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CONTENTS

Editorial.

Economic Planning. Every nation wants a place in the sun. This is literally and metaphorically true. The need is for tropical territory. Where the sun shines best and the rain falls most that is the place for nature to be bountiful. Solar energy is utilised to the best advantage. The tropics are obviously the richest portions of the world in natural resources. In them are contained the fuel and the food of the future. These tropics have an indigenous population helping in the production of agricultural and other raw produce. Most of the tropics are divided among the western nations, though in recent years, the self-consciousness of a few indigenous races is tending to assert itself in terms of nationality. The basic agricultural material of the tropics is essential for industrial expansion, and, without a proper blend of agriculture and industry the general level of the life of the population tends to be low and its national progress is at a low ebb. Not all nations of the West share this wealth of the tropics equitably, nor do the peoples in the tropics evenly share in its bounty. There is thus an ill-balance in the possession and control of the goods of this world as nature gives us, and in the capacity to utilise such goods as man wants to set his hands to.

The primeval conception of each nation to itself is as impossible as the concept of each man to himself. An individual who lays claim to civilisation can ill-afford to be his own carpenter and doctor. Ill-distributed as natural wealth is, the self-sufficiency of a nation is clipped down to the extent to which it lacks some essentials and is to that degree, complimentary to and dependant on another territory. When a nation is solely the producer of raw materials whose consumption abroad keeps goods coming in, which this very nation has to purchase, there is a mis-fit between industry and agriculture, whose repercussions are often seen in the tendency at intense national economics (familiarly called in India the *Swadeshi*) which, born as it is of a reaction to activities beyond control, tends to take the sinister shape of boycott, which brings in its train unpleasant and unprofitable consequences. Where the head should get active and economic planning should be the result, the emotions are set in motion with the resultant chaos. Boycott is an expression of impotence in constructive effort. When once the need for economic planning is realised, it will be evident that as a corollary to it, the complimentary nature of the economic equipment between any two countries, should be realised with the consequence, that treaties and conventions to the mutual advantage of both should be inaugurated, so that a spirit of give and take will prevail to the mutual advantage of both the countries thus collaborating. A self-sufficiency that dignifies incompetence into a renunciation might, for the nonce, dazzle an emotional crowd. But sooner or later it would have pulled down the standard of living to such low depths as to have done irreparable injury to all powers of recuperation. International co-operation along the lines indicated above, seems to be the only way in which there could be a recovery from this world depression. Manipulation of gold, silver, currency and tariffs will not end this impasse. What is needed is "Contractual economic relations between economic units complementary to each other." In this respect India is in an unique position in the world. She is an ancient country rich in resources. Her people are civilised and simple. Being the cradle of many religions and civilisations, her people have an ethical setting on to which constructive national efforts could be safely super-imposed. She is the pivot of Asia. To the East and North are the Mongols and to the West the virile Moslems. Both these Asiatic forces have blended into her constitution and under the dynamic impact with Britain—the premier Western nation—she has within her the potentialities for an ideal move in any world movement. She is on the threshold of intense national consciousness and the whole world looks to her for a sane move in economic planning, so that in her will be symbolised activites tending to smoothen the acerbities of a world grown sick of inequity. Will she rise up to the occasion?

Licensing Bulls. The Minister of Agriculture in England and Wales has made regulations that will tend to the improvement of live-stock. From August 1934 all bulls attaining the age of 10 months should not be kept without a license. A sum of 5 sh. per bull will be payable as fee. After an application is made an officer of the Ministry will inspect the bull and when it is passed it will be tattooed. No license will be granted for animals of defective conformation likely to beget inferior progeny, for animals infected with contagious diseases or otherwise unsuitable for breeding purposes. For temporary affection a suspension is provided. If a license is refused there will be compulsory slaughter or castration. Appeal against refusal of license is provided for on payment of 2 guineas. These measures will ensure healthy livestock and should commend themselves to the consideration of our legislators interested in livestock, the back-bone of agriculture.

The Birthday Honours. The Companionship of the Order of the Indian Empire has been conferred upon Dr. William McRae. Dr. McRae was the first Mycologist of Madras. His work on the *Mahali* desease of Areca palms, Bud-Rot disease of Palmyra and the secondary leaf fall of *Hevea* rubber, are well known. In 1921 he was promoted as Imperial Mycologist at the Agricultural Research Institute, Pusa and retired as its Director. He worked at Pusa on the wilt disease of Red gram and was instrumental in the evolution of resistant strains. His work was always directed in a manner which appealed to the Indian ryot.

The Rao Rahib conferred on Mr. V. Muthuswami Ayyar is a fitting recognition of his long and faithful service in the cause of South Indian Agriculture. Many are the students that sat at his feet and learnt enlightened agriculture and many more are among those that profited by his unobtrusive and ever-available instruction. By his untiring and selfless labours on behalf of the Union and this Journal he has contributed substantially to their present status.

We offer our felicitations to both these officers and wish them long life and a further period of usefulness to the cause of Indian Agriculture.

PRELIMINARY STUDIES IN HORSE-GRAM

(Dolichos biflorus ; L.)

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Horsegram is a tropical pulse that derives its name from being primarily the gram that is fed to horses. It is the cheapest of pulses and is hence the poor man's pulse. It is the legume for poor soils and is often grown as the first crop on lands freshly reclaimed.

Name. The Sanskrit name of this pulse is *Kulattha* and many of the North Indian names are but modified expressions of this word. In Madras its vernacular names are, *Kollu* (Tamil) *Ulava* (Telugu), and *Hurali* (Canarese).

Acreage. An extensive rainfed crop, it occupies an area of over 1¾ million acres, distributed throughout the Madras Presidency. Anantapur, Coimbatore and Salem have over 200 thousand acres each ; Bellary and Madura have each over 100 thousand acres ; Malabar and Tanjore are the only two districts with less than 10 thousand acres.

Yield. In poor soils the yield of seed varies from 200 to 400 ℔. 500 ℔ may be considered an average. Good yields run up to 800 ℔ of seed and 2000 ℔ of *Bhusa* (hay and chaff).

Characteristics and uses. The horsegram is a hardy plant, and thrives in areas of low rainfall and requires little or no manuring. Its cultivation is very easy, practically no care being required after sowing. Its long duration is an advantage in that its low, bushy, and matted growth serves to keep down weeds. It is an excellent green manure. When cut for fodder the roots remaining in the soil enrich it (Benson, 1879). Even when harvested for seed, the shed leaves enrich the soil and the *Bhusa* serves as an excellent fodder. It has the capacity to adapt itself to varying depths of sowing without serious impediments to germination and stand (Benson, 1885). It requires a good deal of lime in the soil to ripen the seed (Benson, 1879). The ash of the seeds contains a large quantity of phosphoric acid and the long continued use of the seeds is regarded as injurious (Church, 1886). In red soils horsegram follows *cholam* or *cambu* or a cereal in one year or the pulse and the cereal may be sown in alternate years if only one crop is raised in a year.

Description. This legume is a low, downy, herbaceous annual with profuse branching. It consists of a central main stem from which about 6 or 7 branches arise. Each main branch produces 3 to 9 secondary branches, which arise from the first node to the 9th, all along the branch. The length of the main branches varies from 45 to

105 cm. and the side branches vary from 15 to 75 cm. The ends of branches, after a period of about two months after sowing, lengthen out and begin to trail and intertwine among the plants and this gives the mat-like appearance to a well grown horsegram field. The leaves are trifoliate. The leaflets are oblong, pointed and are attached to the petiole by short thickened stalks. The central leaflet is slightly bigger than the lateral ones.

The flowers are in axillary clusters of two to four, two being the most common, and are chiefly borne on the secondary branches arising from the main branches. They arise from the first to the seventh axil of the branch, the rest of the branch not bearing any flowers. The flowers being produced at the basal portions of the branches, they are hidden under the mass of foliage. In a field of horsegram the flowers are, therefore, not conspicuous. The period of the differentiation of the stems into trailing branches connotes the beginning of flower production in the plant. The flowers are papilionaceous and are yellow. The standard has a prominent purple eye in the middle of the inside. The stamens are ten in number and are diadelphous. This diadelphous nature which usually escapes notice is traceable easily after the dehiscence of the anthers. The stamens are of two lengths, five of each kind. The anthers are oblong and yellow in colour. The style is long and slightly bent at the tip below the stigma. The stigma is green and is encircled by colourless hairs.

The pod is 1½ to 2 inches long, recurved, rather flat, falcate and 5 to 6 seeded. The seeds are kidney shaped and are generally a mixture of chocolate and brown of shades. There are also minor varieties with black, black-mottled, and black-patchy seeds.

The study of this crop commenced in the year 1930 and the observations made during the three years are recorded.

Time of sowing. This is usually a cold weather crop and stays in the field after the cereals are harvested. Being long in duration, the time to sow at Coimbatore is from September to November. To suit a shorter duration certain black-seeded varieties are perferred in parts of the Presidency.

To determine the effect of sowing at various parts of the year, sowings were made at the beginning of each month from January 1933. Two lines, each a chain long, were sown in beds. The January, February, March and April sowings gave crops very leafy with late stray flowering and practically no setting of pods. Seed could be gathered from the crops sown from May to December. The May crop could be gathered early in March next. The duration of the May crop was 230 days and gradually decreased until that of the December crop was only 95 days. This reduction in duration was brought about conjointly in the dual periods up to first flowering and from flowering to

harvest. The longer duration and the earlier sowings conduced to keep up the gross out-turn of plant material as compared with the December sowings, but the optimum sowing time could be gauged from the following figures, which represent the ratios between gross yield and seed yield:— May 25, June 13, July 11, August 9, September 4, October 3, November 4, and December 29. From these figures it will be obvious that September to November is the best time to get the best out of the crop. Beyond this zone, the plant tends to be leafy and is fit only for fodder or green manure. This experiment serves to throw some light on environmental factors and their inter-relationship to the vegetative and reproductive phases of dry crops—a study so very essential to an intelligent pursuit of the problem of seed treatment as applied to dry crops in the tropics.

Leaf movements. The leaflets of horsegram make certain daily movements in response to temperature and light. In the morning (from 6 to 8 a. m.) the three leaflets are well spread out. From 8 a. m. onwards the central leaflet gradually moves upwards till it is erect and then droops down exposing its rear, while the two lateral leaflets gradually fall down and with increasing heat tend to curl so that their conjoint vertical disposition helps their surfaces to avoid the direct rays of the sun. This position is maintained till about 5 p. m. in the evening. At this period the central leaflet regains vigour, makes a retrograde movement and bends down backwards The two lateral leaflets also untwist themselves As darkness increases the leaflets bend further down and are almost massed together and assume a very compact and drooping appearance. This disposition of the leaflets gives the plants the conical look they assume at nightfall. This resting position is maintained throughout the night. The next morning the leaflets unfold again and continue their daily movements. This adaptability on the part of the leaves helps not a little to fit the gram as the most suitable one for dry-farming conditions.

Floral observations. The flowers of the horsegram are in axillary fascicles. The floral parts are of the usual papilionaceous type. The dehiscence of anthers takes place in the evening from 4 p. m. onwards, The bud at this stage is still unopened and the back of the standard still green. Anther-dehiscence is by longitudinal sutures. The pollen grains are massed together, not free and powdery as in *Dolichos lablab.* The grains do not shed, but as the stigma (at the time of anther-dehiscence) is on a level with the anthers and among them, it gets fully covered over with this massed pollen. This massed pollen is evidently a device for securing the pollination under the enclosed and sheltered condition in which this gram is fertilised. The individual pollen grains are very big. The standard opens out during the night, and continues to be so for nearly 24 hours. It then slightly fades and folds in as in the bud position, so much so, it is sometimes difficult to distinguish

this from the unopened bud. The young pod grows and pushes out through the dry petals.

The flowers are small and their pollination is so delicate that th·ir crossing presents considerable practical difficulty. Many endeavours were made with little success. Being pollinated while still the flowers are closed, and sheltered as the flowers are by the leafy mass of the plant, any disturbance for artificial pollination results in the dropping of the treated flowers.

Purple pigmentation. As in almost all crops horsegram shows a variation in the manifestation of purple pigmentation. Unlike many other crops, this shows only two types of purple pigment named P_1 & P_2. So far, no case has been met with where purple was completely absent in the plant, there being a purple eye in all flowers. P_1 is recognised by the presence of purple in the hypocotyle, internodes, petioles, stipels, a purple eye on the standard, and a light purple wash on the wings, keels and the style, when fresh. The developed pods are splashed with purple. In tne P_2, the purple is absent in the vegetative parts though the flower colour is the same as in P_1. The difference between them lies only in the presence or absence of purple in the vegetative parts. From two families D. B. 14 and D. B. 27, which are of the P_2 type, three P_1 type natural crosses were spotted in 1931. The second generation raised in 1932 behaved as follows:—

Family.	D. B. No.	Segregation in F_2 P_1	P_2
D. B. 14 family	75	230	84
Do. Do	76	285	95
D. B. 27 Do.	78	114	48
	Total	629	227

A single factor is thus responsible for the difference between P_1 & P_2.

Pods. Pods are commonly found sticking upwards from the axil of the leaf. In a few families pods have been observed to droop downwards from the leaf axil. This type of drooping pods is commonly noted in the varieties coming from Northern Circars. Similar erect and drooping pods have been met with in the field bean (*Dolichos lablab*).

Seed colours. The most common colour of horsegram seed is brown. This seed is admixed with a few chocolate coloured seeds. These two colours are produced in the same plant and also in all positions in the same pod. In the soaked condition this mixture of tints cannot be differentiated. In the year 1932 there were unusually heavy rains in November when the pods were developing. It is remarkable that from this crop the seeds were all brown and there were no chocolate coloured seeds excepting those that were insect attacked, badly set or otherwise deficient. In 1931 chocolate and brown seeds were

sown separately. At harvest time it was noticed that in both of them there were both kinds of seeds. This difference in colour is thus traceable to differential environment during the ripening of seeds.

The rarer seed-coat colours are (1) black, (2) black-mottled, and (3) black-patchy. The black-mottled seed consists of both chocolate and brown seed coats dotted over with black dots. In the case of the black-patchy, the seed has black patches on the seed coat, the black-free regions being mostly along the rim of the seed. The black seed is completely black. Crops from black coloured seeds have a tendency to be shorter in duration and a little less vigorous than crops raised from the more common brown seeds. In the varieties examined, it is noticeable, that black seeds, entire or mottled, appeared only on P_1 plants.

References.

Benson, C. (1879). Dolichos biflorus—*Saidapet Experimental Farm Manual and Guide.*

„ (1885). Dolichos biflorus—*Records of the Saidapet Experimental Farm.*

Chandrasekharan, S. N. and Ramakrishnan, T. S. (1928). *Jour. Madras Agr Stu. Union,* Vol. XVI. p. 281.

Church, A. H. (1886). Dolichos biflorus—*Food Grains of India.*

Duthie and Fuller. (1893). Dolichos biflorus—*Field and Garden Crops of North West Provinces and Oudh.*, Part III, p. 2.

Watt, G. (1890). Dolichos biflorus—*Dictionary of Economic Products,* Vol. III, p. 175.

„ 1908. *The Commercial Products of India.*

THE PRESENT POSITION OF THE COTTON STEM WEEVIL PROBLEM *

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Introduction. *Pempheres affinis* or the cotton stem weevil, as a pest of indigenous and exotic cottons is of considerable importance in South India. It is not definitely known when and how this pest was introduced into this country; in fact it is even difficult to say whether it is one of the introduced forms at all; although the nature of its scattered and somewhat isolated distribution would appear to indicate its exotic origin.

When first noticed in South India it was found to be confined to the Coimbatore district and to the Cambodias in particular. Since then, it has spread to almost every cotton-growing centre of the Presidency and to all types of cotton.

* Paper presented at the College Day and Conference, October 1933.

These facts point to the necessity for the control of the pest and it is proposed to present in this paper, the present position of this aspect of the *Pempheres* problem in so far as it is revealed by studies of the bionomics, habits and life-history of the insect.

Life history:—The life-history of the insect has been worked out in some detail by Ramakrishna Ayyar [2] and has been confirmed, with some minor differences by Ballard [1]. Studies made during the last two seasons are largely in a line with these findings and briefly stated are somewhat as follows:—

The adult *Pempheres* lays its egg in a small cavity made for the purpose opposite to the medullary rays, preferably on the hypocotyl regions of the cotton plant, and covers it up with a gummy exudation secreted from its body; and at this early stage in the life of the insect, begins the association between the plant and the insect which is in every way advantageous to the latter and disadvantageous to the former and is ended in most cases only by either the death of the plant or the successful emergence of the young adult. After hatching out from the egg, the young larva cuts its way through the medullary ray and thereafter tunnels round the stem along the cambium taking a slanting and downward course and feeding on the soft portions as it goes along. It then scoops out a pupal chamber in the wood and emerges when ready, by cutting through the bark at the other end. The plant, on the other hand, seldom puts up anything like an aggressive fight and tries to escape death only by increasing its out-put of building material and in spite of the best it could do, often succumbs with all its wealth of flowers and bolls to mechanical disturbances like high winds.

A consideration of facts led the earlier workers to suggest the adoption of long close periods as a preventive measure, the enforcement of which was attended with very many complications. More detailed studies of the life-history of the insect and of the progress of infestation have furnished fresh lines of attack.

It is not proposed to deal with all the aspects of the problem that were investigated but only with such of those as have been suggestive of the possible means of controlling the pest and this is perhaps best done along with a consideration of such measures as formed the subjects of these investigations.

1. Biological Control. This has in recent years met with a large measure of success in the case of certain pests and is rather popular with entomologists because of its cheapness and easy applicability. With regard to stem weevil, two methods of biological control seem to be feasible.

Firstly during the examination of the larval burrows a few dead grubs were obtained that had been parasitized by fungus. This suggested the idea of the utilisation of such fungi for the control of the

insect. Isolation of these parasitic organisms was then made from the dead grubs and the affected stems by the usual methods of repeated subcultures and finally by the single-spore method. Four forms of fungi were thus isolated and their pathogenicity was established by parasitisation experiments and reisolation of the fungus from the affected grubs. The method adopted for utilising these fungi for the control of the pest, consisted in periodically spraying the plants with an aqueous suspension of the spores of the most virulent of the four forms isolated. The other method is the common one of using parasites. Unfortunately very few insects, have so far, been found parasitising the weevil. Two chalcids were discovered feeding on the larvae. Experiments are, however, under way to observe if any useful parasite can be found. Incidentally it might be remembered that this pest is found to be rare in parts of Tinnevelly, Madura and Ramnad districts. It is proposed to study the conditions that have engendered this happy state, and if any clues are available, they will be tested at the Cotton Breeding Station, Coimbatore, to determine their applicability.

2. Utilisation of the defensive mechanisms of the plant. As already mentioned the habit of the larvae precludes the use of insecticides. In their absence one naturally has to turn to the plant for such mechanisms as it may possess which might cause the insect to avoid such plants. It is surprising to note that all the varieties of cotton studied at Coimbatore are susceptible partly or wholly. The few plants that look free have shown themselves later on as mere escapes. The next useful item is the selection and isolation of resistant and tolerant types.

An examination of the attacked portions of the plant showed that by far the most important characteristics in the present case, are the hairiness, gum and gall-formation. Of these, however, gall-formation is far from being a reaction of an aggressive type. It is only a way to set right the damage before it proves fatal. Failure to form galls at the early stages in the life of the plant, has been found to be one of the sure causes of its death when attacked, and such measures as would enable the plant to form galls even at these early stages should help to reduce the mortality due to the infestation. Experiments are in progress to study if this characteristic is heritable.

"Hairiness" of plant organs is often connected with direct resistance. In the case of *Pempheres* the preference of the non-hairy part of the hypocotyl regions for egg laying seemed to point to this suggestion.

In an examination of a large number of varieties, it was found that Gadag I alone has a hypocotyl, the upper 2/3 of which is pubescent; and in all varieties there is generally a thick coat of hairs only above the cotyledonary node. By earthing up to the cotyledonary node, the non-hairy part is prevented from being attacked and the above-ground

parts would then all be hairy so that the insect would find it extremely difficult to infest. Field trials gave not too discouraging results. Experiments are in progress to breed a Cambodia with a pubescent hypocotyl.

Some of the plants have the capacity of producing quickly a gum-like substance in the wounds, which if produced profusely imprisons the grub or the emerging weevil from being a future source of infestation. Attempts are being made to evolve a type possessing this defensive trait.

3. Artificial Methods. In the course of these studies, it was considered that, although the insect was capable of attacking any cotton plant and under all conditions, the severity of the attack might vary with the environment. A definite correlation between these or their easily reproducible combinations and the incidence, should if established, lead to a better understanding of the controlling causes and the formulation of more effective measures of checking the pest.

With this idea in view, a number of agronomic experiments were conducted to study the influence of rotation, irrigation, manuring, spacing and the systems of cultivation on the incidence. The results of these experiments are summarised in the following table.

Percent of Pempheres Attack in 1. Spacing, 2. Manurial, 3. Rotation and 4. Irrigation Experiments.

(1932-33)

No.		Treatment.		% of attack.
I		**Spacing**		
	1	Control	3′×9″	50·1
	2	Spacing close	3′×4″	45·5
	3	Flat Beds		56·0
	4	Spacing between rows	2′×9″	52·4
II		**Manurial**		
	1	Control (Farm Yard Manure)	5 tons.	72·7
	2	Potassium sulphate	2 cwts.	71·4
	3	Gypsum	5 cwts.	70·6
	4	Farm yard manure	10 tons.	73·2
III		**Rotation**		
	1	After Cholam		81·31
	2	„ Ragi		77·69
IV		**Irrigation**		
	1	Dry		63·61
	2	1 week		46·01
	3	2 weeks		53 3
	4	3 weeks		54·4

In the case of the 4″ spacing experiment, the incidence was found to be significantly less. This is rather interesting in that it affords a

confirmation of the effect of light. In the life-history studies made, it was observed that the greatest emergence takes place during the hottest part of the day and the insect invariably shows definite heliotropic tendencies. This perhaps is responsible for the crowding of the insects under the open conditions of the field to the wider spaced, and therefore better lighted portions of the field. This might also mean that when the plants are crowded, the micro-climate amidst them might not be suitable for its development. But experiments tried to test the limits of humidity within which the insects might thrive best. signified that they could stand both the maximum and minimum humidities.

It is interesting to observe that the adults, pupae and larvae shrivelled up soon, when the green stems were dried immediately. If the plants are pulled and sundried individually for seven days, there is no chance for any insect to emerge out of the stalks. This measure along with the close spacing seemed to be very hopeful.

4. Indirect Methods. The suggestion for a long close period as an effective method of starving out the pest had been recommended, and tried, but it was far from being an unqualified success due to various reasons. This unfortunate result is largely due to the apathy of the ryots.

It has been found that the life period of the insect is about 3½ months at its maximum which is itself a little too long to be practicable. Added to this, is the ability of the *Pempheres* adult to live on plants other than cotton and these are neither few nor uncommon. The only feature that makes a measure of control such as this, somewhat hopeful is, that the insect as far as our experiments go, is unable to breed, leaving a few *Corchorus* plants, on any plant other than cotton.

Under these circumstances, the only hope of exploiting to the full, the use of this specific relationship of the cotton plant to the density of the insect population, lies in shortening the growth period of cotton so as to enable two early harvests to be had. Two lines of work are being pursued towards this end. One is vernalisation and the other is breeding of early varieties.

Based on Lyssenko's observations that growth is distinct from development, the process of vernalisation consists in temporarily keeping growth in check and in subjecting the germinating seeds to the influence of factors like darkness, humidity, aeration and temperature that favour the reproductive development. With the transfer of the seeds thus treated to proper conditions of growth, it is claimed that the period of vegetative growth is shortened and that there is saving in the time ordinarily taken by the plant to pass from the growth to the developmental or reproductive phase.

The details of the technique are given in (Bull. No. 9, I. A. B. 1933) and consist in giving the seeds the amount of moisture just necessary for embryonic development and exposing them to the intense conditions necessary for the progress of the reproductive phase. It is hoped by such means to materially shorten the growth of cotton so as to ensure a sufficiently long close period.

The other method is to breed by hybridisation, a type of American cotton which will give the two pickings before the 15th May. Fortunately Uganda cottons are found to be the earliest of American cottons. When crossed with Co. 2, some of the plants in F_2 population portended to produce types which will come up to our ideals. Progenies of the promising cultures are in the F_3 generation at present.

In conclusion it may be said, the lines on which we propose to proceed for solving the *Pempheres* problem are :—

1. The production of early types of cotton which would enable us to observe a long close period.
2. The evolution of selections which will not permit the insect to breed in the plant.
3. Isolation of types that will get over the injury done by the insect very quickly.
4. Recommending the adoption of such agricultural practices which will considerably reduce the surviving insect population.
5. Detection of parasites that will effectively keep the insects under control during their developmental phase.

Acknowledgement. The authors are indebted to the Indian Central Cotton Committee, Bombay, for financing the Pempheres & Physiological scheme, under which the work outlined above is being carried out. Thanks are also due to the Cotton Specialist, Agricultural College, Coimbatore, for the many helpful suggestions given during the progress of the work.

References.

1. Ballard E. (1922) *Mem. of Dept. Agr. in India* Ento. Series. Vol. VII : 243—255, 1922.
2. Ramakrishna Iyer, T. V. (1918) *Madras Agr, Dept. Year Book* 1—13.

THE MANGO FRUIT PRESERVE

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The mango fruit is admittedly the best of all fruits. Containing the vitamins necessary for proper nutrition, the fruits may be eaten in plenty. There is a method of drying the fruit juice by which surplus fruits could be utilised during seasons of plenty. This mango fruit-preserve has many virtues of the fruit. There is no satisfactory device known to garden-owners for preserving the fruits,

but the fruit juice can be, by a cheap process, dried and kept over two years without undergoing deterioration. Very few, in the circars, take to this business, and most garden-owners allow their surplus produces to rot in the market, or to be disposed off at a loss. As a subsidiary occupation in the mango season, the manufacture of the preserve can be taken up and if possible exported with profit. The mango juice preserve compares favourably with foreign jams, jellies, and other much advertised preserves. The author studied the preparation of the juice practically, with a view to find how far it would pay him and since the results were promising, he ventures to publish this note, so that the method might become known to a wider circle.

Method of manufacture. This fruit-preserve manufacture must be taken up from April to June, when the fruits are in abundance, and the sun is hot. Costly and delicious fruits like *Rajamanu, Goa, Suvarnareka, Banganapalli, Neelam* etc. which have no fibre in the pulp, generally find ready sale in the market. It is in the ordinary variety of fruits the trouble arises due to less demand, and these are good enough for our purpose; only, the juice must not be too thin or too acid in taste. It must be fairly ropy in consistency, and sweet. The costly fruits, if they are not disposed off, may also be used to supplement the inferior ones. But they should not be chosen in place of ordinary cheap mangoes, as the final fruit-preserve will not repay the cost of the fruits. The fruits are washed in cold water to free from dirt, gum and other matter on the surface of the fruits. The fruit is squeezed thoroughly and the juice collected in suitable vessels. The fruit-rind is much liked by cows and may be fed to them, alone, or with bran. As many fruits as one can utilize for the day should alone be squeezed, for, the juice should not be kept over for the next day. When all the fruits are squeezed, the juice is then well stirred to form a homogeneous mass. A bamboo mat preferably, or palmyra or date leaf mat of suitable size is spread flat. Any sweet oil is thinly spread on the top surface to enable the final product be easily removed. The juice is now poured on the mat and with a clean hand, evenly smeared over the whole surface. The quantity of juice sufficient for one such layer will have to be judged by experience. However, it should not be too thick, for, it will not dry up soon, and the preserving quality will be poor. The drying up of the juice should begin when the sun is bright. The mat should be placed on a high-level ground, or bench to avoid as far as possible, dust, ants and flies. Birds voraciously feed on the juice if not watched. When the first layer is just drying up as indicated by the brown colour formation, it should be levelled up, by gently passing a clean mangonut over the surface, to form an even surface. When after some time, the finger does not stick to the surface, it is ready for pouring another layer of juice over it. As above, the juice is poured and smeared evenly, to form a second layer. When this

dries up, the operation is continued till the sun's rays can help the drying. During a clear day when the sun is bright, five to six layers can be put in. Whatever the number of layers laid, it is necessary that the layers are allowed to dry perfectly. Otherwise, putrifaction will set in, and the labour is wasted. During the night the mat must be kept inside, away from rats, silver-fishes, cock-roaches ants &c. If the bamboo trays are one cubit square each, they are suitable to be hung up indoors. If the trays are larger, or mats are used, there is some inconvenience. Hence bamboo mats of one cubit square, each, and any number of them as one can manage may be had for convenience. For two days the juice as it is expressed is used. But from the third day onwards, the juice will have to be filtered through a thin muslin. Metal sieves should not be used as they spoil the taste and colour of the preserve. Simply pouring the juice over the cloth, will not filter it completely. By clean fingers, the juice in the cloth will have to be rubbed against the cloth, till all the juice is filtered, leaving only a small quantity of fibrous matter which is thrown out, or fed to cows. This preliminary operation should be done sufficiently early in the morning to be ready for drying the juice. The need for filtering is to avoid the useless fibrous matter, bits of fruit rind, and to give good appearance to the final product. On every eigth or tenth day, crystalline sugar is finely sprinkled over the juice after it is evenly spread. This gives better taste, makes the preserves keep longer, and fetches better price. One may continue this preserve manufacture, as long as fruits are available cheap and the sun is bright. When a sufficiently thick layer is formed, the preserve is lifted at the bottom with a blunt knife, cut into neat sizes, wrapped in butter-paper, and enclosed in attractive card-board boxes. The mango-preserve will keep well if periodically dried in the sun.

The writer during this season prepared the preserve and obtained the following figures. The fruits chosen were of ordinary type which were not in great demand in the market. There is, as will be shown below, profit in undertaking this business on a small scale; as a cottage industry.

Yield & Economics of produce from one mat :—

Weight of juice dried per day.	Total No. of fruits.	Quantity of juice got.	No. of days taken to dry.	Quantity of crystalline sugar used.	Quantity of preserve got.
1½ lb.	240.	40 lb.	30 days.	¾ lb.	6 lb.

Fruits 240	Rs.	0–12–0
Crystalline sugar ¾ lb.	,,	0—1–6
Bamboo mat.—One Cubit Square	,,	0–0—6
Total expenditure	Rs.	0-14—0
6 lbs. of mango-preserve sells in the market at	Rs.	2—8—0
Profit	Rs.	1-10—0

The above figures show that one can make a profit of Rs. 1—10—0 (or more, if the product is good, and more demand created) from 240 fruits of ordinary type, which otherwise find poor market, or result in loss by decay, and rarely fetch a few annas. A family of five members, may individually prepare the preserve, and in the season of 3 months, can make a net profit of Rs. 24 - 6—0, with an outlay of Rs. 13 for the whole family. If the family has a mango garden, the outlay will only be, for sugar and mats. Hence, whether one owns a mango garden or purchases the fruits, there is always a profit made. It is hoped, that mango gardeners will take to this mango-preserve manufacture, as a side line and advance the industry.

ABSTRACTS

The Control of Weevils in Rice. (*Science—New series* Vol. 79, No. 2043. February 23, 1934. Science—supplement pp. 5 and 6.) Coating rice with mineral dusts, to keep down heat generation during milling. also discourages the breeding of insects that infest the stored grain, according to Dr. E. R. de Ong, consulting entomologist of San Francisco.

Weevil injury to stored stocks of rice becomes very severe at times since much of the crop must be carried through the hot weather of summer until the harvest in late fall. Insect breeding is rapid at summer temperatures and a light infestation in the spring, if unchecked, may result in almost complete destruction of the stock of rice by fall.

The difference in weevil infestation of rice coated with calcium carbonate and untreated rice was noticed and experiments made to determine the value of the coating for protection alone. In a jar of uncoated rice, several living rice weevils and bran bugs were placed. A similar number of living weevils and bran bugs were placed in another jar containing rice to which one per cent. of finely ground calcium carbonate had been added. These jars were kept at a temperature ranging from 50 to 75 degrees Fahrenheit, with sufficient moisture added to favour breeding.

In sixty days the rice weevils had decreased 50 per cent. in the coated rice and 25 per cent. in the uncoated rice. The striking results, however, came at the end of a year following the higher summer temperatures which had stimulated breeding. The number of weevils in the coated rice had remained absolutely stationary throughout the year. That is, there had been just sufficient breeding to equal the small number dying. In the uncoated rice, the weevils had increased more than one thousand per cent. The bran bugs had decreased slightly in both lots of rice, they apparently not finding conditions suitable for breeding.

The weevil attack in the uncoated rice resulted in a loss in weight of 42 per cent., a cubic foot of the coated rice weighing 76 pounds and the uncoated rice 44 pounds. The infested rice also had a very dirty appearance, necessitating the expense of recleaning besides the additional loss of weight. M. A. S.

Micro-erganisms in relation to soil fertility. (Jacob G. Lipman. *The Newer Knowledge of Bacteriology and Immunology* by Jordan and Falk pp. 341—350). The average cultivated soil is a good culture-medium for higher plants and for micro-organisms. There is a close relationship between the macro-flora of soils on the one hand, and micro-flora and fauna on the other. The soil fertility is affected by a series of factors both internal and external, such as physical texture, temperature, concentration and composition of soil solution, the chemical composition

of the soil, environmental factors, rainfall, weather processes, glaciation, aridity, conservation of soil moisture and the use of irrigation water and a host of other factors. The intensity is indirectly reflected in the intensity of chemical changes and both are intimately related Both positive and negative influences are exerted by micro-organisms. A judicious treatment of the soil to reduce to a minimum the negative effects, and increase to a maximum the positive effects, of the microbiological activities is therefore essential to maintain soil fertility.

Apart from the natural forces influencing soil fertility, soil treatment involving tillage, crop rotations, the application of lime, green manures, organic and inorganic fertilisers, is also an equally important factor to be reckoned with. The stirring of soils brings about the uniform distribution of micro-organisms, modifies the circulation of air and water and also the intensity of oxidation and reduction processes. Crop rotations affect the nature of the soil as a culture-medium and incidentally the microbiological activities. Liming changes the reaction of the soil and influences the activities of the micro-organisms, controlling thereby the formation of ammonia and nitrates, fixation of nitrogen by symbiotic and nonsymbiotic organisms Ploughing in of green manure supplies readily decomposable organic matter of wide carbon-nitrogen ratio, conserves plant food under certain conditions, stimulates bacterial activity and increases thereby the resources of the soil. Organic and inorganic fertilisers including artificial composts also serve to increase the soil fertility by stimulating biological activities. The organic manure, especially the farm yard manure and artificial composts, serve as best sources of inoculum for the mass culture-medium of soil. The artificial fertiliser, especially monocalcium phosphates, increase the activities of the nitrogen-fixing organisms—symbiotic and nonsymbiotic.

Micro-organisms are thus essential for the mobilisation of an important position of soil nutrients. Soil fertility is also affected by a continuous cultivation of a crop for a number of years. The so—called "soil sickness" is due to this factor and some of the pathogenic organisms—fungi and bacteria, or parasites associated with the plant directly, are responsible for it. This can be avoided by adopting the rotation of suitable crops and also primarily by one application of fungicides and insecticides harmful to their growth and also by increasing the soil reaction by the application of sulphur.

Soil fertility is further increased by inoculation with imported soils and composts rich in micro-organisms, activated sludge, and a rich culture of legume bacteria; the last one being of great importance in enriching the soil fertility, especially nitrogen. T. R.

The Canning Industry (by T. N. Morris. *Jour. Roy. Soc. Arts*, Vol. LXXXII, No. 4246, pp. 555–574, April 6, 1934). This is a paper read at a meeting of the Royal Society of Arts, London. It is in two parts, the first dealing with the historical and statistical account and the other with the problems of the process.

Canning can be regarded in one sense as one of the advances stimulated by war. In 179 Napoleon offered a prize for the discovery of a new method of preserving food. After several years Nicholas Appert, who devoted a good deal of attention to the study of foods and their preparation won the prize for foods preserved in sealed glass containers. It was an Englishman named Peter Durand who is said to have been the first to use tin-plate for the food container. But the real development of the industry took place in America and not in Europe. "To France, therefore, we owe the idea, to England the container and to America the development of the great mechanised canning industry." It was 60 years later (about 1860) that the connection between micro-organisms and putrefaction and fermentation was established by Pasteur. This was the first step in the scientific study of the process; but till the nineties of the last century there was little

attempt at further scientific development. Two Americans, Prescott and Underwood, carried out studies on the heat penetration into cans during cooking and these may be regarded as the pioneers of scientific investigation.

The growth of the industry can be gauged from the following figures. In 1870 there were about 6,000 workers, by 1890 there were about 50,000 and by 1929 about 100,000. while the productive capacity was multiplied many times through mechanisation. Japan produced 4,312,714 cases. Soviet Russia is also making vast plans, and produced 2,027,000,000 cans between 1929 and 1932; their potential output is now 1,250.000,000 cans annually. The British canning industry is small, but large quantities of canned fruits and fish valued at about £ 6,000,000 each are imported and consumed. It is only within the last decade that there has been some development in this country with fruits and vegetables.

The paper then deals with the process. The product must be attractive and palatable. Good, clean material must be used. The cans are filled with these and any syrup or covering liquid added. The cans are then *exhausted*; i. e. the greater part of the air is removed before the cans are sealed. This minimises the corrosion of the can and reduces the destruction of the vitamins in the food. Different methods (old and new) of *exhausting* the filled cans are given. After this the cans are sealed and pass on to the cooker. The object of cooking is to have the food ready for serving direct from the cans and to prevent subsequent spoilage through the action of yeasts, moulds or bacteria. The temperature and duration of cooking depends upon the nature of the material. The last stages in the process are cooling and packing.

With regard to wholesomeness it is stated that instances of food poisoning associated with canned food are no longer of common occurrence. But all the same the author warns the canners to make as full use of scientific advice as they can get. Dealing about toxicity of tin, it is stated that the limit for tin in foods is 2 grains per lb. and this is very rarely exceeded except after very prolonged storage under bad conditions or with a few specially corrosive foods. Canned foods ought to contain more essential constituents as the cooking is done in closed containers and are likely to be comparatively more easily digestible. "In America many trials have shown canned foods to be superior in vitamin potency to those cooked in the ordinary way." Heating in the presence of air causes destruction of the vitamins, but in canning air is removed and heat alone has relatively little effect.

Then the author deals with the containers, namely tin-plate, what it is, in what ways better than glass and what are its draw-backs. Lacquering the inside is done in the case of some coloured fruits to prevent discolcration. The paper is concluded with "a brief consideration of the place of canning in human affairs," its peculiar advantages and uses. Tinned foods have been of great use both in war and peace as the "tin can is not only a thing which is easily transported and need not be handled with care, but its contents are protected from rats, insects, and all other pests both animal and vegetable which devour or spoil food packed in other ways. The canned foods are in a form very nearly ready to serve and constitute an invaluable reserve to provide for an unexpected guest. Canning enables us to have an all-the-year-round supply of purely seasonal commodities. As regards the bearing of canning on other industries, it is obvious that it affects a good many, chief of which are steel and tin industries, "can making, lacquer making and last and probably most important of all, the fundamental industry of Agriculture."

In the discussion that followed many members took part and special stress was made on the prejudice which still existed against canned foods and on the improvements to be effected in the containers. M. A. S.

Control of Water Hyacinth. (*Bengal Agricultural Department Annual Report for 1932-'33*; pp. 46—473). The method described below is found quite efficient and a cultivator can profitably adopt it for converting water hyacinth into a useful manure. The plants are heaped in the pond or watercourse itself, one layer over the other. just as paddy straw is stacked. It is found that after putting on two or three layers. men can stand over them and go on building the heap; in fact the heap thrown and floating on the water collects hyacinth on the way. Heaps of about 13 feet in diameter and 12 feet deep are prepared, about 5 feet of this depth being under water. As the height above water gradually diminishes due to rotting, a further quantity is added over this. To keep the heap in a fixed position a bamboo pole is passed through the heap. In about 4 weeks the bottom layers get fairly decomposed. The rotted hyacinth has a good manurial value, similar to that of dung, as can be inferred from the analysis noted below:

		$N\%$.	$K_2O\%$.	$P_2O_5\%$.
1.	Rotted Water hyacinth (dry weight basis).	1·74	2·93	0·58.
2.	Cowdung (Do.).	1·74	1·60	1·81.

S. R. S.

Asafoetida. (By Dr. T. K. Ghose and N. B. Dutt. *Drugs and Health, Vol. 2, No. 53*). Asafoetida is chiefly used as a drug all over the world, while it is also used as a condiment in India and a few other countries of the East. The name is a compound of Arab "asa"—drug and Latin "foetida"—evil smelling. The plant producing this product belongs to the genus Ferula, *N. O.* Umbelliferae, and there are about 60 species; and they generally occur in parts of Europe, North Africa and Central Asia. They are herbs which grow annually from a perennial root stock. The bazaar product is a gum-resin, generally an admixture of two or more kinds of resins. The qualities of these gum resins may vary according to their species, locality, season of collection, parts of the plant (root or stem) from which collected, method of drying the juice and the nature of foreign matter admixed. It is chiefly exported from Persia, and Bombay is the principal trade centre in India. The product is generally received in a good condition but it is largely adulterated by dealers. The best quality is blackish-grey and brittle with few bits of the stem sticking on. S. R. S.

Gleanings.

Copper and Colouration of Onion Scales. A point of both scientific and practical interest is dealt with in Bulletin 552 of Cornell University Experiment Station, in which Dr. J. E. Knott gives an account of manurial experiments upon the colour and thickness of onion scales. Colour in particular seems to be improved in many soils by the addition either of superphosphate or copper sulphate, the latter salt being most effective. A dressing of 200 to 300 pounds to the acre is recommended when onion scales are either thin or poor in colour. (*Research Items—Nature, Vol. 132, No. 3343, p. 825*).

Storage and Transport of Food. Following upon an American observation that ripe apples placed among potatoes retarded sprouting, it has been discovered that the growth of young pea seedlings and other seeds is delayed or distorted by exposing them to air which has passed over ripe apples. The active substance is present in very small amount, about one part in 30,000; the evidence so far obtained points to its being either ethylene or a body of a similar nature. Although the growth of the seedlings is inhibited by 'apple air', their rate of respiration continues unchanged: the emanation increases the rate of oxidation of other apples. The active substance is given off by the fruit at the 'climacteric', that is, the period at which the respiratory activity of stored fruit suddenly increases for a short time. The climacteric occurs also in tomatoes and bananas;

in the latter the yellowing of the skin and ripening of the flesh occur after the fruit has passed through this change. The active substance given off by apples hastens the ripening of green bananas and young apples. Evidence has also been obtained that bananas give off a substance which hastens ripening and counteracts the retarding effect of a reduction in the amount of oxygen in the atmosphere to which they are exposed. (Department of Scientific and Industrial Research. Report of the Food Investigation Board for the year 1932. Pp. x—304. (London: H. M. Sty. Office, 1933 5 sh. net). *(From Nature Vol. 132. No. 3341-11-11-33 p. 737).*

Economics of Men-making. If prices do not measure character, still less do they measure love. And what shall we say of the huge wages of captains of industry? Do they measure the power they wield, for good or for ill? The love of power is stronger than the love of money. Even the child will give away a coin, but not his kiddie-cart or his tricycle! For these give him a sense of power. Why do men desire to drive fast cars and fast air-planes, even sacrificing their lives in the desire for greater speed? Is it not because their highest satisfaction is found not only in spending their own magnificent powers, but in controlling and guiding the flow of the greatest possible energy? Think of the countless expenditure of parents in little loving cares and worries. Children are a lot of trouble but they are worth it a thousand times over. Is it not partly because of the sense of power, the sense of creating something finer and more valuable than any thing else in the world? Is not the love just measured by the care and the toil put into it? Is it not possible that when we have measured all the energy that goes into love and the pursuit of power and is expressed in character and creative art, we may find that the values men set on these things were not so far from the truth? If we find that sometimes energy is misapplied in vast advertising, in senseless exhibitions of power, in reaping the fruits which others have sown, we need not be surprised. Even a child with the slightest expenditure of energy may topple over a beautiful vase, causing it to smash to pieces, and to lose at once all the potential energy it had acquired. We do not therefore say the laws of physics were broken. Rather we consider it a proof of those very laws. It was by its own potential energy that the vase was broken, not by the energy of the child. Then why should we consider it a breach of the economic laws that the value of the vase is gone? This value was also a store of labour. And possibly the child may even be taught for the first time in its life to appreciate beauty and the value of labour. It will also be necessary to punish the bigger children who break vases in order to prove their power, especially those who break men!

The most marvellous increase of wealth is in the training of children We should take away from those who break men, and give to those who make men! The child who was worth his weight in silver can be made into a man who is worth his weight in gold, by training and education! This is the real alchemy! If the alchemist had only known, he could have created permanent gold, instead of wasting his time trying to create a gold which would immediately have lost its value, had he succeeded!

An Ostwald has suggested there are higher kinds of energy which may defy our measurements. It may be that the human body is always storing up more energy than it can ever give away. Even if we reduce everything to physical energy, we do not therefore destroy the possibility that joy is greater than pain. We are storing energy for immortality, and though the vase lie broken, the labour that went into it may still live on, and mould the spirit of the child who broke it! (Closing portion of the Presidential Address of Professor C. D. Thompson of the Allahabad University, at the 17th Indian Economic Conference at the Annamalai University.)

Manuring of Coconut Palms in New Caledonia. The coconut is one of the plants which benefit most obviously from manuring. The mean annual production,

for example, can be increased from 25 nuts to 40 or even 60 after a few years of fertiliser application. Manure is required as soon as the first spathes and the first fruits appear. According to M. Lepine, the quantity of materials extracted each year from the soil by a plantation of 156 coconuts (covering an area of 1 hectare) is as follows (in kilograms):

Mineral substances.	Roots.	Trunk.	Leaves	Fibre and peduncles	Spathes and fruits fallen before maturity	Total.
Sodium chloride.	0·093	14·604	21·403	3·042	20·051	59·193
Potash salts.	0·702	51·480	82·707	16·931	212·581	364·401
Calcium phosphate.	0 098	3 369	200 070	4·714	13·595	221·836
Calcium salts	0·317	10·485	92·149	2 273	53·266	158·490
Magnesium salts.	...	...	...	2·074	...	2 074
Silica.	0·035	0·374	24·362	1·359	6·383	32·513
Total.	1·245	80·312	420·691	30·383	306·876	838·507

These figures give accurate indications of the substances composing the coconut palm, but all these return to the soil except what is removed in the kernel of the nut. It is by the composition of the kernel that fertilisation must be guided. According to the results of certain analyses the ash of the kernel is composed mainly of potassium chloride (45·84%), phosphoric acid (20·33%) and sodium chloride (13·04%). The other components are of only secondary importance. Thus it appears that the coconut requires mainly potash; twice as much as is required of phosphoric acid and common salt, which are also necessary. In the lime-rich soils (emerged coral reefs) of parts of south and south-east New Caledonia potash is supplied in the form of chloride; potassium sulphate is more suitable in soils less rich in lime. Annual applications of 150 to 200 kg. of chloride or sulphate of potassium are given. Nitrogen may be supplied in the form of fish meal, poultry manure or calcium cyanamide (in soils poor in lime). The necessary phosphates are given in fish meal or in Walpool guano (300 kg. per palm). It is advisable to give a dressing of sea salt from time to time to coconut plantations far inland.

All these fertilisers are relatively costly in New Caledonia and it would appear that the most economical dressing would be 40 tons of farmyard manure to the hectare—(Ch. Jacques, *Revue Agricole de la Nouvelle-Caledonie*, November—December, 1932 abstracted in the International Review of Agriculture, September 1933, No. 9, page 392—393).

Book Preservation. Mr. E. A. Savage, Secretary of the Library Association, in an appendix to his recent report on the libraries in the West Indies and British Guiana, gives useful advice regarding the preservation of books in the tropics in respect of buildings, bookshelves and hygiene. When books are rebound, the paste used should be poisoned with a mixture of 5 grms. corrosive sublimate dissolved in 60 drops of wood creosote, 2 pints of rectified spirit and 1 oz. of carbolic acid. When already bound, this same preparation should be painted upon the hinges of the books, and inside the back (but not upon the gold lettering). As a preventive against the attack of cockroaches, gum shellac dissolved in rectified spirit or methylated spirit to form a thin varnish should be applied to the cloth in two coats. As a means of general disinfection, books are placed in a gas-tight box with the leaves fanned open, and a vessel containing 1 oz. of carbon bisulphide for every 50 cub. ft. of space in the box is placed above the books, the box being closed for 24—36 hours. (*Extract from the International Sugar Journal* Vol. XXXVI, No. 424, Page 165.)

Fig 1.

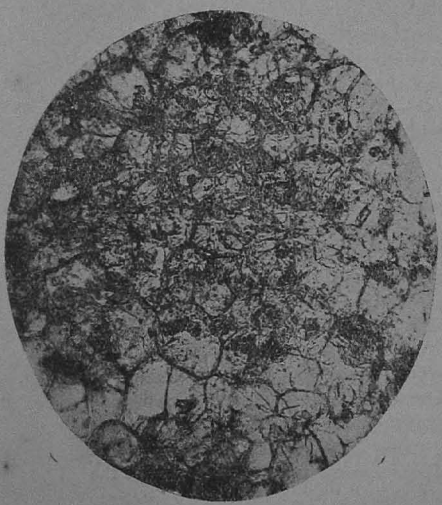

Fig. 2.

Fig. 3.

Research Notes.

Gall in the Mango Fruit.

Though the existence of galls in parts of the mango tree such as the stem, leaves etc., has been frequently noticed and studied, there does not seem to be any mention in literature about the occurrence of galls inside the mango fruit. A peculiar case of gall in the fruit was noticed in a variety called *Neelam* fairly common in Coimbatore. It is a rather small sized fruit with a thick skin which is usually light yellow, the mesocarp also being of the same colour. It is sweet and non-fibrous. It is frequently found to be attacked by beetles and when the fruit is cut, one or more of them emerge from holes in the nut. The specimens herein described contained, however, no beetles and the nut was entire though undersized and thin. They were obtained during two seasons—1932 and 1933.

The gall was found to be in the form of nodules (Fig. I) which were rather hard to eat and when eaten had a slight irritant effect on the throat. It filled most of the fleshy portion of the fruit. On making a hole at one end of the fruit and squeezing it, the thin nut along with a small quantity of pulpy matter came out. The gall remained inside and was found to be sticking to the skin fairly firmly.

A close examination of a fresh specimen of the gall revealed no trace of the presence of animal matter or of any fungus. There were however plenty of bacteria having the shape of rods and cocci. It appears therefore that bacteria are associated with the gall and this aspect of the study is being continued.

The photomicrographs of the section of the gall cut from a preserved specimen (Fig. 2 and 3.) reveal prominently the thickening of the cell walls and the existence of granular bodies inside the cells. From microchemical tests it is found that the cell walls are not made up of cellulose but that they are mostly cutinised with lignin-formation in certain of the highly thickened portions. The granules inside the cells contain starch.

Agricultural Research Institute,
Coimbatore, October 1933.

T. R. Seshadri.
G. Seshadri.

Dewan Bahadur K. Rangachariar.

In the passing away on the 10th of May last, of Dewan Bahadur Kadambi Rangachariar we are today the poorer by a personality that was at once impressive and inspiring. Born in humble circumstances he made a mark for himself in the Botanical world, and an indelible impression in the hearts of all he came in contact with, by sheer merit and labour. His life would ever serve as a noble example to all his students in the years to come, and cheer them in their despondent moods by its inspiration.

Kadambi Rangachariar was born on 3rd of September 1868 in Mukundagiri, a village in Maduranthakam Taluk, Chingleput district. His father, one Mr. Srinivasachariar was a land owner of small means, and stress of circumstances forced him to migrate with his family to Hosur, to obtain a better living. There, he started life as a *Vakil gumastha* and later enrolled himself as a pleader. He prospered for sometime but death snatched away the bread winner, and young

Rangachari left fatherless at an early age with only his young mother to look after him, returned to Mukundagiri where he prosecuted his studies. He passed the Matriculation in 1885 from the Wesleyan Mission School, Maduranthakam, the F A. in 1888 from the Christian College, Madras and the B. A. in 1890 from the Pachaiyappa's College, Madras. The remarkable fact that during these years he supported himself entirely by his tuition fees, marks him out as an inspiring example of a selfmade man, whom adverse circumstances could not deter, and for whom no obstacles were too difficult to surmount. The award of a Government scholarship which he obtained by his brilliant achievement at College, enabled him to pass the M. A. and L. T., examinations by 1894. In the M. A. examination he ranked first in the Presidency taking the only first class in Botany a very unique distinction indeed.

He first joined service in 1895, as Headmaster of the High School, Anantapur. From there he was drafted in 1897, to the Government Museum, Madras as Herbarium keeper. While at the Museum, he had ample opportunities for carrying on research, and his instinctive observative faculties, coupled with his studious application to work, enabled him to publish original papers which attracted the notice of the Government and paved the way for his future. Till the 14th of February 1907 he continued at the museum with occasional breaks, off and on, as Assistant Professor of Botany at the Presidency College, Madras. During this period he also acted in 1904-05 as Superintendant of the Ethnography Department. His work on the habits and customs of hill tribes is a very valuable contribution to ethnographic literature. In 1907, he was definitely taken on to the Educational Department, in which capacity, he served in the Presidency College, the Kumbakonam College and the Teachers' College. On the 7th of October, 1909 he was deputed as Assistant Economic Botanist, and from that day to his retirement in 1923, his associations were at the Agricultural College at Coimbatore, in the evolution and development of which to the present state, he played a great part. In 1914, Government conferred on him the title of Rai Bahadur, and his brilliant official work was further fittingly recognised, when in 1923 he became a Dewan Bahadur. Eminently a Botanist with a rare knack for teaching and training students, the lure of his early love—Ethnography—still attracted him and after his retirement from the Agricultural College, he spent sometime in the Ethnography Department, Madras.

The late Dewan Bahadur K. Rangachariar was a man of many parts. Brilliant and hard working, he was at the same time, unostentatious and unassuming, and as years grew, his simplicity added grandeur to his personality. He was extremely social and very popular with all classes. He was hard to beat as a hospitable host ; and, several generations of students who passed through him and who owe

their present position to him, will never forget his encouraging smile and his paternal interest in their behalf.

Mr. Rangachariar was also a pioneer and connoisseur in many fields. He was a very good photographer, and most of the early photographs at the College, still bear testimony to his skill. He was a musician with a sensitive ear for fineness, and his criticisms were valued. In the early days when the gramaphone was not the perfect instrument that it now is, he managed to take a number of records on the phonograph, of the songs of the hill tribes, the credit of the perfect recording, being entirely his. He took part in all activities of estate and was four times President of the Officer's Club at the Agricultural College.

It is as an educationist, however, that his name will be remembered not only at the Agricultural College, but throughout the Madras Presidency. As Examiner in Botany in the Madras University, his was a familiar name throughout his official career. He was the first to write and publish a book on South Indian Botany which still is a standard text book for University students. That he saw tendencies ahead of his times, is evident from the fact that he published his book not only in the English language, but produced Tamil, Telugu and Canarese translations as well; he thus paved the way for the vernalarisation of studies.

His name will endure as long as the College, and even longer. His collegues will remember his smile and his versatility; his subordinates can never forget his kindness and his consideration; his students will cherish his memory and when in the slough of lethargy, his life and achievements will serve, by a mere recall, to pull them out of the mire; for,

> unto him was given
> A life that bears immortal fruit
> In such great offices as suit
> The full-grown energies of heaven.

May his soul rest in peace.

M R. B.

Correspondence.

Locust Eggs—Destruction.

Rao Sahib Y. Ramachandra Rao, M. A., F. E. S. Locust Research Entomologist, writes from Karachi. In connection with the correspondence published with reference to Locust Control in the May issue of your esteemed Journal, I have to add that I had written to Mr. M. H. Hassan, Masjid-i-Sulaiman, Persia, asking for information in regard to the species of locusts infesting his neighbourhood. From his reply, which reached me sometime ago, it is clear that the Locust in question is the Moroccan Locust *Dociostaurus Maroccanus*. Fortunately this species does not occur within Indian limits.

Crop & Trade Reports.

Production of Cane-sugar in various countries of the world.

Countries.	1933–34 1)	1932–33	Average 1927–28 to 1931–32	1933–34 1)	1932–33	Average 1927–28 to 1931–32	Percentages for 1933–34	
							1932–33 = 100	Average = 100
	Thousand centals			Short tons			%	
America.								
Argentina . . .	6,965	7,697	8,176	348,250	383,361	408,807	91	85
Barbados . . .	2,700	2,151	1,426	130,000	107,542	71,299	123	185
Brazil	22,046	21,385	21,081	1,000,000	1,070,000	1,054,045	103	105
Cuba	51,866	44,690	87,789	2,593,314	2,234,488	4,389 366	116	59
Ecuador	441	441	472	20,000	20, 00	23 576	100	94
United States (La)	4,040	4,460	2,976	202,000	223,000	148.800	91	136
Guadeloupe . .	1,014	1,013	518	51,000	50,667	25.921	100	196
Jamaica	1,473	1,240	1,282	73.674	62 008	64,103	119	115
Mexico	4.409	4.695	4,784	200.0 00	234.723	239.172	94	92
Peru	8,598	8.551	8,618	430,000	427,566	430.899	101	100
Puerto Rico . .	19,620	16,539	15,893	981,004	826,926	794,910	119	123
Dominican Republic . .	8,378	8 056	8,301	420,0 00	402 801	415,068	104	101
Total America	131,550	120,888	161,321	6,449,242	6,043,082	8,065,966	109	82
Asia.								
Formosa . . .	13,665	13,971	17,488	683 239	698.555	874,391	98	78
India	133,501	104 922	70,627	5,675 000	5,246,100	3,531,400	108	161
Japan	2,39	1,773	1,980	119,802	88 668	99,019	135	121
Java	13,230	30,894	62,071	661.400	1,544 683	3 103,523	43	21
Philippine Is .	32,408	25,353	19,432	1,620, 00	1,270,000	971.576	128	167
Total Asia	175,200	176,913	171,598	8,759 432	8,848,006	8,579,909	99	102
Africa.								
Angola	551	437	2) 278	27.559	21,849	2) 13,885	126	198
Belgian Congo	173	141	3) 38	8,650	7,03	3) 1,89	123	456
Egypt	3.373	3,754	2,544	168,700	187,704	127,183	90	133
Mauritius . . .	5,764	5,450	4,826	288,200	272 510	241,230	106	119
Reunion . . .	1,323	1,197	1,023	70,000	59,868	51,151	110	129
Union of South Africa . . .	7.823	7,178	6.243	391,173	358,905	312,145	109	125
Total Africa.	19,007	18,157	14,952	954.273	907,857	747,542	105	127
Oceania.								
Australia. . . .	14,330	11,973	1 ,204	720,000	598.634	61 ,195	120	117
Hawaii	20.579	20.580	18.913	1,028,970	1,029,000	945,700	100	109
Fiji Is.	2,734	2,921	1,991	137,000	146,100	99,569	94	137
Total Oceania.	37,643	35,474	33,108	1,835,970	1,773,734	1,655,464	106	114
General Totals	363,400	351,432	380,979	18,048,917	17,572,679	19,048,881	103	95

1) Approximate data. 2) Average 1927–28 to 1929–30.

3) Average 1929–30 to 1931–32.

College News & Notes.

Re-opening. The College reopened after the Summer recess on the 15th June when the II and III year classes assembled. The short course in Agriculture for gentlemen farmers began on the 12th June with about a dozen students from different parts of the presidency.

Students' Section. The selection of students for the I year B. Sc. Ag. course took place as usual at Samalkot, Madras and Coimbatore during the 4th week of June by the Committee appointed by Government. Mr. K. Gopalakrishna Raju, Headquarters, Deputy Director of Agriculture was coopted as a member of the Committee vice Rao Bahadur D. Ananda Rao who was unable to attend the sittings of the Committee at Samalkot and Madras. Consequently, Mr. R. C. Broadfoot, the Principal of the College officiated as Chairman of the Committee at these centres. It is learnt that 4. students have been selected at the three centres.

Weather. The latter half of May and the beginning of June were oppressively warm at Coimbatore, but the advent of the monsoon during the second week of June has effected a salutory change in the weather.

King's Birth Day Honours. The colony was delighted at the news of the award of the title 'Rao Sahib' on Mr. V. Muthuswamy Ayyar, our popular lecturer in Agriculture.

Personal. On the return of Mr. S. V. Ramamurti, I. C. S. the Director of Agriculture from leave on the 29th June, Rao Bahadur D. Ananda Rao the Offg. Director of Agriculture will take charge of his permanent appointment as Principal of the Agricultural College.

Dr. (Miss.) E. K. Janaki, M. A., D. Sc., who has been appointed by the Imperial Council of Agricultural Research as Cytologist and posted to the Imperial Sugarcane Breeding Station, Coimbatore, has joined her appointment early in May. It may interest the readers of the Journal to know that Dr. Janaki was till recently holding an officiating appointment as Professor of Botany at the Maharaja's College of Science, Trivandrum where hers was the first instance of the appointment of a woman to the Professorial chair at the College.

Mr. N. G. Charley, B. E., who has been reappointed as Research Engineer to the Madras Agricultural Department for a further term of five years, has returned from Australia and has joined duty on the 4th June.

Rao Bahadur B. Viswanath, F. I. C. who has been selected to be the Imperial Agricultural Chemist, is expected to join his new appointment at Pusa, early in July.

Mr. P. V. Ramiah, M. A., B. Sc., Assistant Agricultural Chemist, who was on long leave in Great Britain, has returned to India and has taken charge of his duties.

Mr. K. Ramiah, Paddy Specialist, has availed himself of the annual 'hill recess' and has left for Bangalore.

Electrification. The farm buildings, students' hostel, and the streets in the colony are now supplied with electricity, and the lights were switched on on the 17th June.

University Examination Results—Some corrections. The following mistakes occurred in the results of the last B. Sc. Ag. degree examinations published on P. 192 of the May number of the Journal. The mistakes are regretted.

Final Examination. B. G. Narayana Menon's name should be added and the name of C. Vadamalai should be deleted.

Second Examination. G. Murugesan has failed in two subjects viz. Agriculture and Engineering. P. Govinda Rao's name should be deleted from the list of successful candidates.

Second year—Part I. K. Radakrishna Rao's name should be added.

First year (New Regulations). R. Shanmuga Sundaram's name should be added.

Weather Review (MAY—1934)

RAINFALL DATA

Division	Station	Actual for month	Departure from normal	Total since January 1st	Division	Station	Actual for month	Departure from normal	Total since January 1st
Circars	Gopalpore	0·0	−1·7	0·3	South	Negapatam	0·8	−0·1	9·5
	Berhampore	0·2	−2·0	0·3		Aduthurai *	0·0	−2·8	8·9
	Calingapatam	0·2	−2·0	0·4		Madura	1·2	−1·1	7·3
	Vizagapatam	0·3	−1·3	0·4		Pamban	0·0	−1·1	11·5
	Anakapalli *	0·4	−2·7	0·9		Koilpatti *	0·8	−1·2	12·2
	Samalkota *	0·0	−1·5	0·0		Palamkottah	2·2	−1·7	11·7
	Cocanada	0·0	−0·5	0·7					
	Maruteru *	0·1	−1·1	0·7					
	Masulipatam	0·2	−0·8	0·0	West Coast	Trivandrum	5·7	−2·0	16·0
	Guntur *					Cochin	3·5	−2·0	14·9
						Pattambi *	3·8	−7·0	9·7
Ceded Dists.	Kurnool	0·5	+1·0	2·4		Calicut	4·2	+1·9	11·3
	Nandyal *	0·6	−1·3	2·2		Taliparamba *	0·6	−8·2	3·1
	Hagari *	1·2	−0·9	3·0		Kasargode *	1·0	−8·4	4·9
	Bellary	0·5	−0·5	1·4		Nileshwar *	0·6	−10·0	2·9
	Cuddapah	0·1	−0·2	1·4		Mangalore	2·0	−2·1	3·4
	Anantapur	0·8	...	1·3					
Carnatic	Nellore	0·0	−0·6	1·1	Mysore and Coorg	Chitaldrug	5·7	+2·3	7·8
	Madras	0·0	−0·3	2·8		Bangalore	2·6	+1·5	6·7
	Cuddalore	0·0	−0·8	1·9		Mysore	1·8	+0·9	7·5
	Palur *	0·0	−1·3	2·2		Mercara	3·4	−0·3	4·3
	Palakuppam *	0·1	−1·9	3·9					
Central	Vellore	0·6	−1·9	3·3	Hills.	Kodaikanal	7·1	+0·7	25·0
	Salem	2·6	−0·9	6·2		Coonoor	4·8	...	19·9
	Coimbatore	2·8	+1·3	6·9		Kallar *			
	Coimbatore Res. Inst. *	3·7	...	6·7		Ootacamund *	4·8	−3·6	13·0
	Trichinopoly	1·3	−2·4	6·9		Nanjanad *	5·2	−1·0	12·2
	Hosur cattle farm *	4·9	+4·4	7·6					

* Meteorological Stations of the Agricultural Department.

Summary of General Weather Conditions. Dry weather prevailed throughout the Peninsula except for a few scattered and intermittent thundershowers in Malabar, Madras Deccan and South Madras. Fairly widespread thunderstorms occurred in Assam and scattered showers in Burma and Bengal almost throughout the month.

On the 30th indications of advance in the monsoon occurred in South Bay of Bengal with unsettled weather conditions in Central Bay off Circars coast.

During the month seven western disturbances affected weather over north-west India. The first passed away eastwards after causing local rain in Kashmir on the 2nd and 3rd and scattered light showers in the hills of the Himalayas during the next two days. The second caused scattered light showers in the hills of N—W India, nearly general rain in Kashmir with a few falls in the Punjab hills. Further it caused a few dust storms in the plains of the Punjab and persisted over the extreme north till the 13th and passed away eastwards. The next did not give any precipitation. The fourth disturbance caused thundershowers in N. W. Frontier Province, Kashmir on the 16th, 17th and 18th with scattered dust storms in Baluchistan on the 17th, Punjab on the 17th and 18th, east Rajputana, West Central India West Central Provinces on the 18th. The fifth gave scattered light showers in N—W Frontier. the Punjab Kumaon hills, and N—E. Baluchistan till the 21st when a sixth disturbance occurred and passed away with a few local showers in Kashmir till the 24th. The last western disturbance resulted in scattered thundershowers or dust storms in N. Baluchistan on the 26th in the hills of N—W. India and N. Punjab, the next day with local rain in Kashmir on the 27th and 28th. Widespread thunderstorm rains were recorded in the Punjab and Kumaon hills, East and North Punjab on the latter date.

The temperature was below normal in the Punjab and its neighbourhood from the 10th to 15th and above in Bihar, on a few days during the latter part of the month. The maximum temperature was above normal in the Punjab, United Provinces, Chota Nagpur, Orissa, Central Provinces and Hyderabad.

Humidity was mostly in defect over the Peninsula. Maximum temperature was normal during the first fortnight and was above normal during the rest of the month. The minimum was quite normal throughout. Heat wave conditions prevailed in North Madras and S. E. Madras during the latter part causing mortality both in cattle and men due to sunstroke. The highest maximum recorded were Kurnool 113°F (22nd), Cuddapah 110°F (23rd), Nellore and Masulipatam 111°F (24th), Cocanada 116°F (29th), Madras and Cuddalore 110°F (30th and 31st).

Rainfall was highly in defect throughout the Presidency except for a slight excess recorded in Mysore Even though there were signs of the approaching monsoon, there has been considerable delay in its advance. Consequent on this water scarcity was reported from Malabar and other parts of the Presidency

Weather Report of the Research Institute Observatory:

Report No. 5/34.

Absolute maximum in shade	99°F.
Absolute minimum in shade	68°F.
Mean maximum in shade	94·9°F.
Mean minimum in shade	73·3°F.
Total rainfall	3·72"
Heaviest rainfall in 24 hours	0·91"
Number of rainy days in the month	8
Mean daily wind velocity	2·6 M. P. H.
Mean 8 hours wind velocity	1·3 "
Mean humidity at 8 hours	74·7%
Total hours of bright sunshine (first 3 weeks)	204 hours.
Mean daily hours of bright sunshine (first 3 weeks)	9·7"

Summary of Weather Conditions. The pressure distribution was steady till the end of the third week when there was a marked fall which persisted steadily till the end of the month. This fall in pressure is fairly characteristic of the approaching monsoon. The mean humidity and mean minimum were normal whereas the mean maximum was above normal. The rainfall of 3·72" recorded in the month was distributed at even intervals accompanied by high

winds and thunder. Even though there was a fall in pressure with the wind direction S—W in the latter part of the days commencing from the fourth week of the month there was no distinct tendency for the onset of the monsoon. The weather continued to be hot and sultry throughout.

C. V. R. & D. V. K.

Departmental Notifications.

Appointments, postings and transfers. The following transfers of Upper and Lower Subordinates are ordered. Mr. E Achutan Nayar, A. A. D, Tellicherry, to IV circle; Mr. K. P. Sankunni Menon, F. M, Palur, to VII circle; Mr. P. A. Kunhiraman Nambiar, A. A. D., Perintalmanna, on the expiry of his leave on 6—6—34 to VI circle; Mr. C. S. Sankaranarayana Ayyar, A. D., Tinnevelly, to VII circle. Mr. M. Narasimham, Permanent Assistant, Cotton Section, on other duty as Assistant in Paddy Section at the A. R. S. Maruteru, to Agricultural Section Permanent, for work in the Rajahmundry division in the I circle. Mr. P. N. Krishnaswami Rao, Permanent Assistant, Paddy Section, on other duty in the Cotton Section to be Assistant in the Cotton Section, in the permanent post liberated by the transfer of Mr. Narasimham to the Agricultural Section—to continue to work at Coimbatore. Mr. M. P. Narasimha Rao, Upper Subordinate, Agricultural Section, II circle, to the Science Section to be Assistant in the Paddy Section, Maruteru, in the permanent post liberated by Mr. P. N. Krishnaswami Rao. Mr. B. Shiva Rao, A. D., Madanapalle, on the expiry of his leave on 30—6—34, to the II circle. Mr. P. Satyanarayana, A. A. D., Kaikalur, on the expiry of his leave on 31—5—34 to the III circle. Mr N. Annaswami Ayyar, A. D., Kadiri to the IV circle.

Mr. Muhammad Obaidullah Shah, whose offg appointment as Upper Subordinate, Agricultural Section will terminate 14—5—34, will continue to officiate till 31—6—34, *vice* Mr. B. Shiva Rao, granted leave; he will continue to work in the IV circle. Mr. K. Jagannatha Rao, A D., Anantapur is appointed as District Agricultural Supervisor, Bellary, *vice* Mr. V. N. Subbannacharya granted leave. Mr. M. Krishnaswami Ayyangar, A. D. on reserve duty at Bellary is posted as A. D., Anantapur. Mr. P. A. Kunhiraman Nambiar, A. A. D. VII circle posted to the VI circle, to report to the Superintendent, A. R. S., Koilpatti, on the expiry of his leave on 6—6—34. Mr. L. Sankarakumar, A. D., Periyakulam, transferred to Tinnevelly. Mr. S. Ramchandra Ayyar, A. D., Tirupattur, to Periyakulam. Mr. M. S. Kailasam, Entomology Assistant, Coimbatore, transferred to Anakapalle *vice* Mr. V. Tirumala Rao granted leave.

Leave. Mr. K. Govindan Nayar, Chemistry Assistant, Coimbatore, is granted extension of leave on half average pay on medical certificate for 4 months from 26—5—34. Mr. R. Balasubramanya Ayyar. Permanent Assistant, Cotton Section, and temporary senior assistant in the Madras Herbaceum Scheme, is granted leave on average pay from 1—6—34, or date of relief. Mr. C. Rangaswami Ayyangar. Agricultural Demonstrator in Mycology, l. a. p. for two months from 5—6—34. Mr. K. Sitharama Ayyar, A. D., Perambalur, l. a. p. for four months from 1—6—34 or date of relief. Mr. K. P. Sankunni Menon, F. M., Palur, extension of l. a. p. on m. c. for four months from 15—5—34. Mr. D. Bapaiah, A. D., Guntur, l. a. p. on m. c. for two months from 28—5—34. Mr. R. Sankara Ayyar, Assistant Cotton Section, l. a. p. out of India for purposes of higher study in Plant Physiology, for two years from 1—9—34. Mr. S. Mayandi Pillai, Cotton Assistant, A. R. S., Koilpatti, l. a. p. on m. c. for two months from 28—5—34. Mr. V. Tirumala Rao, Entomology Assistant, A. R. S. Anakapalle, l. a. p. on m. c. for two months from date of relief. Mr. V. N. Subbannacharya, District Agricultural Supervisor, Bellary. l. a. p. for four months from 1—6—34.

DEWAN BAHADUR K. RANGACHARIAR, M.A., L.T.

(Born : 3, September 1868—Died : 10, May 1934).