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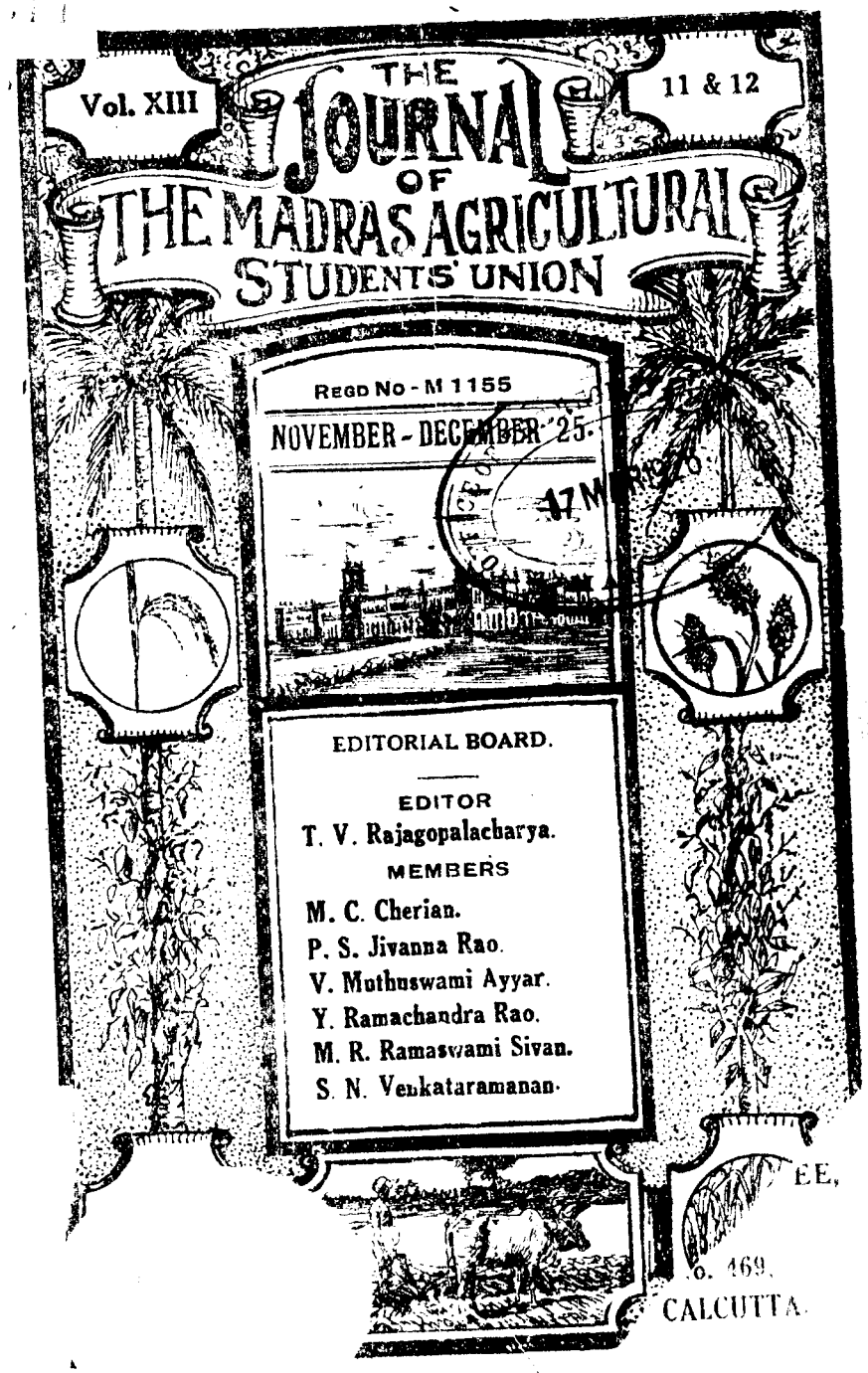

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THE JOURNAL

OF

The Madras Agricultural Students' Union.

Vol. XIII] NOVEMBER—DECEMBER [No. 11 & 12.

CONTENTS.

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

THE JOURNAL

OF

The Madras Agricultural Students' Union.

Vol. XIII] NOVEMBER & DECEMBER 1925 [Nos 11 & 12

Diseases of Crops caused by Fungi in the Madras Presidency.

(*Continued from page 262, Vol. XIII*)

Popular name.	Diseases Scientific name.	Time of occurrence.	Locality.
II. Pulses—Redgram (*Cajanus indicus*).			
1. Wilt.	Fusarium udum Butl.	January.	Coimbatore. Godavari.

The leaves s ddenly droop and dry up while attached to the plants ;eventually the whole plant dies.

Rhizoctonia solani (Kuehn).

The leaves suddenly droop and dry up while attached to the plants ; eventually the whole plant dies.

Beans (*Dolichos Lablab*).

1. Leaf spot.	Cercospora Dolichii (Ell.) Evr.	July.	Coimbatore.

Brown or red usually angular spots, later on developing a grey or brown centre occur, on leaves.

Popular name.	Diseases Scientific name.	Time of occurrence.	Locality.
2. Mildew.	Oidiopsis	March. September.	Godavari, Coimbatore.

Ashy grey growth on leaves which look as though ash was dusted on them.

French Beans.

Anthracnose.	Colletotrichum Lindemuthianum. (Sacc.) Mag.	May.	Nilgiris.

Black sunken spots with pinkish dots appear on pods and make them rot.

Cowpea (*Vigna catiang*).

1. Rust.	Uromyces appendiculatus (Pers.) Lk.	April.	S. Kanara.

Brown raised spots occur on leaves.

2. Anthracnose.	Glomerella Lindemuthianum (Sacc. and Mag.) Shear.	August.	Coimbatore. S. Malabar.

Same as anthracnose on beans causes shrivelling of pods.

	Vermicularia sp.	January.	Coimbatore.

Same as anthracnose on beans causes shrivelling of pods,

3. Wilt.	Rhizoctonia.	October.	Coimbatore.

Leaves suddenly droop and dry up ; small black dots are formed on affected roots.

Bengal gram (*Cicer arietinum.*)

	Vermicularia sp.	November.	Coimbatore.

Tiny black spots appear on pods and cause slight damage.

Cluster Bean (*Cyamopsis tetragonoloba*)

1. Leaf spot.	Alternaria sp.	December.	Trichinopoly. Coimbatore.

Large brown spots on leaves forming concentric rings in the discoloured areas.

Popular name.	Diseases. Scientific name.	Time of occurrence.	Locality.
2. Mildew	Oidiopsis tauri (Lev.) Salm.	January.	Tinnevelly. Coimbatore.

Greyish-white patches on leaves presenting a powdery appearance.

3. Die-back.	Colletotrichum.	January.	Trichinopoly.

Causes die-back of the stem, tiny black dots forming on it.

III. Vegetables, Roots and Oil seeds :—

Potato (*Solanum tuberosum.*)

1. Early blight.	Alternaria solani. Sorauer.	May. September. November.	Ootacamund.

Pale brown spots scattered irregularly and showing concentric narrow dark lines on leaves.

2. Scab.		September.	Ootacamund.

Rough raised outgrowths on the surface of the tubers.

3. Ring Disease.	Bacillus solanacearum.	May.	Ootacamund

Causes sudden wilting of plants. Tubers show a brown ring almost concentric with the edge when cut into two.

Tomato (*Lycopersicum esculentum.*)

1. Leaf spot.	Macrosporium tomato.	January.	Coimbatore.

Dirty brown spots on the leaf.

2. Wilt.	Rhizoctonia solani Kuehn.		Coimbatore.

Causes plants to wilt and roots to rot.

Groundnut (*Arachis hypogea.*)

1. Tikka-leaf-spot.	Cercospora personata, Bett. et. Ell.	August.	N. Malabar.
	Septogloew arachidis Racch.	August. October.	Coimbatore. Coimbatore.

Dark spots surrounded by a bright yellow ring appear in large numbers on leaves.

Popular name.	Diseases Scientific name.	Time of occurrence.	Locality.
Linseed (*Linum usitatissimum*).			
1. Rust.	Melampsora Lini (Lk.) Desm.	December.	Ootacamund.
Bright orange coloured pustules appear in large numbers on leaves and tender fruits.			
2. Wilt.	Rhizoctonia.	August and October.	Coimbatore.
Causing wilting and rot of plants.			
Castor (*Ricinus communis*).			
1. Rust.	Melampsorella ricini (Biv Ber) de Tone.	January.	Coimbatore.
Bright orange coloured spots covering the whole leaf presenting a rusty appearance.			
2. Leaf-spot.	Cercosporium ricinella Sacc and Berl Speg.	January. February. December.	Coimbatore.
Irregularly angular spots greyish white in the centre with a brown marginal ring.			
3. Wilt.	Rizoctonia solani.	April.	Coimbatore.
Causus wilting and root-rot.			
4. Stump-rot.	Diplodia Ricinella Sacc.	October.	Bellary.
Causes stump rot.			
5. Mildew.	Oidium sp.	February.	Coimbatore.
Greyish white powdery growth on leaves.			
Gingelly (*Sesamum indicum*).			
1. Mildew.	Oidium.	July.	Coimbatore.
Greyish white powdery growth on leaves.			
2. Leaf spot	Cercospora.	January & March.	Coimbatore.
Greyish brown spots on leaves.			

Popular name	Diseases Scientific name.	Time of occurrence.	Locality
Safflower (*Carthamus tinctorius*).			
1. Leaf spot	Cercospora.	November to January	Coimbatore.
Dark brown roundish spots on leaves.			
IV. Dye, Drugs and Spice Crops :— Tobacco.			
1. Mildew.	Erysiphae cichoraceum D. C.	January and February.	Coimbatore Godavari.
A whitish web becoming powdery chiefly on the upper surface of the leaves.			
2. Leaf-spot.	Cercospora Nicotianae. Ell and Ever.	December. and January February March.	Coimbatore. Kurnool. Godavari.
Small brown spots gradually becoming white in the centre appear on the leaves.			
3. Damping off.	Phythium Butleri.	October.	Coimbatore.
Causes seedlings in the nursery to rot and fall over.			
Turmeric (*Curcuma longa*)			
1. Leaf spot.	Vermicularia curcumae (Syd).	August. October. November. November.	Kistna. Godavari Coimbatore. Kistna. Erode.
Brown irregular patches with black dots appearing in concentric rings in the centre enclosed by a yellowish margin. Rhizomes do not develop properly.			
2.	Rhizomorph.	April.	Bhavani.
White thick cord-like strands of mycelium adhering to the rhizomes.			
Ginger (*Zingiber officinale Rose*).			
1. Soft-rot.	Phythium Butleri.	October.	N. Malabar.
Yellowing and withering up of leaves and rotting of rhizomes.			

Popular name	Diseases Scientific name.	Time of occurrence.	Locality
2. Leaf-spot.	Vermicularia Zingiberae	December.	Godavari. Malabar.

Yellowish brown spots with greyish centre on leaves.

Chillies (*Capsicum frutescens*).

1.	Fruit rot.	Vermicularia capsici (Syd).	February.	Coimbatore. N. Malabar,

Fruits turn yellow and rot and sunken spots with black dots arranged in concentric circles are formed. The fruits lose the pungency and become useless.

2.	Mildew.	Oidiopsis Taurica.	January and February.	Guntur.

Greyish powdery growths on leaves as in other Mildews.

3.		Cleosporium.		Coimbatore.

Fruits rot, with symptoms like those of vermicularia.

Pepper (*Piper nigrum*).

1.	Leaf-spot.	Colletotrichum necator.	August.	N. Malabar.

Brown spots with pinkish margin and dotted with black pustules

Betel vine (*Piper Betle*).

1.	Leaf spot.	Colletotrichum sp.	Coimbatore.

Blackish irregular spots with brown margin on leaves.

2.	Mildew.		Dindigul.

Fenugreek (*Trigonella Foenum graecum*).

1.	Mildew.	Oidiopsis taurica, Lev et. Salm.	January. August.	Coimbatore.

Resembles other powdery mildews.

V. Fibre—Crops Cotton (*Gsosypium sp*) :—

1.	Wilt	Fusarium sp.	February.	Coimbatore.

Sudden dropping and withering of leaves, rotting of roots and yellowing of stem.

Popular name	Diseases Scientific name.	Time of occurrence.	Locality.
2. Shore-shin.	Rhizoctonia solani Kuehn.	March. April. April.	Coimbatore. S. Arcot. Tinnevelly.

Symptoms same as wilt but with shredding of bark and formation black dots in the bark of roots.

3.	Leaf spot.	Macrosporium. nigiricantium Atk.	March. October.	Coimbatore. Coimbatore.

Brown spots marked by concentric rings on leaves.

4.	Rust.	Uredo-Gossypii.	December.	Godavari.

Small purplish brown spots on the upper surface of leaves.

5.	Angular. leaf. spot.	Bacterium. Malvacearum.	July.	Ramnad.

Soft sunken angular purple spots turning brown and drying up; affects leaves only.

6.	Grey mildew.	Ramularia Areola (Atk).	November December.	Coimbatore. Godavari.

Small grey spots on the lower surface of leaves occuring in the small spaces between the veins.

7.	Anthracnose.	Collectotrichum Gossypii (South W. Edg)	August.	Coimbatore.

Small reddish brown sunken spots on the bolls.

Sannhemp (*Crotalaria juncea*).

1.	Wilt	Fusarium.	August.	Coimbatore.

Sudden wilting of leaves and drooping of plants with formation of pinkish dense outgrowths on the stem and roots.

2.	Rust.	Uromyces decoratus (Syd).	August. September. October.	Coimbatore. Coimbatore.

Appears as minute yellowish brown spots on leaves and as dark brown spots on stem.

3.	Rust.	Rhizoctonia solani.	November.	S. Arcot.

Symptoms as above but minute black dots appear on the loose shredded fibres of the roots.

Popular name	Diseases Scientific name.	Time of occurrence.	Locality.

IV. Palms—Palmyra (*Borassus flabelliformis*).—

1. Bud-rot. Phytophthora palmivora. Butl. August. Godavari. Kistna. Guntur.

The central shoot yellows and dries up and the other leaves droop one by one. The bud rots and the tree dies.

2. Leaf-spot. Graphiola Borasss. Syd. Butl. July. Godavari.

Small black warty eruptions on the leaves.

Coconut (*Cocos nucifera*).

1. Bud-rot. Phytophthora palmivora Butl. September. Cochin. Malabar. S. Kanara.

Similar to Palmyra Bud-rot.

2. Fruit-fall. Phytophthora Arecae August. Cochin state. Malabar. S. Kanara.

Greyish white patches on the fruit and dropping of immature nuts.

3. Leaf-spot. Pestalozzia Palmivorum Cooke. February. December. S. Kanara. S. Kanara.

Small brown oval spots with a brown centre and grey margin appear on the leaves.

4. Stem bleeding. Thielaviopsis ethaceticus (Went.) January. February. May. July. September. Travancore. N. Arcot. Madura. S. Kanara. Cochin state.

Yellowish brown patches on the bark formed by exudation of reddish brown fluid from the cracks of the stem.

5. Cochin disease September. Cochin state.

Browning and drying up of the top leaves and the formation of pinkish red spots on them.

Arecanut (*Areca catechu*).

1. Mahali. Phytopthora Arecae. August. May. October. S. Malabar. S. Kanara. Cochin.

Greyish white patches appear on the fruits ; and the fruits rot and drop down from the bunches.

The Improvement of the Cotton Crop.

(*Continued from page 326 Vol. XIII*).

Environment.

Climatic Conditions. It is well known to every one who has experience of cotton that variations in climatic conditions have an enormous influence on the yield and quality of the cotton crop. As an extreme example it may be quoted that Cambodia cotton grown under fair conditions in South India will grow to a height of 4 to 5 feet, and will give a yield of 1000 lbs. of seed cotton per acre, whereas if grown in North India it tends to grow to a much greater height and give no yield. This knowledge of the effect of season on the cotton crop exists, but it is too general and needs to be systematised. As a means of doing this, it is suggested that the following scheme should be carried out each year for a number of years.

1. At each Agricultural Station in each important cotton tract a plot of the particular pure strain of cotton evolved at and distributed from that station should be grown as far as possible on similar land and under similar cultural conditions.

2. Throughout the year a daily record of rainfall, temperature, humidity, etc., should be maintained at each of these stations.

3. Throughout the growing season a daily record of flower buds produced and shed, flowers opened, bolls shed and burst, should be kept for a group of plants in each of the plots.

4. A record of the treatment given to the plot and of any occurrence such as an attack of pest or disease, should be maintained.

5. The yield obtained from the plot should be recorded.

6. A sample of the seed-cotton obtained should be sent to the technological laboratory for a detailed examination of the lint to be made and for a spinning test to be carried out.

By doing this an exceedingly valuable set of records would be obtained. After some years the information collected would make it possible to interpret more accurately the effect of seasonal variations in different parts of the same tract. As a result a more reliable forecast of the probable yield and quality of the cotton from that tract could be arrived at than is the case at present Moreover, such information is very necessary if the results obtained from experimental work affecting other environmental conditions under human control are to be correctly interpreted. Also this information would be a distinct aid in calculating the chances of success of the introduction of a variety into a new tract.

Pests. The problem of insect attack offers the following main lines of investigation.

1. Description and life-history of the pest. 2. Habits of the pest, how it spreads, and how it carries over from one crop to the next. 3. The amount of damage caused. 4. Means of control, by enemies, poisons, or manipulation of the crop.

The description and life-histories of the more important of the insect pests of cotton in India are fairly well known. More detailed information in regard to items 2, 3, and 4 is needed, more particularly if local authorities are to be convinced of the need for legislative measures.

Except in the case of the Jassid, where the possession of hairs on the leaves affords to the plant a distinct measure of immunity from attack, breeding with the object of evolving resistant strains does not at present seem hopeful. It is, however, definitely known in Madras Presidency that the stem weevil and the spotted boll worm, and possibly the pink boll worm, show a decided preference for Hirsutum cottons as compared with the indigenous species. The reason for this is not known, but must lie in some constitutional difference between the two species, as both are sown at the same time and are equally exposed to attack. This inforamation, if known, would be a distinct aid to selection and breeding work aiming at the isolation of resistant strains.

Diseases. Investigation of disease follows similar lines to those indicated for pests.

Where the disease is definitely known to be due to an organism, the most hopeful solution of the problem appears to lie in plant breeding work aiming at the isolation of resistant strains.

Where the disease is known to be definitely physiological, detailed investigation of the soil, the plant, and the conditions of growth is necessary. It may also be possible to attack this problem by evolving strains which are not, or are only slightly, affected by the disease.

Water. A certain amount of work on the use of water for the cotton crop has been done in India. Where, however, the crop has to depend mainly on the supply of irrigation water, more information as to the quantity of water to be given per irrigation, the number of irrigations to be given in all, and the interval which should elapse between successive irrigations is needed. This problem is, however, inextricably bound up with problems of soil, manure, and methods of cultivation, and has to be considered along with them.

Soil. As yet only the fringe of the work lying waiting to be done on cotton soils in India has been touched. Broadly speaking, the problem may be considered as falling under the four following heads.

1. Mechanical and chemical analysis. 2. Fauna and flora. 3. Physical Properties. 4. Climate.

It is not suggested that definite schemes should be formulated, having as their object the carrying out of wholesale surveys all over India along these four lines. Each may be approached through some definite problem the solution of which will yield results of economic importance. For example, under

1. There are indications that there is a relation between the quality of a lint, and (a) its chemical composition, and (b) the chemical composition of the soil on which the crop was grown. Further enquiry is needed to establish definitely the existence of this relationship. If the result confirms this point, the fact will be of importance in devising manurial experiments, and a step towards the solution of the problem of levelling up the quality of the cotton of a tract to a fairly uniform condition will have been taken.

2. The relationship between the soil organisms and the production of nitrates in the soil needs investigation. After soil moisture lack of nitrogen in the soil is the most important factor in limiting the yield of the cotton crop in India. Artificial manures to remedy this defect have either proved uneconomical or involve the possession of more capital than the average cultivator has at his disposal. Experimental work to discover cheap methods of increasing the efficiency of beneficial soil organisms is needed.

3. The investigation of the physical properties of the soil should go hand in hand with the investigation of problems of plant growth, and of cultural and irrigation problems.

4. The examination of the soil, climate is necessary in investigating problems of plant growth e. g., bud and boll shedding. A knowledge of the relationship between the climate above ground and the soil climate, and the effect of variations in the latter on the plant would lead to a better understanding of the causes of variation in yield and quality of the crop, the first step in devising means of control.

Other problems will occur to other investigators as the work proceeds. In time the whole field will be covered.

Manure. A considerable amount of work on the kind and quantity of manure for the cotton crop has been done in India, and some work on the time and method of application. Much work, however, remains to be done.

One of the outstanding manurial problems which has as yet not been solved is the economical manuring of black cotton soil. In certain parts on this soil an increase in the yield of the cotton crop of from 50 to 60 per cent can be obtained by growing it after a leguminous crop. The introduction of this procedure in practice, however, cannot be recommended. If adopted the area under cotton and grain crops on the cultivator's holding would be reduced from one-half to one-third, and unfortunately the legume cannot always be depended upon to make up the loss on the grain crop. Along this line of attack the problem is bound up with the improvement of the other crops in the rotation. Some other solution may, however, be possible.

Methods of cultivation. Much work has already been done in India on (a) preparatory cultivation, (b) methods of sowing. (c) the treatment given prior to sowing (d) soil moisture condition at the time of sowing. (e) the seed itself.

The question is of importance in connection with the distribution of seed to cultivators

(From " The Empire Cotton Growing Review " July 1925).

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*Some Biological Methods of Insect Pest Control.

By T. V. R. Ayyar.

It is quite evident that from those very early days when half civilized man gave up his wild and predatory habits for a settled life and began to grow crops and tend cattle, the struggle between man and nature must have commenced to increase appreciably—man consciously or unconsciously upsetting the normal conditions prevailing in the universe, and nature asserting herself every time to re-establish her supremacy. Gradually, through ages of civilization as this protracted struggle continued, the most important change effected has been a more and more pronounced readjustment of the relations that originally existed between man and lower forms of life.

*Paper read at the Science Congress Benares, 1925 and published in the July Digest of the Madras Deparment of Agriculture.

Under the artificial conditions brought about by human agency, what is known as the "balance of life" in nature is constantly upset, especially among the lower forms of animals like insects ; and one of the various resulting phenomena happens to be an abnormal increase in the number of some lower forms of life which affect man—in other words, there is an outbreak of pests. It is generally believed that the most important factors which play their part in keeping up the normal balance in nature, especially among lower forms of life like insects, are food, climate, and enemies : and among the many human influences that help to upset the balance may be mentioned the destruction of forest areas, the growing of single crops in extensive areas, the frequent transport of plants and animals from place to place, and the indiscriminate destruction of several natural enemies. Man has, of course, recognized this self-inflicted but necessary and inevitable evil through past decades, and in all countries where scientific methods of agriculture have become well established, various methods of insect pest control have been devised from time to time, and in many cases with marked success. Prominent among these modern measures are the different agricultural and mechanical methods, and the use of insecticides in various ways—spraying, dusting, fumigation, etc. It has, however, been found by experience that such mechanical methods, however effective and practicable in some cases, are found in many instances to be quite impracticable, ineffective and quite uneconomical. Experienced entomologists in defferent countries, who have bestowed some thought and attention to this important aspect of economic entomology, have within recent years begun to feel that these time-honoured methods of fighting pests which are found to prove expensive failures in many cases must be supplemented or in some instances entirely replaced by some others which might be found more practicable and effective. With this idea a new line of treatment to control pests has been initiated. Very briefly explained, this comparatively novel method consists in the utilization of the natural enemies to control various kinds of pests. The different aspects connected with this line of treatment constitute what are generally known as the "biological methods of pest control." The object of this paper is to explain a few facts with regard to this method of pest control by insect agency, and to offer some suggestions with regard to what may be done in India in this interesting line of work.

The more outstanding features of the biological methods of insect pest control may be put down as (1) the recognition of the different natural enemies of the various insect pests of a country and a thorough study of the bionomics of those natural agents in all their relations with the host insects or insects very closely allied to the host ; (2) affording all possible facilities for these natural enemies to multiply

unhampered, and to carry on their beneficial work successfully ; (3) whenever and wherever possible and necessary, introduction of such insects from a different agricultural tract or country where they may be noted as efficient agents against some pest or pests of a similar nature. In fact, the whole idea is to try to restore as far as possible by artificial means conditions approaching the original natural balance of life. Though among natural enemies there are found fungi, bacteria and higher animals that may be utilized for this purpose, only the subject of insect agency is considered in this paper.

The recognition and study of beneficial insects.

"The first step towards vanquishing an enemy," says Curtis, " is to ascertain correctly its habits, the next is to be certain of its appearance so as not to mistake one part for another, and a third and no less important object is to be well acquainted with our friends and allies." Being very familiar only with the more obvious injuries done by insects, our farmers naturally conclude that there cannot exist any good insects. It will therefore by very useful if all cultivators begin to realize that among insects there are several forms which are eminently beneficial to man and learn to differentiate the good from the bad and not condemn all alike. The elder Pliny seems to have classified all insects into two divisions—*Coccids* or those preyed upon, and *Coccinellids* or those that are predatory. However curious this classification may be, it certainly shows that even in those early days the controlling influence of natural enemies was recognized as an important factor. Even Linnaeus, who was written so much on insects, does not appear to have made any mention of insect pests, evidently showing that even in his days the balance of life was fairly well kept, and as such no serious outbreaks of pests occurred as at present.

Among the various enemies of insects in nature, apart from higher animals like some insectivorous birds, mammals and reptiles, which levy an appreciable toll on the insect world, there exist among insects themselves several forms which, by their predatory and parasitic habits, act as natural enemies of various insects. These are what may be called insect-feeding or entomophagous insects. It is important to note, however, that among these entomophagous insects only such forms are of economic importance that depend for their food on particular species or groups of insects which are in any way harmful to man, and not others which feed indiscriminately on various forms. A knowledge, therefore, of such insects and their life habits is essential before any biological methods of inseet control are attempted. Prominent among these friendly insects are the great bulk of the group of beetles called 'lady birds' (*Coccinellidae*), many

'hover flies' (*Syrphidae*)$_2$ the numerous lace wing flies (*Chrysopidae*), the 'bristle flies' (*Tachinidae*) and the hordes of parasitic hymenoptera. All these natural enemies are either predatory or parasitic in habits. Those of the former kind hunt their insect prey and feed on them like wild beasts, while the parasites, instead of killing their hosts immediately, make use of them as food for their offspring by depositing eggs on or into their bodies : these eggs hatch and the larvae grow at the expense of the body contents of the host which is gradually killed.

The lady bird beetles include the most important of the predatory insects of economic importance. These are well known to wipe away from infested plants whole colonies of plant lice, scale insects, mealy bugs, white flies, etc., which are often found to be serious pests in most countries; and in countries like California, Australia and South Africa, etc., different species of these beetles are being regularly made us of to fight scale and mealy bug pests of fruit trees. There are a good many species of these beetles in India but very little is really known of them, especially regarding their food habits. For example, the writer has recently found a new species of these beetles (*Scymnus coccivora*) which has been noted to be an extremely effective natural enemy of the destructive nim scale (*Pulvinaria maxima*) in and around Coimbatore, the beetle and its grub voraciously feeding on the eggs of the scale pest. A study, therefore, for the Coccinellid fauna of a tract with special reference to their food relations will be of very great use, and in South India, especially if made with particular reference to the green and brown bugs of coffee, which are serious pests in our coffee and citrus plantations. Similar to the lady birds the larvae of different kinds of lace wing flies (*Chrysopids*) are also predatory enemies of plant lice, mealy bugs, etc., but they do not appear to be so very effective as the lady birds for use on an economic scale The larvae of some flies destroying plant lice and eggs of mealy bugs are also known as friendly insects. Among other predatory insects useful for man, mention may be made of one—the caterpillar of a moth, *Eublemma scitula*(k)—which is very commonly found all over India exercising an efficient control over some important species of scale insects; and another—a butterfly larvae, *Spalgius epius*—which feeds ravenously on destructive mealy, bugs of sorts. Besides these there are found stray cases of predatory beetles, insect-sucking bugs, and hunting flies, etc., which occasionally help the farmer but these are of minor importance compared to the Coccinellidae and others noted above.

Coming to the parasitic forms, in the opinion of many experienced entomologists, the work of these insects is a very remarkable but little known phenomenon ; outbreaks of pests are often suddenly

stopped as if by magic by these useful forms. The insect groups of the greatest importance in this work are the tachinid flies and the parasitic hymenoptera. The former confine their attacks mainly to caterpillars of various moths and butterflies, many of which are among some of the worst crop pests, viz., the swarming paddy caterpillar and the caterpillar pests of grasses, tobacco, castor, sunnhemp, groundnut, cholam, etc. But our knowledge of these flies and their bionomics is extremely limited. As far as the writer knows, one species, *Sturmia bimaculata* appears to be one of the commonest in South India and known to parasitise some of the more important lepidopterous larvae. With regard to the work of parasitic hymenoptera one cannot help repeating what the late Dr. Sharp has said : "the division parasitic hymenoptera," says he, "is one of the most neglected of the great groups of insects though it is perhaps of greater economic importance to mankind than any other" This large conceptus of parasites includes thousands of species exhibiting remarkable variations in structure and habits, and a thorough study of the bionomics of even a few of these interesting insects will not only help the economic entomologist who may wish to utilize them for pest control, but will be found to be of absorbing and fascinating interest even to the pure biologist. India abounds in numerous parasitic wasps carrying on their remarkable work of pest control often unknown and unnoticed by man, but unfortunately our knowledge of their life activities is very very meagre.

Methods of utilizing natural enemies of insects.

After having pointed out very briefly the importance and necessity for a thorough study of the insect friends of economic importance found in the country, with some information on what little has been attempted in the direction we may consider the different methods in which such natural enemies may be utilized against insect pests to the best advantage. Some of these methods that might be adopted are simple and quite practicable in most cases. Where plants are badly infested with pests, say caterpillars, or of different kinds of grubs, infested parts being removed and burnt or buried as is at present done in most cases they may be kept enclosed in cages with gauze netting to allow the natural enemies alone to emerge in due course; the mesh of the gauze should be of such dimensions that it will only allow the natural agent to fly out and not adult of the pest which in most cases, is a moth or butterfly. This might be done not only in the case of various defoliating caterpillars such as those attaking paddy, cholam, castor, groundnut, palms, etc., but also with borers of sorts such as the stem borers, shoot and fruit borers, of various valuable crops. For this purpose special cages or parasite

boxes suited to each insect pest and its natural enemies could be devised ; such boxes containing infested plants or portions of plants, which allow only the natural enemies to emerge, may be placed in the infested fields. Trials in this direction were made in the Punjab a few years ago for the cotton bollworms (*Earias sp.*) and on a small scale such a trial is now being made by the Madras Agricultural Department for the black-head caterpillar (*Nephantis serinopa*) of coconut, a serious pest in some places along the West Coast. Similarly in the case of many pests of which the egg masses can be easily found and collected, as in the case of the paddy stem borer, the tobacco caterpillar, hairy caterpillars of sorts on cholam, castor, etc., and various others where the eggs are laid in masses, these latter may also be kept to allow any of the egg parasites to emerge ; egg masses may with advantage be kept exposed on a tray of water or in the middle of an antpan so that the egg parasites might fly away and any minute larvae that might hatch out of unparasitised eggs might drown themselves if they attempt to crawl out. The stubble and debris of various borer-breeding plants like cholam, paddy, wheat, cane and various vegetable crops after havest may also be treated similarly to allow any natural enemies that might breed in them. In these simple ways the existing parasites or predators in each tract might be helped to do their useful work more effectively ; on the other hand, when the collected pests or the pruned branches containing pests are buried or burnt, as is usually done, the natural enemies also get destroyed. The adoption of such simple methods will substantially supplement the ordinary mechanical measures of control generally adopted at present.

But when it comes to a question of adopting the biological methods as a primary measure of pest control in cases where the ordinary mechanical methods are impracticable or uneconomical, arrangements of a more organized nature will be found necessary, if substantial and sustained benefits have to be derived. Such is evidently the case when we have to fight pests spread over extensive areas, and fixed insects like scales, borers, etc., on fruit and avenue trees, some of which may be perennial. They cannot possibly be collected and brought together without great inconvenience and expense. To carry out a regular campaign of biological control, in the case of important crop pests, where the ordinary mechanical methods have proved unsuccessful, the most important thing necessary is, in the first place, a plentiful supply of the predator or parasite ready for liberation in the infested areas. For, the liberation of only a few individuals has the disadvantage of these few separa-

ting from one another and spreading far away, thus preventing the chances of union of sexes and multiplication of the species; in some cases there may not be present sufficient or any females in the small lot let out. In the simple methods described above of heaping collected material inside cages to liberate the natural enemies, we get absolutely no idea of the actual numbers liberated to form any correct estimate of the work of these natural agents. Another important factor that vitiates to a great extent the expected results of such simple methods, and which is overlooked very often, is the work of hyperparasites, parasites that attack the natural enemies themselves, not an uncommon phenomenon in nature. A braconid wasp (*Aphrastobracon flavipennis*) which the writer has recently discovered as a parasite of the useful scale-feeding caterpillar (*Eublemma*) is an example of such a secondary enemy spoiling the good work of a friendly insect. In the simple use of wire gauze cages it may not always be possible to keep back such secondary enemies and allow only the primary one to emerge. Yet another defect one has to guard against in such a measure is the probable contingency of the natural enemy being starved or destroyed when liberated in any tract either for want of sufficient food or becoming subject to the sudden and unusual climatic changes which might in some unfortunate cases affect the natural enemy very seriously. To guard against these and other incidental defects the best thing to do is to have these parasites and predators of known capacity reared in large numbers in field laboratories or insectaries under the supervision of skilled hands, and then distributed in batches to different infested areas whenever necessary. The study and elimination of hyperparasites, the question of sufficient food supply, protection from weather conditions, all these may be carefully attended to in captivity. The ideal natural enemy to be selected for such use should be one which would breed easily and plentifully in captivity, which has no enemies of its own and which would attack its host in any stage. This is the sort of work that is being carried on in countries where biological methods of pest control have advanced to some extent. The United States Gipsy Moth Laboratory at Melrose. Highlands, Massachusetts, is an institution of world-wide reputation which was primarily instituted to carry on investigations on the natural enemies and their efficiency against the Gipsy and Brown tailmoths which are very bad pests in some of the New England States. The field laboratories in different parts of California specially to fight the black scale and the mealy bugs of fruit trees are also well known. Such insectaries or field laboratories will not only help in affording the necessary facilities for the proper breeding and distribution of the natural enemies already studied as a routine, but would serve as institutions where all sorts of investigations and experiments could be safely and accurately carried on with various local and introduced insects of economic importance.

Search for natural enemies in other tracts and their importation.

Before concluding the paper a few words may be added on the subject of introduction of natural agents from one country to another, as distinct from the conservation of the native beneficial forms. This aspect of the question is far more important in countries where a good number of the cultivated crops are foreign, and the insects on that account mostly foreign introduced with the former; these latter, deprived of their original natural checks in their new homes, often multiply remarkably and become serious pests. In such cases attempts are made to locate the original home of the pest and bring such of its natural enemies found there which keep it in control. As such, Australia, including many other colonies in the Pacific, South Africa and many parts of the New World are the regions chiefly interested in such search and importation of these natural agents. The most remarkable of such pioneer attempts is the well-known introduction of the famous lady bird beetle (*Novius cardinalis, M*) in 1889 by Koebele from Australia to California to fight the cottony cushion scale (*Icerya purchasi, M*), a very destructive pest of citrus trees in different parts of the world. As a result of the phenomenal success of this introduction this predatory lady bird beetle was taken to various other countries like Portugal, South Africa, Italy, Hawaii, Formosa, etc. The United States Department of Agriculture, ever since the establishment of their Parasitic Laboratory in Massachusetts, have deputed numerous parasite collectors in different regions of the East and imported several natural enemies for trial. More prominent among the later attempts are the trials with the natural enemies of the black scale and mealy bugs in California, the fruit flies in Italy, South Africa, Australia and Hawaii, and the sugarcane pests in Hawaii. In 1907 and 1910 two Americans, Messrs. Compere and Woglum, visited India on similar missions; Mr. Compere, who remained in Bangalore for some time where the writer had the chance of making his acquiantance, carried with him to Australia a hundred thousand live parasites of the Guava Fruit Fly (*Dacus spp.*) to try it against the dreaded Mediterranean Fruit Fly (*Ceratitis capitata*) in Queensland. Mr. Woglum came in search of parasites of the Citrus White Fly, a serious orange pest in Florida, and found a few lady bird beetles and parasitic wasps which he forwarded to America from the Punjab. Several examples of such attempts now made by entomologists in many countries may be added. It cannot be said that such attempts may not be necessary or useful in India ; it is quite possible that there may exist somewhere outside our country effective natural agents keeping in check pests which are the same or very similar to some of our own which are serious here, and in such cases, it would certainly be worth our while to introduce such forms and give them a trial.

Agricultural and Mechanical Engineering in India.

By D. Clouston, Agricultural Adviser.

In a thoughtful article contributed to the Asiatic Review in July this year on agricultural and mechanical engineering in India, Sir Alfred Chatterton gave it as his opinion that the development of agriculture in India is likely to be of a very restricted character unless it connotes the application of the resources of mechanical engineering to the tilling of the soil, the supply of irrigation water, the harvesting of the crops, their transport to the factories, and to the machinery for converting them into finished, or that at any rate easily marketable products. If the people of India are, he says, to achieve any marked de gree of industrial success in the future they must cease to neglect mechanical engineering and must realize that in its application to agriculture there lies a field open to immediate exploitation. The initiation of measures must, however, rest with the principal landowner, namely the Government; the cultivators, numerous and poor, have no natural leaders and by temperament are conservative and suspicious.

To achieve results commensurate with the interest involved, he advocates standardisation of plant as being absolutely essential. What Henry Ford has shown to the world can be done with such a complex machine as a modern motor car required for service under an almost infinite variety of conditions can, be avers, be achieved in India with ploughs, motor pumps, sugar mills, threshing machinery, oil presses, and a number of hand tools of almost universal utility: India pays dearly for the privilege of being able to select its machinery from the numerous competitive types imported from abroad. Notwithstanding the decentralisation of the control of the department of Industries and Agriculture the Government of India are still in a position to standardise the requirements of rural India, and if suitable standardised iron ploughs for example, could be substituted for the 30 millions or so inefficient wooden ones at present in use, nearly half the draught cattle could, he thinks, be dispensed with, or the work of ploughing done in half the time.

To the development of agricultural engineering even in the more advanced countries the services of mechanical science have not been applied to anything like the same extent as to that of the great manufacturing industries of the world. Mechanical discoveries in the other fields of engineering have, however, tended to filter down to agriculture and to be gradually adapted to its requirements. In these countries farmers have been forced by economic conditions to resort to the use of labour saving machinery, for, manual labour on the farm means dear labour and high production costs. The cultivation of the soil has been raised to a fine art, and a great variety of highly specialised implements designed for the various operations such as ploughing, sowing and harvesting are freely used.

In India we are now at the transition stage between manual and mechanical power on the farm. A beginning has been made in substituting steam and internal combustion engines and in introducing implements and machines worked by bullocks. The relatively low standard of cultivation attained in India is largely the result of the inefficiency of the local plough ; this same plough inefficient though it is, is used for several operations for which special implements have been invented in the West. This plough, may be roughly described as a piece of wood shod with an iron point which corresponds to a share. It is fitted with a wooden pole and is drawn by one or two pairs of bullocks. It has no mould board and having no cutting parts it does not eradicate weeds. The iron ploughs now being introduced are the handiwork of engineers who have devoted much time and thought to their evolution. The exact relationship of their different parts to the work which they have to do have been thoroughly studied with the results that we have today various types of ploughs which are well nigh perfect

Within the last 20 years several attempts have been made to design types of a plough suitable for India. For these attempts, several of which have been successful, we are mainly indebted to one or two well-known English engineering firms, but particularly to Ramsomes, Sims and Jeffries assisted by agricultural experts in this country. The ploughs evolved may be described under three heads, namely, heavy ploughs, medium ploughs, and light ploughs. Heavy types such as the Steel Eagle and Turnwrest are suitable for heavy soils such as the black-cotton soil found over a great part of peninsular India ; of these there are many thousands now in use more especially in Bombay and the Central Provinces. Being heavy in draught they require from 2 to 3 pairs of good bullocks. Of the lighter types introduced the M. S. N. is the best known. Many of these are now at work in the rice tracts of India. Two or three excellent ploughs of medium weight have been designed for use in the Gangetic alluvium of Northern India, where they are used both in the cold weather and during breaks in the rains. One of the best ploughs yet designed for India, is the Sabul, the characteristics of which are that the share is provided with an adjustable bar point of high grade steel. The bar is held in position by a steel wedge knocked in from the front. The Sabul is suitable both for stiff black cotton soil and for the lighter soils of the Gangetic plain.

It may be pointed out here that the designs of ploughs invented by enterprising English engineer firms are now being copied in India, and that considerable numbers of somewhat roughly—made but useful imitations of the English article are being manufactured and sold in this country.

The chief handicaps in the way of indroducing improved iron ploughs on a large scale are that the bullocks which supply the motive power are, over a great part of India, somewhat weak and small; still an ever-increasing demand for such ploughs has already been created. The demand is the result of the activities of the departments of agriculture: for provincial departments have demonstrated their use in the villages and have on Government farms stocked for sale and hire the types found suitable. From these Government depots 20227 ploughs and 9249 spare parts were supplied last year. The existence of a demand for spare parts would appear to indicate that the ploughs are being freely used.

There were millions of acres of weedy lands in India which year after year give poor yields because the land is invested with *kans* or other persistent weeds which rob the crop of so much of its plant food and moisture. There are, moreover, hundreds of thousands of acres of good land lying fallow because these weeds have entirely overrun the fields. Very large stretches of land are to be found more especially in the Central Provinces, Bundelkhand and in Gwalior. In many cases these lands are overgrown with *kans* after the great famines of 1896-97 and 1900-01 as a result of the bullock power available being reduced to a very large extent owing to shortage of fodder in the years. This weed can be eradicated by means of iron ploughs worked by strong pairs of bullocks; but the number of these available is limited. For such tracts there is little doubt but there is an opening for the use of steam ploughs and perhaps motor tractors.

Steam ploughs have been in use in the West for over 70 years. At the present time there are about 40 sets of Fowler's steam tackles worked on the cable system in India. That many more have not been used is due to the fact that the landowners who might reasonably be expected to use them have not yet come forward to play their parts as pioneers in the field of agricultural development. In the cable system of steam ploughing the engines remain stationary while pulling the plough or other implement used, and can therefore develop their full draught power on the cable. This gives an enormous saving in efficiency as compared with a motor-tractor which loses much of its power in pulling itself. The chief advantages claimed for steam cultivation by the cable system are that any depth of ploughing up to 20 inches can be done by this system, that land overrun with persistent weeds can be reclaimed with ease and that the work is done very quickly. With a K type double engine cable set an area of almost an acre can be ploughed to a depth of 11 to 12 inches in a hour.

During the last 5 years motor tractors have been tried in different parts of India. The general opinion now is that they are useful for the purposes namely, (1) light and shallow cultivation on large estates when a considerable area of land has to be cultivated in the shortest possible time, and (2) for clearing lands infested with persistent weeds. They are being used, too, for stationary work, but when employed for such work are less economical than an oil engine. The types of tractors tested in India up to date are not sufficiently powerful for ploughing where the soil is very heavy and weedy. They are not sufficiently fool-proof either: it is very difficult to keep them in good working order, as first class mechanics are not easily obtainable and spare parts are not always available in this country. Still the fact remains that with intelligent use the tractor is a farm-power unit of considerable possiblities in tracts where the draught power at present available is inadequate, and where, in the absence of any other form of mechanical power, it is impossible for the agriculturist to perform his tillage operations under optimum conditions. The introduction of iron ploughs on a large scale in India supplemented by the use of mehanical power in the shape of steam and internal combustion engines will enable the cultivator to get his land more quickly and therefore under more favourable conditions. It would enable him too, to get rid of the weeds which at present rob his crops of their rightful dues, and to bring under cultivation large areas of good land which have been overrun with *kans* or other weeds.

There is already a large demand in India for iron cane mills and some demand for power pumps, winnowers, reaping machines, fodder cutters, threshers, hoes, and harrows. There is a growing demand, too, for pig-proof fencing, for both wild and domesticated animals do an enormous amount of damage every year to crops. Of the wild animals, the pig is, perhaps, the most destructive and the most difficult to control. Being a nocturnal feeder he lies down during the day in the jungle or grass-covered waste land and comes out at night to feed on the village crops. Pig-proof-woven fencing is being introduced in some provinces with excellent results; the demand for such fencing is likely to increase very much.

When the landed aristocracy in India waken up to a sense of responsibilities the demand for improved hand and power appliances for the better cultivation of the land will be enormous: the annual demand for ploughs alone may run into hundreds of thousands. To foster and stimulate the demand, the department of agriculture is doing its utmost. It is demonstrating the work of approved implements and machines in the villages. It displays them at agricultural shows and ploughing matches. It stocks them for sale and in some cases for hire at depots on Government farms. It is organising their sale

through co-operative societies, and in some provinces it is giving pecuniary assistance in the shape of *taccavi* for their purchase. More than this it cannot do at present, for, its staff is small and its activities extend over a very wide field of which the introduction of labour-saving machinery forms but a small part.

(From the "Pioneer" Trade Industrial and Economic Supplement 16th November 1925.)

The Sugar Industry in Cuba.

Cuba exported in 1924, 4,538,853 short tons and in 1923, 3,872,353 short tons of raw sugar largely to the U. S. A. for refining. At full capacity, the 18 mills now operating could manufacture 6 million tons annually. The centrals are scatted over the whole island. About one-third of the mills are owned and operated by Americans. 60 per cent of the American owned mills are in the two eastern provinces of Camaguey and Oriente. The other two-thirds are owned or controlled by Cubans and Spaniards and a few by English and French interests. Most expansion since 1914 has been in Eastern Cuba. A considerable amount of good land in the two provinces abovenamed is used as cattle land which could be brought under cultiyation.

Exclusive of this, there are probably not over 330,000 acres of good cane land left unused on the whole island. Cuba is endeavouring to make an industry of cattle raising ; so unless the price of sugar improves the likelihood of the cattle lands being taken for sugarcane growing is more remote. In the eastern provinces at present good cane land may be had for about 60 dollars per acre, and for about 150 dollars per acre with the cane planted on it.

Exports of raw sugar were as follows :—for calendar years.

COUNTRIES.	1913	1922	1923	1924
	Figures		in 1000 lbs.	
U. S. A. ...	4,837,425	8,901,553	6,936,335	7,214,644
Canada ...	53,442	172,659	86,910	151,567
France ...	27,430	301,040	57,536	122,817
United Kingdom ...	547,103	1,520,324	571,452	1,126,828
Other European countries	11,211	131,736	33,535	—
China and Japan ...	—	122,624	—	—
Other countries ...	282	14,458	65,036	173,111
Total ...	5,476,900	11,164,694	7,750,804	8,788,954
or short tons	2,736,450	5,582347	3,775,402	4,394,477

Accurate returns are available only for lands owned and controlled by mills.

Early in the year a planting programme is drawn up by mills and by the beginning of summer they know what acreage of cane they are going to have for harvest at the next campaign. The mill makes an estimate of its owa lands and for lands under lease to the colonos.

The mill manager through the field managers gets in touch with the colonos during October and November and ascertains how much cane may be furnished to the mill. Until the effect of rains and temperatures in September, October and November is known, no fair estimates of production is possible.

The tendency is to increase sugar areas. With the planter much depends on whether or not he will increase his areas at the time he plants, whether the ground is moist enough when he is ready. But the only climatic condition that can interfere is the dry season and that is also the grinding season. The grinding season begins usually about the middle of December or early in January and usually runs from 4 to 6 months. Up to now little systematic work has been done and while high yielding varieties have been developed little progress has been made in their dissemination. The variety grown almost universally is 'Crystalina.'

A man planting 660 acres of cane is regarded as a small colono Some colonos are said to plant as much as 3300 acres, and occasionally more. A colono after clearing the land and planting the cane has a lien on the subsequent crops harvested from the first planting. The party who purchases the ratoon from the colono assumes the colono's contract with the mill. Usually the mill makes the settlement for cane delivered in cash rather than in sugar, but the colono may take the sugar if he desires. The price is determined every two weeks. When sugar prices are low, mill operators have more difficulty in borrowing ample money to conduct their operations. If the centrals are not able to get the money they need, they will not be able, of course, to finance the colonos, then they will automatically curtail plantings, since the contracting colono, can not operate without funds from the centrals.

It appears that most of the good land is under the control of existing mills, and it is thought altogether unlikely that the number of mills will be substantially increased in future. Indeed, it is regarded as possible that the number may be reduced because of consolidations and the abandonment of old sugar land which has ceased to be profitable for sugar production. Some of this old land is in the provinces of Matanzas, Pinar del Rio and Havana. In Matanzas and Havana some such lands are being put into henequen, or sisal. Henequen gives promise of being a profitable crop for Cuba.

According to certain mill managers, there are three plantings of sugar in a year in Cuba: *Primavera* (spring) planting which runs from April to June inclusive. *Medio tiempo* (mid-season) planting is done in February and March, and *frio* (full) planting in October, November and December. By June the planting is finished for the approaching campaign. Spring planting is said to give the best yields and some of this crop may be harvested towards the close of the first campaign after planting, at about the same time that the proceeding *medio liempo* cane is harvested. *Medio tiempo* cane does not yield so well as *primavera*, but gives second best yields. *Frio* cane runs from about one year to 15 months from planting to time of harvest; that is, planted in the fall of one year, it is ready for harvest at the beginning of the second campaign after planting.

Yeilds vary according to the season and locality in which the cane is planted, according to some mill managers. Managers at centrals in Santa Clara province, adjacent to Cienfuegos, say that new spring plantings and new *media tiempo* (mid-season) yield from 750 to 1000 short tons per unit of 33 acres, first cutting, but that *frio* or late planting does not do that well. Ratoons (stubble) give an average of about 500 short tons. In this particular area the ratio of ratoon cane to plant cane is given as 3 to 1. The heaviest yields are reported in the eastern provinces, where the lands are new and good in comparison with the middle and western provinces. Yields in Matanzas are said to run as low as 375 short tons per 33 acres when not fertilized, and some lands there with fertilizer yield as high as 625 short tons, the average for that province being about 560 short tons. Some mills there gave the yield in 1-10 acre units (cordellas) and the yield per cordella as 3125 lbs. of cane equivalent to about 15·3 tons of cane per acre. In Camaguey, yields range from 937 to 2500 short tons per 33 acres, first cutting, and no fertilizer used. An authority on cane in the field mentions yields in Camaguey province as high as 3500 short tons per 33 acres on virgin land, first cutting and no fertilizer used, and no cultivation. According to the same authority, in Camaguey province the first year they get about 1250 short tons, and after first cutting the land will yield well for about three or four years, because the cane will have stooled out and have better roots. On land planted in 1914, one central is getting 937 to 600 short tons per 33 acres. In Matanzas province it is told that after first cutting, the cane stools out better, so that the second, third and even the fourth cutting is as good as the first. After that the yield diminishes steadily. But the practice neverthless is to keep cutting from the ratoon for a number of years.

The number of arrobas (25 lbs.) of sugar paid by the mills per 100 arrobas of cane delivered, varies about the Island. It is highest

in the middle and western provinces and lowest in the eastern provinces. Production is easier and cheaper in the eastern provinces by reason of the lands there being newly brought into sugarcane and yields being larger. Some centrals in Matanzas province say their contracts are for 150 lbs. (six arrobas) of sugar, with colonos not under contract getting as much as seven and a quarter, and even seven and a half arrobas in some cases. In Camaguey and Oriente provinces, the contract figure is as low as 112 lbs. (4½ arrobas). In certain sections the colonos at present are demanding 125 lbs. (5 arrobas) of sugar, a figure thought by the mills to be too high.

Colonos make their contracts at an agreed price for a period of perhaps 10 years. Usually the contract provides that the colono will receive so many arrobas (25 lbs.) of sugar for every 100 arrobas of cane that he delivers at the mill. If sugar prices fall low trouble sometimes occurs between the mill and the colonos, because the colonos want to throw over their contracts. More arrobas of Sugar per 100 arrobas of cane are demanded and if demands are not allowed the colonos refuse to deliver the cane. When a central cannot grind all its available standing cane, the cane is sent to some other central for grinding. If that cannot be done, the cane is allowed to remain standing until the next grinding season and is shown in the mill's statement of operations as green cane available for grinding during the campaign but left standing.

Estimate of Sugar production.

	Secretary of Agriculture, commerce and labour. Short tons.	Guma mejer, Co.. Short tons.
1899—1900 to 1900—1904	4,284,237	4,293,728
1905—1909	6,994,400	7,008,047
1910—1914	11,434,259	11.435,259
1915—1919	18.122,834	17,967,220
1920—1294	21,797,265	21,651,902
1925—1926 estimates	5,011,216	5,516,000

The free colono not under contract, grows "free cane" on land owned by the colono himself, or at any rate not owned by the mill. He owes the mill nothing so may sell his cane to whichever mill will pay him the highest price. It sometimes happens that there are half a dozen or more mills close enough for the free colono to sell to and it becomes necessary for the mills to bid against one another for the cane. The highest bidder each year gets it. In one year a central might not get more than one million and may be none at all.

world opinion is becoming insistent upon majority rule and self-determination as political principles. These are wholly inapplicable in the existing conditions. It were surely wiser to rely on a clear proof that even in the interests of non-Europeans the present regime is justified than to maintain it by force.

Public opinion seems unanimous upon the essential necessity of developing the agricultural resources of the country and encouraging the settlement of white communities upou the land. But for the recent discovery of minerals other than gold and diamond the need for a larger agricultural population would have been more generally realised. Beyond question this is urgent. Even with large deposits of coal and iron the cities will still require a large and prosperous population in their agricultural hinterland and supplying them with a large variety of production and providing a home market for their manufactures and imported commodities. In other words without a much greater number of European families upon farms, there will be no prosperous and progressive South Africa.

Settlement of this kind is being actively promoted by philanthropic and commercial agencies and individuals, Notwithstanding this the opinion is that unless the occupation of farming-is-and can be made more remunerative and attractive, the proportion of white farmers will not be materially increased. A long and wide experience of work among rural communities shows that even in counties where the political influence of the agricultural class is predominant the effective public opinion must be looked for in the cities, their press, their teachers, their preachers, their lawyers and their industrial and commercial leaders. The explanation of this paradox is simple. Farmers use their political influence for the satisfaction of their immediate needs as they see them They do not dictate the agricultural policies of Governments, because they do not think in terms of their policies. They have no clear idea of the respective fuuctions of state aid and private initiative in fostering their industry and protecting their interests. So they expect much to be done for them. They do not realise that even when the Government has done all it legitimately may, they will still have to modernize their business methods before they can be prosperous. Not realising the full significance of these fundamental considerations they will not make the needed reforms of their own initiative.

South African agricultural resources : their potential development under European control :—

Agricultural resources are abundant. Maize is the staple crop. Given the right breed of pigs and increased cultivation of lucerne an

export becon trade might rapidly develop. There is plenty of fruit. South African tobacco is world famous. There are districts quite favourable to the dairy industry. Production of poultry and eggs should be universal. Natal and Zululand possess and can develop their cane sugar. Many cattle whose chief value is their hides furnish the basis of leather industries. Sheep could be increased

with a possible home development of a wollen manufacture. Cotton has a bright future. There might be many more irrigation projects. There is no lack of cheap labour. This might be better paid if it was better educated with advantage to the employer. The main consideration is this. There agriculture is so diversified that its successful exploitation depends upon the organizing capacity and technical skill of the British and Dutch farmers. The marketting of the greater part of their product is in Europe, 6,000 miles away, so that efficient distribution no less than efficient production is beyond the reach and ken of the native races. In the circumstances the economic justification for the white man's domination is complete provided he does well the duty assigned to him.

A criticism of South African farming:—

The country has more than its share of animal and plant diseases which may be counteracted and of droughts and floods which are beyond human control. The Government is doing more to help the farmer. The Ministry of agriculture is noted for the efficiency and devotion of its administrative and expert staff. The legislation for the promotion of co-operation constitutes one of the most advanced agricultural policies in the British commonwealth. The Land Bank seeks to provide a sound system of agricultural credit. In the region of voluntary efforts the couutry is well supplied with co-operative organization of one kind or another. To them a larger section of farmers nominaily belong : but too ofen they only patronise them when they cannot do as well with commercial agencies competing for their business. Again many individuals, in some cases, captains of industry of world reputation have become "Cheque-book farmers."

Yet in the typical farming communities the members buy everything they require in their industry at retail and sell what they produce at wholesale price—not a get-rich-quick procedure. They raise working capital needed by short term loans, suitable no doubt to city business, with its quick turnover but only unsuitable to agriculture, which has to wait on the slow processes of nature. In spite of the existence of the Land Bank and the farmers' co-operative organizations, at least three-quarters of the farmers in the Union are deeply in debt to the storekeeper who transacts their buying and selling business on credit.

Even if he charges no interest on overdue accounts, the actual interest exacted would make Shylock green with envy. Yet the trader is often impoverished by bad debts. The system is vicious, bad for all parties and disastrous to the nation.

The essentials of an agricultural policy:—

A conference on agricultural co-operation was held at Wimbley in July 1924. The leading agricultural organizations were represented. A resolution was passed emphasizing the necessity for the fulfilment of the three conditions to ensure agricultural prosperity.

(1) The application of scientific knowledge under the guidance of the State to the farming industry.

(2) The Voluntary organization of farmers for business on co-operative lines and

(3) A reconstruction of social life in the country with a view to remove the disparity between the respective attractions of town and country. This is simply an expansion of the Irish formula. Better farming, better business, better living.

Another resolution demanded that there should be established in London a clearing house of information for the service of the movement primarily throughout the English speaking world.

In 1922, Sir Thomas Smartt piloted through South African parliment a remarkable law to provide for the formation, registration and management of co-operative agricultural societies with unlimited liability, co-operative agricultural companies with limited liability and co-operative trading societies with limited liability. It admits of the intervention of the Government to the extent of applying compulsion to make the members of a voluntary co-operative society obey its rules. Compulsory co-operation certainly would not be justified if there were some efficient voluntary agency which specialised in the organization of farmers, was competent to instruct them in the technique of co-operation and could imbue them with the co-operative spirit. When the co-operative spirit does not exist compulsion will be evaded: where it does; it will be superflous, compulsion will defeat its own end. Alongside of the protected and policed marketting organizations will be carried on a big business through the ordinary channels of trade. Powerful communal firms will demonstrate that they can do better for larger individual producers than co-operative federations can do for them. The co-operators by compulsion will agitate for freedom of action, the whole co-operative fabric will collapseand with it the hope of a 'white South Africa.

Whatever Government compulsion may be later resorted to, the organization of the primary producers must be done by themselves with the friendly counsel and advice of their leaders and not by the Government. There are many reasons for this precaution. You cannot compel traders to combine for buying at wholesale and selling at something nearer retail prices than now prevail without an interference with the existing trade interests politically well organised. Trade as a whole, profits by the larger consumption of general commodities which follows upon the proper organization of farmers. There is temporary disturbance of local trade, the Government gets into trouble and the work is blocked. Secondly civil servants cannot specialise for this work and cannot claim to have the qualification of an agricultural organizer. Thirdly, in proportion as the Government succeeded in organizing farmers they would increase the demand for their technical services and funds would be depleted; one more objection is that it weakens the sense of responsibility and destroys private initiative in farming communities. Better farming is the function of Government and not better business. And the surest and quickest method for organizing farmers in a large way is to begin in a small way and to restrict an intensive campaign of co-operative education and organization to a few farming communities, say in each province.

(Abstracted from the Journal of the Union of South Africa October 1925.)

Agricultural Research in relation to the Community.

By Sir Daniel Hall.

Research leads to efficiency & efficiency is a means of making money. The modern State must cultivate research if it is to become efficient and survive in the world's competition; hence all are agreed on the endowment of research, and since in farming there are no great business corporations, agricultural research must for many years to come be maintained by the State.

If, then, research is to become of such importance to the State, it behoves us to ensure conditions for the research worker under which discoveries are likely to be produced. To do this properly we must understand the psychology of the investigator. If it is true that research, like art, grows by a process of intuition, we can no more organise it into existence than we can organize the output of poetry. Nor are we likely to obtain it by a system of prizes, of rewards, commensurate to those obtained in the great professions, in industry or commerce. What we can do is to contrive sheltered places in our

community in which research workers can live. We cannot guarantee results but we may wait in faith because, as we have said, the impulse to make discoveries is fundamental in man's mind. Now the sheltered places in which the research worker can live are the universities.

One last word, the State must have research in order to obtain efficiency, but does mankind really care about efficiency? At bottom man does not, he wants to "loaf and possess his soul". Efficiency is a beautiful word, but efficiency to what end? If pursued for its own sake it may become a curse. Many people have vivid recollections of the sufferings they endured under a really efficient parent in an efficient household. I myself, am officially engaged in promoting efficiency, in bringing up the efficient farmer and in insuring the efficient use of the land. But I cannot help having a great deal of sympathy with the old fashioned farmer, who is content with what the land brings him, who is making his living but not worrying overmuch about making money. He is often inefficient, but again he is ofen a very worthy human being.

(Extract from the Jour. of the Ministry of Agri. Vol. XIII, No. 4).

Norton—Vijiaraghavachariar Conversations, Views on Land Problems.

E. Norton.—Very well. Let us assume Dominion Home Rule is granted you tomorrow. Will you give me some samples of measures that would be for the first time introduced for the amelioration of the lot of the toiling millions of the people?

C. Vijiaraghavachari —There are several that I can think of. The first and formost measure will be the rearrangement of the country's finance. The true principle of taxation should be that everybody's surplus income and surplus produce alone should be taxed.

E. N.—Let me interrupt you for a second. Is that not the system now?

C. V.—Not at all so. Take for instance the land tax system. It is not the income from the land but it is the land itself that is taxed annually. The utter absence of principle and the injustice of it are obvious. Take as an example three peasant brothers. One of them owns two acres of land and his annual gross income is one hundred rupees. He pays tax to the Government a sum amounting to half or even occasionally more than half of his gross income. One of his brothers is a shop-keeper and earns a thousand rupees a year

He pays no tax because an income up to Rs. 2,000 is free of taxation. The other brother is a contractor and makes an annual profit of Rs. 1,950. He also pays no tax. And what is more, the land tax-system is radically of two different kinds one kind, relates to permanently settled areas and the other to non-permanently settled areas, the latter are better known as Ryotwari lands or tracts. The tax on the former kind of lands was once for all permanently fixed in the early days of British rule of India and is comparatively light as well as rigid, being incapable of any modification. But the tax on the latter kind of lands is comparatively and absolutely heavy and is also elastic capable of periodical increase under the name of "resettlement." This periodical increase is regularly taking place, not by law but by executive and departmental orders. This artificial division was due to erroneous notions of the early British Government in India, especially in Bengal that feudalism prevailed in India as in England. You know that feudal system was ever unknown to this conntry and was a special product of the continent of Europe which travelled to England via Normandy chiefly. What the Home Rule Government should do and would do would be to introduce one uniform system of taxation throughout the country upon the only rational and economically sound basis of individual income. Land as land should no more be taxed apart from its income than jewels worn upon the person or capital not made use of, but kept locked up in a box.

E. N.—Do you think that a law getting rid of the permanent settlement of land tenure would be easily enacted and be popular?

C. V.—I desire to explain. I do not mean a law should be enacted compulsorily to expropriate the landlords, that is, to confiscate their estates. That would be Bolshevism. I mean that this fical reform should be brought about with the consent of the landlords and on adequate compensation to them, very much on the lines and policy of Prussia in the early 19th century, in regard to the enfranchisement of the peasantry and their land.

E. N.—Do you think that the landlords would voluntarily co-operate with Government in bringing about this enfranchisement?

C. V.—I think they would. It may be difficult to induce them to adopt that course now. But in the enthusiasm of the new regime of self Government they will do so. Several of the landed aristocracy in India are descendants of ancient princes and the whole class are fast be-coming more and more enlightened and public spirited. We may expect them freely to co-operate with the new government in their endeavour to improve the condition of the agricultural peasantry and to have a system of taxation on the equitable basis.

REVIEW.

Report on the operations of the Department of Agriculture, Madras Presidency for the year 1924—25.

The season was on the whole not favourable. The rains were either abnormal or in defect. These conditions were reflected in the yields of crops.

Of the eleven crops dealt with in the report, paddy recieves attention first. On the two breeding stations at Coimbatore and Aduthorai, the work of isolation and test of strains were continued while the study of inheritance of characters was restricted to Coimbatore. A new variety known as Coi. No. 3 has been fit to be put out. A number of selections in both the strains have proved satisfactory.

In the districts the work on this crop took three forms—introduction and spread of proved varieties, reduction of seedrate and economic planting, and manuring.

Ryots in the first and fifth circles seem to have shown a greater partiality for better seeds as over ninety-two thousand pounds in the former and seventy-two thousand in the latter were distributed. Other tracts have not evinced the same keenness and when the results are better known, it is hoped they will not lag behind, in profiting by the cultivation of better strains. For one thing it looks as if the ryot in the fifth circle which has only two-fifths of the paddy area that there is in the first, is more keen than his brother. For, we find that area for area the fifth circle has brought more seed than the first circle.

In regard to the second item of demonstration work which taxes the energies of the overworked and generally little appreciated district staff figures show that there was steady progress which should be measured by the character of the season and the number of hands available at seeding or transplanting times and which depends less on the persuasive eloquence of any one individual or a well laid out plan or very clear cut instructions on paper.

The persistent advocacy of green manuring has borne fruit and it is gratifying to note that the practice is well nigh established in most paddy tracts in this Presidency. The more extended use of other manures referred to in the report is also encouraging.

The all-obsorbing but more refractory cotton behaved differently in the four places in which it was grown. At the Coimbatore station where the season was abnormal, the meticulous care taken in the study of the inheritance of characters which is more difficult than is the case with paddy only revealed a bare truth that if this line of work is to be carried out as it should be, a very much larger staff is needed than is employed at present. Figures collected of cotton strains so far, have shown that strain No. 440 was the best, mainly because it has been able to withstand the attack of the stem weevil. Insect attack took a heavy tool of the three crosses and the local herbacium cotton under observation. In the other places, Guntur, Nandyal, Hagari and Koilpatti, the season was satisfactory and fair results were obtained. The experiments with artificial manures made in Nandyal, Hagari and Koilpatti proved a total lack of response by the plant.

The district work on cotton, on the other hand, showed very rapid progress. The quantities of seed sold by the department showed an unmistakable increase. Cambodia alone was sold to the tune of over 300,000 lbs. Hagari 25, Nandyal 14 and Karunganni seeds amongst themselves showed a no less respectable figure, considering the nature of the lands in which they are sown.

The investigations of the problems connected with the so-far known most elusive millets were confined to Coimbatore and chiefly centered round cholam and ragi though a few plant selections were put down in small plots in Nandyal and Hagari and minor tests were made at Hagari and Palur on cholam and ragi respectively.

The control of the Cane-breeding station passed into the hands of the Central Government with effect from April 1925. Varietal and manurial tests made at Anakapalle and Samalkota in the first circle and Palur in the fifth circle were highly encouraging. J. 247 gave the best yield in Palur and at Anakapalli the heaviest doses of cake viz. 15 cwt. of groundnut an acre proved most remunerative while at Palur, no differences were discernible.

The horticultural aspect of the activities of the department was not less in evidence during the year and the Botanical gardens at Ooty attracted a very large number of visitors and it would be useful if the local boards and the municipalities interested themselves in this line of work and encouraged gardening in important places.

The receipts from the fruit gardens at Coonoor, Burliar and Kallar just covered their expenditure and it is satisfactory that Burliar and Coonoor more than repay their expenditure.

E. N.—But can we expect them as a class voluntarily to descend from the position they have been so long occupying and to give up their profits and privileges.

C. V.—I think we can. They won't have to give up their profits which would be merely commuted. They will have to surrender their prestige and privileges. We have an instance, a glorious instance in Japan. The Samurais, the military and ruling class of that country before the Soghunate was got rid of in the revolution of 1868 when the Mikado was restored to his ancient rights, voluntarily retired from their exalted and privileged position and were absorbed among the people. But in the new regime they easily rose to high positions in the service of the country. In the Russo-Japanese war, it was the Samurais that were dominating everywhere, in the army and navy and council of elders. So the landed aristocracy in India have a bright future before them and we may be sure that they would follow the inspiring example set by the Japanese Samurais.

(Extracted from the Hindu, dated 31-10-1925.)

Disturbances during the cold weather period in India December 1900 to March 1921.

By Dr. J. C. Kameswara Rao.

The disturbances during the period may be classified into two groups:—

(1) The late monsoon disturbances and (2) The western disturbances. The former are responsible for the rain in South India while the latter cause rain in North and Central India. But both favour Burma.

The late monsoon disturbances are the continuation of the regular monsoon which is the chief source of rainfall in India and which retreats by the end of September but continues to give rain in the South Indian Peninsula. The disturbances are of two classes:— (a) those that are associated with storms in the Bay of Bengal or the Arabian sea, (b) those that are not. (a) The storms in the bay are generally formed off the Coromandal Coast or near the Bay Islands. The former cross inland and dissipate rain in South Indian Peninsula sometimes they cross over to the Arabian Sea and assume the characters of regular storms. In rare instances, they travel along the Coast to Chittagong, never entering inland. The Bay Island storms bring rain to Burma. Only one instance is on record of a storm formed on the Arabian Sea giving rain on the West Coast.

(b) The disturbances of this class are shallow depressions or areas of low pressure formed in the Bay and rarely in the Arabian Sea, travelling inland. When formed in the south-west of the Bay, South Peninsula gets rain. And the depressions extend northwards into the Deccan or westwards into the Arabian Sea. When they are formed in the south-east, they proceed northwards, the Bay Islands and Burma receive rain. Rarely, depressions form in the Arabian Sea and travel into the Deccan and Central India. In most cases the sea is rough near the coast, when the disturbances pass inland. Widespread rain is sometimes possible in the Peninsula even when there is no regular area of low pressure and when the sea or the coast is not affected. This is probably due to the projection of the equatorial belt of squally weather northwards.

(2) Western disturbances. (a) Single (b) Double. The first causes rain along a single tract, while the other proceeds in two directions north and south and precipitates rain, passing through the central parts of India.

During winter the cold weather western disturbances are the chief source of snow and rainfall in the Hills and the plains of Northern India. They are presumably continuations of depressions of the Mediterranean Sea. They pass over the hilly areas of Turkey, Persia and Baluchistan and when they reach North-west India, they lose the character of ordinary sea-storms. Their advent however towards the North-west frontier of India is heralded by a fall of pressure and increase of temperature in West-Persia. In advance of the disturbances, a heat wave passes, and in its wake a cold wave. Entering India, they travel eastwards and reach Bengal in 2 to 5 days, sometimes extending to North Burma, giving rain all along. A few branch off north, visiting Kashmir with rain and pass over Tibet to Assam in 3 days. The third southern branch brings showers to Central India and Orissa. There are also cases of extensive disturbances which shower rain in North-west and Central India and in some cases the two regions of rainfall are well defined while in others one or the other is more pronounced. [The term "late monsoon disturbances" in the above note refers to conditions during what is popularly called the North-east monsoon period in Madras and the term "Western disturbances" refers to those which bring cold weather rains in North India.—Editor].

(Abstracted from the Journal of the Science Association, Vizianagaram. October 1925.

The work of the several research sections was satisfactory.

Chemistry:—The soil survey of North Malabar was completed.

Experiments were laid out to test the effects of Calcium Cyanamide, phosphates, oilcakes, with fish guano and bone meal. The first showed a definite increase of yield, the second produced a depressing effect and of the several cakes, groundnut cake was found most satisfactory.

The number of routine analyses made was 1441 and was 150 per cent of that recorded in 1923-24. It is a matter for consideration whether it is not advantageous to relieve the Government Agricultural Chemist of routine work and enable him to devote all his time to research work.

In the Lecturing Botanist's section, Herbarium material was as usual sent to Kew for the preparation of the Flora of the Madras Presidency of which the sixth part was published during the year.

The pathological sections of Entomology and Mycology continued to do useful work in the districts besides studying the insect pests and diseases both in the laboratory and in the field.

The Poona Agriculture College Magazine-December 1925.

This issue contains a very sensible explanation as to why propaganda work in India does not progress so well as it should be. Here are the writer's words; "The cultivator must feel that the propagandist is not there merely to teach him how to improve but that he is a man who has the power to redress his grievances, if there are any real grievances. At present the district propagandist knows full well that he has no power over the Irrigation or Forest department. He knows that sanctioning or granting of *Takavi* does not rest with him and that he has only partial influence in the control of the agricultural co-operative societies.

The cultivators, therefore, ignorant as they are, know that they need not mind what the propagandist says and they manage to send back the propagandist with his improvement with a kind word of thanks as they would do a man who goes to preach them lessons on morality. Sometimes we find that agricultural propaganda and agricultural research become some insignificant appendages of an irrigation scheme although an irrigation scheme however big it may

be must be a part of an agricultural scheme. Water is for agriculture, and not agriculture for water. The present position is unnatural and, topsyturvy. If the Board of Agriculture in India is able to put forward definite proposals to bring under the Agricultural Department all the departments dealing with agriculture it would be a great step forward. But unless and until, agricultural co-operation, granting of *Takavi*, irrigation schemes and agricultural schemes of famine work are under the control of the Agricultural Department there is no prospect of having any substantial progress in agriculture."

We endorse every word in this paragraph and are sure that until the agriculturist comes by his own and makes his position strong, he will continue to be a plaything of several departments.

The experience in the Poona Agricultural College which has been affiliated to the University for a long time seems to have necessitated the assignment of a separate place for Agricultural Engineering in the examination. That this should have taken so long for realization is a matter for surprise but it is all to the good seeing that mechanical principles are daily receiving more and more attention in modern agricultural methods.

Mr. H. M. Desai's account of a study during the rainy season of 1924, of the movement of moisture in a medium black soil derived from the Deccan trap varying in depth from 12 to 15 inches, is very interesting. The author says that there was a murum layer below the soil he experimented with, which helped drainage. His observations were confined to the upper 12 inches only. The previous crop in the plot was a garden crop which was irrigated up to the middle of February 1924 and had received a dressing of farm yard manure and safflower cake at 8 tons and 1200 lbs. an acre respectively. The crop under observation was cholam fodder which was sown on 31st July and for which the land had been prepared with ploughing to a depth of 7 inches and pulverized by a disc harrow and to which no manure was applied. Prior to sowing 4'425 inches of rain fell and after, 14.83 inches. On the day of sowing there was 5.28 inches of moisture and on the harvest day 3.77 inches in the upper 12 inches of soil. Plants began to wilt when the moisture content was only 3.50 inches but revived when it rose to 6.95 inches. The moisture content was confined to a range between this figure and 5,72 during the whole of September and an appreciable reduction was perceptible on the 3rd of October and reached a culminating point on the 22nd of that month when the moisture content was 3.77 inches.

Our Future Viceroy. Mr. E. F. L. Wood, the Minister of Agriculture, has been appointed Viceroy of India in succession to Lord Reading. Mr. Wood has been Minister of Agriculture for about a year, having been appointed to that position when the present Government was returned to power in October, 1924. Mr. Wood, who is 43 years of age, has represented the Ripon division of Yorkshire in Parliament for 15 years. During the last two years of the war he was Assistant Secretary to the Ministry of National Service; Parliamentary Under-Secretary for the Colonies in 1921 and 1922; President in the Board of Education in 1923; and Minister of Agriculture during the past year. There has not been a contest in the Ripon division since Mr. Wood was returned at the General Election in December, 1910, by 5894 votes, as against 5024 for his liberal opponent. His successor (for the post of Minister of Agriculture in England) is to be the Right Honourable W. E. Guinness, M. P. for Bury St. Edmunds.

(Scottish Farmer. dated 7th November, 1925).

How to make Candy. Take 5 lbs. of sugar for every one lb. of water. Boil the water in a brass pan or enamelled pot. Then add sugar until all is melted. During this stage the heat must be gentle. When all is dissolved add a ½ tea spoonful of cream of tartar, set the pan over a brisk fire and stir without stopping until the syrup boils. There is still excess of moisture and this must be evaporated. Then withdraw the pan from the fire, place it in a sink with a stream of running water flowing round and beneath it, keep contents motionless and continue cooling until the little finger can be inserted into the mass without scalding. Now begin to stir until it creams. As soon as it thickens and looks like paste before it gets too stiff, pour into suitable boxes and molds. This saves you 200 per cent of cost of sugar.

(Scottish Farmer, October 31, 1925.)

Number of farmers in the Union of South Africa. According to the census of 1921, there are in the Union 163,830 European males of 15 years and over who are engaged in agriculture. This is out of a total of 782, 035 of which 320, 939 are dependents and children forming by far the greatest section of the population. This means for every 1000 European males 410 are children, 210 males of 15 and over engaged in agriculture. When the number of farmers gainfully occupied (that is actually working with a monetary return) is compared with European males similarly occupied in other directions, it is found that for every 1000 males there are as many as 374 farmers.

(Journal of Union of South Africa, October 1925)

Burning stumps. Bore a two inch hole 8 inches deep in the centre of the stump. Fill this hole within two inches of the top with saltpetre and cover with a light sprinkling of dirt and fill with water. Then forget for a season. Dig out the hole and fill with kerosine, set fire to the oil and the stump will burn out to the roots even several feet underground.

(Queensland Agricultural Journal, July 1925.)

Place of Agriculture in Scotland. While agriculture has declined relatively to other industries in the course of the last 60 years, it took the fourth place among the industries of Scotland, being excelled as regards number of persons employed only by "the manufacture in metals," "commerce and finance," and "personal," says Ramsay, Superintendent of Statistics. Scottish farmers were much more concerned with stockraising than with the growing of crops for direct human consumption. Scottish farming was relatively simple in its scope, the crops of wheat, barley, oats, potatoes and turnips accounting for 96 per cent of the arable area.

(Scottish Farmer, 7th November 1925).

The Date Palm. The date palm is the most resistant to extremes of heat and cold of any member of the palm family. As a species it has survived without permanent injury extremes of temperature from four decrees to 125 decrees F.

Provided the maximum temperature of the day is well above the growth zero point, 50°F. growth may continue when the minimum air temperature of the day is several degrees below freezing point. This is due to the presence of a protective layer over the growth centre of the palm which is of a highly non-conducting and insulating nature.

(S. C. Mason in Journal of Agriculture Research, 1st Nov. 1925).

Agriculture in Hawaii during the past 150 years. When Cook visited the island there were 160,000 inhabitants. In 1868 there were hardly 60,000 people. The native Hawaiians have been gradually going backward and they were to-day only 21,000 out of a a total of 255,472. As sugar began to develop, Porto Ricans, Chinese, and Japanese began to flock in, of the last of which there are at present 109,274 Portuguese and Spaniards number 28,000. The Japanese were brought in because of their adaptability to plantation work. They increase faster than others owing to their increased birthrate; but they are clannish, young people drift into cities and

This, I consider, is a very appropriate method of perpetuating the memory of one who while here did so much for his students. Several of his old students have told me he was one of the easiest lecturersto approach when in difficulty and this token of your respect shows your loyalty and your esteem for his work. It is also very commendable for such a small number of students to carry this memorial to a successful conclusion.

A word of thanks is due to the artist. I am sure it is your wish that I should express it. It is a very fine likeness taken, I understand, from a small photo. All who know Mr. Sundararama Ayyar will clearly remember him from the portrait. Once again I express my thanks to you all and in accepting the custody of the photo I can assure you it will have its place of honour in the first place in this room and later on in the main hall of the new Teaching College.

Estate News.

The Officers' Club Day:—The annual Club Day of the Officers' Club was celebrated by the members with great *eclat* on Saturday, the 21st November 1925. The entertainment and the annual dinner came off on the previous evening. This year's entertainment was a great success, a novel method of entertaining by "shadograph" being one of its special features.

On the 21st morning the members of the club assembled on the club premises for sports and a long programme consisting of very interesting items was gone through, both young and old taking part in it. At 6-30 p. m. the President of the club, this year M. R. Ry. T.V. Rajagopalachariar, distributed prizes to the winners in the sports and club-day tournaments. The club premises presented a *gala* appearance and the day was closed by the display of fire-works and illumination which was greatly enjoyed by all.

Death:—We mention here with great sorrow and regret the death of Mr. M. K. Subramania Pillai, a clerk in the Agricultural Engineer's office, which took place on Friday the 13th Novhmber. Mr. Subramania Pillai was one of the oldest residents of the estate and the heart-felt sympathies of the Estate go with his bereaved family.

Students' Corner.

Cricket. In connection with the Ronday Cricket tournament held under the auspices of the local Y. M. C. A., we had an interesting match with the Forest College team on Saturday, the 24th October. The Foresters batted first scoring 91 runs in all. We scored 136 runs thus winning the match by 45 runs.

The Cricket match between the C. U. C. and the Officers' Club which took place on the 22nd November, on the College grounds ended in a win for the former by 60 runs, the visitors scoring 130 and the officers 70.

Hockey. The Hockey match with the Foresters on the 28th October was a one-sided affair. The Foresters easily won the match by 6 goals to 1.

Football. The students have improved their game by playing a series of practice matches with the officers. They should be able to put up a strong team for the coming abraham Memorial Tournament.

Editorial Notes.

The Imperial College of Tropical Agriculture.

Dr. H. MartinLeake, late of Cawnpore and now of Trinidad read a paper on the Imperial College of Tropical Agriculture on December 9th, before the Royal Society of Arts.

The meeting was presided over by the Hon'ble W. Ormsby-Gore, Under-Secretary for the Colonies.

In this paper, after making a brief reference to the functions of the Imperial College and the historical development of the British Empire which has followed the harnessing of power through the steam-engine, its adaptation to transport, the factory system and the growth of industrialism, Dr. Leake observes" that the results of a hundred years of progress are most apparent in *Britain* where not only the individual cities but the entire country is *no longer self-supporting in* the *mere essentials of living.* More than this it is not self-supporting *in the raw materials by the conversion of which into manufactured goods* and by the sale of which, when so converted, *it is enabled to purchase those essentials.*"

"The same conditions are rapidly arising throughout the temperate zone. America has reached a stage when she views an excess population as a danger. As England is the least self-supporting of all countries, as she owns and administers vast tracts of productive lands within the tropics which at present yield but a tithe of their latent capacity, she must develop these areas or lose the position she now holds amogst the nations." How is the development to be effected?. Dr. Leake answers in one word "transport" and says that there are areas and extensive areas in Africa, where the indigenous population is very sparse and where the country is suited for a permanent white population and expropriation is justifiable if anything for the reason that the world has grown too small to justify a small community claiming the right to occupy a large area unless it undertakes development. If expropriation is not possible, economic agriculture for bulk-production with its essential concomitant-capital should be undertaken. The landowner must be financed, he must be educated and trained men are required to organise, to make trials, to keep away pests and diseases, to improve farm stock, to evolve new types of crops and to inculcate sanitary principles amongst the population.

Dr. Leake claims that the supply of such trained men comes from the West Indian College which, by its peculiar position, the advantages Trinidad enjoys and her connexion with England, is best adapted to enable this to be achieved.

In the discussion that ensued interesting observations were made by several speakers.

The Chairman said that for the adequate development of the world, both the plantation policy and the native production policy were necessary, and that the success of the planters must depend upon their personal efficiency and knowledge of the scientific side.

Lieut. Col.—Sir David Prain late of Calcutta remarked that they owed to the West Indies the movement which had led to the establishment of scientific institutions.

Sir Edward Davson regretted that at a time when they did not know what to do with the young men of the present age there should be posts open with decent salaries which the young men of England were not able to fill and for which America supplied the material.

Dr. J. A Voelckar, whose extensive tour in India in 1895 and whose monumental report led to the creation of the agricultural departments in this country in 1904, in moving a vote of thanks very truly observed that all who were interested in scientific agriculture

must have a great desire to see the college prosper and itsgood work continue, for he stated that in England they, after a good deal of struggling and trying one thing after another, hit on something like a scientific agriculture but that there was this difference between the agriculture of England and the agriculture of the West Indies, namely, that the former did not pay whereas in the West Indies, there was at least a prospect of some profitable outcome from it.

Prof. H. E. Armstrong, the celebrated chemist, warned the audience that there was the greatest need at the present. day for education of the right type, bearing in mind the caution that scientifically trained people always learned in the end that they knew less of the subject they were practising the more they got into contact with practical men. He wanted to know why it was that they were not producing men in England at the present time who were fit for anything which was true in all branches and not only in one.

Mr. Aspinall supplemented as an example of what Dr. Armstrong had said, by mentioning that there was a prospect of having temporarily to close the sugar school at Trinidad next session because there could not be found within the British Empire a technologist to carry it on.

If the state of affairs revealed in the remarks referred to above causes anxiety to thinking men in the most advanced country—England—the plight in which India finds herself is much more serious and should set educated men a thinking in devising methods to reconstruct their educational formula for the true development of the agriculture of the country and it will not be a day too soon of the rumoured appointment of the Royal Commission on agriculture becomes an accomplished fact to further the interests of Indian agriculture on its correct setting.

J. S. Gamble—A Pioneer in Forestry.

The death of Mr. Gamble removes from the Botanical world one of the greatest personalities that had laboured hard in the initiation and development of the immense forests of India.

Born in 1847, he joined service in India in 1874, after graduating B. A. at Oxford and a couple of years' training in the French Forest

school at Nancy. Two years' wandering in the bewitching land of rubies and forests-Burma-fitted him for a transfer to India proper. Except for a short interval of 2 years from 1877 to 1879, he spent 7 years in bewildering old Bengal, where he laid the foundations for his future eminence. His travels in the Sunderbans, Dacca, Chittaging, Chota Nagpur, Santhal Purgannas and Orissa enabled him to acquire immense knowledge. In 1882, he came to Madras as a well trained Forest Officer and during his 9 years of service in this Presidency, very intelligently built up the Forest department and for his foresight is due the extension of the valuable Eucalyptus plantations on the Nilgiris. He left Madras in 1890 to take up the enviable and responsible post of Director of the Forest school at Dehra Dun which he filled with credit to himself and with the approbation of Government and the public until he retired in 1899. An energetic man and a sincere worker, he could not live the life of ease. He whole-heartedly plunged himself into the more lasting service of collecting materials in Europe and elsewhere and publishing monumental works on trees. His private collections were considerable. At the moment of death, he was editing the seventh volume of the flora of the Madras Presidency. Just before his demise he very generously made over his private collections to the British nation and they have been added to the Kew Herbarium. Besides he was one of the founders of the "Indian Forester,", of which he was an editor for some years and a zealous contributor frequently.

Professor H. Maxwell Lefroy.

In the deplorable death at a premature age, of Prof. H. M. Lefroy, India has lost one of the poineers in the building up of her agricultural services. Mr. Lefroy was 48 years at the time of his death and fell a victim to science in his pursuit after discovering remedies against insects. A short introduction to the study of Entomology which he gained in the West Indies brought him to India as an Imperial Entomologist in 1902. The locust pest in Bombay afforded the opportunity and through hardwork he immediately came into prominence and began his series of memoirs and books which deal with insects, chief amongst which were, "Indian Insect Pests" and "Indian Insect Life." Towards the end of 1910, he joined the professorial staff of the Imperial College of Science at South Keningston and during intervals his services were offered and gladly utilized by sundry departments of government and public bodies for several

investigations. During the war he worked in Mesopotamia in combating fly-pests and his recommendations were of great economical value. After the war, he returned to his old college and was engaged in teaching and research and by the loss of this remarakable man, economic entomology is certainly the poorer today. We, in India, are particularly indebted to him for the interest he created in the agriculturist in knowing his insect enemies and combating them.

Departmental Notifications.

NOVEMBER. LEAVE ETC.,

Second Circle. Mr. S. Sithapathi Rao, Assistant Demonstrator, extension of leave for one day.

Third Circle. Mr. S. Varadarajulu Nayadu, Assistant Manager, Hagari, leave on average pay for 15 days from or after 25th November 1925.

Mr. B. S. Suryanarayana, Farm Manager, Hagari, leave on average pay for 6 days from 10th November 1925.

Fifth Circle. Mr. R. Subramaniya Ayyar, Assistant Demonstrator Pattukottai, leave on average pay for 20 days from 4th December 1925 with permission to avail himself of the Christmas holidays.

Sixth Circle. Mr. V. Chidambaram Pillai, Demonstrator, leave on average pay for one month and leave on half-average pay for one month in continuation from or after 1st December 1925.

Seventh Circle. Mr. K. Soopi Haji, Assistant Manager, Kasargod, eave on average pay for 10 days from 26th November 1925.

Eighth Circle. Mr. K. G. Sangappa Bhandary, Demonstrator, leave on average pay for three months from 4th January 1926 with permission to prefix Christmas and New Year holidays.

Central Farm. Mr. V. T. Subbayya Mudaliar, Farm Manager, extension of leave "not due" for one month.

Live Stock. Mr. V. Suryanarayana, Farm Manager, extension of leave on average pay for 26 days and on half average pay for 4 days.

DECEMBER, APPOINTMENTS, TRANSFERS, ETC., DURING.

Mr. H. Narahari Rao, Assistant Demonstrator, to Hosur Central Cattle Farm on relief by Mr. T. A. Rangaswami Ayyangar.

Mr. S. Ranganatha Mudaliyar, appointed Supervisor, Central Cattle Farm, Hosur in the scale of Rs, 100-5-175, on probation for 2 years.

Messrs. S. Ramanujam and C. Rajasehara Mudaliyar to be Scientific Assistants 5th Grade the former on probation for 2 years and the latter in a temporary post and posted under Paddy Specialist, Agricultural College.

LEAVE ETC.,

Second Circle, Mr. V. Ratnaji Rao, Demonstrator, leave on average pay for 4 months from or after 15th January 1926,

Mr. K. Gurumurthi, Demonstrator, extension for 8 days with permission to suffix Christmas Holidays

Third Circle. Mr. V. Narasimha Murthi, Assistant Manager, extension of leave without allowances for four months.

Mr. R. Swami Rao, Demonstrator leave on average pay for 15 days from 26th November 1925.

Mr. S. Varadarajulu Nayadu, Assistant Manager, extension by one day.

Mr. M. Viraraghava Rao, Demonstrator, leave on average pay for 6 days with permission to suffix Christmas holidays.

Mr. A. Krishnaswami Ayyar, Demonstrator leave on average pay for 3 weeks with permission to prefix Christmas holidays.

Mr. P. V. Subba Rao, Assistant Manager, leave on average pay for 3 days in continuation of the Christmas holidays.

Fourth Circle. Mr. V. Kumaraswami, assistant demonstrator leave on average pay for 6 days in continuation of the Christmas holidays.

Mr. I. Kurma Rao, Assistant Demonstrator, leave on average pay for 5 days in continuation of the Christmas holidays.

Mr. M. Narayana Ayyar, Demonstrator, leave on average pay for 6 days from 18th December.

Fifth Circle. Mr, L. S. Natesa Ayyar, Demonstrator, leave on average pay for 15 days from 4th December 1925.

Sixth Circle. Mr. L. Sankarakumara Pillai, Demonstrator, leave on average pay for one month and 22 days from 1st December 1925.

Seventh Circle. Mr. V. K. Kunhunni Nambiyar, Demonstrator, leave on average pay for 9 days with permission to avail of the Christmas holidays.

Mr. K. Achyuthan Nayar, Assistant Manager, leave on medical certificate for one and a half months from 26th November 1925.

Mr. K. Krishna Hedge, Assistant Manager, extension for 8 days.

Planting Districts. Mr. K. W. Chakrapani Marar, Farm Manager, leave on average pay for 18 days with permission to avail of the Christmas holidays.

Live Stock. Mr. V. Suryanarayana, Farm Manager, extension of leave without allowances for one month.

Cotton Specialist's Section. Mr. R. Chockalingam Pillai, Assistant, leave on average pay for 3 weeks from 3rd December 1925 with permission to suffix Christmas holidays.

Leave on average pay is granted to the following officers.

Mr. N. S. Purnalingam Pillai, Sub-assistant, for 19 days, Mr. P. Narayana Nayar, Assistant, for 15 days, Mr. V. Ramanatha Ayyar, Assistant, for 11 days, all in continuation of the Christmas holidays.

G. L. B's Section. Mr. M. Singara Royan, Artist, leave on average pay for one month from 16th November 1925.

Mr. K. Cheriyan Jacob, Assistant, leave on average bay for 2 weeks in continuation of the Christmas holidays.

G. M's Section. Leave on average pay with permission to avail Christmas holidays is granted to the following officers, Mr. V. D. Kenchiah, sub assistant, for 9 days from 15th Mr. K. M. Thomas Assistant, for 3 days from 21st, and Mr. D. Marudarajan Assistant for 13 days from 4th January 1926.

G. E's Section. Mr. A. G. Ramaswamiah, Sub-assistant, for one month from or, after 16th January 1926.

Mr. C. J. George, Assistant, leave on average pay for 6 days in continuation of the Christmas holidays.

Superintendent's Section. Mr. G. R. Venkatachalapathi Raju, Assistant Manager, leave on average pay for 3 days from 10th December 1925.

The Ramasastrulu—Munagala Prize 1926.

1. The Prize will be awarded in July 1926.

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 fools-cap pages type-written on one side.

4. Intending competitors should notify the Secretary of the Madras Agricultural Students' Union not later than the 15th May 1926 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 June 1926, with a covering letter showing full name and address of the sender. The author's name should not be shown on the paper which should be entered under a non-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 in July 1926.

7. The Union reserves to itself the right of publishing all or any of the papers.

8. All reterences in the paper to published books, reports, or papers by other workers must be acknowledged.

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

(Sd.) U. VITTAL RAO,
General Secretary.
M. A. S. Union.

The Journal of

THE

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OFFICE-BEARERS FOR 1925—26.

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The resident Vice-President and the ten resident members with the following student members form the Working Committee.

Student-Members (3) K. C. Kumaraswami Chetty, B.Sc I.
U. Achyutha Wariyar, B. Sc. II,
K. Varadachary, B. Sc. III.

Editorial Board (7).—as indicated above.

AUDITORS.—K. Krishnamurti Rao,
T. S. Ramasubrahmanyam.

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