pig tastes superior to that of the Berkshire. The pigs being generally raised under filthy conditions in villages the author has not ventured to verify this opinion.

The following table is given to compare the two types of pigs :—

	Berkshire at Hosur.	Indigenous pig at Pedda Belagonda Palli.
First heat period	9—10 months	1 year old
Gestation period	110—120 days	About 126—135 days
Number of piglings in a litter	Average 8	6—11
When the sow takes to the boar after farrowing	3—4 months	4—5 months
When piglings are weaned	2 months	No regular weaning period
Number of farrowings in a year	2*	No accurate information available.

The information given above with regard to the indigenous pig was obtained from the Reddy Dhomber community of Pedda Belagonda Palli about 3 miles from the Livestock Research Station, Hosur. The villagers do not keep records in any books, but they have a remarkable memory and generally calculate their periods either by linking them with some well known Hindu festival or by reference to the lunar system.

Pig keeping is not taken up by any particular caste as such. Pigs are maintained by certain communities varying from place to place. At Pedda Belagonda Palli for instance the pigs are kept by the Reddy Dhombers.

Generally the piglings do not get any extra feed until a month old. The chief concentrated feed is tamarind seed soaked in water for half a day before feeding. The coat of the seeds is removed as they soak but no crushing is done.

An adult gets 11½ lbs. of tamarind seed in addition to some buttermilk, ragi balls and kitchen slops given haphazardly. The pig generally grazes all round the villages and scavenges in most places. The pig generally consumes wild ficus fruits during the fruiting season.

The cost of 11½ lbs. of tamarind seed used per day is 2 as. 2 ps. If the fattening period is to last 9 months the cost of this item alone will exceed Rs. 16/-; while the selling price of 5 months old boar gilt is Rs. 8 to Rs. 9/- a fattened animal will fetch about Rs. 18/- to Rs. 20.

If all the items are taken into account and charged for, the margin of profit will indeed be narrow; but it has to be remembered that when pig keeping is done as a side line the actual cost of maintenance is very low.

The indigenous pigs are not usually weighed. Nevertheless with a great deal of dexterity on the part of the owners some of them were weighed with the following results :—

A 5 months old boar weighs 82 lbs.
A 5 months old gilt weighs 80 lbs.
A 1 ½ years old sow weighs 204 lbs.

The above weights indicate that the indigenous pig is a slow grower. From the view point of economics it would be profitable to raise either the Berkshire or Berkshire crosses with the indigenous type.

Acknowledgement. The cost of raising pigs at the Livestock Research Station, Hosur in particular was worked out by the Asssistant Farm Manager, Mr. P. M. Appasami Pillai to whom my thanks are due.

THE PALMYRA FIBRE INDUSTRY IN THE GOLUGONDA TALUK : VIZAG DISTRICT

BY P. L. NARASIMHAM,

Agricultural Demonstrator, Narasapatam.

This industry is said to have first come into existence in this taluq during the famine year (*Khara)* 1891, when some of the cultivating and labouring classes took to it as a side line; but as conditions became normal, most of the cultivating classes gave up the industry while the labouring classes continued it. In due course it became the monopoly of the 'Malas' who form the bulk of the non-cultivating lower classes. These people spend most of their leisure hours on this industry and earn either a part or a whole of their weekly market expenses. The industry now affords occupation for no less than 2,000 families who would have otherwise emigrated either to Rangoon or Assam.

Leaf sheaths (i e. the basal portion of the leaf stalks) of palmyra trees are cut, split into two, and the sharp edges and a thin layer of the inner side are removed. The remaining portion is beaten with a wooden hammer on a hard floor till the fibres are separated. They are then combed on sharp tines fixed to the end of a flat wooden plank, (2½" long and 8" wide, the tines 3" long) being fixed in two rows of six each, alternating. The preliminary combing is not thorough, but some amount of the nonfibrous matter is removed in order to separate the fibres. The stuff is then bundled and taken to the weekly shandies or disposed of day after day, if the market is near, to the merchants who deal in the article. It usually fetches Rs. 2/4 to Rs. 3/6 per cwt.

In one of the central villages Kondalagraharam, where intensive propaganda on agricultural improvements is being carried on, there are 16 families having 32 working members who produce about 100 maunds of fibre fetching about Rs. 50 to Rs. 75 per week, which works out to 3½ to 5¼ annas per head per day, but out of this amount about 25% has to be paid as rent to the owners of the palms.

When the industry was in the infant stage the owners of the palms allowed the leaf sheaths to be cut free of cost, but when they found that a large number of these people had made this their main profession the owners began to demand Rs. 10 to 12 for every 100 palms. The rent is sometimes higher in case of palms which are between ten and fifteen years of age as they supply a large number of sheaths which produce a higher percentage of fibre. Generally 100 lbs. of these sheaths produce about 30 to 33 lbs. of fibre but the percentage falls down to about 20% in the case of sheaths from young palms. In one test, while 108 leaf sheaths were required to yield 25 lbs. of fibre in the case of trees 10—15 years of age, 238 sheaths from young trees and 195 from old trees respectively were required to yield the same quantity.

The total weekly output of fibre in the whole taluq is estimated at 5,000 mds. of crude fibre valued at Rs. 2.500 to Rs. 3,750 depending upon the quality. Out of the total production 50% goes to the Makavarapupalem market, 25% to the Narsapatam market, and the balance to the Tallapalem shandy. Thus the taluq is trading annually in about Rs. 1,50,000 worth of fibre.

The merchants who purchase the crude fibre get it thoroughly combed and dried in the sun. The fibre is then graded into 'Black' and 'Brown' and tied into small bundles of 2 to 2½" diameter. They are then polished under foot on a rough surface (usually on stone slabs), and are finally combed, and tied into bigger bundles weighing 2 to 2½ mds. This operation is usually given on contract to women coolies @ 5 annas per cwt. Sometimes the brown fibre is dyed black with catechu, myrabolams and iron compounds (the actual process of dyeing being kept a secret) to obtain a better price in the market.

The price generally ranges from Rs. 14 to 18 per cwt. of black fibre and Rs. 7 to 9 per cwt. of brown fibre, the price depending upon the quality and demand.

The profits realised by the merchant generally depend upon the percentage of 'Black' fibre the crude product contains. One cwt. of crude fibre usually yields 14 lbs. of black fibre and 28 lbs. of brown fibre, which fetch Rs. 4 at the rates quoted above. Taking the purchase value @ Rs. 2-12-0 per cwt. the merchant will have a net profit of 8 annas per cwt. after allowing for cleaning and transport charges as shown below:—

Balance sheet of the merchant.

Cost of 112 lbs. of crude fibre	Rs.	2—12—0
Cost of cleaning	Rs	0—5—0
Transport charges	„	0—7—0
Total outlay	„	3—8—0
Value realised from 14 lbs. of Black fibre @ Rs. 16 per cwt.	Rs.	2—0—0
„ „ 28 lbs of Brown fibre @ Rs. 8 Do.	„	2—0—0
Total	„	4—0—0

The profit on every one cwt. of crude fibre purchased, cleaned and sold, is thus Rs. 0-8-0.

The local merchants transport the final product to Cocanada, the central market for this commodity, from which place it is exported chiefly to Japan and America.

A SHORT NOTE ON THE CULTIVATION OF CHARAKANDA IN GANJAM DISTRICT

By M. GOPALA RAO,

Assistant Agricultural Demonstrator, Berhampur.

Charakanda is one of the Colocasia crops grown in the Ganjam district during the summer months with heavy manuring and copious irrigations. Its cultivation is found on a large scale in the northern portions of Ganjam, where conditions permit the tapping of subterranean water. Its cultivation, though on a limited scale extends, up to the northern portions of Vizagapatam district. In the Oriya parts it is exclusively cultivated by Oriya Brahmins, while others take to its cultivation in Telugu parts. The extent a single ryot cultivates varies from 20 to 50 cents, and 30 cents can be taken as the average.

Soils. The soil most suitable for the cultivation of *Charakanda* is a light rich loam. In places where such soils are not available, its cultivation is found even on heavy soils. The crop can be grown even on rich laterite soils but only if they do not contain any considerable proportion of sand. The heavy feeding habit of the crop coupled with its long duration of seven to eight months needs soils of a rich type.

Preparation of the Land. After a thorough ploughing eight to ten times, the plot is laid into trenches 2 to 2½ feet apart from centre to centre, 1 foot wide, and 12 to 16 inches deep The length of each trench is limited to 10 to 12 feet, so that the middle portion of the trench may be reached from either side, while water is being splashed from the irrigation channels formed at both the headlands of the trenches. Holes of about 6" diameter are dug in the trenches prepared at a distance of 9" from centre to centre, and planting is done in these holes.

Planting Material and Planting. The planting season commences with the middle of January, and extends up to the middle of April. For purposes of planting well-ripened corms about nine months old are selected, and after the removal of the adhering roots and soil the corms are preserved in a single layer on a structure made of wood or bamboo, and raised above ground. Free aeration is considered to be essential for the proper preservation of the seed material. At the time of planting the corm is cut into pieces each containing a single eye bud. About 900 lb. of corms giving 7,500 to 8,000 eye buds are required to plant an acre. Each of the holes dug in the trenches receives a single piece with a sound eye bud, and after the completion of planting the planted material gets hand-watering.

After-cultivation: The planted material completes its germination within a week after planting, and the first irrigation is given after the completion of germination. Subsequent irrigations follow at intervals of 3 to 4 days until the crop is about 1 to 1½ months old

after which the individual plants get a dose of oil cake at the rate of 900 lb. per acre. The crop has to be irrigated daily during the cool hours of the day after the application of oil cake. Till the time of the first application of oil cake the plants in the trenches are either hand watered with the water stored in the irrigation channels at the headlands of the trenches or irrigated by splashing water from the irrigation channels into the individual trenches with a hand shovel. The application of oil cake necessitates the filling up of trenches with the earth from the ridges, and the subsequent irrigations are affected by allowing the flow of water into the trenches direct. The second manuring is given after an interval of about 6 weeks from the time of the first application, and the rate of first application is 900 lb. per acre as in the first instance. In rare instances there is the practice of giving a third application of cake at the usual rate after another interval of 6 weeks, and this application is considered to bring increased returns outweighing the expenses involved. With the completion of application of oil cake the trenches get completely filled up with the soil from the ridges, and the cultivator is kept busy in looking to the daily liberal irrigation of the crop.

Harvesting and Yield: A period of seven months is usually considered sufficient to ripen the crop, but it is believed that the longer the crop is kept the better it proves in quality. The crop intended to supply seed material is allowed to stand from 8 to 10 months. The yellowing of the leaves is an indication of the maturity of the crop. The corms of each individual plant are lifted separately with all possible care, and after lifting, the leaves as well as the fibrous root along with the soil adhering are scraped off, and the corm is thus ready for marketing. A corm of average size weighs about 2½ lb. The outturn is about 16,800 lb. per acre costing about Rs. 290 at an average local wholesale rate of 55 lb. per rupee.

Cost of Production. The labour charges for the cultivation of an acre of *Charakanda* come to about Rs. 175 of which irrigations alone require Rs. 150, and the balance towards other operations. If to this the cost of manuring which comes to about Rs. 50, and the cost of seed material at about Rs. 30 are included there is hardly any profit for the cultivator. But the object of the ryot in taking to the cultivation of this crop is to earn a decent amount for his personal labour during the off season, and in this there is perfect justification since the actual cash expenditure a ryot has to incur is only about Rs. 50 for manuring, the rest of the field operations being managed by himself.

Markets. There is very little fluctuation in the value of this vegetable, since the sale does not depend on any outside demand. There is always a good demand for this vegetable, and there is considerable margin for the extension of the area under this crop to meet

the local demand leaving aside the possibilities for its export to other areas, where its cultivation is not known.

In these days of agricultural depression the cultivation of *Charakanda* in high level paddy areas with facilities for irrigation deserves encouragement as it occupies the field during the off season for paddy. The thorough preparatory cultivation and the heavy manuring which this crop receives benefits the subsequent paddy crop to a considerable extent.

THE CULTIVATION OF PIPPALI (PIPER LONGUM) IN THE AGENCY TRACTS

By N. M. BHUKTA,

Asst. Agricultural Demonstrator, Vaddadi.

The agency tracts of the Padwa, Veeravalle and Golugonda taluks are said to be the only places in the Madras Presidency, where *Pippali* (*Piper longum*) is cultivated. It is generally grown for its roots known as *pippali moli* or *pippali modu* and not for its fruits. It is a perennial crop and gives good yields from the second year up to the 30th, when they decline. But crops said to have been planted over 100 years ago are sometimes seen. The crop is believed not to thrive in the plains, as it becomes stunted in growth and produces inferior roots.

This being a very valuable commercial crop of the agency tracts referred to above, the hill tribes cultivate the crop in patches varying from 20 to 50 cents in area. The crop is grown 'dry' with the rains which average about 70 inches per annum. Generally it is grown pure, though in a few cases it is seen as a mixture with maize, yams (*Dioscorea* sp.), turmeric, ginger and sweet potato.

Soil:— The soil is a good loam, very rich in its content of organic matter, and is particularly suited for the cultivation of this crop.

Preparation of the land:— The land to be planted afresh is ploughed 3 to 5 times with the receipt of the summer rains. While ploughing, stones in the surface soil (if any) are removed and these along with stones brought from outside are piled round the plot and formed into a wall to prevent trespass of wild animals and cattle. The land is then levelled and made ready for planting.

Manuring:— No initial manuring is ordinarily done. About a month after the planting of the vines, cattle manure at about 5 cart-loads per acre is applied.

Planting material and planting:—Cuttings from a crop of more than one year old are taken for planting. Each cutting consists of 5 to 6 nodes and is about 1½ feet in length. Planting is done just after the break of the South-west monsoon i e in June—July. The cuttings

are formed into rings, the end of the cutting projecting 3 to 4 inches further. These rings are planted at a distance of 9 inches to 1 foot in furrows opened 1 foot apart by a country plough and covered over by foot leaving the projecting ends above ground. If the crop is to be grown mixed with any other crop named above, the seed material of the same is sown or planted in the midst of every 6 vines of *pippuli*.

After Cultivation:— About a month after planting one hoeing and weeding is given and the gaps, if any, are filled in. Two more hoeings are given at an interval of one month, after which only weeding is done as often as necessary.

Harvest:— The crop gets ready for harvest for the first time 18 months after planting, i. e., in November and December of the following year. After cutting off the old vines close to the ground the roots are dug with a crowbar or a *mammaty* with a long handle, and cleaned.

Ratooning:— For a ratoon crop the clods are broken, after the harvest of the previous crop and cattle manure about 5 cart-loads per acre applied. The crop comes up from the residual roots left in the soil. The crop is then hoed and weeded in the same manner as for the first crop. If there are gaps they are filled in while giving the first hoeing with fresh cuttings obtained from an old crop. A ratoon crop gets ready for harvest only 2 years after the harvest of the previous one i. e., a crop is obtained only in alternate years.

The roots after cleaning are heaped in shade for a day, after which they are cut into pieces of 1 ¼ to 2 inches in length, and graded into 3 main sorts, namely:

1. *Modu*:— Superior grade; 1 to 2 pieces weigh a tola, each piece having 5 to 8 nodes. A maund (25 lbs.) of this fetches Rs. 100 to Rs. 150.

2. *Enchupulla*:— Medium grade; 3 to 7 pieces weigh a tola, each piece having 2 to 5 nodes. A maund of this fetches Rs. 30 to Rs. 80.

3. *Putturasi*:— Inferior grade; 20 to 40 pieces weigh 1 tola—very thin stuff, a maund of produce fetching Rs. 5 to Rs. 20.

Yield:— The average yield is about 500 lbs. of all the three grades, fetching Rs. 750 to Rs. 1,000 per acre on the whole.

Marketing:— Madgole is the chief market for this produce. The merchants of this place give advances to the growers of *Pippali moli* to an extent of Rs. 300 per acre. The produce is packed in Adda (*Bauhinia vahlii*) leaf baskets and sent to Madgole, where the merchants after taking delivery of the produce further grade it into various sorts, the value of which varies from Rs. 5 to Rs. 150 per maund. It is reported that during the last harvesting season about Rs. 4¼ lakhs worth of this hill produce was exported from Madgole to a good num-

ber of towns in India, chiefly to Bombay. Messers. Navaneetha Lal Savai Lal and Chandulal Motilal are the two noted firms in Bombay which deal with all the superior sorts of this produce. Some of the cheap products valued at Rs. 10 and below per maund are sent to Madras chiefly to Messrs. Sanjivi Dhanai Lal Mansa Lal and Appa and Co. The other important towns dealing with the produce are Secundrabad, Warangal, Bezwada and Guntur. Its export to other countries is not common.

Uses :— The uses of this drug are not much known. The stuff is noted to have good medicinal properties. It is administered to women in confinement to heat the system. It is also said that it is consumed with milk or coffee by a large number of people in certain parts of the Bombay Presidency.

INHERITANCE OF MILKING CAPACITY

Karl Madsen of the Institute of Animal Genetics, Edinburgh, writes in *Nature* (Jan. 30, 1932) as follows :—

A study of the milk yields of the progeny of 728 bulls of the Red Danish breed has been made with a view to determine—first, the ability of each bull to transmit the different degrees of milking capacity ; and secondly, having thus obtained an index of this ability, to determine the extent to which it was influenced by the various animals in his pedigree. The average number of daughters to each bull was 18. The figures were taken from the annual reports of the Milk Recording Societies throughout Denmark for 1918—1931. The daughters' yields were mainly calculated on the average of the first two lactations and corrected to the third lactation. The records of the dams and grandams were based on as many lactations as possible, from three to ten, and averaging 5·5. The average of these uncorrected lactations was taken as an indication of the milking capacity of the dam or grandams.

To measure the genetic aspect of the ability of bulls to transmit milking capacity, correlations were made of the average yields of the daughters of these bulls to the average yields of the daughters of their sires, and to the actual yields of their dams and grandams. Thus, the milking capacity of the bulls (as measured by the yields of their daughters) has been correlated to the milking capacity of the sires and grandsires (similarly measured) and to the dams and grandams (as measured by actual production). These correlations are as shown in the accompanying table:

x	y	N	Total yield of milk			Total yield of Butterfat		
			r	$R\frac{x}{y}$	$\sigma y/\sigma$	r	$R\frac{x}{y}$	$\sigma y/\sigma x$
Bulls to Sires	... ...	555	0·255	0·291	0·877	0·324	0·388	0·834
,, to Dams	... ...	725	0·173	0·117	1·47	0·183	0·141	1·30
,, to Paternal grandsires	...	473	0·202	0·263	0·767	0·193	0·267	0·723
,, to Maternal grandsires	...	505	0·194	0·208	0·932	0·258	0·291	0·885
,, to Paternal grandams	...	721	0·026	0·018	1·45	0·061	0·055	1·10
,, to Maternal grandams	...	715	0·112	0·077	1·46	0·170	0·134	1·27

The standard error of "r" ranges from $\pm$ 0·03 to $\pm$ 0·04. R=regression.
Bulls (x) mean total yield of milk=4403 Kgm., σ=440,
,, ,, ,, of butterfat=179·64 Kgm., σ=20·48.

It is to be noted that the genotypes of the bulls have not been compared to the genotypes of their male ancestors, but to the phenotypes of their female ancestors. Hence the correlation figures to the male ancestry cannot be directly compared with those to the female ancestry.

It will be seen that as regards milk yield, the paternal grandsire has an effect equal with the maternal grandsire, though as regards butterfat yields, the maternal grandsire is of slightly greater importance. This can be accounted for by the methods employed by the breeders, who for the past fifteen years have, through an intelligent appreciation of the value of the progeny test, paid almost exclusive attention to the male line. From a study of the records of the progeny of the two grandsires and the deviation of the yields of their daughters, it was found that the more highly selected bulls which appeared as paternal grandsires, were distinctly more homozygous for the factors affecting the transmission of milking capacity than were the less highly selected maternal grandsires.

There is, however, a highly significant difference between the correlation figures to the two grandams. The correlation to the paternal grandam is practically nil, while that to the maternal grandam is significant.

Smith, Scott and Fowler (*Jour. Dairy Res.*, 1930, vol. 1, p. 174) working with correlations of Ayrshire cows to their ancestors, found a significantly lower correlation to the paternal than to the maternal grandsire, and from this deduced a possibility that sex-linked factors might be involved. In the present study, the correlation to the two grandsires is approximately the same, but a difference is found between the correlations to the two grandams. The present study is

of *bulls* and of their ancestry. A character inherited in a sex-linked manner cannot be transmitted to a bull from his paternal grandam. (But a paternal grandam can transmit sex-linked factors to her granddaughters). Accordingly, in the present work, the test as to whether sex-linked factors are involved in the transmission of milking capacity depends on whether or not there is in this respect a difference between the correlations of the bull to his two grandams. This has been found to be the case. Thus, while from these figures it can be demonstrated that autosomal factors are concerned in the transmission of milking capacity, it is also clearly shown that this capacity is to no small extent conditioned by factors inherited in a sex linked manner.

VEGETATIVE PROPAGATION

A fresh plant may generally be raised by two methods ; from seed, or from some fragment of a parent plant other than a seed, or, as in budded seedling stock, by a combination of both methods. Seed propagation involves a sexual act, and produces a definitely new individual which may or may not closely resemble the parent type. In most orchard crops, the offspring usually show considerable variation. Vegetative propagation is not a sexual process and does not produce a new type, it merely extends the original parent type.

Considerable advantage has been taken of vegetative propagation with temperate orchard crops, and there is every reason to anticipate that a wider application of such methods to tropical crops would prove of advantage. The realisation of this will depend primarily on the discovery of methods of vegetative propagation suitable to commercial application, and secondly, in the interest shown by planters in the use of vegetatively raised stock.

The practical classification of methods of vegetative propagation may be made into :— (1) Rooting processes, and (2) Grafting processes. The first groups of methods aims at the production of new roots and shoots upon plant parts such as stems, roots or even leaves, the new root and shoot system being eventually established as a new plant. This group may be further subdivided according to whether the new roots are formed while the organ is still retained on the parent plant, or after it has been removed as a cutting. Thus there are :—(1) Layering, stooling and allied processes such as " bagging " or " marcotting ". (2) Cuttings, which may be either hardwood or softwood stem cuttings, root cuttings or leaf cuttings.

The second main group consists of the method of grafting, budding and approach grafting, sometimes collected under the general term " graftage ". There are many modifications of practical methods,

but the basic principle is always that of inducing the tissues of two separate plants to grow together, in order to form one composite plant. In grafting or budding, a part of one plant, either a small piece of stem or a piece of bark including a bud, is removed and placed in contact with the cambial tissue of the other plant, so that the tissues grow together. In approach grafting, two plants are made to grow together, while each is still on its own roots, by removing the bark from portions of the stems to expose the cambium and binding the two stems together with the bared surfaces in contact.

ADVANTAGES

The advantages of vegetative propagation are as follows :—

(a) **Uniformity.** The extension of a type by vegetative propagation makes possible a degree of crop uniformity, both of yield and of quality, which is rarely attained in a seedling population. This uniformity is of great advantage both in the scientific and the commercial fields. In scientific work, a high intrinsic variability in the experimental material obscures the variability caused by the experimental conditions ; for the grower, the presence of low yielding types increases the overhead costs of the plantation. The root stock upon which a variety is budded often has a marked influence upon the yielding capacity of the scion. If uniform yielding material is required, the variety must either be established on its own roots by root cuttings or stool shoots, or else it must be budded on to a clonal root-stock. Only if the root system is clonal can a reasonable uniformity of yield be obtained.

(b) **Extension of Environmental Range of a Crop.** The isolation of individual plants, chosen for special qualities, such as cold or drought tolerance, and their subsequent vegetative propagation can increase the range of cultivation of a crop by bringing in districts which are unsuited to the average type. This is analagous to the breeding of hardy strains of wheat, when however, vegetative propagation is not necessary to fix a type, as pure genetic lines are readily raised.

(c) **Increase of vigour of weakly types by working on to suitable clonal Root-stocks.** In temperate horticulture it is a standard practice to work certain varieties on to vigorous stocks, thus improving either their vegetative growth or cropping capacity, or both. In tropical crops, modern breeding work will probably produce delicate varieties which require the assistance of hardy root-stock.

(d) **Propagation of Sterile Types.** Some desirable fruit varieties, such as seedless oranges, grapefruit and sapodillas, are highly sterile and thus cannot be propagated by seed. In these fruits, vegetative, propagation must be used to extend the variety.

(e) **Early Maturity.** A bud from a seedling may often be made to grow and bear fruit sooner than the original seedling, by working

it on to a stock. This hastening of maturity would be of great value in speeding up genetic work on an orchard crop.

DISADVANTAGES

(a) **Initial Cost.** The first cost of a vegetatively raised nursery plant will be usually higher than that of a seedling planted at stake. However, the increased yield expected from such nursery plants should amply justify the initial increased expenditure.

(b) **The Root System.** A tap-root is by definition an organ peculiar to a seedling. However, exactly similar functioning roots can grow on vegetatively raised plants. It is highly probable that in most orchard crops, after a certain age, the root systems of trees which grew from seedling root-stocks and those which grew from vegetative root-stocks will be found to be indistinguishable. Even in seedlings it is doubtful whether the primary tap-root is persistent in a mature tree.

(c) **Senescence and Degeneration.** Does continued vegetative propagation necessarily result in any lack of vigour, either vegetative or sexual, in the plant? The question of senescence always arises in connection with vegetative extension of varieties. At the present day, the occurrence of true senescence in clones on continued vegetative propagation is neither proved nor disproved. However, even if some senescence were proved to occur, it would not affect very much the policy of orchard crop growers, who normally would wish to plant new varieties from time to time, rather than to replant with old varieties which would have begun to wane in popular favour. There, is however, the problem of contamination of clonal varieties by rogue plants, either of seedling or clonal origin, or by diseased plants. This contamination may materially reduce the yield from a plantation and give the impression of senile change, or "running out" in a variety. The solution must lie in the prevention of the propagation of rogue types by care in taking bud-wood or cuttings and by vigilence in the nursery.

(d) **Problems of Sterility within a Clone and between Clones.** Self-sterility occurs in many varieties of fruit crops. Even different varieties may not be sufficiently cross-fertile to ensure sufficient setting. Some edible fruits develop with a low percentage of ovules fertilised, and in these, high degrees of sterility occur without affecting yield. In a seed crop, however, a high percentage of ovules must be fertilised as seed is rarely produced without fertilisation. In such crops, therefore, precautions must be taken against sterility by planting mutually cross-fertile varieties together.—*Malayan Agricultural Journal* (Abstract of an article by E. E. Pyke B. Sc., A. R. C. S. in *Tropical Agriculture*, January 1932).

ABSTRACTS

Influence of size and shape of plots on the precision of field experiments with Potatoes. Justesen, S. H. (*Jour. of Agr. Sci.*, London, 1932, Vol. 22, pp. 366—372). A uniformity trial on potatoes was conducted at Ormskirk on a field about 200 ft. by 223 ft. (one acre area), by growing 103 rows of 'Ninetyfold' potato, the space between rows being 26 inches. The field was harvested in single row plots 33 ft. 7 in. long, 6 of these making up the length of the field, so that there were in total 618 plots. In analysing the data a system of randomised blocks was designed. It was found:— (1) When the size of the plot is increased, the standard deviation in per cent. of the mean decreases up to a certain limit and then increases due to interference of soil variation. (2). Two-row plots show less variation than either 1 or 3-row plots, probably due to row competition. (3) When the area to be used is fixed, smaller plots are more efficient than larger, owing to the greater number of replications in the former case. One exception occurs in the case where border rows are not harvested; here 4-row plots are more efficient than 3-row plots, owing to the fact that a larger part of the soil is included in the calculations when 4-row plots are used. (4). Long and narrow plots are more efficient than shorter and wider of the same size. The only exception is again explained by row competition. (5). In field experiments with potatoes fairly large plots should be used; at least 2 rows wide and preferably long and narrow strips. (C. N.)

Studies on the influence of external conditions on the flowering of rice plants. Y. Noguchi (*Jap. Jour. of Bot...* 1929, vol, 4, 237—76). The author summarises in the present paper the results of experiments extending over seven years conducted with the "Kumamoto" and "Goshiu" varieties of rice in the gardens attached to the Imperial University of Tokyo, with a view to determine the influence of external conditions like temperature, light, humidity, atmospheric pressure etc. on the dehiscence of anthers and flowering in rice plants. The conclusions arrived at are :—(1). In nature, flowering takes place in rice when the temperature at 8 a. m. amounts to about 27—28° C. The higher the temperature, the more active it is up to 32° C, at which temperature it ceases. The optimum temperature for flowering, both in the open and in the laboratory thermostat, was 30±2 C; in the thermostat, 50° C is the maximum limit for flowering. (2). The dehiscence of the anthers and pollination occur best at about 30° C. The angle of opening of the glumes is quite independent of the temperature. (3). The optimum humidity for flowering is 70—80 % and sudden change of this in the morning is soon followed by the main flowering period. Air saturated with moisture seems to hinder the opening of the flowers. (4). Excessive moisture prevents the dehiscence of the anthers which are often quite incapable of bursting, so prejudicing pollination. The grain setting of panicles developed under such conditions is 59% instead of the normal 65%. (5). In the open, flowering may occur with 50 % of moisture, although even below 70 % the number of opened flowers decreases and under 65 % this process occurs rarely. (6) Neither the dehiscence of the anthers nor the pollination is prevented by dryness, although grain setting is significantly reduced, which is probably due to the damage or death of the stigma. (7). In darkness the number of opened flowers decreased considerably and the flowering process is markedly disturbed so that the chief flowering period is delayed about an hour. The dehiscence of the anthers, pollination or grain setting are not in the least injured by it. (8). With monochromatic light, orange light accelerated most the opening of the flowers then follows yellow; ultra-violet light has no stimulating effect on flowering. Electric light considerably accelerated the process. (9). Change in atmospheric pressure in nature has no influence on the flowering of rice. (10). The opening of flowers is somewhat delayed by rain and storm, but the total number of opened flowers

remains the same. The dehiscence of the anthers and pollination are somewhat hindered, but grain setting is not affected by rain and storm. (C. N.)

Conservation of Fertilizer materials from minor sources.— C. C. Fletcher (Misc. Public. No. 136 of the U. S. A. Dept. of Agr. Jan. 1932). describes methods for the preparation of composts (synthetic farmyard manure) from various farm refuses. (1). The Rothamsted process consists in adding to every ton of dry weight of plant refuse materials, such as straw or leaves, 100 lbs. of sulphate of ammonia and 100 lbs. of finely ground limestone. The straw is laid down in a layer about 1ft. thick and some of the chemicals applied, then another layer of straw or organic matter is used, followed again by chemical treatment; and the process is repeated until the pile is built up. During this operation, the pile is sprinkled with water and kept moist. The pile is made concave, so that it can retain water added, and it is kept moist to promote decomposition. (2). The New York Agric. Expt. Station at Geneva, N. Y. recommends that to each ton of dry straw the following fertilizer materials be added:—Sulphate of ammonia 60 lbs., ground limestone 50 lbs., super-phosphate 30 lbs., muriate of potash 25 lbs. The straw or other organic matter is spread out in a pile, layer by layer. Each 6-inch layer is treated with the chemicals. The pile is built up layer by layer until it is about 4 feet high. Each layer is wet as placed, and finally the pile is kept moist as decomposition occurs. A mixture of this character started in July was thoroughly decomposed in 3 months, (3). The Missouri Agrl. Expt. Station has used and recommends a mixture of 45% ammonium sulphate, 40% finely ground limestone and 15% acid phosphate. This mixture used at the rate of 150 lbs. per ton of straw, with moisture, converts straw into a brown product having all the general properties of manure. (4). The Iowa Agrl. Expt. Station used two mixtures—one of 45 % ammonium sulphate, 23 % finely ground rock phosphate and 32 % finely ground limestone, and the other of 45 % ammonium sulphate, 15% super-phosphate (16% grade), and 40% finely ground limestone. Both these mixtures made satisfactory composts when sufficient water was added. The pamphlet ends with a useful table giving the analysis for N. K. P of a large number of commercial materials, useful as manure. (C. N.)

A Study of the influence of climate upon Nitrogen and Organic matter content of the Soil. Hans Jenny (*Missouri Agri. Expt. Stn. Research Bull.* No. 152). Difficulties encountered in the maintenance of Nitrogen and organic matter in Missouri soils led to the study of climate as a possible factor controlling the nitrogen level in soils. After suitable climate maps of the United States had been constructed and a large number of nitrogen analysis correlated with temperature and moisture, it was found that climate exerts a dominating influence on the amount of total nitrogen in soils. With increasing temperature, soil nitrogen and organic matter decrease, while with increasing moisture values they increase. It is possible to construct an idealized Nitrogen-climate-surface for the soils of the Great Plains area and the Prairie region. A causal relationship between the Nitrogen-temperature relation on the one hand and soil organic matter maintenance low corn yields in southern regions on the other has been suggested. (Author's Summary).

Experiments on Rationing of Silage to cows. Dave, C. N. and Singh, H. (*Agriculture & Livestock in India*, 1932. vol. 2, pp, 13—22). In order to determine the relative merits of high and low silage feeding to cows in milk, the authors have experimented with 22 freshly calved cows (Scindhi and cross—bred), paired into two groups A and B, of which A was supplied with excess of Ragi silage and B with less. both the groups being given in addition ragi straw (ad. lib.) and a concentrate mixture of wheat bran, gram husk and groundnut cake in proportion to the milk yield of the animals. The following conclusions are arrived at:—(1). An average animal could not consume more than about 30 lbs of fresh silage per

day (containing 26 % of dry matter). (2). The animals which were given less silage consumed more straw, animals in both the groups A and B consuming about 20 to 25 lbs. total dry matter per day, (3). There was a slightly lower yield of milk from the batch A fed with more silage (A : 17·2 lbs., B : 17·9 lbs. per day), but this was set off by a slightly higher percentage of fat (A ; 4·02 %, B : 3·90 %) and of protein, so that the net products obtained in both the cases were almost the same. (4). The experiment shows that silage, which is expensive to make and feed, may be reduced to 17 lbs. per head per day, without affecting the milk yield. (5) The data show that Scindhi cows of average live weight, 650 lbs., consumed about 26 to 27 lbs. dry matter, while crossbreds of average live weight 830 lbs. consumed about the same quantity of dry matter (27·4 lbs.) (6). Analyses of the Starch equivalents of feeds consumed showed that for milk production about 0·2 lb. S. E. per lb. milk was required, which is much below Kellner's standard (0·25 lb. S. E. per lb. of milk). This difference is attributed to the under-estimation of the starch equivalent values of Ragi straw and Silage, especially after chaffing, which process tends to appreciably increase the S. E. values, (C. N.)

Gleanings

Protection of Beneficial Insects. While special laws for the protection from wanton destruction of birds useful in agriculture exist in most countries of the world, parasitic and predaceous insects which are equally, and often much more, beneficial than birds remain unprotected. The main reason, of course, was that there was no need of such protection, but recently an interesting situation arose in Mauritius. A scoliid wasp, *Tiphia*, was introduced into that island from Barbados as a means of checking the beetle *Phytalus smithi*, one of the worst pests of sugar-cane. Colonies of *Tiphia* were successfully established in several places, and the wasps began to spread, doing very useful work in the control of *Phytalus*. The beneficial effect of wasps was soon appreciated by sugar planters, who became very eager to secure the parasites for their own plantations. As a result, mass capture of the wasp and even a regular trade in them developed to such an extent that the carefully elaborated plans for a gradual establishment and spread of the parasite were in danger of being overthrown. In order to prevent this an ordinance has just been issued by the Government of Mauritius providing for the protection of any insect declared to be beneficial, and forbidding anyone to kill, injure, or molest any such insect. The declaration of an insect as beneficial rests with the Director of Agriculture, who is empowered to make surveys of private lands in order to ascertain the presence and the quantity of beneficial insects available for capture and distribution. The ordinance can be regarded as a *de jure* recognition of biological control of insect pests.— *Nature.*

Climate and Soil Physics. Dr. B. A. Keen, Assistant Director of the Rothamsted Experimental Station, delivered the G. J. Symons memorial lecture befor the Royal Meteorological Society on March 16, his subject being "Soil Physics in Relation to Meteorology". Dr Keen introduced his subject with a description of the different soil types found in different climate zones. In soil temperatures, the porous and moist nature of soil produces special effects. In particular, the downward percolation of water appreciably reduces the loss of heat from the soil. A full account was given of recent investigations at Rothamsted on the movement and distribution of water in the soil. It was shown that such movements are much less, both in amount and extent, than previously supposed.

Water which has reached a depth of about six feet in the average soil is not drawn back to the surface again by evaporation. Many of the farmers' and gardeners' cultivation operations were at one time supposed to conserve this subsoil water for use by plants, but the explanation has now to be sought for in other directions. The lecture concluded with a review of the development of cultivation implements, from the rudimentary form of a pointed stick, which merely stirred the ground, to the wide range of different types now in use. —*Nature.*

Land area for food.— 'It takes more than two acres of crops to produce food for an American but it takes only one acre for a German, one-half an acre for a Chinese and only one-fourth of an acre of land to feed a Japanese, according to Dr. O. E. Baker, Economist of the United States Department of Agriculture. Doctor Baker points out that these differences in the acreage of crops needed to feed one person are due principally to differences in diet. However, twice as much land is necessary to produce food for a Chinese as for a Japanese, because crop yields are much higher in Japan.' (*Scientific American*, May 1932.)

Smell of apples discourages sprouting of Potatoes.— Apples make the ideal companions for potatoes in storage, according to a report by Dr. O. H. Elmer of the Kansas Agricultural Station, in a recent issue of *Science*. Dr. Elmer's experiments revealed that potatoes stored with apples through the winter remain firmer and show less tendency to sprout than do potatoes stored alone. He attributes this to the volatile substances given off by apples, having apparently established the fact that potatoes will not sprout as long as they can "smell" apples. Apparently only ripe apples will do the trick, for Dr. Elmer's experiments seem to indicate that neither green apples nor rotten ones have any discouraging effect on the tubers; nor have the other fruits that he tried, including oranges and bananas. (A. E. B. in *Scientific American*, May 1932).

Notes and Comments.

The Locust Problem: The problem of fighting locusts in different parts of the world has been in existence ever since the days of Paroha and still continues to engage our attention. Within the last few years these creatures have caused serious and extensive damage throughout the north temperate regions extending from North Africa and Sudan on the one side to Turkestan and N. W. India on the other. It is satisfactory to note that serious attempts are now being made by different countries to check this constant menace. A locust conference was recently held in Rome which was attended by Italian, British and French delegates These three nations have agreed to recognise the Imperial Institute of Entomology, London, as the international centre for research on this subject and it was agreed that this institution will record all information available regarding locusts in North African French possessions, Sudan, Italian East Africa, etc. The British East African colonies and the Empire Marketing Board are financing the investigations which aim chiefly at studying locust conditions, their breeding places, the courses of locust swarms and the routes of

their various invasions. Two research officers have been engaged one in Uganda and the other in Sudan. This problem in North West India appears almost equally serious and the Imperial Council of Agricultural Research has very wisely taken up this problem. It is understood that this work in the North West Frontier and Baluchistan is carried on in co-operation with several workers in locust areas like Syria, Turkestan, Persia and Egyptian borders. We are, however, of opinion that the solution of such problems is not a very easy one or the work of a year or two; such investigations demand the close attention of specialists for four or five years before any satisfactory results can be achieved. It is, therefore, hoped that the Imperial Council of Agriculural Research having started the work in right earnest, may not give it up at this stage when it has only just started the investigations, however much they may be influenced by short-sighted proposals for retrenchment.

Agricultural Graduates and their Prospects: Some dis-satisfaction and heart burning were created by an ambiguous Government order issued sometime ago regarding the prospects of agricultural graduates in the Madras Agricultural Service; some doubts were entertained as to whether graduates of the local Agricultural College (B. Sc. Ags) were eligible for appointments in the Science branches and in the Madras Agricultural Service. It is gratifying to note, however, that in a recent G. O. No. 632 of 2nd May, Government has been pleased to clear the doubt by laying down that B. Sc. Ags are eligible for all grades of appointments in the Madras Agricultural Department.

Retirement of Mr. Fletcher, the Imperial Entomologist: Mr. Thomas Bainbrige Fletcher, the Imperial Entomologist, Pusa, recently left India on leave prior to retirement. Readers of our journal would remember that Mr. Fletcher was the first Government Entomologist appointed by the Government of Madras in April, 1912, and his pioneer work in this province is seen in his excellent work on *Some South Indian Insects* which is still the bible of Entomology students of S. India. In 1914 he was transferred to Pusa as Imperial Entomologist when Prof. H M. Lefroy left Pusa and since then has been holding the post of Imperial Entomologist. Those who have seen Mr. Fletcher and his work will bear testimony to the fact that he has a real love and enthusiasm for the subject and those who have had the fortune to work under him can never forget the encouragement and help he gave to the study of this interesting science. As a Systematic Entomologist and a specialist on the group of Microlepidoptera he has few equals. We wish Mr. Fletcher many years of well earned rest and opportunities for further useful work. It is gratifying to note that Mr. P. V. Isaac B. A., M. Sc., D, I. C., a Madrasee and who was at one time in our Institute is now in charge of the post of the Imperial Entomologist.

Sandal Spike and Lantana. At a conference recently held at Bangalore of Forest Officers and others interested in the investigation of the notorious spike disease of sandal it was reported that the notorious '*Lantana*' weed plays an important role in the spread of sandal spike and that serious measures have to be adopted towards the control of this undesirable weed which has very widely overrun some of the hill districts of the West Coast and the Mysore uplands. Suggestions were also made as to whether the pest cannot be controlled by biological methods as in the case of Prickly pear which is being very successfully exterminated by the introduction of the Cochineal insect. We are aware that some work has been done in the investigation of Lantana insects by Rao Saheb Y. Ramachandra Rao some years ago but as far as we can make out the economic aspect of the Lantana problem stands where it stood before. It will certainly be worth while doing something in this direction especially now that some relation has been pointed out between Lantana and Sandal spike.

The Gramaphone as a Teacher: There is a growing circle of men who have begun to suggest the gramaphone as a teacher for music and science lessons. In the United States some of the schools have started the use of gramaphone records to enliven science teaching to boys by bringing to the class rooms the voices of some of the most eminent men of Science. Such a course has also been suggested for music teaching in our houses for our boys and girls in the daily press by eminent musicians and artists. Little boys and girls of an impressionable age pick up conversations and music lessons through the "music grinder" far more easily than from tedious tutors.

Reviews.

(Bansi wheat of the Bombay Deccan and its improvement. *Part I. By B. Nazareth. Dept. of Agri. Bombay Bull no. 166 of 1931.)*

The bulletin first deals about the importance of wheat as a crop in Bombay, its place among the other cereals, and parts of the province where it is cultivated. The particular wheat dealt with in the bulletin, Bansi, is a hard white macaroni wheat mostly used in the preparation of sweets. The outturn is just enough to meet the local demand, there being very little of export trade in it. The wheat is grown under dry conditions as a rabi crop. It takes about four months to mature and it is seldom manured. During some years when the weather conditions are favourable black rust *(Puccinia graminis)* appears in an epidemic form and the entire crop is said to be destroyed. Since the rust appears about the second week of January cultivators prefer early varieties which when sown in the first or second week of October could be harvested by the end of January.

The method of pollination in this wheat is then described. One of the chief defects of this wheat is said to be the production of mottled grains under certain soil and atmospheric conditions which lowers the value of the produce considerably. Though the author states that by careful cultivation and the choice of seed this defect could be overcome to some extent, it is not clearly stated how this is to be done.

The selection work to get higher yielding strains out of this variety is then described. Strains have been evolved giving 15 to 20% more yield than the local seed, bringing in a net extra profit of Rs. 10–12 per acre to the cultivators who have grown them. But the strains are however, not resistant to rust and are also late in maturing. The method of yield trials described are rather too elementary.

We are afraid that the bulletin falls short of a real scientific publication and it is also not written in a sufficiently popular way to be useful to the laymen.

(K. R.)

Banana Breeding at the Imperial College of Tropical Agriculture. *By E. E. Cheesman. Empire Marketing Board publication No. 47.* The report gives an account of the progress of the author's breeding work which is directed towards evolving a new banana immune to Panama disease and yet retaining the characters of hardiness and attractive appearance of Gros Michel which have placed it in the forefront of commercial bananas. The bulletin gives a complete history of the work done at Trinidad since 1923 which consisted of raising seedlings and testing them, a method analogous to that employed with so much success in sugarcane.

Though the variety Gros Michel does not set seeds when pollinated with other members of the genus *Musa* some seedlings were obtained by pollinating it with *M. malaccensis*. Some of these are said to resemble Gros Michel and one seedling, I. C. I. is found to be resistant to panama disease. Attempts made to back cross this seedling to Gros Michel to get plants more like Gros Michel than the F1 hybrids and at the same time retain the disease resistance, have proved useless. The close resemblance of the hybrid to Gros Michel, the female parent has been found to be due to the doubling of the chromosome. According to the author there is greater scope in the first generation cross by other seeded types and a collection of possible male parents is being made with this end in view. About half the number of varieties in the collections have shown themselves capable of producing seed. Some of these are said to have good commercial qualities and progenies are being raised from them for study. The low germination percentage and a proportion of dwarf and weakly plants among those that do germinate makes progress slow.

The absence of a definite nomenclature and classification of the banana varieties existing in different parts of the world and varieties having different local names in different parts obviously complicates the work of the breeder. A good collection of varieties have been gathered at Trinidad from several parts of the tropics. Identity of the different varieties is done with great care by observing morphological differences, by checking chromosome numbers, and by comparing fruit bunches under storage conditions. Observations are also taken on seed production, on pollination, pollen fertility etc. This work becomes particularly important in as much as bananas are specially difficult to study from anything but living material. The collection and survey of types is carefully done by first growing the material in Kew in special quarantine green houses lest any new disease may be introduced with the suckers. This risk is, however, absent in the introduction of seeded types because of the absence of any seed borne disease.

The bulletin contains plenty of useful information for anyone who may be starting breeding work in bananas. (K. R.)

Another useful bulletin for a banana breeder (United Fruit Company, Boston, Mass., Research bull. 23, abstracted in Horticultural Abstracts, Vol II No. 1, 87) deals about the laboratory and field studies of the pollen from some varieties of *Musa*. The studies relate to the variations in pollen material in different varieties of bananas carried out to ascertain the more promising varieties for breeding

work. It has been shown that while the pollen of certain varieties show good germination there are others, where the pollen do not germinate making them unsuitable for breeding purposes. The whole technique including the different mediums used in the study, the different variations adopted in the mediums and the reactions of the pollen to such variations are all discussed in the bulletin. The pollen from about 97 different varieties have been examined and divided into 4 groups based on their physical characteristics and the germination percentage on artificial cultures. Of these four, one group with dry clean uniform pollen, germination 20–90%, and having no pre-germination in the anthers includes the majority of the seeded varieties. Another group having germination under 1%, characterised by having moderately scarce or even no pollen, a heavy matrix, and pre-germination within the anthers rare to frequent, includes the majority of the edible varieties. (K. R.)

Yet another bulletin equally interesting to the banana breeder (United Fruit Company, Boston, Mass:, Research bull. 22, abstracted in Horticultural Abstracts Vol 11 No. 1, 86) deals about the nature of sword and water suckers in the bananas. The point that the sword suckers make better propagating material than water suckers long known to the planter was under investi ation. The examination of the water suckers has revealed that the slender offset connecting them to the parent plant has been injured in some way usually by insect or fungal attack. Experiments conducted to test the view that the production of sword or water leaves was a matter of correlation between the sucker and the mother plant have proved that the production of sword sucker is due to the suppression of the growth of the sucker by the parent plant of which it is only a branch. The purpose of the delayed leaf development of the sword sucker is to provide a support for the leaves when they eventually develop which will lift them well above the ground and enable them to spread their lamina and to obtain better illumination. (K. R,)

College News & Notes.

Admission of Students to the College. The same committee as in last year consisting of, the Director of Agriculture, the Principal, and three Non-Officials, Dewan Bahadur C. S. Ratnasabapathy Mudaliar, Dewan Bahadur M. Ramachandra Rao and Khan Bahadur Kulifulla Sahib, met and interviewed the candidates at three centres, Tamalkota, Madras and Coimbatore. The final list of students selected is not yet ready but we hear that the number of students seeking admission to the College has fallen this year due in all probability to Government's decision to charge tution and lodging fees, apart from the question of unemployment facing the graduates of the college.

With the reopening of the college on 15th June for classes II and III, the maidan is once again busy with the games activities. The college had lost among the students who had passed out during the year some good all round sportsmen and we do hope there will be some useful additions to the list of men proficient in games and sports among those who are to join in the first year.

We understand that W. C. Thirumal Rao, student II year failed in Engineering of B. Sc. (Ag.) Examinations Part I, this year and not in Chemistry, as reported in the May issue. We regret the error.

Send-off. There was a pleasant function on the 15th got up by the old boys, friends and admirers of Rao Sahib T. V. Rajagopalachariar to bid him farewell on the eve of his retirement from the Department. We are glad Mr. Achariar is settling permanently at the Rathnasabapathipuram Extensions, close to the college estate. In his retirement we shall be missing a very popular personality and we wish him long life to enjoy his well earned rest.

Visitors. Among the visitors to the college during the month may be mentioned the Director of Agriculture, the three non-officials of the students' selection committee, Sir. T. Vijayaraghavachariar, Vice President, Imperial Council of Agricultural Research, L. W. Ilife, Manager, Lam Rural School, Guntur, H.H. Moyer, Manager, Bhimavaram High School, West Godavari, Lt. Col. King, Director, King's Institute, Guindy, and the Rajah of Munagala with two of his sons.

Weather Review (MAY, 1932)

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st	Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars	Gopalpore	0 1	−0·4	1·5	South	Negapatam	1·3	−0·6	7·6
	Berhampore *	1·0	−1·1	2·5		Madura	3·6	+0·8	5·4
	Calingapatam	4·5	+2·1	5 6		Aduthurai *	3·6	+1·1	8·5
	Vizagapatam	1·2	−1.0	3·1		Koilpatti *	1 1	−0·9	8·1
	Anakapalli *	0·8	−1 9	6·0		Pamban	1·9	+0·9	5·3
	Samalkota *	1·0	−0·7	2·2		Palamkottah	2·6	+1·2	6·1
	Cocanada	1·0	−1·0	1·6					
	Masulipatam	1·0	−0·2	3·9					
	Maruteru *	3·4	+2·9	5·31					
					West Coast	Trivandrum	19·3	+10·9	21·8
Ceded Dists	Kurnool	0 9	−0·2	1 7		Cochin	28·3	+16·9	30·7
	Nandyal *	3 6	+1·9	4·0		Calicut	40·3	+31·8	42 3
	Bellary	1·40	+0·9	2·60		Pattambi *	22·7	+17·2	28·2
	Hagari *	1 2	+0·7	2·4		Taliparamba *	28·8	+20·1	29·7
	Cuddapah	1·0	−0·5	1·1		Kasargode *	22·7	+15 3	23·1
						Nileswar *	....	...	...
Carnatic	Nellore	3·0	+1·8	5·3		Mangalore	17·2	+11·1	17·6
	Madras.	0·6	−1·2	1·9					
	Cuddalore	2·4	+1·1	5·8					
	Palur *	1·8	+0·7	5 6	Mysore and Coorg	Bangalore	4·4	+0·1	4·7
	Pallakuppam *	2·8	+1·2	4·7		Mysore	9·3	+4·3	11·0
						Mercara	17·6	+12·1	20·5
Central	Vellore	3·5	+0·4	4·3					
	Salem	5·7	+1·1	10·1					
	Hosur Cattle Farm *	6·7	+6·0	12·.	Hills.	Kodaikanal	7·9	+2 0	15·2
						Coonoor	6 5	...	9·9
	Coimbatore Town	5·1	+2·8	10·5		Kallar *	9·.	+5·7	14·6
						Nanjanad *	7·8	+1 9	13·7
	Coimbatore Res. Inst. *	6·1	+3·9	11·2		Ootacamund *	9 3	+1·4	10·6
	Trichinopoly	7·7	+4·7	10·4					

N. B. * Meteorological Stations of the Agricultural Department.

Monsoon Forecast. Forecast of the monsoon rainfall for 1932: The known factors give conflicting indications this year, and all that can be said is that the monsoon rainfall is not likely to be less than 87 per cent. of the average in the Peninsula, 80 per cent. in North-West India and 95 per cent. in North-East India —A. P.

General weather conditions. The weather at the beginning of the month was fine and dry, with pronounced hot weather conditions over the Deccan and a few scattered thunder storms over the rest of the area. About the middle of the month unsettled conditions set in over the south of the peninsula, and thunder storm rain became general over the south. On the 17th weather became unsettled

in the south-east Arabian sea, and a temporary advance of the monsoon occurred on the Malabar coast accompanied by heavy rain and rough weather. A depression formed here but failed to develope and persisted till the 24th causing general rain on west coast and a strong monsoon in the peninsula. An advance of the monsoon also occurred in the Bay about the 20th, and the unsettled weather developed into a storm centred about 17° N and 87° E on the 23rd. This storm moved Northeastwards and crossed the coast at Sagour Island on the 24th as a storm of great severity and passing inland into Bengal weakened rapidly. It influenced the weather over the reporting area to a small extent, and some rain was reported on the Circars coast. The monsoon on the west coast began to recede on the 26th and more normal conditions set in thereafter over the south of the peninsula.

The month's rainfall was above normal outside the Circars and Deccan, the excess being most marked on the west coast. Some heavy falls of rain were reported, the chief being: Trichinopoly 6·0″ (18th) Calicut 6·6″, Cochin 6·3″, Mercara 5·5″ (19th), Calicut 5·4″ and Kasaragode 7 6″ (20th), Calicut 10·6″ (24th) and Pattambi 5·2″ Temperature was high in the Deccan area for the greater part of the month and on the North Madras coast at the end of the month. Cuddapah reported a maximum of 110° F on the 5th. Temperature was below normal over the south and Malabar during the second half of the month in consequence of the unusual rainfall.

Weather Report for the Research Institute Observatory; Report No. 5/32.

Absolute Maximum in shade	99·2°
Absolute Minimum in shade	68·5°
Mean maximum in shade	90·9°
Aean minimum in shade	73·0°
Total Rainfall in month	6·08″
Mean Rainfall for May	2·16′
Departure from normal	+3·92
Number of Rainy Days	10
Heaviest fall in 24 hrs.	1·98″
Mean Daily wind velocity	2·2 M. P. H.
Mean 8 hrs. wind velocity	2·0 M. P. H.
Mean Humidity at 8 hrs.	77·8 %
Total hours of bright sunshine	210·1
Mean daily hours of bright sunshine ...	6·8·

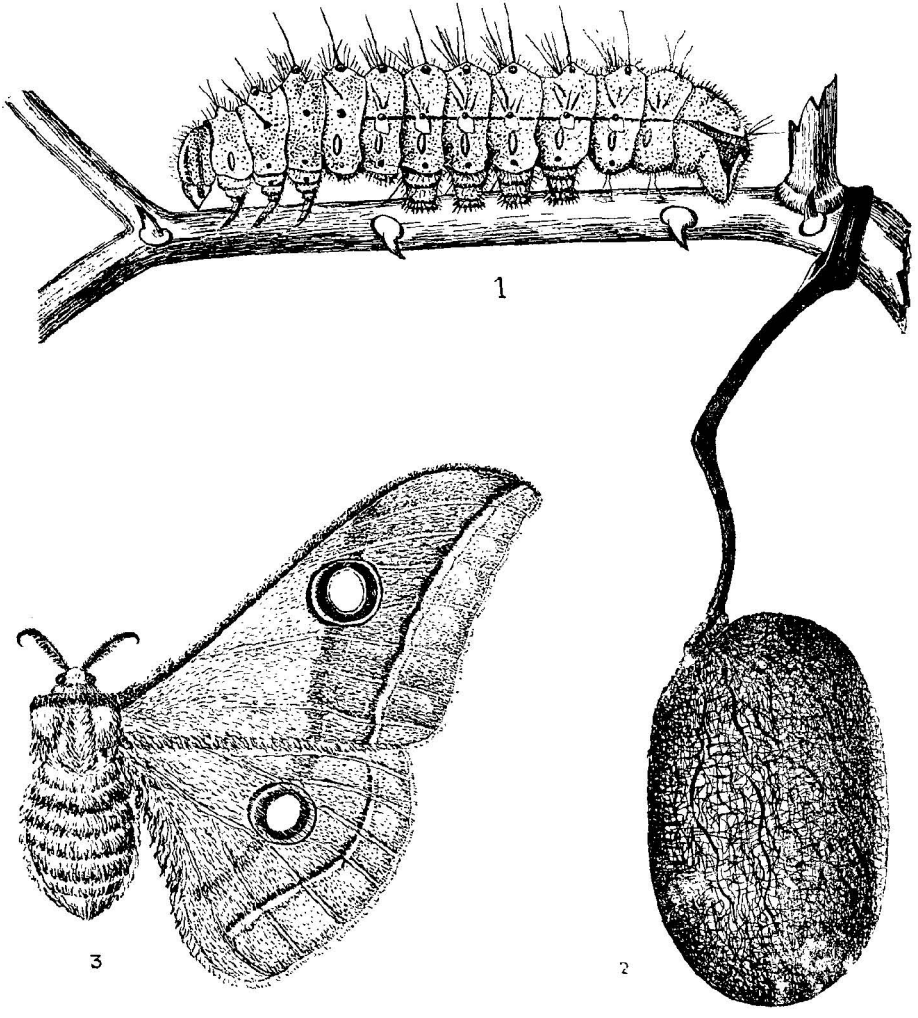
General weather conditions: Weather was normal of the hot weather for the first week of the month, with high temperatures and dry weather. Unstable conditions set in about the 13th of the month with a falling barometer and frequent occurrence of lightning. Between the 14th and the end of the month rainfall was frequent and sometimes heavy. Severe local storms gave heavy rain on the 15th, 16th and 17th and conditions were typical of those before the onset of the monsoon on the west coast. The total rainfall was 6·08 inches distributed over 10 rainy days and was 3·92″ above the average. This month was one of the wettest on record for the time of the year the month of May 1918 having had 6·20″.

Temperature was low for the second half of the month owing to cloudy skies and showery weather.

P. V. R. & P. K. R. M.

Departmental Notifications.

I Circle: M V. Kondala Rao A. A. D., Rajahmundry, extension of 1. a p. for 3 months on m. c. from 13—5—32. N. Rama Dass, A. D., Cocanada 1. a, p. for 10 days from 11—5—32. **II Circle:** P. Suryanarayana, A. A D., 1. a. p. for 6 weeks from date of relief. K. V. Seshagiri Rao, A. A. D., 1. a. p. for 15 days from 3—6—32. V. V. S. Varadarajan, A. D , 1. a. p. 8 days from 4—6—32. **III Circle:** C. Rangaswami Iyengar, Mycological Demonstrator, Tadpatri extension of 1. a. p. for 2 months in continuation of 4 months leave already granted. **IV Circle:** P. S Venkatasubramanian posted as A. D., Tindivanam. S. Ramachandran 1. a. p. for a month from 25—5—32. P. Janakirama Ayyar, A. D., 1. a. p. on m. c. for 2½ months from 14—5—32. M. Narayana Ayyar, A. D., Tindivanam 1. a. p. on m. c. for 4 months from 28—5—32. C. S. Krishnaswami Ayyar, F. M , Palur, 1. a. p. from 23—5—32 to 4—6—32. Bhairy Siva Rao, A. D., Madanapalli 1. a. p. for 29 days from 11—6—32. C. Annamalai A. D., Palamaner to be in additional charge of Madanapalli. **V Circle;** V. Krishnaswami, Asst.. Aduturai, 1. a. p, for 27 days from 4—6—32. **VI Circle:** D. Shanmukhasundaram posted to work in the Agricultural Motor Van in the Madura Division. S. V. Ramachandran will remain in the Tinnevelly Division during June and July 1932. G. Venkatakrishnan, A. D. under training, posted to Melur as A. D. and A. Rama Dass to Coimbatore, as Assistant Cotton Section. **VII Circle:** C. Raman Moosad, F. M., A. R. S., Taliparamba, transferred as A. D., Ponnani. E. Achuthan Nair, transferred to Taliparamba. M. Damodara Prabhu, F. M., Taliparamba, 1. a. p. for 14 days from 4—6—32 or date of relief. **P. S. 'S Office:** C. V. Sankaranarayana Ayyar, Sub Asst., 1. a. p. for one month from 16—5—32, **G. A. C. 'S. Office:** C. V. Ramaswami Iyer, Asst. 1. a. p. from 13—6—32 to 31—7—32 K. Veerabadhra Rao, Asst. 1. a. p. for 13 days from 25—5—32. B. S. Narasimha Ayyar. Asst. 1. a. p. for one month from 6—6—32. **Curator's Section:** S. Madhava Rao, on return from leave posted as F. M., to Nursery, Govt, Botanical Gardens, Ooty. and P. Govindakutty Kurup to Burliar and Kallar Gardens. **D. A.' S Orders:** T. Narayana Rao, Asst., M. S. 'S section transferred to A. R, S., Guntur from 1—9—32. R, Krishnamurti, Asst. in Cotton to A. R. S., Guntur from 1—8—32. S. Mayandi Pillai, Asst., Cotton Section to A. R. S., Koilpatti. M. Venkoba Rao Asst., A. R. S., Koilpatti to Hagari. Dr. C. J. George, Entomology Section, on other duty as Offg. Personal Asst. to the Director of Fisheries, Madras, 1. on h. p. for 8 months and 12 days from 11-6-32 and extraordinary leave without allowance in continuation. P. Satyanarayana Asst. in Chemistry, 1. a. p. for 1 month and 14 days from 26—5—32. S. Rajarathanam Chêtty whose offg. appointment will terminate on 25—5—32 will continue to officiate vice P. Satyanarayana. N. K. Thomas. Offg, Asst. Paddy Section, transferred to Central Farm as F. M. M. Subbayya Pillai, Offg. Upper Subordinate, Agrl. Section to Science Section to officiate as Asst. in Paddy and continue work at Aduturai. C. Rangaswami Iyengar and K. E. Viswam Iyer who were reverted to lower subordinate grade on 30—11—31 are again restored to their original appointments, viz., Upper Division V Grade and Lower Division IV Grade respectively from 1—8—31. R. Anantapadmanabhan, Probationer, Upper Division V Grade, who was shown against a permanent vacancy will be considered to have offiiciated for C. Rangaswami Iyengar. A. Muhammad Ali, Probationer, whose offg. appointment terminated on 22—5—32 is appointed to officiate as Upper Subordinate, Agrl. Section, V Grade, vice M. Narayana Ayyar on leave.



THE TASAR SILKWORM
1. Larva; 2. Cocoon; 3. Female Moth.