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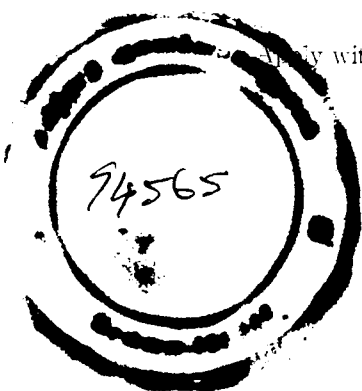
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 * Farming will never be a success unless the farmer *
 * had more voice in the disposal of *
 * his produce—P. Morrel. *

The 182 Madras Agricultural Journal

ERRATA

Vol. XVIII. No. 5.

Page 232. In line 8 from the bottom. For "thereby commanding at every stage" read "thereby commanding top prices. At every stage."

Page 248. In line 19 from the bottom delete "5 men" insert "4 men @ 5 as..... 1-4-0."

In line 16 from the bottom insert "3-10-0".

export to foreign countries. Cigarettes were introduced into India about seventy years ago and have now become very popular among all classes of people from the prince down to the peasant. It was in the United States of America that the fine yellow tobaccos suited for cigarette manufacture were evolved by the application of modern scientific principles and appliances. In the earlier days, all the cigarettes used in India were those of European manufacture. Their high cost due in great part to the heavy import duties naturally led to the installation of cigarette factories in India for manufacturing them cheap. But then, these factories required a supply of raw tobacco of high quality, which could not be imported owing to the heavy taxes. It was therefore found imperative to have Virginian tobacco grown in India so as to get a sufficient and cheap supply for purposes of manufacture. For this purpose, various tracts in India were explored and finally the Guntur tract was selected as the best suited for the cultivation of cigarette tobacco on a commercial scale. As long ago as 1921, experimental cultivation of Virginian tobacco was started in this District with the aim of evolving the best methods of cultivation, curing and production of the fine yellow grades of leaf suitable for cigarettes.

Soil. Soil plays an important part in producing fine light tobacco. The soil, situation and climatic conditions of Guntur are admirably suited for the

cultivation of this crop. The whole of the tobacco producing tract of Guntur may be roughly divided into three sections, viz., one producing bright yellow quality, a second, producing dark heavy quality and a third, producing the medium coloured variety. Great care was taken to select the proper tract for this experiment. As irrigation has an adverse influence on the colour of the tobacco, it has to be raised purely as a dry crop, and this is possible only in Guntur District where highly retentive soils are found.

Manuring. Tobacco requires good manuring, but this should be done cautiously as heavy manuring affects the colour of the leaf and renders it unfit for cigarette purposes. Tobacco being a Potash feeder, potash manures are highly congenial not only to the healthy growth of the crop but also to promote the burning quality of the leaf. Nitrogenous manures must be completely avoided as nitrogen is prejudicial to the development of the quality and colour of the leaf. Great care should be exercised in the rotation of crops also, and in fields intended for tobacco, nitrogen fixing crops like pulses should be avoided as rotation crops and nitrogen feeders like cereals preferred.

Seedbeds and seedlings. Tobacco seed is extremely small in size and raising good seedlings is really an art, requiring great care and skill. The seedbeds are located in a relatively elevated part of a field, in the vicinity a small pond where rain water could be obtained for watering the seedbeds. The plot is thoroughly ploughed five or six times, levelled and then manured with well rotten cattle manure. Raised beds five inches high, one yard broad and thirty yards long are made in rows with a drainage channel one foot broad and six inches deep between successive beds to drain away the excess water. Two teaspoonfuls of seeds mixed with four Madras measures of sand are uniformly sown in two beds, i.e., sixty square yards; and this area of seedbed will supply enough seedlings to plant an acre. As soon as the seeds are sown, the seedbeds are pressed down well with the feet to make it a firm seedbed so that the tender sprouts may easily fix the first roots and grow. Then the seedbeds are regularly watered for eight or nine days so as not to allow them to get dry even for a short time. Usually on the ninth day after sowing, tender seedlings will be seen to sprout. Thereafter, the nurseries are carefully and periodically watered and in about forty-five days the seedlings will be ready for planting. The sowing is generally done by the middle of August and the seedlings will be ready for planting by the first week of October.

Planting. After preparing the field, parallel lines 2½ to 3 feet apart are marked out lengthwise and breadthwise over it, and at the junctions of lines the tobacco seedlings are planted, generally between 4 p.m. and 6 p.m. With a pointed stick a small hole is made at each junction and a small quantity of water is poured in the hole and a seedling planted. About 5,500 seedlings go into an acre. The next morning pot watering is given and again also on the third morning. After this, no watering is done. Tobacco is planted in lines to facilitate economic bullock hoeing. As the seedlings are rather delicate, planting between 9 a.m. and 4 p.m. must be avoided. Early planting results in the production of fine long broad leaf of good colour when cured, while crops planted late in the season, i.e., by end of October or November, give short, narrow leaf of inferior colour. So, care should be taken to avoid late plantings. As already stated, the cigarette tobacco should be grown only as a dry crop. Irrigation not only kills the colour in tobacco but results in a strong leaf unsuitable for cigarette making. If rains are received in the course of growth, they tend to wash away the gum 'Nicotine' from the surface of

the leaves and enable the tobacco to get a mild flavour and to cure bright. As the soils are highly retentive, growth is not affected whether there be rain or not; and by the beginning of January, the plants become well advanced in growth. Further, mother Nature comes to the aid of the crop in December and January, when a peculiar kind of sea breeze known as 'Payara Gali' blows over the country and serves to accelerate its growth. Virginian tobacco grows to a height of 5½ feet with about twenty-two to twenty-four leaves, which may be considered to be its normal growth in this District. In the meantime, two or three hoeings and weedings are given with bullock hoes to remove the weeds and to conserve the soil moisture for the utilisation of the plants.

Topping and Suckering. By the first week of January, the plants reach their maximum growth and commence to flower, when topping operations are started. In the case of cigarette tobacco, the topping is done very high, i.e., practically at the flower head, only two or three top leaves being removed, so that about twenty-two to twenty-four leaves are allowed to develop and mature. The object of topping is to make the plant food to distribute itself among the leaves so as to produce a mild tobacco suited for cigarette making. When the plants are topped a number of side shoots known as suckers, spring up. Unless these are removed, the normal growth of the leaves is affected. 'Suckering' is therefore absolutely essential, and as fresh suckers tend to appear within a week or ten days, the same process has to be repeated two or three times.

Harvesting. Harvesting demands timely care and attention. By the beginning of February, the crop will be ready for harvest. The crop should not be allowed to over-mature since complete ripening of leaves results in a strong tobacco with bad colour, due to too much juice in the leaves. The proper stage for harvesting is when the leaves begin to turn greenish yellow in colour, and the crop should, therefore, be kept under close observation and watched.

Curing: General. There are three systems of curing tobacco yellow, for cigarette making; and they are *flue curing*, *sun curing* and *air curing*. The Flue Curing system is too costly for India, but in America where coal and timber are available in plenty, timber houses (barns) can be constructed most economically and the question of fuel also is solved, coal being available cheap. But in India, the conditions are quite different and in the experimental tract especially, i.e., Guntur District, *Flue Curing* is too costly to adopt owing to the scarcity of coal and timber. Hence in the early stages of the experiment it was found necessary to adopt a combined system of *sun and air curing*, which is not only economical, but highly favourable for the production of tobacco on a large scale for commercial purposes. The *sun and air curing* method entails the exposure of the crop in the open fields suspended on racks and if the district be subject to rainfall during the curing period, there will be no possibility of curing tobacco on an extensive scale; for, occasional rains in the curing period would necessitate the constant shifting of the stringed tobacco from the sun to the shade and *vice versa*. Such disturbance at this juncture will affect the quality and colour of tobacco. But as this district is free from rains during the curing period it is well suited for adopting this method on a large scale. The *sun and air curing* system preserves the natural flavour and develops a porosity in the leaves which enables the absorption of artificial flavourings during manufacture. Curing should not be confounded with drying. It is a life process dependent

on the activity of living cells and is influenced by the structure of the leaves and atmospheric conditions. It is a very delicate operation requiring numerous adjustments during the different stages of curing suited to the structure and kind of leaf and the nature of the atmospheric conditions. Before proceeding to the description of *flue curing* it is necessary to describe the *sun and air curing* system which was adopted from 1921 to 1928.

Sun and Air Curing. Fairly ripe leaves are removed from the plants after 4 p.m. till 6 p.m. and left in the field throughout the night so that the rigid leaf may wilt a little. Early in the morning, the leaves are collected, brought and stored in shade and stringed thinly—say about 150 to 175 leaves in a 7½ feet 5 ply jute twine. Close stringing of the leaves affects the colour and sufficient precautions should, therefore, be taken.

Yellowing process. This is a process which causes the green leaves to turn yellow. Owing to the delicate character of Virginian tobacco, the following system was adopted to obtain the colour. The stringed green tobacco is tied to a thin bamboo 9 feet long (tier pole) and these tier poles with green leaves hanging from them are placed on racks arranged closely inside the curing sheds, care being taken to avoid direct sun light as much as possible. Generally, it takes 24 hours for green leaves to turn yellow.

Drying process. When the leaves are turned yellow, the next step is to fix the colour quickly, since slow drying is apt to change the colour. For this purpose, the tobacco strings are, at this stage, immediately placed 6 inches apart on racks fixed in the open field. This sudden exposure to the sun fixes the colour very well. In about six days the leafy portion becomes well dried, but the midribs take a little over three weeks to become fully dry. During nights the racks are covered with mats to prevent the dew from affecting the colour of tobacco. The mats also afford protection from possible slight drizzles and rain during nights. In this connection, it must be noted that if any rain happens to fall while the tobacco is on open racks it completely damages the crop and renders it unfit for the market. But as already remarked, this district is free from rain during the curing period.

Bleaching process. When tobacco strings are completely dry, they are removed from the racks in the morning hours and spread on the floor so that the sun's rays may play fully on one side of the leaf and this is kept on for nearly 36 hours. Then the ropes are turned and the other side is exposed to sunlight for a further 36 hours. The rays of the sun have a wonderful effect on the tobacco leaves and contribute largely to the development of the finest yellow colour. The tobacco is, then, bulked.

Flue Curing. This is a new system by which the curing of tobacco is done in barns provided with flues. In America, where tobacco culture is highly advanced, people cure tobacco yellow only by means of flues in barns built of timber, for coal is available there in plenty for carrying on curing on a large scale. In the case of the *sun and air curing* method, though by taking great care, tobacco of the required colour can be produced, the colour is not of a permanent nature and the flavour is not so good as in the case of the product obtained by *flue curing*. For the past two or three years, attempts have been made to try flue curing at Guntur and during the last season, i.e., January to April 1929, a number of ryots including myself tried this system with much success. It is hoped that during January to April 1930 it will be more widely adopted. Timber being very costly, barns were built with bricks and chunam. Much experience and judgment are required in curing

tobacco yellow. Barns are built small in order that they may be filled quickly. Fairly ripe leaves of greenish yellow colour and uniform size are removed from the plants in the field from 4 p.m. to 6 p.m. and left in the field for the night. Early in the morning, they are collected and brought to the barn. On both sides of a tier pole (a split bamboo 5 feet long on which green leaves are suspended) about 72 to 84 leaves are suspended in lots of three alternatively on both sides of the tier pole by means of twine. About 800 of such poles are prepared and housed on racks arranged inside the house about 9 inches apart, all before 6 p.m. the same day and heat is applied at 6 p.m. The main aim in curing is to expel the sap in such a way as to get the desired colour and to prevent the loss of juices which give flavour and suppleness by improper or too rapid curing. This is accomplished by regulating the heat with great care. Heat is applied by means of a flue running inside the barn heated by coal fed from outside in a furnace. A thermometer is put inside the barn so as to determine and regulate the degree of heat at various stages of the process of curing.

Yellowing process. To start with, a temperature of 90° F is obtained and is maintained for about 24 hours. It is during this period that the tobacco turns yellow.

Fixing colour. Now the temperature is raised to 100° F and maintained between 100° F and 120° F for about 24 hours. During this period the colour is fixed. It is only at this stage one must exercise great judgment in regulating the increase and degree of heat. One should not allow the leaves to get reddish in colour or 'sponging of the leaves' as it is called.

Curing process. This takes nearly 48 hours and the temperature is maintained between 120° F and 125° F. During this process the leafy portion is cured completely.

Curing of stem. This is the last stage of flue curing. This takes generally 12 hours and a temperature of 125° F to 175° F is maintained by gradual rises of 5° every hour. Curing tobacco yellow is an art which requires the closest attention and the nicest judgment to attain perfect results. To regulate the temperature, there are ventilators on the sides of the walls, as also a door. The ridge of the roof also is provided, with lifting arrangements and by operating the same free air may be let in and shut out in a moment. When the stalks and stems of the leaves are cured, paddy straw is spread on the floor of the barn and water is sprinkled on it, the door and the ventilators are opened. This is generally done during the night and early in the morning the leaves will become soft and will be in a fit condition for bulking.

Bulking. This is a very important process and must be done only by experts in the line. After the bleaching process is completed in the case of *sun and air curing* system, the dried up strings are removed and folded on a fine morning when they are rendered soft by the action of dew and cool breeze and are then bulked in an ill ventilated room. In the case of flue cured tobacco the leaves are removed from the tier poles on a fine morning when they are rendered soft and bulked. The bulks are shifted from one corner of the room to the other and the shifting depends on the moisture contents of the tobacco rope. If the bulk contains an excess of moisture it is shifted the next day, but if it is moderately soft the bulk is shifted for the first time on the third day. The second shifting is done a week after the first. The third shifting is a fortnight later. Just at this stage 2% Citric Acid is sprayed uniformly over the bulk and this preserves the aroma. Then the shifting of

the bulk is done once in a month or once for two or three months according to the moisture content of the tobacco. Generally two to three months bulking will make the leaves ready for use. Then the leaves are graded according to different shades of colour and packed in cases or pressed into export bales of 250 lbs. nett with gunny covering inlaid with mats. Such finished cases or bales are intended for sending by rail or sea for factory use. Under pressure in pressed bales and cases the tobacco develops a fine aroma and preserves it.

The Financial aspect of the Experiment. One acre of the experimental plot produces 5,000 lbs. of green leaves, which when cured gives 1,000 lbs. of dry leaves. The cost of production and curing comes to annas four per lb. of dry leaf in the case of *sun and air curing* and annas five per lb. of dry leaf in the case of *flue curing*. Sun and air cured, fine, yellow tobacco sells ordinarily at 8 annas a lb. Flue cured yellow tobacco sells at 9 annas a lb. Thus a nett profit of Rs. 250 per acre is obtained in either case. An expert with great prudence and economy and with a knowledge of local conditions can manage 40 acres in either case with a nett profit of Rs. 10,000 to his advantage per year.

Conclusion. The foregoing paragraphs are the result of experiments carried on during a period of over 7 years under very trying conditions. No other crop certainly requires as much technical knowledge to grow it to perfection as this crop and the scientific handling of Tobacco culture has only just begun to be appreciated in India. The curing of the leaves and its subsequent treatment has only just been recognised as scientific processes. The plant is easily influenced by the climate, the soil and the different methods of cultivation. Climate imparts the flavour and soil determines the texture. Every producer ought to test the variety on his farm in order to ascertain just what would give the best results both in point of quality and quantity. In each district the soil formation aided by climatic conditions, gives its own impress on the qualities of the leaf as to texture, flavour, colour and special fitness for varied uses. The ability to cultivate the plant and to cure the product in such a way as to give it the desirable qualities, is of the utmost importance to the farmer and upon his skill in accomplishing this depend his profits. As Nicotine is the active principle of tobacco it would to all appearances look as if its development to a high degree were desirable. But such is not the case. The best qualities of leaf are those that contain a small percentage of nicotine, and a large percentage indicates, on the other hand, coarseness. The different processes of curing are, therefore, essential to regulate not only the colour but also the percentage of nicotine and render the leaf mild and agreeable for cigarettes. Finally, the culture of tobacco has a bright future before it and the increased demand and consumption would in course of time lead to the opening of a large number of factories in India herself. Consequently, a large area will have to be brought under cultivation and the flue system of curing will have to be extended. As has been pointed above, if the various processes described in the foregoing pages are carefully followed all such agriculturists as may undertake this system of curing would derive considerable profits and greatly improve their economic condition.

[From the report of the Imperial Economic Botanist, incorporated in the Scientific Reports of the Agricultural Research Institute, Pusa, for the year 1928-29, it will be seen that tobacco can be successfully flue cured in India to a colour which is suitable for cigarette manufacture. Ed. M.A.J.]

OBSTACLES TO THE SPEEDY EVOLUTION AND TO THE SUCCESSFUL SPREAD OF ECONOMIC STRAINS IN COTTON

By C. JAGANNATHA RAO AND J. R. SANKARAN.

Agriculture is India's premier industry and the basis of our national development. Among the various activities directed towards the promotion of Indian agriculture, plant-breeding in general and cotton-breeding in particular, occupy a place of supreme importance. Cotton is a commodity of world-wide importance and is one of the chief raw products of India playing a role of importance in the welfare of a large proportion of her population dependent on it either directly or indirectly. India ranks next to America, as a producer of the world's cotton and is responsible for about a fifth of the total world out-put, while Madras is responsible for about a tenth of India's total production.

The Indian cotton-grower is handicapped in more ways than one, in the competition for the world's markets. The production of lint per acre is exceedingly low, being a third of the average production of the cotton areas of the United States of America and the quality of the Indian cottons is poor, the bulk of it being short-stapled and unsuited for spinning yarn of high counts. These two basic defects together with defective methods of picking and some commercial mal-practices are greatly responsible for the low prices meted out to Indian cottons. With a vast area suited for the cultivation of cotton and with these defects staring in our faces, the need for the improvement of our cottons is obvious. In the following paragraphs, attention will be confined to a consideration of the chief obstacles to the quick evolution of economic strains and to their successful spread, resulting in the amelioration of the economic status of the cotton grower, having in view conditions in the Madras presidency which are no less representative of conditions outside, in general.

As with other crops, yield of lint is one important objective in cotton-breeding. We are all aware that a small sample of lint consists of innumerable white fibres, unicellular in their build, each fibre being ribbon-like and holiow in shape and structure, respectively, with a number of convolutions or twists when viewed under the microscope. Botanically, the cotton hair is the out-growth of the epidermal cell of the cotton seed. In most other economic crops, say for instance cereals, we are concerned with the yield of grain, a normal, at the same time, a vital part of most members of the flowering group in the plant kingdom. But, here, in cotton, our efforts are directed to the production of the maximum quantity of these epidermal cells of the seed coat and the total weight of these cells per acre will be the yield of lint per acre. This is the first objective of the cotton-breeder and is obviously one presenting considerable difficulties in cotton-breeding.

The second aim is the quality of this lint. There is, perhaps, no other important crop so much valued for the quality of its raw product as cotton. Length of these unicellular cotton fibres, strength, colour, lustre and uniformity in each of these heritable characters together go to make up quality in raw cotton. Quantity and quality ought to go hand in hand in plant-breeding work with cotton. Strains merely of heavy yielding capacities without the required quality will be of no use. If yielding powers were the only requisites, the cotton tracts of the districts of Tinnevely, Ramnad and Madura would probably have been one continuous expanse of Roseum cotton, known

popularly as 'pulichai' and there would have, perhaps, been no need for a cotton-breeding station to improve 'karunganni' cotton, in this tract. The reason why the growth of this 'pulichai' has been discouraged both by the Department and by the ultimate consumer is common knowledge. Experience has shown that there is a general trend for heavy yielding types to be associated with poor quality lint and this relation acts as a source of difficulty in the production of good yielders with the requisite quality of lint.

These characters of quality are only an imperfect guide at the best and in the present state of knowledge the cotton-breeder has to depend upon these properties in his line of work. The determination of the quality of lint presents very great difficulties and 'the final test of the quality of any material is its behaviour in use and as cotton is for the most part eventually used in the form of woven or knitted goods, it follows that ideally the quality of a cotton should be judged by the service it gives when made into such goods', and hence the need for conducting spinning tests of new strains is of paramount importance; and, at present, this aspect of the problem is outside the province of the breeder. These tests are conducted at the Indian Central Cotton Committee's Technological Laboratory at Bombay, and if at this stage, a strain is found unsuited for spinning yarn of good counts, it will have to be rejected and years of the breeder's labour will be in vain. The lack of simple spinning devices at the disposal of the cotton-breeder to enable him to retain or discard strains even at the early stages and more especially the primitive state of knowledge of the various lint characters that conduce to yarn strength and high warp counts are, some of the breeder's obstacles to the speedy evolution of economic strains.

Out of a total of 2,079,000 acres under cotton, the estimated area in Madras, 282,000 acres are under Cambodias, mostly under irrigated conditions, the rest being under rainfed cottons mostly of the indigenous types. The following observation, pertaining to environmental effects, will, therefore, apply to these latter class of cottons, in particular. These cottons depending upon the atmospheric rain for their resources, thrive under conditions very variable from year to year. This dependence on rain and its vagaries is the foundation of one of the chief of obstacles confronting the cotton-breeder. Thriving, as these cottons do, in arid climates in most parts of our presidency, the need for the conservation of moisture in the land is obvious and we are all aware of the specialised Ceded districts' implements which are used at various stages in its cultivation and which have found and are finding a place in cotton culture in the other cotton-growing tracts of the presidency. The constant use of these implements is noteworthy in the case of the cotton crop and together with a systematic rotation and a manurial scheme afford an environment regulated like clock work for breeding operations, so much so, strains springing from such conditions are often said to be too delicate for handling and consequently suffer under hap-hazard cultivation which is rather the rule than the exception, outside the station.

It will be a woeful tale to narrate the harmful effects of untimely rain on a crop of cotton. There is, perhaps, no other crop which is so susceptible to shedding as cotton. Imagine the ryot who had prepared his land carefully and manured it properly, who having had timely rains had sown his improved and carefully selected cotton seed with great dexterity when the soil was under the best of conditions, who has had the assurance for a vigorous and a healthy crop from the village astrologer, whose propitiations to his village deity to present or counteract insect and fungoid pests were particularly to his good and

whose eyes were bright and whose heart was full of joy and who is all thankfulness to the Almighty at the sight of his crop luxuriant with vigorous healthy buds predicting a bountiful yield and consequently, a year of full meal, sufficient clothing and perhaps, something to lay by. And lo! the sky grows unexpectedly dull, clouds gather and grow thick and unwanted precipitation follows. His hopes are blasted as he soon sees his crop growing bare, quarrelling as it were, with its various productive units, the buds and the bolls and eliminating them from off their connections. Thoughts of a half meal, scanty clothing and the memory of the village money-lender grow imminent in the mind of the ryot at the sight of this bud and boll shedding which may be called the cotton-blast.

The result of this shedding is often a delayed crop, though somewhat poor both in quantity and quality, provided no further rains occur; and, if further rains, again at the wrong time, occur, very poor late crops will result and such deferred crops are mostly poor in quality due to the severity of insect attack and due to the mechanical action of the rain. This year, the Cotton Breeding Station, Kovilpatti, and the tract round about experienced last season a severe set of such conditions and an unprecedentedly low acre yield for the season has been the result. The increases in the yields of lint of improved strains over the yields of mixtures from which they might be extracted by breeding methods, particularly by selection, are very often smaller than those due to the effects of good weather conditions over the effects of bad years. To put it more explicitly, other things being equal, an improved strain under bad weather conditions generally fares worse than the ordinary crop grown from bazaar seed under favourable weather conditions. It will, therefore, be obvious that the fight with nature is very keen in plant-breeding work with cotton and in its cultivation.

A breeding station has very often to cater to the needs of tracts differing in the environments they provide to the cottons grown therein. The breeder has to evolve strains suitable for different tracts and this adds to his difficulties. In the 'Tinnies' tract, the northern half comprising the district of Ramnad and part of Madura, is suited to the growth of early maturing strains as the monsoon sets in earlier than in the southern portion which is congenial to the growth of long duration varieties and each of these tracts now grow specially improved strains, A 10 in the north and C 7 in the south.

'There are few of the world's great crops which are more liable to be badly damaged by insect pests than cotton and it is certain that the annual loss on their account, throughout the world, runs into many millions of pounds sterling. Luckily, the most serious of all the pests, the Mexican cotton boll weevil (*Anthonomus grandis*) which has spread like a scourge over almost the whole of the cotton belt of the United States, is not so far known in India, but there is a constant danger of its introduction.' The stem-weevil (*Pemphres affinis*), the pink and the spotted boll-worms (*Platyedra gossypiella* and *Earias fabia*, respectively), are the chief insect pests in our presidency. The Red and the Dusky cotton bugs (*Dysdercus cingulatus* and *Oxycaenus laetus*, respectively), the cotton aphid (*Aphis gossypii*) and the cotton Leaf-Roller (*Sylepta derogata*) rank among the minor insect pests of cotton. The wilt disease in Bombay and the Black-arm disease in our own presidency are the fungoid and the bacterial diseases, respectively, of cotton in India. The havoc done by all these pests at various stages of the crop's growth is again a handicap to the breeder and to the grower of the improved cottons.

The cotton seeds with their adherent lint are located within the fruit called bolls with a variable number of compartments or locks ranging from the rare two to five. Experience has shown that a five-celled boll contains the greatest number of seeds and a three-celled the least and though the lint from a seed located in a boll of a higher locular composition weighs less than that of a seed from a boll of a lower locular composition, the total quantity of lint per boll is greater in the former case. And, even within a lock, the weight per seed is the maximum for the seed located in the middle of the lock and the weight of lint per seed is greatest lower down the lock. Further, bolls of higher locular composition are produced at a certain period, generally early in the season and unlike most other crops of importance, the harvesting period spreads over a very long time (from March to July, a period of about five months, in the Tinnevely district) and consequently, there is a very wide range of variation in the quality of raw cotton and its weight per seed. Experiments have, again, shown that the weights of lint and seed, per seed, and lint length decrease with the advance of the season as also the strength and the spinning quality.

Owing to the peculiarities enumerated above and owing to the very long harvesting period which by itself is a handicap in comparison to the crops of brother breeders, the need to make out, for every single plant, representative samples from the material picked during the whole of this harvesting season, for the testing of yielding power and quality has become imperative. Avoiding details, the stages of sampling, ginning, an operation requiring an amount of care to obviate the mixing of seed and combing for the determination of the staple length take a great amount of time, thus acting as a limiting factor to the handling of a large number of plants so essential to increase the chances of striking at useful strains.

Most Indian cottons suffer from the admixture of a good proportion of dirt and leaf due mainly to defective methods of picking and consequently fetch low prices. The admixture of this leafy matter from the leaves and bracts, parched up and rendered brittle due to extreme temperatures is again a peculiarity of cotton and even under very careful harvesting, the admixture of a certain amount of this extraneous matter with the picked kapas is unavoidable. However, a slightly higher premium may prove to be an incentive to careful picking.

Further, a very common abuse in trade, is the adulteration of superior quality cotton with cheap inferior commodity, so much so, that the grower of improved cottons often fails to get a premium for his cotton. It is, generally, very difficult to detect this admixture for any but expert graders. In spinning operations, more than one kind of cotton is used and this is the reason why even worthless cottons find a sale and a value. This is one of the chief post-evolution obstacles of a strain for its successful spread and cultivation. It is a consolation to note, that some of these bad practices are being remedied by means of two important weapons, the Cotton Transport Act and the Cotton Ginning and Pressing Factories Act. The Cotton Transport Act protects a 'definite area of cotton by prohibiting the importation of cotton into the area except under licence.' Prior to the application of the provisions of the Act, inferior cottons used to find a free entry into areas producing stapled cottons for purposes of mixing and 'the reputation of several valuable Indian cottons was ruined, with consequent loss to the growers of the good varieties.' The second of the two Acts viz., the Cotton

Ginning and Pressing Factories Act is a necessary complement to the Cotton Transport Act inasmuch as it enjoins the owner of the press to mark his bales in a prescribed manner and to send compulsory weekly returns of cotton pressed. This Act has been able to check 'abuses and malpractices which have had an adverse affect on the cotton trade and on the cotton-grower in the past.'

Cotton, being a commodity of world-wide importance and as America is the country producing the maximum portion of the world out-put, market prices are mostly dictated by America. India is more or less dependant on America in her export trade of cotton. A plentiful American crop may mean poor return for the Indian peasant. This dependence on America very often entails wide fluctuations in the prices and a ryot may grow poor or rich according to the circumstances of the case.

Despite the various ameliorative measures, the ryot often fails to get the prices he deserves for the quality of his cotton. There are various reasons for this sad state of affairs. The general low intellectual level of the ryot, his dependence on the money-lender, the existence of the middleman and the lack of co-operative agencies for the marketing of his commodity on correct lines stand prominent among such reasons. The spread of compulsory education and the starting of innumerable co-operative village-banks and sale societies for mutual benefit—these only can fetch the peasant the profits he is entitled to. If education, thrift, self-help and mutual help were to become his watch-words, the situation will easily be solved. The Indian Central Cotton Committee are interesting themselves in the finance of the cotton crop and as a result of their investigations on the subject, valuable recommendations for the improvement of the methods employed might be the outcome.

The last, but not the least in importance, is the consideration of the maintenance of the purity of improved strains in the hands of the ryots. The peculiar operation, in respect to cotton, namely that of ginning or the separation of the lint from the seed, acts as a source for the mixture and the consequent deterioration of the improved seed. The maintenance of a pure stock at the breeding station, therefore, becomes most necessary, if the breeder's efforts of years are not to be lost. Again, since most of the ryots are in the habit of disposing of their produce as kapas, the need to meet the large and growing demand for the seed of the new strains is most imperative and the necessity for the extension of seed farm areas will be more keenly felt than ever before.

As enumerated in this paper, there are ever so many difficulties, constitutional, environmental, commercial and technical, in the way of the evolution and the successful spread of economic strains in cotton. The responsibility for the solution of these problems cannot be placed on any one group of persons. It is one in which the full co-operation of growers, spinners, ginners, breeders, the cotton trade and agricultural workers is required.

Under the constructive programme of the cotton breeder, desirable characteristics found declaring themselves in any of the lines will be keenly watched for and developed, and despite the various obstacles that have to be surmounted and the length of time necessary, new strains thus developed will after being thoroughly purified and tested, be released from the breeding stations for the benefit of the ryot and the country's economic development.

Acknowledgment

Our thanks are due to Messrs. V. Ramanathan and G. R. Hilson, now Cotton Specialist and Director, respectively, for their kind suggestions.

THE GERMINATION OF PADDY SEED

BY G. JOGI RAJU

In conducting germination tests of paddy varieties it has been found that some germinate almost cent per cent, immediately after harvest, while others require rest before they are capable of sprouting. The resting period again varies with different varieties. In the table below, a list of some varieties is given showing the percentages of their germination at intervals of one month from September to March.

Variety	Harvested in the month of	Percentage of germination (average of 5 determinations) in the month of						
		Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March
1. <i>Swarnalu</i> ...	September	99	...	...	...	...	...	...
2. <i>Garikasannavari</i> ...	October	...	97	...	...	...	...	...
3. <i>Punasa Atragada</i> ...	do	...	...	100	...	...	...	...
4. <i>Dalwa</i> ...	do	...	...	99	...	...	...	...
5. <i>Basangi</i> 33 ...	do	...	...	97	...	...	...	...
6. <i>Rasangi</i> 21 ...	November	...	...	2	...	94	96	99
7. <i>Rasangi</i> 26 ...	do	...	...	48	...	93	96	100
8. <i>Punasa Konamani</i> 3 ...	do	...	...	...	3	62	92	99
9. <i>Pala Gummasari</i> 7 ...	do	...	...	...	5	45	86	100
10. <i>Punasa Akkullu</i> 3 ...	do	...	...	...	7	45	92	97
11. <i>G. E. B.</i> 24 ...	do	...	...	...	0	9	91	99
12. <i>Co</i> 1 ...	do	...	...	...	7	62	96	99
13. <i>Co</i> 2 ...	December	...	...	...	16	59	91	100
14. <i>Co</i> 3 ...	do	...	...	...	61	95	99	99
15. <i>Ratnachudi</i> 9 ...	do	...	...	...	0	55	95	99
16. <i>Kanaka Sompū</i> ...	do	...	...	...	1	18	87	99
17. <i>Navakoti Sannalu</i> ...	do	...	...	...	1	16	86	100
18. <i>Krishna Katukalu</i> ...	do	...	...	...	0	37	94	95
19. <i>Konamani</i> ...	do	...	...	...	1	51	85	98
20. <i>Panianla</i> ...	do	...	...	...	0	41	84	98
21. <i>Harisankar</i> ...	do	...	...	...	9	33	99	99
22. <i>Baital Fakir</i> ...	do	...	...	...	0	1	25	98

Many early varieties appear to require no resting period for germination, but there are exceptions, e.g., *Rasangi* 21. In some varieties, e.g., *Garikasannavari* the seed germinates even while on the plant, if the crop lodges or if there is heavy rain after ripening. Such varieties therefore are usually harvested at an earlier stage of ripening. Another practical application of a study of this character in respect of which even two similar strains of the same variety may differ, has been brought to the writer's notice during a

recent tour in the Amalapur taluk of the Godavari district where the ryots of some villages complained about the seed of *Rasangi* 26 germinating while on the crop when it lodged, thereby suggesting that under these conditions *Rasangi* 21, the seed of which does not so germinate, would be preferable (vide items 6 and 7 of the table). Yet another application of a knowledge of this aspect of paddy varieties is that the seed of varieties, which germinate immediately after harvest, produced in the first crop season (*sarwa*) can be used for sowing in the second crop season (*dalwa*).

The late varieties, in general, appear to require a considerable period of rest for the seed to germinate, but there are exceptions, e.g., *Co* 3.

When conducting germination tests of seed, this character should be taken into consideration because a premature test giving negative results may lead to the rejection of vital seed.

THE DRYING OF PADDY SEED

By G. JOGI RAJU

On the Agricultural Research Station, Samalkot, paddy seed intended for sale to ryots is generally stored in gunnies and before bagging, the seed is dried on a Cuddapah slab floor over a period of four to seven days. It has been found, however, that grain treated in this way produces a high percentage of broken rice when pounded or milled and that in consequence when sold for consumption and not propagation, its value is reduced. In the year 1929 an experiment was made with *Punasa Konamani* No. 2 to ascertain the exact amount of drying necessary to maintain the vitality of seed in storage. The crop was harvested on January 20th and the grain was threshed out the same day and put into five bags each of which weighed 166 pounds gross. The bags were numbered I to V.

Bag No. 1 was not dried, whereas the contents of numbers II, III, IV and V were spread to a depth of 1½" and dried on a tarpaulin for one, two, three and four days respectively, after which they were weighed and bagged again. The weather, throughout this period, remained bright. Periodic weighments of the bags were made at intervals till August 1929 and a test of the germinating capacity of samples from each bag was also made in the first week of May. The weights obtained from time to time and the results of the germination test are noted below.

Serial No. of bag	Weight on day of harvest	Weight after drying		Percentage of reduction in weight	Weight on							Germination*
		Days	lb		24-1-29	26-2-29	29-3-29	1-5-29	1-6-29	2-7-29	10-8-29	
1	2			4	5	6	7	8	9	10	11	12
					lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
I	166	...	166.00	nil	158.00	154.75	153.50	151.25	151.00	151.25	151.50	94
II	166	1	154.00	6.9	153.50	152.50	152.50	152.50	151.00	151.50	150.75	96
III	166	2	149.25	10.1	150.00	150.50	150.00	149.75	149.25	149.75	150.00	97
IV	166	3	147.25	11.3	149.25	149.50	149.50	149.25	149.00	149.25	149.75	98
V	166	4	147.00	11.5	148.85	149.00	149.50	149.00	149.00	149.25	149.75	99

* Average of five determinations.

The figures show that the percentage of dryage on the original weight on the first, second, third and fourth day was 6.9, 3.2, 1.2 and 0.2 per cent respectively. In the case of No. 1 bag, the contents of which were not dried and No. II which was dried for one day there was a gradual reduction in weight up to the end of the hot season, after which there was a slight rise again due to reabsorption of moisture. In the case of the bags dried for 2 and 3 days (Nos. III and IV), the grain continued to reabsorb moisture until the end of February after which, there was again a fall in weight. At the beginning of the rainy season there was again a slight reabsorption of moisture and consequently a gain in weight. In the case of grain dried for four days, the reabsorption of moisture continued until the end of March, after which the weight followed the same course as that in the case of bag Nos. III and IV. An almost stable equilibrium was reached after two days' drying when the grain weighed about 150 lbs. and any moisture lost by further drying was reabsorbed from the atmosphere.

Though the percentages of germination of the samples from the five bags show a general increase in favour of the well-dried ones, the difference is slight and under normal conditions, therefore, two days drying in fair weather in November may be taken as sufficient for storage in a ventilated store room. In the Northern Circars, the weather is usually dry from the time paddy seed is stored until it is sown, so that no further drying of the seed appears necessary when once the optimum point is reached. The grain of *Punasa Konamani* No. 2 is one of the coarsest and hence the above remarks apply to many of the common varieties under cultivation, if the crop is allowed to ripen well in the field. Rough trials in the previous year, as well as general experience during the past ten years shows that there is no necessity for unduly severe drying. In places where the weather conditions continue to be humid after the storage of the seed, and when the seed has to be stored for a longer period, as is often the case in the southern districts, it may be necessary to dry the seed again, occasionally. The statement made above to the effect that two days' drying is sufficient,

therefore, applies only to conditions obtaining in the Northern Circars and it will hold good only when the other conditions referred to above are satisfied. This note is only intended to indicate that unduly severe drying is not necessary.

THE INDIAN ELM (*HOLOPTELIA INTEGRIFOLIA*)

A LESSON IN NATURE STUDY

By P. S. JIVANNA RAO

This common tree of Coimbatore which is known as the Indian Elm, based on the resemblance of its fruit to that of the European Elm, shows very peculiar behaviour which is well worth study by the student of nature.

This is a deciduous tree which sheds its leaves to such a large extent that at the end of the vegetative period the plant is rendered completely bare and presents a most distressing appearance. This happens usually in January—February and the very interesting phenomenon is soon noticed, viz., the appearance of flowers when the tree is leafless. These are dirty brown in colour appearing in clusters and, if carefully examined with a hand lens, disclose numerous flowers some of which—the males—are small with 4–8 perianth leaves and the same number of stamens, while others are bisexual carrying a prominent ovary raised on a stalk. With regard to the phenomenon of shedding it may be observed that, barring young trees which may show idiosyncracies of behaviour, the tree is one of those in which flowers appear after the leaves are shed, fresh leaves appearing only later. There are other trees in which flowers appear after the leaves or simultaneously with them as in *Pongamia* and *Margosa* respectively for instance.

The most striking peculiarity, however, is at the fruiting time, when the tree presents a very unique aspect with the flat, green, developing fruits which may be mistaken for leaves. In fact no leaves appear till after the fruits dry and fall off which generally happens in April and for another eight months the tree retains its foliage and a long period of vegetative activity ensues.

Of all the parts of the plant it is the fruit that compels attention. It is a thin flat rounded membranous body with the seed-containing portion in the middle surrounded by the wing which is really an expansion of the ovary wall. On account of the winged nature the fruit is known as a 'Samara' and the wing itself is usually considered to be an efficient adaptation for dispersal by wind in order to prevent overcrowding of seeds. While this explanation may be partly true, it is possible the expanded covering of the fruit may serve another useful purpose from the plant's point of view. An examination of the skin of the fruit under the microscope shows the presence of functioning stomata and the fruit also contains chlorophyll which may be extracted by means of hot alcohol. As the iodine test further shows the presence of starch there is no doubt that the winged green fruits assimilate starch and do the work of green leaves either for self nourishment or for the benefit of the plant as a whole which in the case of this particular tree is a special advantage because of its leafless nature for a period of three to four months.

The above observation made in the case of this tree raises an interesting question 'do fruits assimilate; if so to what extent?'

BOTANY OF SOME PICKLE PLANTS

By S. N. CHANDRASEKHARAN

It is a matter of common knowledge that pickles form a very important item of the daily diet of an Indian. They are useful in two ways. They enable a man to eat his food with relish, and secondly they are very helpful in the digestion of food. In the light of recent advances in science, it has been proved that such of our food materials as are lacking in vitamin content have low food values. It is also known that almost all the materials used for pickling do contain the vitamins necessary for our healthy growth. In various families a statement is often made by old grandmothers that people of a generation or two ago habitually used pickles in large quantities and in great variety every day along with their food and were able thereby, to lead healthy lives and live much longer than the average man or woman of to-day. It is also claimed by them that in capacity of work and in intelligence they far excelled men of the present day. That diet has a great deal to do with the health and longevity of persons is admitted by medical men in all parts of the World. A diet accompanied by pickles is also generally recognized to be healthy and invigorating. An attempt is therefore made in this article to give botanical notes on some of the common pickles in use in South India, with the hope that those who may have a taste for them may know what they are botanically, while others that may not know them may cultivate a taste for them. In our country where economic distress is so severely felt, we have to aim at the cheapest, and yet the most wholesome food. A little of cooked rice, some salted buttermilk and a slice of pickle will make up all the *menu* that a poor man may need. Pickles are so cheap and so good that one wonders why they are not used more largely.

1. *Allium Cepa*, Linn. The Onion. *Family*: Liliaceae. *Tamil*. Vengayam.

The plant is a biennial herb with large bulbs that are usually solitary. It has been under cultivation for a long time in all parts of the Presidency and there is probably no other vegetable that is so widely and extensively used as this. The bulbs are cut into small pieces and lime juice is added and in this form they form an excellent pickle. Incidentally, it might be mentioned here that it is considered that the Allyl sulphide in Onion stimulates the flow of digestive juices and hence the recommendation of onions for people suffering from constipation and piles.

Another interesting point to be noted in onion is the presence of a small amount of starch and sugar, whence its value as invalid food in cases where starch is not advised to be taken.

2. *Capsicum annum*, Linn. and *Capsicum frutescens*, Linn. The Chillies. *Family*: Solanaceae. *Tamil*. Milakai and Mormilakai.

Both are undershrubs extensively cultivated in all parts of the Presidency. The fruit, while forming an important spice, is also used in pickles. Raw fruits, are salted and used as such or they may be soaked in curd, sun dried and fried before use.

3. *Carissa Carandas*, Linn. *Family*: Apocynaceae. *Tamil*. Kaiaakkai. *Telugu*. Kalivi.

A common large thorny shrub met with all over the Presidency in dry forests and very often cultivated. The plant forms an excellent material for fencing. The fruits which are berries form a very suitable and cheap material for pickling.

4. *Citrus medica*, Linn., *var. acida*. The Sour Lime.—*Family*: Rutaceae. *Tamil*. Elimicham.

The plant is a shrub that is most widely grown throughout the Presidency; the chief markets being Vellore, Salem and Pollachi in the South. The value of limes is too well known to need special mention. Limes are pickled in a variety of ways; they may be salted and stored, or kept sundried or used fresh.

5. *Citrus medica*, Linn., *var. Citron*. *Family*: Rutaceae. *Tamil*. Narathan.

This is a shrub like other species of *Citrus*. The plants are cultivated in many parts of the Presidency. The fruits are pickled fresh or salted and sundried. They are considered very salutary and prescribed even for convalescents.

6. *Citrus medica*, Linn., *var. Limonum*. The Lemon. *Family*: Rutaceae. *Tamil*. Periya Elimicham.

The plant is a shrub but not much cultivated. The fruits are pickled fresh or salted and sundried.

The leaves of *Citrus medica*, Linn., *var. acida* and *var. Citron*, are sometimes pounded up with chillies and other spices to form a powdery preparation, known as *Veppilai Katti* in Tamil. This is reputed to be a most healthy condiment and is very popular.

7. *Coccinia indica*, W. and A. *Family*: Cucurbitaceae. *Tamil*. Kovai. *Telugu*. Kai-donda.

The plant is a herbaceous tendril climber commonly met with on hedges and bushes all over the Presidency. The young fruits are cut, salted and soaked in curd and pickled or sundried and fried.

8. *Curcuma Amada*, Roxb. The Mango Ginger. *Family*. Zingiberaceae. *Tamil*. Mangai Inchi. *Telugu*. Mamidi-allam.

Like all members of this family, the plant is a perennial herb with an underground stem or rhizome and large erect, leafy, aerial branches. The plant grows wild in Bengal and on the hills. The young rhizomes are salted and pickled. They are obtainable in large quantities in the Circars.

9. *Daucus Carota*, Linn. The Carrot. *Family*: Umbelliferae.

The plant is a small herb extensively cultivated in Bangalore and on the hills. The root forms an excellent vegetable. It is also cut into pieces and pickled along with slices of lime.

10. *Decalepis Hamiltonii*, W. and A. *Family*: Asclepiadaceae. *Tamil*. Mahali.

A climber common on the hills, e. g., Anamalais, Kambakkam Hills of Chingleput, Veligonda Hills of Nellore, etc.

The young roots are sold in the bazaar in small bundles. They are commonly met with in Pollachi, Coimbatore and Trichinopoly markets. The roots are soaked in water, and the bark and the thick central vascular tissue are removed, after which they are cut into small pieces, soaked in curds, salted

and mixed with lime slices and green chillies. The pickle is a good digestive and is also considered to be a blood purifier like Sarasaparilla.

11. *Elettaria Cardamomum*, Maton. The Cardamum. Family: Zingiberaceae. Tamil and Telugu. Elam.

A perennial fleshy herbaceous plant with thick fleshy rhizomes and erect leafy stems, 4 to 8 feet in height and long much branched inflorescences which arise close to the ground. It is commonly met with growing wild in tropical rain forests in Western Ghats, in Kanara, Mysore, Coorg, Wynaad, Travancore and Madura. It is also extensively cultivated in these regions at altitudes ranging from 500 up to 5,000 feet above sea level.

While there is no doubt cardamums form one of the most important spices, their use as a pickle is not known to many. Quite tender fruits of Cardamum may be salted and preserved for use as a pickle.

12. *Mangifera indica*, Linn. The Mango. Family: Anacardiaceae. Tamil. Mankai. Telugu. Mamidi.

It is a well known evergreen tree, large, spreading, growing to a height of 50 feet or even more. It is distributed all over the Presidency and is found both cultivated and wild.

The young fruits (drupes) are collected and pickled in various ways. The small sized fruits, i.e., those whose length varies from $\frac{1}{8}$ to 1 inch at the most are salted and preserved fresh and go by the name of *Vadu* in Tamil. The fairly large sized fruits are cut into pieces, spiced and preserved in gingelly oil either as *Enna Mankai* in the Tamil Districts or as the *Ava Kaya* of the Telugu Districts. Mango pickle easily lasts for more than a year and is one that is very much valued.

13. *Myristica fragrans*, Houtt. The Nutmeg. Family: Myristicaceae. Tamil. Jathikkai. Telugu. Jajikaya.

A native of the East Moluccas and a bushy evergreen tree. It is grown only in a few localities as the Burliyar Gardens on the Nilgiris, the hills of Madura, etc. The nutmeg of commerce is the large seed and the aril forms the spice *Mace*. The fleshy pericarp is cut into pieces, salted and pickled.

14. *Emblica officinalis*, Gaertn. Family: Euphorbiaceae. Tamil. Nelli.

A small tree with crooked trunk and spreading branches and of the deciduous type. It is found wild in the deciduous forests of the Presidency and is also cultivated. The fruits (berries) which are fleshy and about $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter form one of the highly valued pickles. They are salted, spiced and used. They are available in large quantities in Coimbatore, the supply being from the hills round about, particularly Marudumalai.

The fruit also goes by the name of *Emblie Myrabolan* and is largely used in Ayurvedic medicines, e.g., as one of the ingredients of the *Triphala*.

15. *Solanum nigrum*, Linn. Family: Solanaceae. Tamil. Manathakkali.

A common erect annual herbaceous plant growing as a weed both in waste places and cultivated lands in all Districts and at all elevations.

The fruits which are berries are collected, soaked in sour curd salted and used as pickle. Their value as a digestive is well known. They are also salted, sundried and fried. It is considered they contain copper and as such valuable in cases of ulcers in the mouth and abdomen.

16. *Solanum torvum*, Swartz. Family: Solanaceae. Tamil. Sundakkai.

A shrub growing almost as a weed in waste places and reaching about 10 to 12 feet in height. It is distributed in all Districts while in the hills it is met with up to about 3,000 feet.

The berries are collected quite green before they are fully ripe when they turn yellow, salted and preserved. Very often, they are also sundried and fried. This is one of the cheapest vegetables for pickling purposes. A Madras measure may cost about 3 to 6 pies.

17. *Solanum trilobatum*, Linn. Family: Solanaceae. Tamil. Tootuvalai.

This is a prickly trailing or climbing undershrub. It is commonly met with as a weed in all places. It thrives very well in black soil and equally so along the Coast.

The small berries are pickled in the same manner as *Solanum xanthocarpum* or sundried and fried. The value of the leaves in cases of ulceration of the mouth is well known. Usually, the leaves are cooked like any other vegetable or made into a soup and administered.

18. *Solanum xanthocarpum*, Schrad. and Wendl. Family: Solanaceae. Tamil. Kandan Kathri.

A prostrate perennial spiny herb very commonly met with in black soils. The plant is easily recognized by its armour of spines and large conspicuous flowers.

The berries are jammed, washed to remove the bitter taste to some extent, salted and pickled in sour curd. They are considered very valuable in lung affections.

19. *Tamarindus indica*, Linn. The Tamarind. Family: Leguminosae. Tamil. Puli.

The Tamarind tree is well known in Southern India. It is both self-sown and wild and also cultivated.

The young fruits are pickled and form a favourite condiment particularly among the Telugus.

20. *Zingiber officinale*, Rosc. The Ginger. Family: Zingiberaceae. Tamil. Inchi.

A herbaceous perennial with an underground main stem or rhizome and a number of erect leafy aerial branches. They are cultivated commonly all over the Presidency particularly in Malabar and Tanjore. The dried rhizomes form the ginger of commerce. The value of ginger is well known both in Indian and English Pharmacopia. The young rhizomes are salted and pickled. The ginger pickle is considered as a necessity on the *Sradha Day* in the Hindu household—evidently as a help in the digestion of the rich food taken on the occasion.

STUDIES IN THE COST OF PRODUCTION OF CROPS

(Continued)

By D. G. MUNRO

V

Name of Crop : Paddy.
 Area : 1 Acre.
 Locality : Omalur Taluk (Salem District).

This ryot is a big farmer. Among other lands which he has sublet to his tenants he cultivated a portion under his own management with his own men employed on monthly wages and with his own cattle. As in other places, the season was very bad. The lands are wet lands, but are also commanded by wells. Even in bad seasons, paddy could be cultivated with the help of well water. The seed beds were prepared in time, i.e., on the 25th July with well water. The variety of paddy, viz., Local *Karthikai Samba*—of 5 months duration, was transplanted when 50 days old. As usual, sprouted paddy seeds were sown, and the wet seed bed was allowed to dry up, and irrigation was given occasionally. The fields had to be irrigated only with the help of well water till the tanks got filled up during the middle of October. The plants were found diseased in the early stages and hence the crop did not grow satisfactorily. Irrigation charges were heavy. The farmer's cattle were mostly grazed by boys during half day and so the charges for maintenance of cattle are not much, and hence other cultivation expenses are comparatively low. The cattle were fed with concentrated food, viz., cotton seed and bran during the irrigation period. The Crop was harvested on the 25th December, 1928.

Details of cost of Cultivation

PARTICULARS	LABOUR			Amount
	Men @ 4 as	Women @ 3 as	Pairs @ 6 as	
<i>Preparatory Cultivation</i>				Rs A P
Well-irrigation for 15 days at 2 pairs per day before planting ...	...	...	30	11 4 0
Ploughing—3 pairs for 12 days ...	...	...	36	13 8 0
Total ...	...	...	66	24 12 0
<i>Seed and sowing</i>				
Preparing seed bed—irrigating, ploughing, etc. ...	...	...	6	2 4 0
Manuring seed bed with 14 bundles of Kolinji leaves at 3 as. per bundle ...	...	...	...	2 10 0
Tramplng. ...	...	2	...	0 6 0
Irrigating seed bed ...	...	...	5	1 14 0
Draining fields ...	1½	...	...	0 6 0
Cost of seed—25 vallams—(5½ lbs. per vallam) 141 lbs. at 14 lbs. per rupee ...	...	...	...	10 0 0
Pulling out seedlings and transplanting...	...	30	...	5 10 0
Total ...	...	32	11	23 2 0
<i>Manures and manuring</i>				
80 bundles of Kolinji leaves at 3 as. per bundle ...	...	...	...	15 0 0
Tramplng leaves ...	...	10	...	1 14 0
Total ...	...	10	...	16 14 0
<i>After cultivation</i>				
Weeding ...	...	20	...	3 12 0
<i>Irrigation</i>				
Mhote buckets and mouth pieces ...	...	...	80	30 0 0
Mhote ropes and tail ropes ...	...	...	...	4 2 0
Blacksmith's and carpenter's wages for mhote repairs and chuckler's wages for repairing mhote buckets ...	...	...	...	4 8 0
Total ...	...	...	80	48 10 0

Details of cost of Cultivation—Continued

PARTICULARS	LABOUR			Amount
	Men @ 4 as	Women @ 3 as	Pairs @ 6 as	
<i>Interest on Capital</i>				
Interest on the capital expenses on cattle costing Rs 500 and cultivation charges, etc., Rs 100 for 4 months at 12 per cent.	...	...	...	36 0 0
<i>Harvesting &c.</i>				
Harvesting and threshing including cattle threshing	12	2	8	6 6 0
Assessment	...	...	...	7 8 0
Total	...	...	...	13 14 0
Grand total of expenditure	...	...	...	167 0 0

Yield of crop—Area 1 Acre

Grain—14 <i>khandagams</i> (of 225 lbs. or 90 M. M.)	3,150 lbs.
Straw—80 bundles of 50 lbs.	4,000 lbs.
	Rs A P
Value of paddy at Rs 13 per <i>khandagam</i>	182 0 0
Value of straw—4,000 lbs. at 100 lbs. per rupee	40 0 0
Grand total	222 0 0
Net profit	55 0 0

Note. The crop was affected by stem borer, during the growth of the crop, and hence the yield was not satisfactory. The charges of cultivation were rather heavy because a large amount had to be spent in irrigating the crop from the well.

VI

Name of Crop :	Paddy.
Area :	1 Acre.
Locality :	Pottipuram Village (Omalur Taluk).
District :	Salem.

This tenant cultivated the lands on *Varam* system—3/5 share of the produce and the whole straw is taken by him, while 2/5 of the grain is given to the landlord. The land in question was under the tank irrigation, but the tank supplied water only for about a month.

The variety *Sadai Samba* was sown in the seed bed by the end of July, and the seedlings were transplanted when about 75 days old. The harvest was done early in February, so that the crop was found to be one of six months duration.

The tenant has no lands to cultivate excepting the lands of the landlord. He has his own work bullocks costing about Rs. 120 and they were of poor type. No concentrated food is given, but the cattle are fed on grass cut from field bunds or on Cumbu or Ragi straw. Thus the average cost of maintaining cattle comes to 3 annas per pair, while his wages may be put down at 2 annas—the amount required by him for his maintenance.

Practically all the work was done by the members of the family.

Details of the cost of Cultivation. Area : 1 Acre.

PARTICULARS	Men @ 2 as.	Women @ 2 as.	Pairs @ 3 as.	Amount
<i>Preparatory cultivation</i>				Rs A P
Ploughing, irrigating by mhote	16	...	16	5 0 0
<i>Seeds and sowing</i>				
Preparing seed beds, irrigating, etc.	7½	4	3½	2 1 6
Collecting green leaves, trampling, etc....	...	...	...	0 14 6
Cost of seed—42 lbs.	...	...	...	3 0 0
Transplanting (on contract)	...	...	...	4 4 0
Total	...	...	...	10 4 0

PLANT QUARANTINE

By PROFESSOR E. O. ESSIG

University of California

The idea of quarantine¹ had its inception in connection with the attempts on the part of the early Europeans to exclude and prevent the spread of dreaded plague or black death. Venice inaugurated such a restrictive measure as early as 1348, which was followed by other European countries. In spite of the long experience of human health quarantine, England did not establish her first health quarantine until 1710, and delayed in passing the Public Health Act until 1896. Thus we see that many years have been required to perfect the present highly efficient and valuable public health measures now maintained by all the progressive nations of the world, and accepted by all their citizens. It is my firm belief that plant quarantine will, in a much shorter space of time, attain a similar place in the affairs of civilized peoples. Fundamentally it is as sound to protect the plant life of a country from the constant encroachments of insect depredators and plant diseases as it is to protect human health. An abundant and available food supply is as essential to human beings as is health and almost as personal, because it affects the livelihood of every individual, since the prizes and availability of food are largely regulated by supply.

In view of the fact that there is so much general misunderstanding regarding plant quarantine, this article is written with the aim of presenting the claims of this young member of the administrative family.

In the first place, quarantine is a police power. This makes it very objectionable to certain minds. Anything that questions the free rights of individuals to act as they please is ever open to criticism. Law enforcement is always a difficult task, and even the most thoroughly qualified, tactful and resourceful official has great difficulty in handling the public as agreeably as is expected. Nearly all the complaints that arise from quarantine originate in regulatory and law-enforcement proceedings. This fact must be recognized at the outset. In this respect quarantine is no different from other measures enforced by due processes of Law.

Plant quarantine like health quarantine, was born of necessity it was not the child of speculative philosophy, nor was it an ethical experiment. The early introduction into this country of such serious pests as the codling moth, San Jose scale, citrus scale insects, cotton boll weevil, pear psylla, cabbage worm, gipsy and brown-tail moths and many stored-product and household pests, as well as the rapid dissemination over the land of such native insects as the beanweevil, chinch bug, Colorado potato beetle, and other pests, were at first looked upon as a matter of course. But when it was learned that our system of agriculture, embodying the production of large areas of single crops, afforded unusually favourable conditions for these pests to propagate and do

¹ The term *quarantine*, literally meaning a period of forty days, was originally designated as the time during which a ship, suspected of being infected with serious contagious disease, was obliged to refrain from all intercourse with the shore. It has always come under the powers of the police.

PARTICULARS	Men @ 2 as.	Women @ 2 as.	Pairs @ 3 as.	Amount
Brought forward ...	...	...	...	15 4 0
<i>Manuring and transplanting</i>				
Collecting leaves, trampling and trans- planting ...	6	18	...	3 0 0
<i>After-cultivation</i>				
Weeding ...	...	10	...	1 4 0
<i>Irrigation</i>	80	...	80	25 0 0
Mhote buckets ...	...	...	...	12 0 0
Mhote ropes, wages of chuckler, etc. ...	...	...	...	6 0 0
Total ...	...	...	...	43 0 0
<i>Harvesting and threshing</i>				
Harvest threshing at 4 annas ...	4	3	4	1 10 0
Total ...	...	...	...	4 14 0
Total cost of cultivation ...	...	...	...	67 6 0
Rent due to landlord—3 <i>khandagams</i> at Rs. 13 per <i>khandagam</i> ...	...	...	...	39 0 0
Total ...	...	...	...	106 6 0

Note.—Interest on the amount expended for the cultivation expenses was not charged for as the same is very little.

Yield of crop—Area : 1 Acre.

Grain—7½ <i>khandagams</i> of paddy (225 lbs. per <i>kandagam</i>) ...	1688 lbs.
Straw—36 bundles of 60 lbs. ...	2160 lbs.
Value of grain at Rs 13 per <i>khandagam</i> ...	Rs 98 8 0
Paddy straw at 100 lbs. per rupee ...	21 10 0
Total ...	120 2 0
Net profit ...	13 12 0

Owing to late planting the yield was considerably low, hence the margin of the profit is small.

unheard-of damage, a new idea of insect immigration and migration was conceived on the proposition that exclusion is easier than extermination and cheaper than control!

With this idea in mind, the first state plant quarantine laws were promulgated and put into execution. The problem appeared easy at first, when there was but little knowledge of world economic entomology, when insect pests were supposed to be largely carried on nursery stock and when domestic and international commerce was slow and concentrated at the larger inland cities and at a comparatively few seaports. As a matter of fact, it was not difficult to enforce the laws as conditions existed then. But commerce developed faster than plant quarantine, which is well illustrated by the fact that a national conception of plant protection did not crystallize until 1912 with the passage of the first National Horticultural Law. This tardiness of action on the part of the Government permitted the free entrance into most parts of the country of many insects which seriously tax the agricultural welfare of the nation.

To prevent a continuance of this unwarranted spread of pests, plant quarantine has been thoroughly overhauled and strengthened. A number of important steps were recognized and taken. It was clear that to be effective such legislation should at least provide:

1. For the absolute exclusion of certain serious pests and all articles of commerce likely to carry them from known areas of infestation. This is virtually an embargo.
2. The right to destroy, reject or exclude materials when inspections reveal the presence of insect pests or plant diseases.
3. The right to prescribe restrictions and regulations under which plant materials may be admitted into a region.
4. The power to formulate plans and enforce regulations to confine an insect to a given area and to resist its spread from one district to another.
5. The authority, power and financial means necessary to discover and to exterminate, if possible, a pest newly established in an area.

This is a difficult and complex programme which requires expert training, skill and experience. Insects and diseases are carried in many ways. When all these are learned some of the complexities will be removed. Years of careful study will be required to solve many of the problems of pest introduction and to perfect ways and means adequate to meet them.

It is impossible to predict what an insect will do in a new environment. A great many of our worst pests were either unknown or of no economic importance in their native homes. Therefore plant quarantine can never be safely administered as a compromise measure.

In considering the above five points it would appear that complete exclusion is the most important, and at the same time most difficult to enforce. Such exclusive quarantines have been maintained against all products likely to carry pests from various districts throughout the world known to be infested with fruit flies, citrus canker, and the foot and mouth disease of live stock. Plant pests and diseases as well as human diseases, such as plague, typhus and dysentery, do slip through such quarantine lines, but these failures are shallow arguments that such preventive measures are valueless and should be

abandoned. As a result of such regulations the public becomes aware of the danger and the majority of those engaged in commerce or travel will co-operate to enforce the law, thus materially reducing the hazards of unknowingly bringing dangerous pests and diseases into the state or nation. Many of them will also actually assist in law enforcement. In this manner an insect pest may be kept out indefinitely or its entrance greatly delayed. Such delays enable the entomologists to study the insect and devise methods of control. There is every reason to believe that plant quarantine enforcement, together with the wide and continued publicity in the form of suitable literature placed in the hands of travellers, have been responsible for the fact that the Mediterranean fruit fly has not already been introduced in sufficient numbers into California from Hawaii to have become established here. The exclusion of the Mexican orange maggot and the cotton boll weevil are other instances which might be cited in this connection. If the insect finally slips through some leak it is more likely to be apprehended than in the days before quarantines were known, and the chances of exterminating it before it becomes widely distributed are very favourable—laws, trained men, improved methods of control, equipment like a well-trained and equipped army, are immediately available. In the case of health quarantine, plague occasionally enters our seaports in spite of the eternal vigilance of health authorities. Following this introduction an extermination campaign, at whatever cost eventually conquers it, and no one questions the expense. And now and then a disease, like influenza, slips, through the ports and sweeps over the whole country. Does any one wish to abolish health quarantine because of such lapses?

In the early history of plant quarantine, inspection was the sole basis of admission or rejection of plant materials and is still an important part of present-day procedure, particularly in dealing with intersectional, intercounty, and interstate movements of agricultural products. Inspection can never be 100 per cent. efficient because of the human limitations of the men doing the work. Yet it is the only means whereby produce can be moved with a degree of safety without paralyzing commerce. That very many serious pests are intercepted in this way is another indication that quarantine measures reduce the number of foci of infestation and thus delay a rapid spread over the entire country. Inspectors become more proficient and experienced from year to year, and it is to be expected that the service will thus be gradually improved.

The right to prescribe restrictions and regulations governing the admission of certain products results in no great inconvenience to the shipper and sets up safeguards for the protection of large districts against certain serious pests. Such safeguards in the form of restrictions and regulations are usually agreed upon before legal steps are taken, and all the cases I know of are carried out harmoniously and greatly to the benefit of all concerned. They furnish real financial incentives for those in infested areas to reduce the offending pests to the lowest possible minimum in order to secure more favourable regulations, or as in some cases, to cause them to be entirely withdrawn.

Circumscribing certain areas within a given part of the country which may be infested with a serious pest or disease is an important prerogative of quarantine. This method is commonly employed and is at the present time in force against the gipsy and brown-tail moths, Japanese beetle, European corn borer, date palm scales, Mediterranean fruit fly, citrus canker and similar insects and plant diseases. The idea is to prevent the artificial spread of such pests throughout the country by defining boundaries across which articles of

commerce most likely to carry the pest cannot proceed. In the meantime everything is done through the employment of artificial and biological methods of control to reduce the infestation and thereby reduce the natural spread, which cannot be stopped by legal processes of law. In this manner it is much more difficult for any of these pests to jump across the continent with plant products or other materials sent by mail, express or freight, or carried in private automobiles. As illustrations we might cite the cases of the gipsy and brown-tail moths, the Japanese beetle and the alfalfa weevil. All are gradually and slowly enlarging their boundaries, but none of them have been able to make long-range establishments throughout the country. During the period of restriction all the more important facts concerning the life habits and control of all these pests have been ascertained and distributed throughout the country for the free use of all the people in meeting any like emergencies elsewhere. In these modern times the chances of distributing pests by means of automobiles and even aeroplanes offer probably the greatest hazards now faced by quarantine officials and thoroughly justify the entirely inadequate inspection stations found at some state and national boundary lines. When the private individual is aware of the importance of this service the necessity for it will be greatly reduced and the inconvenience caused accepted without undue criticism.

The extermination of a serious pest, once thoroughly and permanently established in a new district, is a question of very great importance, not only to the industries involved at the present time, but also to untold generations to come. It has often been argued that when once thoroughly established an insect pest cannot be eradicated. This fallacious statement has been based upon a few hard-hearted and inadequately and tardily financed attempts which were doomed to failure at the beginning. Eradication is possible if we as a county, state or nation are willing to pay the price. In this connection it might be well to call attention to the fact that quarantine officials in California have already discovered initial infestations of several newly introduced pests, including the pecan leaf case borer, the rough straw-berry weevil and the citrus white fly, and have apparently successfully eradicated them at a cost so surprisingly low as to call forth no criticisms whatsoever. It now looks as though the campaign against citrus canker is also a case in point. The present campaign against the newly established Mediterranean fruit fly in Florida promises to furnish a glorious example of man's ability actually to exterminate a serious insect pest established over a large territory. Only the obstructionists can prevent its final consummation.

Imagine if you can an area comprising some 1,500,000 acres of fruit trees stretching across nine states with a total valuation of approximately \$1,800,000,000 and an annual crop worth \$240,000,000. This is the area and investment that is subject to possible injury and financial embarrassment by the Mediterranean fruit fly. No one will deny the right of the owners of these orchards to demand protection from the invasion of any insect pest which will add to the great expense already necessary to produce, harvest and market such a valuable crop. The comparatively small sum of \$4,250,000 was appropriated to safeguard this great industry, which in reality belongs to the nation as a whole. It has been spent as wisely as possible in an intensely important and feverish campaign conducted in a few months. The situation has been under orderly and complete control throughout the undertaking. The job has not been completed. No one acquainted with the problem expected it to be finished short of at least two cropping seasons. More money is needed

to finish the task. Instead of an adequate appropriation to continue this work, \$1,000,000 only has been made available. If this amount is not sufficient then other funds must be obtained, because this is one case where the actual financial considerations involved thoroughly justify the expenditure of large sums. This is a national problem and should be met as such. To embarrass financially or to ruin the fruit growers of Florida to accomplish the end in view not only is unjust, but might also result in the defeat of the project. Without the whole-hearted and sympathetic co-operation of these orchardists we cannot hope to destroy the very last fly.

Plant quarantine truly seeks to protect the agricultural resources for all the people. I refer to agriculture because the farmers more than any other class of people have been imposed upon by these foreign insect foes. They have been compelled to suffer great financial losses and to fight a continual and expensive campaign against insect pests and plant diseases. There is no discrimination on the part of the pest; every crop in every section of the continent is subject to their unrelenting attacks which result in absolute waste and therefore loss to the well-being of the entire country.

Is it any wonder then that the farmers have been positive in their demands for protection against additional hordes of insect pests? And even though many of the latter have already invaded the fields and orchards, are we not justified in our requests to close up the leaks and keep the others out? Plant quarantine can do this with proper legislation, judicious law enforcement, adequate financial support and the sympathetic co-operation of a well-informed public. It can never be absolute, but it can be made to meet the agricultural needs of this country through capable and determined supervision.

Are we as a people to stand aside and watch the continued procession of destructive pests file into our country, sweep over our fields, orchards and forests, destroy our live stock and invade our very homes on the shallow assumption that we are helpless because of certain uncontrollable biological factors? Or shall we challenge their right to such free aggressions by the enactment and enforcement of adequate plant quarantine measures? ('SCIENCE' New Series, Vol. LXXI, No. 1840, April 4, 1930, pp. 350-353).



Extracts

FERTILISERS OLD AND NEW

The following Summary of an Address by Dr. E. H. Tripp, of Imperial Chemical Industries, Ltd., to the Bedfordshire Chamber of Agriculture will, we hope, be of interest to our readers. [Ed. M. A. J.]

Applications of scientific discoveries have caused a number of revolutionary changes during recent times, from some of which agriculture has benefited to a considerable extent. The practical farmer is apt to look down upon science, probably because the scientific man does not think sufficiently in terms of £. s. d. and cannot use ordinary, intelligible language. On the other hand, the scientist complains that farmers are too unrespective of new ideas, and that the *practical* man is too often merely the man who practises the errors of his fore-fathers.

Among the conquests made by science in the sphere of agriculture are the breeding of new varieties of plants, e.g., of Marquis and Reward wheats, which have extended the wheat-belt in Canada further north and west. Little Joss and Yeoman wheats, Plumage-Archer and Spratt-Archer barleys are the results of scientific research in England; also the breeding of potatoes immune from wart disease. The increase of the sugar-content of sugar beet from about two per cent. in 1747 to about 18 per cent. at the present time is a triumph of science applied to agriculture.

Science has shown how to eliminate or control many devastating plant pests, e.g., Phylloxera and mildew in the vine, blight in the potato, and more recently the use of coal-tar distillate winter-washes on apple trees has shown that the scourge of capsid bug is controllable. That troublesome pest in Australia, prickly pear, is at last being overcome by means of the maggot of *Cactoblastis* and the cochineal insect, which destroy it; with their aid some two million acres of land are now being reclaimed for agriculture each year in Queensland and New South Wales. Seed-disinfection is another result of science, and the use of certain gases for artificially ripening immature fruit, and for blanching greenery are among the latest applications of science to agriculture.

But, not least, science has shown how to make and use fertilisers for increasing the world's supplies of food and of raw materials for clothing. During the period 1840-1870 crop production was increased in Great Britain by about 50 per cent, owing to the use of superphosphate, nitrate of soda and sulphate of ammonia. These old fertilisers, together with basic slag and certain potash salts, still represent the great bulk of fertiliser consumption, although the modern tendency is to use concentrated fertilisers which contain two or three plant foods. The fertiliser industry is only about 90 years old; consumption has gone up by leaps and bounds and there appears to be no limit to its expansion. The world-consumption of nitrogen to-day in the form of artificials is estimated at about 2.3 million tons (equivalent to over 11 million tons of sulphate of ammonia), that of phosphoric acid is also about 2.3 million tons, and that of pure potash about 2 million tons. Of the new

single fertilisers, nitro-chalk, nitrate of lime, and urea to be especially promising.

A new development in fertiliser manufacture in England is the production by Imperial Chemical Industries of ammonium-phosphate fertilisers. These fertilisers contain up to 60 per cent. of plantfood, as compared with about 20 and 18 per cent. of plantfood in sulphate of ammonia and superphosphate respectively. Production of such concentrated fertilisers enables considerable savings to be made in the cost of bags, handling, freight, hauling, and application in the field; and, as they are prepared in a state of intimate and uniform combination, no mixing costs are incurred.

A further stage in the development of concentrated fertilisers was effected in Germany, where during the past few years large quantities of the so-called nitro-phoskas, which contain all three of the chief plantfoods, nitrogen, phosphoric acid, and potash, have been made and marketed. Many experiments have shown that these fertilisers are quite as effective as ordinary fertiliser mixtures, and in some cases they have proved to be slightly superior. Owing to the economies mentioned above, it is claimed that nitro-phoskas are marketed at prices below the aggregate prices of the plant foods they contain.

Air-Nitrogen Fertilisers

The growth of the atmospheric nitrogen industry is one of the romances of recent times. It is only within the last ten years that nitrogen has been taken from the air in large quantities for making nitrogenous fertilisers. The amount of nitrogen that is being extracted from the air to make fertilisers this year is about 1,400,000 tons; but this is a very small fraction of the available supply. Over every acre of land and sea there is sufficient nitrogen in the air to make 160,000 tons of sulphate of ammonia, and the total available supply of nitrogen is many thousands of million tons. Air-nitrogen fertilisers have rapidly replaced others obtained from different sources. The proportion of fertilisers made from air-nitrogen to those derived from all other sources was 7.93 in 1913, 50.50 in 1926, and is 56.44 at the present time.

Adequately balanced with phosphate and potash, there is no plantfood like nitrogen for increasing the yield of crops. Results over a series of years have shown that in the United Kingdom the increases produced by applying 1 cwt. of sulphate of ammonia are: 2.5 cwt. of wheat or oats, 3.1 cwt. of barley, 20 cwt. of potatoes or swedes, and 32 cwt. of mangolds. The profits from fertilising depend primarily upon these crop increases, upon the prices obtained, and upon the cost of the fertiliser used. There is no doubt that the profits derived from the use of nitrogen to-day are much greater than they were before the War. Fertiliser nitrogen is about the only commodity that is cheaper to-day than before the War.

The bad state of farmers to-day is not due to the cost of fertilisers; in fact, but for fertilisers their state would be worse than it is. The lack of ready cash, no doubt, hinders the consumption of fertilisers, for it must always be remembered that since the War the prices of farm produce have risen far less than the prices of general commodities, including farmers' requisites, such as labour, feeding stuffs, seeds, and implements; and the farmer is one of the those unfortunate individuals who has to buy retail and to sell wholesale.

In spite of the many handicaps to agriculture, the consumption of nitrogen appears to be increasing generally. In many countries the farmer now recognises that without fertilisers he may be able to grow crops, but with fertilisers he can grow money. Why not grow money? During the past two years the United States has increased its consumption of nitrogen by 69 per cent., Japan by 54.4 per cent., France by 45.5 per cent., the United Kingdom by 25.4 per cent., Germany by 9½ per cent. and China by no less than 151 per cent.

A significant feature of the nitrogen industry is that the primary raw materials it uses, air and water, are to be found everywhere. In the past, wars have been waged for the possession or control of raw materials. If all primary raw materials were as available as those used by the nitrogen industry, the world would be a better place to live in, and the bulk of civilised mankind would not now be in servitude, concentrating all its energies on the acquisition of food, clothing, and shelter, with little or no time to devote to non-material pursuits.

It may be that in the fullness of time, science will show how to breed a race of men that will grow feathers or hide to replace clothing, how to obtain building materials as accessible as those which go to make a bird's nest, and how to convert atmospheric nitrogen, carbon dioxide, and water directly into human food. *The Fertiliser Feeding stuffs and Farm Supplies Journal.*

The Ramasastrulu-Munagala Prize 1930

1. The Prize will be awarded in July 1930.
2. The Prize will be in the form of a Medal and will be awarded to the member of the Union who submits the best account, of original research or enquiry, carried out by him on any agricultural subject.
3. The subject matter shall not exceed in length twelve foolscap pages type-written on one side.
4. Intending competitors should notify the Secretary of the Madras Agricultural Students' Union not later than the 15th June the subject of the paper which they propose to submit and the paper should be sent in so as to reach the Secretary, Madras Agricultural Students' Union not later than the 1st July 1930, with a covering letter showing full name and address of the sender. The author's name should not be shown on the paper but should be entered under a *nom-de-plume*.
5. Four type-written copies of the essays should be sent in.
6. The name of the successful competitor will be announced and the prize awarded at the time of the Conference.
7. Papers submitted will become the property of the Union and the Union reserves to itself the right of publishing all or any of the papers.
8. All references in the paper to published books, reports or papers by other workers must be acknowledged.

Any further particulars may be obtained from the Secretary, Madras Agricultural Students' Union, Lawley Road P. O., Coimbatore.

NOTES AND COMMENTS

The labourer is worthy of his wage

The following extracts from the Symposium on the salary question arranged by the Committee of One Hundred on Scientific Research, American Association for the Advancement of Science, at Des Moines, Iowa, on December 31, 1929, published in *Science* of Friday, April 18, 1930, are rather peculiarly interesting, as they show that the general neglect of men of science and the fact that the salaries of men dealing with the academic side of Science have not kept abreast of the general rise in the income and prosperity of the average citizen, are phenomena not particularly restricted to India but of almost world-wide occurrence.

Dr. William A. Noyes, Professor of Chemistry, University of Illinois, in his paper—'Are equitable salaries paid to Professors?' remarks that compared with the general conditions prevalent in 1900, there has been an enormous increase in the total production in the United States, not only in the output of minerals and in manufacture but also in farm products. The average earning power of the average citizen would appear to have enhanced 150 to 300 per cent. On the other hand the salaries paid to professors in the colleges and universities are said to have remained either stationary or risen by less than 100 per cent. According to Dr. Hughes of Pasadena, California, who made a very careful and exhaustive analysis of the salaries paid in the city schools of Pasadena in comparison with those paid to wage earners in other calling, 'compared with the figures in 1914, and taking account of index numbers, the average income of all persons gainfully occupied in the United States in 1928 had actually gained 57 per cent. in purchasing power.' If the professors are to maintain the same economic status relative to other classes of citizens as in earlier years, it is necessary that their salaries should be increased in proportion to the increased income of the average citizen.

'A concrete illustration' says Dr. Noyes, 'will help us to see this. Since 1900 a very large proportion of the people of the United States have found it possible to own or use automobiles. This is one direction in which the 57 per cent. increase in the income of the average citizen is being used. We realise what an immense addition to the convenience and richness of our lives this has made. It is not right that professors should be able to take advantage of these changes, as well as other citizens?'

'Again, a comparison of the salaries paid to science graduates in industrial positions and those doing academic work throws further light on the reasons why some of the most brilliant graduates do not follow academic careers. Enquiries addressed to 146 men and women that had received the degree of Ph.D. in chemistry at the University of Illinois during the years 1918 to 1928, elicited the information that the majority have preferred industrial positions to academic ones. In academic positions, the average initial salary, including summer teaching or other work, was \$2,407 while for industrial work, the average initial salary was \$2,485. In 1928, the average salary of persons who had taught for four to ten years was \$3,472, and the average salary of those who had held industrial positions for four to ten years was \$5,619. The highest initial salaries for academic work were \$3,500, \$3,056, and \$3,000; while for industrial work they were \$4,800, \$4,000, and \$3,840. The

highest salaries drawn in 1928 for academic work was \$4,500, \$4,450, and \$4,433. On the other hand, for industrial work the highest salaries were \$15,000, \$13,000, and \$11,000. It is therefore evident that unless these conditions are remedied the universities must be content to fill their teaching positions with mediocre men.

'It is sometimes claimed that salaries are inexorably fixed by the law of supply and demand, and that it is useless to tamper with such a natural law; but such an attitude treats human beings as if they were on the same level as the inanimate products of their labour. Sociologists are generally agreed that other factors beside supply and demand should be taken into account in determining wages and salaries.

'Foremost among these is the "living wage" which is necessary to maintain the efficiency of the worker and enable him to provide suitable for those dependent on him. Surely the "living wage" for a professor should be on a higher plane than that of a day labourer. No one can do efficient work unless he is freed from the anxiety which comes from the attempt to make an inadequate salary cover the bare necessities of life. He should have a sufficient income to free him from that anxiety and to make it possible for him and his family to form reasonable social contacts with other cultured men and women. In addition to that he should be able to purchase the books which are the tools of his trade and to travel and associate, occasionally, with colleagues in his field, at home and abroad.

'Another factor worthy of careful consideration is the value of the services rendered to the community. The increase in salaries the professors are asking should not be considered as a charity to underpaid men and women. They should be considered as an attempt to pay a part of the debt which the community owes for the services they render, and have rendered in the past. For, illustrations could be multiplied by the thousand to show that the wealth added by the work of professors in colleges and universities very far exceeds the cost of maintenance of all these institutions. The influence of Liebig and his school in many modern chemical commercial developments, such as the synthesis of various coal-tar dyes is indeed well-known; and various other instances, such as the synthesis of ammonia from hydrogen and atmospheric nitrogen, the electric manufacture of aluminium, etc. have also been the results of researches conducted by professors in the laboratories. . . .

Dr. Noyes ultimately makes the following practical suggestions as to the improvement of salaries of men in academic positions. (1) The executives of colleges and universities should redouble their efforts to secure equitable salaries for their professors. They should see clearly that the most important function of the institution is to secure able and efficient men in charge of the various departments and divisions of their work and to relieve them from routine work so that they may continue to be productive scholars as well as efficient teachers. (2) Positions as instructors should be given only to those young men who have the best training in the subject and who give most promise of becoming efficient teachers and productive scholars. These requirements are more severe, in general, than for those who might succeed in industry and the salaries should, therefore, be higher rather than lower than those paid for industrial work. In other words, the executives should seek *the best, not the cheapest*. (3) Such men should be given, after employment, ample facilities and time for productive scholarship and should also be encouraged to become efficient teachers. (4) Lock-step promotion—a regular

increase each year, almost irrespective of accomplishment—an easy device of executives to avoid trouble—should not be tolerated. Men of unusual ability should be promoted rapidly, just as they are in the industries.'

In another paper read at the Salaries Symposium by Mr. Edward A. Filene, President, William Filene's Sons, Boston, Massachusetts, on 'Adequate Salaries for College and University Teachers'—the speaker viewed the question of adequate salaries for university and college teachers from the angle of view of the business man. He said that business men believed in raising the wages of scientific men employed by them, not because high wages were socially desirable, but because of the fact that thereby their total profits might be greater. Such a "commercial" attitude may possibly be resented by a scholarly mind as an ignoble thing. But if the attitude be studied, however, it may be discovered that it is not wholly unscientific. . . . Business men have found that in modern business problems the safest and most efficient leadership is that of Scientific Research. There is a demand for scores of research specialists in various special lines of business—for men who can do the thinking and fact-finding in order to develop the great system of mass production that now dominates the market. Naturally men will be tempted by larger salaries from the colleges and the universities into business and industrial life.

'I hope' he continued, 'when the time comes, that our teachers will prove to be sufficiently selfish. If they should be unselfish, if they were willing to sacrifice themselves and their families to the traditions of education and go on teaching in the colleges while their wives do the family washing, we may be in for considerable trouble; but if they become sufficiently selfish, as I have reason to believe they will, it will be up to the colleges to find a way to keep them from accepting the offers which they get. And the only way that they can find will be through raising their salaries—not to a mere living wage but to several times beyond their present level.'

The observations of the writers extracted above appear to us to apply with rather special force to some of the scientific services of this province also. As shown clearly in the Editorial of this Journal for May 1930, the cuts recently effected in the pay and prospects of the Agricultural and Veterinary services in Madras, for example, will have the effect of disenthusing the present men and of deterring the future entry of men of the right intellectual calibre. Undue economies may result in killing the Goose that lays the Golden Egg.—[Ed. M. A. J.]

Sunn Hemp as a Fibre Plant

The Empire Marketing Board, in a recent publication¹ draws marked attention to the possibility of Sunn hemp finding a ready sale and establishing itself in the European market. For quite a long time, Russian hemp has been the chief source of supply of fibre, for the manufacture of cables, twines, cordage, etc., but since the War, this has deteriorated in quantity and quality. Now is the opportune moment to capture the market; for, Sunn hemp properly cultivated and treated, produces according to authorities, fibre of a class that will hold its own with the best Russian hemp.

¹ *Indian Sunn or Sann Hemp*. A memorandum issued by the Imperial Institute and published by the Empire Marketing Board. H. M. Stationery Office, London. Price 1s. nett.

In India, Sunn hemp is chiefly grown as a green manure crop in garden and wet lands. Being a leguminous crop, it enriches the soil, and smothering all kinds of weeds with its wild growth, cleanses the field. It requires little attention after sowing, but little water for growth, and being only a four months' crop adapts itself beautifully to double crop production. Not infrequently, it is also used as a fodder for cattle.

The problem, on which the Empire Marketing Board wish attention to be focussed, is to so modify the present cultivation methods, that while the leaves and roots of the crop could still be used as green manure. The stems should be entirely given more for the manufacture of high grade fibre. That this is not impossible has been shown by certain experiments conducted at Pusa.

The chief factors that operate are soil and water; while Sunn hemp can grow in almost any kind of soil, from the waterlogged clays of the delta, to the well drained loams of the heights, the crop when grown in the deltas, grows too woody to be of use in the manufacture of fibre, and can only be ploughed in as green manure. In the higher regions, the crop grows beautifully and excellent fibre can be manufactured from it, then; but, water is here the limiting factor, for though the crop requires but little water for growth, large quantities are required after the harvest, for retting the stems. The problem can be best solved by the formation of co-operative syndicates, by whom the crop, after being grown on soils best suited for fibre formation, can then be transported to places where there are large quantities of water available for the retting of the fibre.

Other points which are dealt with, in the bulletin, are, the defects which are at the present day noticeable in the manufacture of Sunn hemp fibre, in India; these are mainly (a) irregularity in the quality due to differences in cultural conditions and care, (b) admixture of dust and dirt due to retting in muddy water, (c) improper retting due to inexperience, (d) unreliability of packing etc. All these can be remedied; although Indian Sunn hemp fibre is not supposed to be as good as Russian hemp, experiments carried out at the Imperial Institute, have shown that when properly manufactured, the fibre is quite as strong as the Russian hemp. The bulletin, therefore, ends with a wish that the publication will stimulate in big ryots, an interest to grow the crop in ideal conditions, and while deriving the advantage of its manurial value from the seeds and leaves, will also make it a useful cash crop, by the production of first grade fibre.

The publication also gives an interesting statement of the fibre producing centres in Calcutta, Bombay and Madras, their gradations, denominations and current values in the market. In the appendix is given the evidence tendered by the Advisory Committee on vegetable fibres before the Royal Commission on Agriculture.

Transplanting versus Broadcasting or Drilling:

The advantages of transplanting over drilling or broadcasting especially in the case of Paddy and Ragi are very well known to agriculturists of South India. *Landtechnik* reports results of German experiments obtained by the *Reichskuratorium für Technik in der Landwirtschaft* which are extracted and published under Research items on page 651 of the issue of *Nature* for April 26, 1930. In 146 experiments observed in 1929, the spacing varied from 20 cm x 20 cm. to 35 cm x 35 cm., tillering in all cases being extraordinarily good. The transplanted plots were eight to fourteen days later in

ripening than those drilled in the usual way, and as the former also suffered from the dry period of the year, the yields may have been unfavourably effected thereby. Only 32.4 per cent of the transplanted plots gave higher yields than the drilled plots, whereas 67.6 per cent showed lower yields. The yield increases were between nothing and 69.2 per cent, less than half of the increases being greater than 30 per cent. In view of the fact that increases of about 50 per cent were obtained in certain properly controlled experiments, the experiments are being continued by the *Landwirtschaftliche Hochschule*, Berlin.

Mineral Supplement to Cows

In the Journal of *Dairy Science* for March 1930 Lindsey and Archibald of the Massachusetts Station report the results of six and half years work on the effect of a mineral supplement on Cows. The experimental animals received daily eight ounces of a di-calcium phosphate carbonate mixture. The animals getting the mineral mixture made considerable gain in liveweight while the non-mineral group showed little change. The supplement had little effect on the growth of young cows and heifers. A similar experiment being conducted here at Coimbatore has produced promising results. The group of calves getting a mineral mixture at a rate in keeping with their liveweight have showed better growth than that getting no minerals.

Dr. C. J. George

Our congratulations go to Dr. C. J. George, M.A., PH. D., on his appointment as Personal Assistant to the Director of Fisheries, Madras. We wish Dr. George every success in his new sphere of work.

Imperial Council of Agricultural Research Grant for Tobacco Research

We congratulate Mr. K. Sankaran Pillai, L. AG., on the grant of Rs 10,000 made to him by the Imperial Council of Agricultural Research for pursuing his studies on the Flue-curing of Virginian tobacco. Mr. Pillai is an old student of the Coimbatore Agricultural College and has taken to private farming in Guntur. The appearance of his paper on 'Flue-curing of Virginian tobacco' in this issue of the Journal is a happy coincidence and we commend his informative article to our readers for their careful perusal.

Upper Subordinate Service

We are glad to note, that as a result of the Memorandum submitted by the Association of Upper Subordinates in September 1929, the Government have sanctioned a few more appointments in the higher grades for 1930-31 both in the Agricultural and Scientific sections. The statement given below shows the increase in the number of appointments.

Grade	Agricultural Section		Scientific Section	
	1929-30	1930-31	1929-30	1930-31
I.	4	7	2	3
II.	8	10	3	5
III.	11	6	5	2
IV.	11	13	12	17
V.	137	135	75	70
Total ...	171	171	97	97

Mr. D. Srinivasa Rao

Mr. Srinivasa Rao has been in the working committee of the Union for the last six years as the Treasurer and it is only those who were in the committee that could know how zealous and painstaking he was and how perfectly he was managing the financial side of the Union. It is indeed a great loss to the committee that he should have had his transfer at a time when the Union and the Journal are coming into greater prominence and usefulness. We wish Mr. Srinivasa Rao all prosperity and luck in his new sphere of work.

Prof. M. Vaidyanatha Ayyar

We are glad to learn that Prof. M. Vaidyanatha Ayyar of the Patchaippa's College has been appointed the Statistician to the Imperial Council of Agricultural Research. Prof. Vaidyanatha Ayyar, it may be remembered, delivered a course of three lectures, under the auspices of the Madras University, at the Agricultural College, Coimbatore, on the 'Mathematical Probable Error as applicable to Field Experiments', which has been published in the April 1930 issue of our Journal. We heartily congratulate him on the appointment, and hope the long-felt want of a proper Statistical Department for India will ere long be removed and much useful work done in this direction.

GLEANINGS**Aeroplane used for Tracking a Cotton Pest**

The Pink Bollworm enjoys the distinction, among all the pests that cotton is heir to, of being the most wide-spread throughout the world. It is now known in virtually every cotton-growing country, and for the last ten years has caused a great deal of anxiety in the United States by its sporadic appearance in various parts of the western belt. The first recorded outbreak was in Texas in 1917, when the pest was found affecting two groups of localities: (1) six centres in Eastern Texas and the neighbouring borders of Louisiana; and (2) five points in Western Texas and New Mexico, all near the Mexican border. The first group is said to have originated from a cargo of cotton-seed shipwrecked on the coast of Texas; but the second group could not be traced to any specific cause, and was vaguely supposed to have come somehow from Mexico, where the pest has been well-known for a longer time.

As the result of very drastic measures taken by the Government, the outbreak in Eastern Texas and Louisiana was apparently got completed under control, no trace of the pest being found there after 1921. But in the Western valleys of the Rio Grande and Pecos rivers a complete eradication of the pest has not been found possible and small sporadic outbreaks have been reported almost every year. It was hoped that the isolation of these districts and the occurrence of a belt of 200 miles of no-cotton country would reduce the danger of spread into these tracts to a minimum.

Since 1921 there have been frequent new outbreaks of the worm in these western parts of Texas and early in 1927 there were really alarming reports that it had spread into the western fringes of the main Texas belt. In the course of investigations made by the Federal and Texas State authorities into the habits of the pest, especially with reference to its powers of spread from

place to place, very interesting results have been obtained. The most interesting of all is what really amounts to a discovery as to the probable means of locomotion of the pest.

The investigators were puzzled by the fact that in these western areas the outbreaks always seemed to be of the nature of a new infestation rather than of a continued presence of the pest carried over from year to year. This, and possibly a hint from some earlier work, suggested to Dr. B. R. Coad of the Government Bureau of Entomology, at Tallulah, La., a line of investigation which has proved extremely fruitful.

In connection with his work, which covers the whole belt, Dr. Coad has frequently to make very long journeys, and for these he uses some of the Government aeroplanes which have been employed for several years in dusting cotton fields for boll weevil. It occurred to him to make some experiments on what might be called the entomological content of the upper air. He devised a small 'bug-trap,' which he carries on his aeroplane and records the captures made at various altitudes, and the first results of his work were to produce definite evidence of the pink bollworm moth flying at high altitudes, up to about 3,000 feet. Following up this clue, the scientists proceeded to trace the movements of the pest, first through aeroplane flights and second by putting down trap plots of cotton in districts far remote from any existing cotton field. To make a long story short, the result is that they have worked out an almost complete chain of circumstantial evidence, from which they have been able to build up an entirely credible theory of the whole nature of the problem. It appears that the prime source of investigation is probably the Laguna Valley in Mexico, where pink bollworm is always present in considerable numbers throughout the whole season.

The first step was to study the habits of the moth at home in this district, and the striking fact emerged that while the moth shows no inclination to stray from home throughout the summer, a period comes about the beginning of September when it suddenly develops a desire to migrate. This was detected by the erection of screens over the fields, and throughout the summer no moths were caught on these screens; but about first September they suddenly began to rise in large numbers. Then the aeroplanes came into the investigation, and they were able to trace the movements of the moth all the way from Mexico across two hundred miles of desert to the nearest outlying points of the cotton belt, which lie in the Big Bend district of the Rio Grande, thence to the isolated irrigated districts in the Pecos Valley, thence to the western fringes of the main cotton belt in Texas itself.

It appears that the moths are carried up involuntarily by strong convection currents to a maximum of about 3,000 feet. There they meet a 'contratrade' wind blowing from south to north, which is apparently persistent and entirely independent of the currents of air lower down. By this they are carried northward till, somewhere north of United States boundary, they meet a kind of wall of contrary winds which checks their progress so that large numbers of them fall to the ground alive. In this way their presence was detected in the trap plots laid out into the desert from the western fringe of the cotton belt, and most of those, which had been quite clear of the pest till about 1st September, were very soon found to be infested after that date.

Not for a long time has so fascinating a theory been found to fit so exactly the facts of the situation, and the most satisfactory feature of the whole thing is that it clearly indicates the line of attack. Existing measures

for tackling the pest when it arrives in the western belt, must, of course, be continued, but the main object of attack must be the centre of infection in Mexico itself. It is understood that measures with that end in view are under consideration, though the problem presents what is probably quite a new feature in international relations.

—Extracted from article by Mr. John A. Todd in the *Commercial*. Vol. xix. No. 488.

From *Tropical Agriculture*, Vol. vii. No. 2, p. 49. February 1930.

Prickly Pear Destruction in Queensland

On the day they assumed office the Prickly Pear Commissioners said that to clear Queensland of prickly pear was at present impossible, as the cost of first clearing alone would exceed £100,000,000. It was not to attempt the impossible but to stop the further spread of the pear and to encourage and reward the efforts of holders of pear lands that the Commission was appointed. That is over five years ago. It can now be definitely stated that the encroachments of the pear have been stopped. Last year (to June 30, 1929) about 170,000 acres were cleared by the Commission, and more than 700,000 acres have been cleared or are in process of being cleared since the board began operations. Pear leases taken up amount to 4,185,322 acres, and an additional 1,143,267 acres have been applied for. This, of course, is only a small proportion of the 63,000,000 acres under the jurisdiction of the board, but not the whole of this is infested.

Lightly infested areas are dealt with by poisoning. The Commission sells arsenic pentoxide at 3d. per lb. which is less than landed cost, and in addition pays the cost of repacking, handling, and freight to the railway station nearest to the purchaser's holding. But it is by biological means that the hopes of final eradication of the pear are founded. Of the cactus-destroying insects imported from other countries three have been specially successful—Cochineal, *Cactoblastis cactorum* and *Chilinedia tabulata*. The Commission is not relying on any one insect to control or eradicate prickly pear. Experience has shown that by a complex of insects the greatest success is attained; therefore the Commission, having distributed Cochineal practically through the pear belt of Queensland, is now in like manner distributing *Cactoblastis* and *Chilinedia*. It is confidently expected that, while *Chilinedia* and Cochineal will sap the vitality of all pear and retard its fruiting, they will also control seedling pear and prevent regrowth, while *Cactoblastis* will destroy the older and larger plants. The Commonwealth Board at Sherwood is carrying out tests with other cactus-destroying insects, and those which prove effective will be distributed.

Such wide-spread distribution of the Cochineal has been effected that it is almost impossible to find a prickly pear infested district without it. In some localities it has almost entirely eradicated the pear; in others, its effect has been less noticeable, but everywhere it has established a marked control of the young growth. From October, 1927 up to June 30, 1929, the Commission has distributed 220,606,000 eggs of the *Cactoblastis* grub. This insect is quicker and more spectacular in its work than Cochineal, but it has been estimated that the latter can be credited with a 50 per cent. control of the prickly pear. The life history of the *Cactoblastis* is somewhat similar to that of the silkworm. In the grub stage it feeds freely on the pear, causing rapid destruction, and as it lives in colonies of 40 to 100 grubs in a pad its work is very striking.

When fully grown the grub spins its cocoon, which is hidden under the barks, logs or rubbish of any kind. When the moths emerge the females deposit their eggs in peculiar chains, or egg-sticks, resembling twigs of pear thorns. The number of eggs to a stick is 80. Each female lays on an average 100 to 200 eggs, and there are two and a half generations a year, so that the increase is astounding.

A new kind of Soap

Usually soaps are prepared by combining a 'fat' with a lye, but Mr. Ralf B. Trusler, of the Mellon Institute of Industrial Research, describes this 'Synthetic' soap in the December issue of *Industrial and Engineering Chemistry*.

The Ethanolamines (of which there are three in the family—mono-, di-, and tri-) are synthesized from ammonia. Any of the three ethanolamines, as well as a mixture of all the three, can be used for preparing the soap, as all combine equally well with fatty acids to produce soaps.

Ethanolamine soaps are pale yellow to reddish brown, depending on the purity and colour of the fatty acids employed, and generally speaking, all these compounds have an agreeable, soapy odour. Those made from the higher fatty acids, such as oleic and stearic acids, are soluble in a great variety of organic solvents, which is one of their unusual and outstanding properties. They are dissolved readily by benzene, toluene, and similar compounds. Turpentine, alcohols, glycols, glycerol, ketones and many aldehydes are excellent solvents for these soaps. It is surprising to note that even heavy petroleum products, such as lubricating oils and petrolatum, will dissolve quite appreciable amounts. This is particularly true of the oleate. In most cases, excepting the heavy oils, the ethanolamine soaps are soluble in the solvents in all proportions, yielding transparent solutions.

Ethanolamine oleate possesses striking emulsifying ability in promoting oil-in-water emulsions.

It has been found that small amounts, in the proximity of 0.3 to 1 per cent of these soaps dissolved in lubricating oils, either increase their viscosity or cause them to get. In many instances heavy oils can be rendered non-running and given increased consistency, and appear to be suitable for pressure oil systems (not for internal combustion engines) and for cup and gear greases.

A convenient and efficient means for removing oil and grease from articles and clothing can be made by dissolving about 10 to 20 per cent of the oleate in a convenient solvent, like naphtha, carbon tetrachloride, ethylene dichloride, and the like. A solution such as this has been successfully used in cleaning greasy walls, woodwork, mechanisms, automobile bodies, and parts covered with grease and oil, by brushing or rubbing it over the surfaces to be cleaned. After the solvent has evaporated, the grease and oil can be often completely removed by washing with water, because the grime is removed as an emulsion as the soap is taken up by the water.

Ethanolamine oleate in the presence of moisture has a marked softening action upon starch, sugar, and other non-greasy substances, thus facilitating the cleaning of garments. In fact, much of the laborious spotting-out operation usually experienced by dry-cleaners can be avoided by using this soap in the regular dry cleaning operation. For cleaning felt and wool hats, where

the soap in naphtha is applied by hand, particularly good results have been obtained.—*Scientific American*, December 1929, p. 534.

The Biological Control of the Citrus Mealybug

A Mealybug—*Pseudococcus gahani* Green, popularly known as the citrophilus mealybug, has established itself as a serious pest of citrus in most of the citrus producing areas of Southern California. Fumigants and sprays having definitely failed to give satisfactory control, a practical method of biological control has been developed during the past few years using the introduced ladybird beetle—*Cryptolacmus montrouzieri* Muls. This beetle is now being propagated on a commercial scale by fifteen insectaries operating throughout Southern California. These insectaries, representing an equipment investment in buildings and equipment running well into six figures, are being operated variously by the several counties concerned, by citrus co-operative organizations, and by individual owners of large citrus holdings. During the 1928 season over 40,000,000 beetles were produced and liberated systematically, usually at the rate of 10 adults per tree throughout the recorded infested acreage.

In general, these beetles are made available for field liberation during the optimum months of April, May and June, when they are most active. The selection of these months is based not only on their being the period of normal development of the host mealybug, but also on their being the time of minimum rainfall and their possessing daily temperatures above 70° F.—*Journal of Economic Entomology*, December 1929, pp. 910-15.

California's Woes

'California fruit trees have escaped the attacks of the Mediterranean Fruit Fly, but they are now menaced with danger of root rot', Dr. Karl F. Kellerman of the United States Department of Agriculture recently explained to the House Committee on appropriations. 'This disease which has hitherto been most damaging to cotton in Texas, has recently been discovered in the Department's Experimental Date Garden at Indio, California. It apparently does not affect Citrus fruit trees, but rots the roots of such trees such as Peach, Almond and Pistachio and many of the deciduous fruit trees. California which is on the verge of becoming an extensive cotton growing state is alarmed both on account of her fruit trees and cotton. It is believed that nursery stock from Texas may have brought the root rot to the California experimental station and Government workers believe they can prevent its spread in California if they soak five acres of the experimental farm with disinfectant. The five-acre tract affected is now isolated from the rest of the farm with an earth and oil barrier. In Texas, where the fungus is widespread, no satisfactory method of treatment has yet been found which cotton growers can apply, though Governmental and State agencies are constantly working on the problem.—*Science-Supplement*, February 28, 1930.

Soy Beans versus Milk

It is generally recognised that human milk is the best food for infants and that in the absence of human milk, the best substitute is cow's milk in some form, modified usually by the addition of various ingredients, such as, sugar, water or egg. There are, however, some diseases in infancy in which cow's

milk is not desirable and there are some infants who react severely to milk, breaking out with eruptions and developing symptoms like those of asthma. It is believed that some cases of severe eczema in infants are due to such sensitization. In case an infant is unable to take cow's milk, it is necessary to have another substitute for human milk. In an attempt to find such a mixture, Drs. L. W. Hill and H. C. Stuart of Boston have experimented with a preparation of the Soy Bean. This has been used in one form or another in China as a supplementary infant food for many years. Using Soy Bean flour as the basis of a preparation, Dr. Hill found that infants sensitive to cow's milk can be kept in a good state of nutrition by a preparation containing Soy Bean, Calcium carbonate and salt. The Soy Bean flour already contains some Magnesium, Potassium and Phosphorus. In order to raise the amount of fat, olive oil was added to the mixture.—*Scientific American*, March 1929

A Biological Method for Destroying Bedbugs

N. T. Lorando (Sci. Mo., 29 (1929), No. 3, pp. 265-268):—In observations made while engaged in work with the Near East Relief in Greece, a spider identified by (A) Petrunkevitch as *Thanatos flavidus* Simon, was observed to control the bedbug effectively, 30 or 40 bugs a day according to their size and quantity of blood food, having been fed upon by this arachnid. Young spiders hatched out after an incubation of 18 days in summer immediately began to attack the bugs. Attention is called to a similar habit of the spider, as reported by Sambon (E.S.R. 24, p. 757), who found them preying upon engorged stable field.—(*Experiment Station Record*, Vol. 62—No. 3, pp. 246).

Rat Control

Continuing experiments in the Pathology Department of the Hawaiian Sugar Planters' Association, J. P. Martin reports on the relative toxicity of rat poison baits. Captive rats, it was noticed, refused to eat barium cakes unless deprived of other food. Although many rats died from strychnine poisoning, many could eat apparently unlimited amounts of wheat treated with this poison. A more attractive bait was found in the form of wheat treated with thallium sulphate, which has now been generally adopted along Hawaiian plantations as a cheap satisfactory rat bait. It has no bad taste, and its ready ingestion is favoured by the rodents. Almost complete cessation of subsequent rat damage has been determined when thallium torpedoes have been thoroughly distributed in the rat-infested areas. Such bait, however, requires to be handled with care, and skin absorption by man is avoided by the use of rubber gloves when the salt is in aqueous solution. *The International Sugar Journal*, Vol. XXXII, No. 375, Page 154.—*Report of the Experiment Station*, H.S.P.A. 1929.

College News and Notes

Mr. D. G. Munro.—Mr. Munro who had been home on leave, arrived at Coimbatore with Mrs. Munro on the 28th May. Mr. Munro has since been posted temporarily as Oil seeds Specialist and has entered on his new duties with his office at the Research Institute.

German and French classes.—Mr. K. Amrita Rao, M.A., L.T., of the Indian Institute of Science, Bangalore, who was on the Estate during May to give a course of instruction in German to some officers of the College and Research Institute, left for Bangalore on the 2nd June. Mr. Rao's help was availed of by some of his 'pupils' to undergo a short course in French also. On the 1st June, Mr. Rao was entertained at Tea by his students, when a very enjoyable evening was spent in his company. One of the officers read an address in German—a good proof of the progress made—eulogising Mr. Rao's admirable qualities of head and heart and thanking him for the trouble he had undergone on their behalf to go to Coimbatore and the pains he had taken to give them a much-needed working knowledge of the two foreign languages.

Sanitary Committee.—It is understood that the College Board has decided to revive the Sanitary Committee now defunct for some years. The revival of this old and useful institution is a welcome move, since by virtue of its representative character it gives opportunities for the elected representatives of all classes of officers resident on the Estate to meet once a month or oftener, discuss the Sanitary needs of the Colony and formulate useful suggestions calculated to foster the well-being of the residents.

Holiday Picnic.—The Public Holiday on the 3rd June was availed of by a batch of over two dozen officers of the Colony to visit the Siruvani water works and to spend an enjoyable day on the hills forgetting for the nonce the routine cares of office and laboratory work. The party left the Estate by motor at 7 a.m. and reached their objective by about 8-30 a.m. They were cordially received and shown round the place by the officers in charge of the works and the several engineering schemes in progress were explained to them. After spending a day of merriment and sightseeing, the party returned to the Estate by nightfall.

Provincial Educational Conference.—The Agricultural College was the venue of the Provincial Educational Conference which was held on the 22nd, 23rd and 24th May under the Chairmanship of Mr. S. K. Devasigamony, the veteran educationist and Headmaster of the Bishop Hebbler High School, Trichinopoly. Rao Bahadur C. S. Ratnasabhapathy Mudaliar, President of the Coimbatore District Board and Chairman of the Reception Committee welcomed the delegates and the Hon'ble Mr. M. R. Sethurathnam Ayyar, Minister for Development, in the course of a speech full of sympathy for the teachers declared the Conference as well as the Educational Exhibition open. Over 300 delegates from different parts of the Presidency, attended the Conference and the College and the Estate presented a very lively appearance during this period. Through the courtesy of Mr. P. H. Rama Reddi, Principal of the Agricultural College, who was one of the Vice-Presidents of the Reception Committee, the organisers were able to provide excellent boarding and lodging arrangements for the large gathering of delegates in the spacious

June 1930]

College News and Notes

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buildings of the Agricultural College Hostel. Many of the Research staff had a busy time explaining the work of their respective sections to the large concourse of visitors.

Visitors.—Dr. K. Kunhi Kannan, Entomologist to the Government of Mysore, visited the Research Institute on the 6th June to meet the Government Entomologist and to discuss with him the subject of the suspected entry of the dreaded coffee berry borer (*Stephanoderes hampei*) into South India.

Mr. R. W. Littlewood, Deputy Director of Agriculture, Livestock, was at Coimbatore during the last week of May to hand over charge of the College Dairy to the Principal.

Imperial Council of Agricultural Research.—Information has been received that Mr. G. R. Hilson, Director of Agriculture and Mr. C. Tadulingam left for Simla on the 5th June to attend the meeting of the Imperial Council of Agricultural Research. Rao Bahadur B. Viswanath, Government Agricultural Chemist, also left for Simla on the 12th June to participate in the deliberations of the Fertilizer Committee of the Imperial Council of Agricultural Research.

College Day and Conference 1930

The 20th College Day and Conference will be held this year from July 15th to 18th. G. R. Hilson Esq., Director of Agriculture, Madras has kindly consented to preside over the Conference.

The following is the tentative programme :

Tuesday 15th July. Sports. M.A.S.U. 'At Home.'

Wednesday 16th „ Exhibition.

Thursday 17th „ Forenoon.—Exhibition.

Afternoon.—Union General
body Meeting.

Friday 18th „ 12 noon to 4 p.m. Conference.

(A Symposium on Sugarcane)

Weather Review

MAY 1930

Rainfall Data

Division	Station	Actual	Departure from normal	Total from January 1st
Circars	Gopalpore	1.3	— 0.6	7.1
	Vizagapatam	8.5	+ 6.3	10.4
	Cocanada	6.3	+ 4.3	6.4
	Masulipatam	5.5	+ 4.3	8.0
Ceded Dists.	Kurnool	1.2	0	1.5
	Bellary	2.2	+ 0.3	2.7
	Anantapur	2.4	+ 0.7	3.3
	Cuddapah	7.1	+ 5.5	7.9
Carnatic	Nellore	8.0	+ 6.8	8.9
	Madras	8.1	+ 6.3	11.8
	Cuddalore	9.8	+ 8.5	27.4
Central	Vellore	9.0	+ 5.9	11.3
	Salem	8.5	+ 3.7	11.9
	Coimbatore Town	6.8	+ 4.5	8.8
	Coimbatore Research Institute	6.0	+ 3.9	8.6
South	Trichinopoly	10.8	+ 7.8	13.2
	Negapatam	7.5	+ 5.6	25.9
	Madura	6.7	+ 4.0	10.4
	Pamban	8.5	+ 7.5	16.4
West Coast	Palamcottah	0.4	— 1.3	6.9
	Trivandrum	11.4	+ 3.0	20.4
	Cochin	16.6	+ 5.1	22.8
	Calicut	22.5	+13.0	23.2
Mysore and Coorg Hills	Mangalore	21.1	+14.7	22.1
	Bangalore	7.0	+ 2.7	10.8
	Mercara	7.1	+ 3.0	9.8
	Kodaikanal	8.6	+ 2.4	15.6
	Coonoor	7.3	+ 3.1	19.7

Summary of weather conditions

Pressure conditions in the Bay were rather unusual in the beginning of the month and resulted in the formation of a Storm east of Ceylon early in the month. On the 5th conditions were unsettled off the east coast of Ceylon, and by the 6th morning a storm was lying in the south of the Bay and causing squally weather accompanied with rough seas and heavy rain in Ceylon, and was affecting the weather in the South. Next morning the storm was crossing

the coast 50 miles south of Negapatam, and during the 8th was traversing the south of the peninsula, and on the 9th it lay as a diffused area of low pressure over Mysore. During the time rainfall was very widespread and remarkably heavy over the whole of the South and was extending to the Circars. On the 10th this area of low pressure, the residue of the Bay storm shifted its centre and on the 11th lay off the South Circars coast, and then moving out to sea on the 12th again developed into a depression centered about 17°E and 90°N, and moving N. E. crossed the Arakan coast near Kyakpuye on the 13th and disappeared. The Storm was remarkable for the rain it induced over nearly the whole of the presidency, and for the long duration of its effects. It induced an inflow of monsoon winds in Malabar and Burma for a few days.

Consequent on the movement of the storm across the peninsula weather was of an unusual type with very low temperatures, cloudy skies and humid atmosphere till the 13th. Day temperature was markedly below normal in the south, Trichinopoly recording a maximum of 74° or 28° below the normal on the 8th and Salem 76° or 25° on the same day. Temperature rose sharply after the storm disappeared, and the area of highest temperature was on the South Circars coast till the end of the month, Masulipatam recording a maximum of 111° on the 31st and temperatures, 105° to 110° on eight occasions between the 15th and 30th.

Rainfall was very much above the average over the whole area excluding the west Deccan, north of the Circars and the far south. This month represents one of the wettest months on record, for the south of the peninsula. The effect on the monsoon which is to come, of this unusual rain remains to be seen. Some very heavy falls were recorded, the most important being:— Negapatam 6.5" (7th); Trichinopoly 7.2" and Vellore 4.7" (8th); Vizagapatam 5.7" (9th); Mangalore 6.1" and Calicut 4.9" (10th); Mangalore 8.4" and Calicut 5.7" (11th); Cox's Bazaar (in Arakan Coast) 11" on the 12th.

Typical Hot weather conditions prevailed in the second half of the month with the usual pressure distribution and isobars running from S. W. to N. E. Winds were normal in direction, and were from some southerly point.

Report for the Research Institute Observatory

Absolute Maximum in Shade	99° . 0
Do Minimum in Shade	68° . 0
Mean Maximum in Shade	91° . 7
Do Minimum in Shade	72° . 5
Total Rainfall in month	6 . 04 inches
Heaviest fall in 24 hours	3 . 26 "
Number of rainy days	6 days
Mean Rainfall for month	2 . 16 inches
Departure from normal	+3 . 88 "
Mean daily wind velocity	4 . 9 miles per hour
Mean 8.00 Hours wind velocity	2 . 1 "
Total hours of bright Sunshine	248 . 4 Hours
Mean hours of sunshine per diem	8 . 0 "
Mean Humidity at 8.00 Hours	75 . 6 % of saturation.

Pressure fell at the beginning of the month during the passage of the Bay storm inland, and reached the minimum on the 9th when the storm lay as a residual area of low pressure over Mysore and the adjoining tracts. The fall

on the 8th was very rapid being 0.110". Pressure increased and stood at 28.563" (unreduced to sea level) on the 24th during a spell of fine weather. The usual oscillations prior to the setting in of the monsoon did not occur till about the 27th when a fall set in and continued till the 31st.

Rainfall was heavy and above the average by 180%, and May has been the wettest month for the last 23 years. There was continuous rain for 3 days during the period of the storm and on the 8th when the storm was traversing the south of the peninsula, a fall of 3.26" occurred.

Temperature was high for the first five days of the month and again after the 18th, Day temperature was very low on the 8th and 9th consequent on the rainfall.

P. V. R.

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Departmental Notifications

First Circle : Mr. A. Ramamohan Rao, Farm Manager, Samalkota, extension of leave on average pay for 10 days from 16-5-1930; Mr. A. Kondayya Sarma, Assistant Agricultural Demonstrator, Nidadayole, leave on average pay for one month from 15-5-1930.

Second Circle : Mr. V. Ratnaji Rao, Agricultural Demonstrator, Nayudupeta, leave on average pay for one month from 5-5-1930; Mr. P. Salvanarayana, Assistant Agricultural Demonstrator, Kavali, leave on average pay for twenty-two days from 29-4-1930; Mr. L. Narasimbachari, Farm Manager, Agricultural Research Station, Guntur, leave on average pay for twenty days from 19-5-1930; Mr. K. V. Seshagiri Rao, Assistant Agricultural Demonstrator, leave on average pay for twenty-nine days from 12-5-1930; Mr. B. V. Venkatacharya, Agricultural Demonstrator, Tenali, leave on average pay for six weeks from 22-5-1930; Mr. Y. Venkateswara Rao, Assistant Agricultural Demonstrator, Masulipatam, extension of leave on average pay for ten days from 9-6-1930; The Assistant Agricultural Demonstrator, Gudivada, leave on average pay for one month from 1-7-1930.

Fourth Circle : Mr. M. A. Balakrishna Ayyar, Farm Manager, Palakuppam, transfer to Vellore Division; Mr. K. Varadachari, Farm Manager, on leave, transfer to Vellore Division, Mr. C. S. Krishnaswami Ayyar, Farm Manager, Palur, leave on average pay for twenty-six days from 15-5-1930; Mr. K. Varadachari, Farm Manager, extension of leave on average pay for one month from 3-6-1930; Mr. M. Narayana Ayyar, Agricultural Demonstrator, Villupuram, leave on average pay for four months from date of relief.

Sixth Circle : Mr. P. Kannappa Pillai, Assistant Agricultural Demonstrator, leave on average pay for three months in continuation of leave already granted from 3-12-1929; Mr. A. Ramalinga Ayyar, Agricultural Demonstrator, Sholavandan, leave on average pay for one month from 2-6-1930.

Seventh Circle : Mr. P. Abdulla Haji, Assistant Farm Manager, Nileshtar, Agricultural Research Station, transfer to Manantoddy; Mr. P. Sankunni Menon, Agricultural Demonstrator, Calicut, transfer to Nileshtar Agricultural Research Station.

Livestock Section : Mr. A. Venkobachar, Assistant Farm Manager, Chintaladevi, leave on average pay for two months from 9-5-1930; Mr. N. V. Ramanayya, Farm Clerk, Chintaladevi, leave on average pay for two months and seventeen days from 27-2-1930; Mr. P. Rama Rao, Storekeeper, Chintaladevi, leave on average pay for two months from 1-4-1930; Mr. P. M. Appaswami Pillai, Assistant Agricultural Demonstrator, Madras General Hospital, transfer to the Livestock Research Station, Hosur; Mr. H. Narahary Rao, Farm Manager, Hosur, leave on average pay for one month from 1-6-1930; Mr. V. Karunakaran Nayar, Farm Manager, Buffalo Breeding Station, Guntur, leave on average pay for twenty days from 4-6-1930.

Curators Section : Mr. M. Arokiaswami Pillai, Assistant Curator, Government Botanic Gardens and Parks, Ootacamund, leave on average pay for one month and twelve days from 1-6-1930.

Principal's Section : Mr. P. N. Krishna Ayyar, Assistant Lecturer in Entomology, promotion from III to II Grade from 1-4-1930.

Millets Specialist's Section : Mr. N. Krishnaswami, Assistant, leave on average pay for sixteen days from 16-5-1930; Mr. M. A. Sankara Ayyar, Assistant, extension of leave for ten days from 20-5-1930; Mr. P. L. Narayanaswami Nayudu's appointment as Assistant, V Grade on probation is cancelled.

Paddy Specialist's Section : Mr. S. Muthuswami Ayyar, Farm Manager, Agricultural Research Station, Aduturai, leave on average pay for twenty-seven days from 26-5-1930; Mr. A. Chidambaram Pillai, Farm Manager, leave on average and half average pay for three and seven months respectively from 15-5-1930.

Government Entomologist's Section : Mr. E. R. Gopal Menon, Assistant, leave on average pay for three days from 13-5-1930.

Government Systematic Botanist's Section : Mr. K. Cherian Jacob, Assistant, leave on average pay for one month from 15-5-1930.

Government Agricultural Chemist's Section : Mr. G. Ganapathi Ayyar, Assistant, leave on average pay for twenty-six days from 5-6-1930; Mr. K. Govindan Nayar, Assistant, leave on average pay for three months from 1-7-1930; Mr. S. V. Kuppuswami Ayyangar, to be officiating Assistant in Mr. K. Govindan Nayar's vacancy.

Cotton Specialist's Section : Mr. M. S. Purnalingam Pillai, Sub Assistant, leave on average pay for one month from 6-6-1930; Mr. N. C. Tirumalachari, Farm Manager, Koilpatti, leave on average pay for twenty-nine days from 16-5-1930.

(5)



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