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Editorial.

The Viceroy and Livestock Improvement. The Marquess of Linlithgow, the Agricultural Viceroy has within a short time of his arrival in this country, given a practical demonstration of his interest in the development of agriculture. The Royal Commission had recognised that the prosperity of Indian agriculture was closely linked with the improvement of livestock and their report had dealt with a number of suggestions. The Viceroy, the Chairman of that Commission has shown by personal example what actually might be done by private individuals to implement the recommendations of the Commission. As the Viceroy pointed out "the cow and the working bullock have on their patient backs the whole structure of Indian Agriculture" and the best way of helping the cultivator would be to improve the breed of cattle all over the country.

The problem involved in the improvement of cattle in India is twofold, firstly the improvement of the milk yields of individual cows and secondly the production of animals for speed and working capacity. The importance of milk in the diet of the people has come to be recognised all over the world. If even in countries like England, Germany and Italy which are far ahead of India in livestock improvement work, there is found a necessity for a campaign of "drink more milk" how

much more should it be necessary for India might be easily imagined. It has been stated that except in the Punjab the quantity of milk consumed in the rural areas of the provinces in India is seriously inadequate. There is not enough of the 'protective food' milk in the country and health experts have been pointing out that the physical impairment and defects noticeable in school children are in a large measure due to deficient feeding, and want of sufficient milk in the diet, during infancy and early childhood.

It was generally believed in earlier days that a herd of good milkers can be produced only by crossing the indigenous cows with the imported Ayreshires. The opinion has since been revised and it is now recognised that some of the special breeds indigenous to India like the Sahinwal, the Hariana and the Scindhe can be used just like the Ayreshires. These breeds with proper attention to breeding, feeding and management are found to stand comparison with the best breeds of the Western countries. In our own province the introduction of the Scindhes has been of a definite advantage in improving the milk yields of cows.

The question of breeding dual-purpose cattle in India, which in addition to producing working bullocks would also provide good milch animals, has often formed the subject of discussion amongst the Departmental officers. With the experience gained so far the right policy would appear to be to continue to breed for work in the natural grazing areas where the development of dairy industry on modern lines would not be feasible, and to breed for highest milk yields in special herds and in suitable areas with the development of the dairy industry in view. It does not mean however that the two view points are incompatible. The experience with the Scindhe herd in Madras has been that the cows of the breed are definitely better milkers than the local breeds and the bullocks are quite satisfactory except probably in road work where quickness is an important consideration. That the milk yields in the two purely work breeds of South India, the Kangayam and the Mysore can be improved by systematic breeding has been demonstrated by the work of the Madras and Mysore Agricultural Departments. The most important point in effecting such improvement is the availability of good pedigree bulls. The ordinary cultivator who requires a general utility animal can get his needs met if pedigreed bulls of definite breeds are placed within his reach. The importance of this question has been recognised by the Viceroy who has presented three pedigree bulls for the improvement of cattle in villages in the vicinity of Delhi. If, as the Viceroy hopes, his example is taken up by men of affluence all over the country there is no doubt that considerable improvement in the livestock of the country will be the result.

In Madras in addition to sale of pedigree bulls from Government farms, private enterprise has been encouraged since some years by the offer of a premium towards the maintenance of breeding bulls. The results of this work have probably not become so apparent yet, as the number of such bulls forms only infinitesimal proportion of the requirements. We are glad that men of position in some of the districts Coimbatore, Tanjore, etc. have come forward to copy the excellent example of the Viceroy. We believe however that the difficulty for a great expansion of this work will be the dearth of a suitable number of bulls of known pedigree. The supply from Government Livestock stations would not be enough and the question of suitably subsidising private enterprise in the direction might have to be considered.

Adulteration of Food Stuffs. The Public Health Department have recently circularised all the local bodies about the importance of the supply of pure food stuffs and drawing their attention to the necessity of extending the provisions of the Madras Prevention of Adulteration Act to all local areas where it is not already in force. This act of 1918 has been until recently in force only in a few of the major municipalities but has since been extended to practically every municipality in Madras. The working of the Act has shown that the adulteration of food stuffs is being carried out on a large scale and statistics, it appears, have shown that in some places over sixty percent of the samples purchased for analysis is adulterated.

The circular gives details of the scope of the Act in respect to some articles of food as milk, butter and ghee, oil, coffee, tea, etc. In spite of the recognition of the importance of milk as a source of food, it is the one substance most commonly adulterated. The addition of water to the milk not only robs children and invalids of an essential nourishment but sometimes the water added carries with it germs of serious diseases. Similarly butter and ghee are often adulterated with other fats both animal and vegetable.

Unlike in the case of milk and butter, the adulteration in vegetable oils such as gingelly, groundnut, coconut is not probably serious as the food value is not apparently affected. The question is simply one of adulterating an expensive sort with a cheaper kind and the adulterant may vary from district to district. The necessary sectional help to analyse samples is proposed to be given to local bodies by Government in return for a small animal contribution. We do hope that every local body, as the custodian of the health of the people in its area will see that the Act is brought into force if it has not been done already.

In addition to the adulteration mentioned above, there is quite a different kind of adulteration often practised in case of food grains.

In rice for instance, old rice and long duration rices fetch a better price but it is becoming usual in trade to adulterate the old with fresh rices and the long duration (*samba*) with the early duration (*kars*). Such adulteration is rather difficult to make out. Unlike in the case of milk, butter and ghee it is rather a difficult proposition to fix standards in the case of food grains but we believe the question is bound to assume importance in course of time.

Rao Bahadur T. S. Venkataraman and the Indian Science Congress. We are glad to learn that Rao Bahadur T. S. Venkataraman, Government Sugarcane Expert has been chosen for the honour of presiding over the 24th session of the Congress in January 1937 at Hyderabad. The Sugarcane work in Coimbatore, though initiated by the late Dr. Barber, has been so ably carried out by T. S. Venkataraman during the last 16 years and more that it has become to be well known all over the sugarcane world. If we wish to give instances where the work of the plant breeder has resulted in enormous benefit to the country and to the cultivators, the sugarcane work at Coimbatore will always stand out as the most striking one.

This is the second time since the Congress was founded that a member of the agricultural service has been chosen as the general president of the Congress, Sir A. Howard having been the President of the Congress in 1926. We offer our very hearty congratulations to Rao Bahadur T. S. Venkataraman on the unique honour bestowed on him.

PINE APPLE CULTIVATION IN THE *MODAN* LANDS OF MALABAR.

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Introduction. Though the soil and climatic conditions obtained in Malabar are ideal for the cultivation of pine apples even on the proverbially poor *modan* lands, yet its cultivation was until recently, confined to a few isolated plants of the local wild variety along the fences of house compounds. The introduction of the Kew and the West Indian variety of pine apple a few years back through the Agricultural Departments of Madras and Cochin State, coupled with the demonstration of the profitableness of its cultivation has given a fillip to the growing of this valuable fruit crop on a plantation scale throughout the West Coast. The cultivation of Kew pine was taken up in 1930 as an alternate crop for paddy in the *modan* land area of the Agricultural Research Station, Pattambi. Encouraged by the success of the first plantation on the station, a comprehensive study of the crop in all its bearings is in progress. Some of the useful observations made during the six years of its cultivation on this station are embodied in this article.

Varieties. There appears to be no definite varietal classification in pine apple. The same varieties are often known by different names in different places. A close study of the collection of all the varieties obtainable in India discloses three broad groups: (1) *Kew* or *Giant Kew*, Spineless or smooth Cayenne, Sarawak, Mexican White etc. This is the best of the fancy pine apples. Leaves have ordinarily a few spines on the margin near the tip and base, although they may be occasionally absent. (ii) *Mauritius* is similar to spiny Spanish or Queen, Joldopi, Ghaspani etc. This is much smaller than the smooth Cayenne, the weight of the fruits ranging from 2-4 lb. Plants are small and the leaves coarsely serrated. (iii) *Wild*—This is identical with the Simhachalam, the local, or the Deshi variety.

Propagation. Most of the improved varieties seldom set seed, though some are said to produce seed. Propagation is generally from suckers which are of different kinds. Those that spring from the base of the mother plant below the soil level are generally known as ' ratoons ' and those that arise from the axils of leaves above ground level out of contact with soil, are called suckers. Besides these two classes, there are crowns at the top of the fruit and ' crown slips ' at

the base of the crowns, and ' slips ' originating from the base of the fruit. All the different kinds of propagating material referred to above are common in the case of the indigenous wild varieties. Ratoons, crowns and suckers are the most common in Kew and Mauritius, while slips are absent or almost so. Ratoons in Kew normally appear only after the harvest of the fruit, while in the case of the Mauritius group suckers grow with the mother plant even before the formation of fruits.

All these planting materials do form fruits when propagated, yet the time taken for the formation of fruits varies with the nature of materials planted. Observations on flowering in crops obtained from different types of planting material. have shown that aged suckers form the first fruits twelve months after planting 16 per cent of the plants planted putting forth heads in 16 months, and 82·6 percent at the end of 30 months. In crops raised from crowns and young ratoons (size similar to crowns) however the first fruit was formed only 25 months after planting and 58·1 % and 38·7 % respectively of these plants blossomed at the end of 30 months. It is therefore clear that fairly uniform suckers of sufficient age (4–6 months) that have grown with the mother plant are ideal for planting, the harvests in them commencing 15 months after planting. If the suckers are too aged when planted, small sized fruits are formed prematurely.

Planting. Planting can be done in diverse ways, in trenches (most commonly adopted) or in shallow pits. Until recently, trenches were dug 4′ apart, 1½′ to 2′ deep and suckers planted in them 3′ apart. As the crop is to be left in the same plot for five or six years, trench planting appears to be convenient as it allows periodical earthing up ot the subsequent ratoons. Pine apple plants develop a shallow roof system spreading laterally to about 9 to 12 inches and the roots are closely matted round the stem.

The plots intended for planting are to be thoroughly prepared beforehand and trenches dug about a month prior to planting, to allow the soil so dug out to weather. It will be even advantageous, if the trenches are burnt with rubbish and the surface soil filled up. Experiments are under way to find out the exact manurial requirements of the crop. The most economic method of planting is to open trenches 2′ wide and 4′ apart and plant 2 rows in each trench, the plants spaced 2′ apart. The results of the preliminary experiment on depth of planting conducted with the Mauritius variety, (Table II), point out that shallow planting (1′ and 6″) induces early fruiting as compared to greater depths of 1½′ to 2′. Over 60 per cent. of the plants of the shallow planted group produce fruits between the first 12 to 20 months as compared to about 20 per cent only among the deeply planted group. Rate of planting in different countries varies with the market requirements. Closer planting is adopted if the fruits are intended

for canning purposes. In cases where there is a demand for good sized fruits, wider spacing would seem necessary. 4,000 to 5,000 suckers per acre would be the optimum, though in certain pine apple growing countries even 10,000 are said to be planted per acre.

Planting Season Pine apple plantation is generally started with the onset of the south-west monsoon rains in June–July, though it can be deferred to the north-east monsoon period also, the only point to be borne in mind being the presence of adequate amount of moisture in the soil for the plants to establish. Successful crops have been raised during both the seasons at the Agricultural Research Station, Pattambi. The advantage of planting in the north-east monsoon is that a green manure crop can be grown during the south-west monsoon and suckers of sufficient growth would be available which can produce fruits in the next year after planting. Further, the adoption of both systems of planting would help to widen the period of harvest in a farm.

After-care. Once the crop is established, it requires very little attention excepting early incorporation of manures and clean diggings, weed control being the chief consideration in the latter.

Harvest. The harvest largely depends on the kind of planting material, season of planting, soil, fertilisers etc. Suckers and ratoons of optimum size (4–6 months) produce fruits within 16 to 18 months, crowns take longer time from 24 to 28 months according to the diverse factors affecting the growth of the plant. The frequency of flowering of a first crop planted in June 1933 is set out in Table III (a). It will be seen from the table that the first fruiting commences 12 months after planting and is completed by about 30 months. The interval between the appearance of the head and the maturation of the fruit varies slightly with the season of harvest, (Table IV a). The post-monsoon harvest (October batch) takes about two weeks less than that of the monsoon batch (June—July). This is evidently due to the heavy monsoon rains and a reduced period of sunshine in June—July which probably retards the ripening process. Harvesting should be done at the right stage lest the flavour should be affected. As the fruits ripen, the 'eyes' or 'pips' flatten, the margins round up, and the space between the eyes wilt and shrivel and the bottom and the centre of the eyes turn yellow.

A too luxuriant growth of the crown is a disadvantage. While harvesting, the fruit stalk should be cut with a sharp knife and any amount of care bestowed in handling the fruit from the harvest until it reaches the consumer, is not wasted, since even slight abrasions are likely to cause a rapid decay of the fruits. The pulp of the Kew fruit is very juicy and the fruits display a great tendency to bleed their juices with the slightest knock or wound.

Yield. Yield varies widely and is dependent on several factors. With closer planting and use of better planting material the average yield can go up to even 20 tons per acre. From the figures available so far the following inferences can be drawn.

(i) There are two main periods of fruiting, the first period from April to July and the second or late crop from October to January though a few fruits may also be available during other periods.

(ii) The size of the Kew fruits go up to 18 lb. and more, under adequate manuring and favourable seasonal conditions.

(iii) The average weight of July harvested fruits is the lowest ranging from 2·4 to 5·2 lb. per fruit wherever the October batch gives the highest average ranging from 7·2 to 9·1 lb. (Fig 1). This may be due to the fact that the June—July fruits flower and grow during the hot rainless months of March – April, while the October batch gets the beneficial effects of the south-west monsoon.

(iv) A crop once planted can be kept for 4 to 5 years. Maintaining the crop longer, say 6 or more years, very much reduces the size of the fruits. The average weight of a fruit goes down from 9 to 3·7 lb. as the plantation gets older.

Economics. Pine apple cultivation in the *modan* lands of Malabar has been proved to be a practical and profitable proposition from the figures given in Table V. Usually such types of lands are of a non-remunerative type. Since the soils are very poor, cultivation is done only once in 4 or 5 years. The net return from an area for a three-year period under the normal cropping practised on such soils at the Agricultural Research Station, Pattambi, would be about Rs. 48—8—0 or Rs. 16 per year. The same area if devoted to pine apple cultivation would give in the corresponding period a profit of Rs. 334—12—0 per acre or Rs. 112 per year, (Table VI).

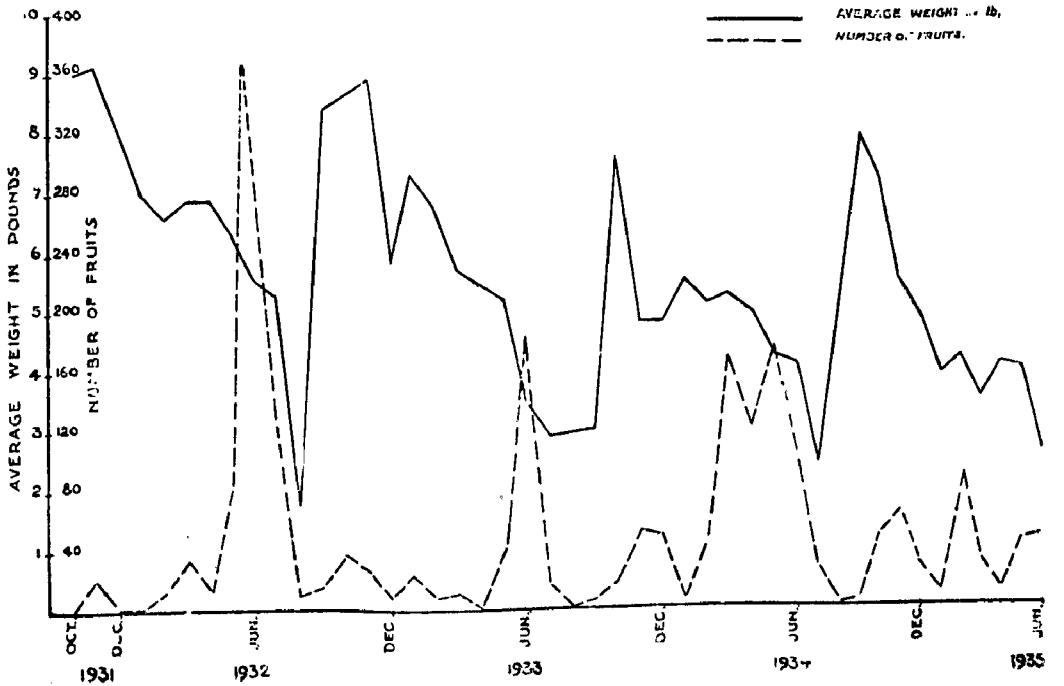
Pests and Diseases. (a) Jackals, certain canine species and rodents are the only major enemies of this crop noted so far in Malabar. If proper protection is not provided, 25 to 40 % of the fruits are likely to be damaged by such animals. A bamboo basket has been improvised to encase each plant just a fortnight before the ripening of the fruit and this has to a very considerable extent diminished the losses. The cost of the basket is only an anna, which if properly preserved may last for two to three seasons.

So far no fungus disease has been noted on the crop. A certain amount of rotting of the central core in newly planted plants is sometimes observed, which in all probability might be due to mechanical injury.

(b) *Sun burn.* When the fruits are directly exposed to sun's rays, injury of a more or less severe type takes place on account of the

GRAPH SHOWING THE AVERAGE WEIGHT OF A KEW FRUIT AND THE TOTAL NUMBER OF KEW FRUITS HARVESTED DURING DIFFERENT MONTHS FROM 1931-1935

A. R. S. PATTAMBI.



scalding and destruction of the internal tissue. Tying up the top whorls of leaves on the fruits mitigates this evil to a large extent.

(c) When the planting material is too small sand or soil sometimes fills up the heart of the newly planted suckers and causes decay. Selecting fairly good suckers of optimum size is bound to lessen this trouble to a great extent.

(d) *Malformations.* It occasionally happens that in the Kew varieties the inflorescence completely proliferates and no fruits are formed. Whether cause of such proliferation is physiological or pathological has to be ascertained. It is surmised that it may be a provision made by nature for propagating its own species by producing numerous plantlets as the Kew variety has been found to be usually shy in producing suckers.

Table I.

Frequency of flowering and harvest of Kew Ratoons, young and old and crowns.

Planted on 14—7—1933.

No. planted.

Young	...	62
Old	...	172
Crowns	...	31

Year	Old ratoons		Young ratoons		Crowns	
	No. flowered	No. harvested	No. flowered	No. harvested	No. flowered	No. harvested
Total for 1934	28	21	—	—	—	—
% ,,	16·3	12·2				
Total for 1935	114	77	24	11	18	8
% ,,	82·6	44·8	38·7	17·7	58·0	25·8

Table II.

Table showing the effect of depth of planting on the flowering and harvest of Mauritius pine apple.

Planted on 14—7—1933. No. of suckers planted—27.

Year	Six inches		One foot		One foot six inches		Two feet	
	Flowd.	Harvd.	Flowd.	Harvd.	Flowd.	Harvd.	Flowd.	Harvd.
% for 1934	66·7	51·9	6·3	51·9	22·2	18·5	18·5	18·5
% for 1935	100·0	100·0	100·0	100·0	100·0	100·0	100·0	92·6

Table III (a).

Periodicity of flowering in kew suckers of fairly uniform size.

Planted on 17—6—33. Area 14·22 cents. No. of suckers—489.

Years	Jan.	Feb.	Mar.	Ap.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total	% flowd.
1934	—	—	—	—	1	—	26	81	20	80	22	—	230	47%
1935	49	14	4	—	3	5	1	93	12	23	36	10	250	98·2%
1936	9	—	—	—	—	—	—	—	—	—	—	—	—	100%

Table III (b).

Flowering of kew suckers when planted in October.

Planted 23 & 24—10—1934. Total suckers planted—653.

	January.	February.
1936	185	15
%	28·6	30·6

Table IV (a).

Table showing the period taken for ripening of kew apples from the appearance of the 'head'.

Range in days.	May—July.	October—November.	Dec.—January.
95—105	—	9	6
106—115	10	38	17
116—125	35	4	7
126—135	9	—	4
Total ...	54	51	34

Table IV (b).

Periodicity of harvest of 'kew fruits .

Planted on 17—6—33. 489 suckers planted.

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total	%
1934	—	—	—	—	—	—	—	—	1	19	70	35	125	25·6
1935	19	82	7	1	37	25	3	1	1	2	38	54	270	80·8
1936	14	14	38	—	—	—	—	—	—	—	—	—	—	—

Table V.

Economics of the cost of cultivation in an area planted in 1933.

Area : 14·22 cents. No. planted per acre : 3425
No. of suckers planted : 489 Planted on 16 & 17—6—1933

Expenditure.	*1933—35.*	*1935—36.*
Preparatory cultivation ...	11—6—3	
Suckers and planting ...	22—1—6	
Manures and manuring ...	8-14—6	3—1—6
After cultivation ...	10—9—9	2—8—0
Proportionate cost for baskets ...	—	3-14—6
Proportionate expenses for putting wire fencing	6—0—0	6—0—0
	59—0—0	15—8—0

	Receipts.	
1933—35.	197 fruits weighing 1235½ lb. at 9 pies per lb.	57—14—8
1933—35.	Suckers	— —
1935—36.	205 fruits weighing 1084 lb.	50—13—0
1935—36.	512 suckers at Rs. 4 per 100	20— 8—0
		129— 3—8
Total Receipts		129— 3—8
Total Expenditure		74— 8—0
		54—11—8
* Profit per acre		383—4—0

* 59 fruits were damaged by rats, bandicoots, toddy cats etc., and this would have fetched an additional profit of Rs. 16 per plot and Rs. 112 per acre.

Table VI.

Economics of the modan land cultivation as ordinarily practised, rotated at the Agricultural Research Station, Pattambi.

(Estimated Cost).

Year.	Rotation adopted.	Cost of cultivation.	Value of produce.	Net profit.
1933-34	Modan Paddy	16—8—0	27—0—0	10—8—0
,,	Gingelly	15—4—0	25—0—0	9-12—0
1934-35	Samai	8—0—0	13—0—0	5—0—0
,,	Horsegram	4—0—0	7—0—0	3—0—0
1935-36	Modan paddy	16—8—0	27—0—0	10—8—0
,,	Gingelly	15—4—0	25—0 —0	9-12—0
	Total.	75—8—0	124—0—0	48—8—0

Profit when pine apple is grown	...	Rs.	383—4—0
Profit when other crops are grown	...	,,	48—8—0
Extra profit when pine apple is grown		,,	334-12—0

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ON SOME CONTROL EXPERIMENTS ON THE DECCAN GRASSHOPPER (*Colemania sphenarioides*, B).

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This paper deals with certain experiments carried out by the author in 1930 and 1931 in Adoni, Bellary. It is considered, a history of the pest for the past thirty years and a resume of the work done till now, will be a useful and fitting introduction for the problem dealt with in this paper and hence a brief introduction has been added.

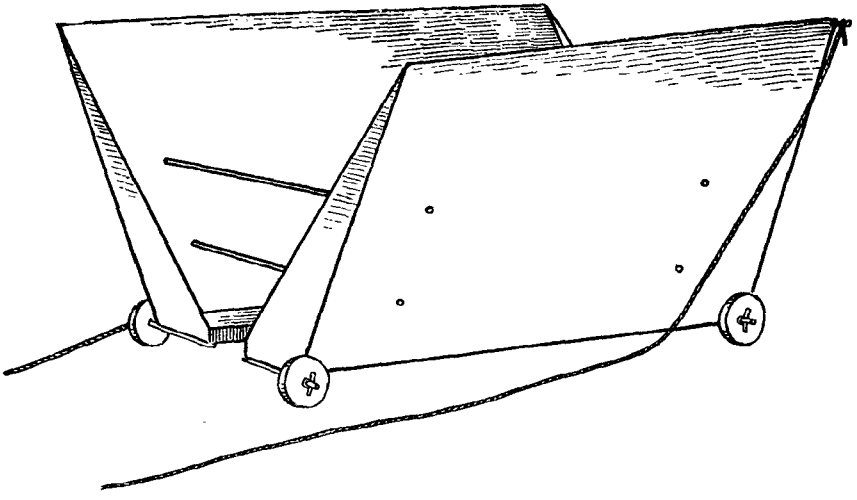
As for the systematic position of the grasshopper, it comes under the tribe *Pyrgomorphini* and is placed very near *Orthacris* which it very closely resembles. The pest would appear to be indigenous to Bombay Presidency, being chiefly confined to the Belgaum, Bijapur and Dharwar tracts; from thence they would appear to have spread south into Mysore, Hyderabad and Madras territories.

The zone of distribution for Madras would seem to centre round the Tungabhadra valley in Bellary and Kurnool districts. Adoni, Kudligi, Harpanahalli, Hadagalli, Siruguppa taluks of Bellary and Markapur, Kurnool, Pattikonda taluks of Kurnool, are the chief centres wherein the pest has been noted in a severe form, off and on. The hopper was first noted in a pest form in 1908; for nine years thereafter it proved very destructive. Subsequently, from 1917 the incidence became negligible. After an interval of nearly eight years the pest was again found to be on the increase from 1925 and continued to be so till 1931, when a slight subsidence was noted. Thus paucity and abundance would appear to move rhythmically in cycles of seven years.

The grasshopper is mainly a pest on dry cereals and attacks them in all stages from emergence of leaves up to the setting of grains. Damage to crop varies with the nature of the incidence, the loss being total when infestation is severe. More information especially on the life history details, mode of infestation of new tracts, etc., is given by Coleman (1911) in the Mysore Agricultural Departmental Bulletin No. 2 (Entomology) and by Ramachandra Rao in the Madras Agricultural Departmental leaflet No. 39.

Control measures that were tried are dealt with in detail. Bagging was found very efficient for Mysore conditions. But, for conditions obtaining at Adoni, where very stiff and severe winds are the feature in August and September, it is not a feasible proposition to try bagging. Nevertheless, trials were made and for the reasons mentioned below they never proved a success. Firstly, it is a strenuous and tiring job even for three men to go on the run with the bag ballooning against the wind. Secondly, it has been found by actual trials that nymphs were not in a mood to be dislodged easily when high winds prevailed with the result the catches were seldom large for the population of nymphs and for the time and labour spent on the operation. Therefore, bagging as a control measure was given up and other methods were put to test. The results obtained at these tests are embodied in this short paper.

Trials. (a) *Guntaka hoeing for destruction of eggmasses in the field.* It was suggested that the then newly designed H. M. Guntaka (Hilson and Munro) might prove an efficacious weapon for destroying the eggmasses in the soils of the field. Therefore, trials were undertaken with this implement. A field that was infested rather badly, the previous season, with hopper adults and with a high density of eggmasses, was selected for trials at Adoni in 1930; the actual operation was done in January 1930 under the supervision of Mr. C. V. Sundaram, then, in charge of the work. The object of this trial was to cut out the eggmasses laid in the soil and expose them to the weather and the dessicating action of the sun which is exceptionally severe from March



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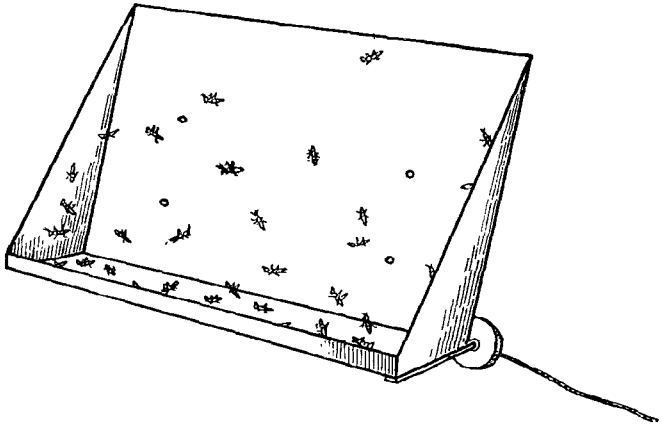

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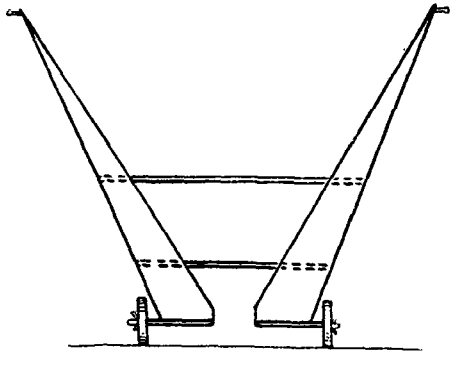

(3)

(1) Hopper dozer—Full view.
(2) Hopper dozer—Inside view showing catches.
(3) Hopper dozer—Front view.

to May. Subsequently, the ryot carried out the preliminary cultivation operations with country plough and *Pedda guntaka* in July. The field was sown to '*Korra*' *Setaria* (Tenai) in the last week of July. The hopper nymphs did not hatch out till the beginning of the 2nd week of August. The adjacent field was taken as the control. The difference in density of hopper nymphs in the unworked and worked fields should be the basis on which to judge the efficacy of '*Guntaka* hoeing' on the destruction of eggmasses. For this, a small tin box with a clearance in the centre was run through the lines on 16th August, a week after emergence and the nymphs that hopped out on either side were caught by the side walls, the inner side of which was painted with a resinous adhesive. The nymphs so caught were immediately counted for each row operated; similarly for the control rows. Discarding the few that escaped from the treated and untreated areas, the counts gave an average population of 27 nymphs for the treated and 15 for the untreated rows. Judged on the basis of these catches one should feel that '*Guntaka* working' had not produced the results anticipated of it and had not given encouraging results to deserve further trials.

(b) *Trapping with hopper dozers.* Therefore, the feasibility of trapping the young nymphs was next considered. Since the crops in Bellary are sown in drills, the idea of running a well designed hopper dozer along the lines seemed promising. The idea was not new. Mr. Ramachandra Rao had tried an ingenious method in 1911 to entrap the nymphs by running several flat boards joined together and painted with tar to serve as an adhesive. But the thing proved cumbersome and was not pursued further.

A hopper trap to operate for a single line, at a time, was designed by Mr. Charley, the Research Engineer, on the basis of suggestions given to him by the author. It was got up in time for trials in 1931 against the hopper nymphs. The hopper cart weighed about 80 lbs. and was mounted on two iron wheels; it was to be pushed from behind by a single person with the aid of the arms. The crop was to be passed through the central clearance and cross bars were provided to shake and jerk the hoppers into the bottom pans which were painted with the resinous adhesive. But, unfortunately, the dead weight of the cart proved too heavy for a single man to operate, especially in these soils where considerable resistance was encountered owing to wheels sinking into the soil. So, bullock power was substituted instead and tried in different villages on 13th August 1931. For 20 lines of *Korra* crop 6 to 9 inches high, 450 nymphs were secured but the difficulty of manoeuvring the trap with bullock power was great as the trap wobbled and sometimes ran over the crop.

Since the principle was acceptable to the ryots and showed some promise, a light tin cart model was made, on the same principle,

weighing not more than 20 lbs.; it was mounted on four wheels, two in front and two behind. The diagrammatic sketch of the model is separately shown so that one could get an idea of the trap. It was to be run through the rows of crops which were allowed to pass through the central clearance provided at the bottom of the trap. The two bottom pans of 5·5″ wide on either side of the clearance into which the nymphs usually hopped, were painted with the resinous adhesive. This served to fix them and keep them from straying out. Similarly, the side walls were painted. The trap measured 46″ along its length and 36″ in height from the surface level. Just as in the previous model, cross bars were provided to jerk the hoppers and to give firmness to the side walls and prevent them from sagging.

Working of the trap. The trap was to be dragged in from front by a couple of boys, by holding the ropes fastened to the rear. The boys were to pass along the adjacent lines of 'Korra', to avoid disturbing the hopper nymphs in the lines that were to be worked. As soon as the bottom pans and the sides got filled up, the resin was scraped off with the nymphs and a second coating was given. The adhesive was kept ready in a mud pot kept warm by paddy husk fire in a mud basin.

Trials. Extensive trials were given in the field of one Narasappa in August 1931. In the initial trials 198 nymphs were secured for 15 lines of 200 yards length despite the fact that a good many escaped slowly owing to the adhesive losing its adhesiveness on account of high winds. But this defect was subsequently corrected by addition of more of oil in the preparation of the adhesive to counterbalance evaporation and drying. At subsequent trials 238 nymphs were secured for 14 lines, 355 for another 14 lines. But when the winds abated a little, the catches mounted upto 709 in the morning and 635 in the evening for 20 lines. The average per line increased from 13 to 33·5 when the winds abated. This only indicates how winds tend to hamper the control operations of this kind. Further trappings gave 712, 718, 698 nymphs for 20 lines each, on different dates. The lines once operated were never again touched. In all 4344 nymphs were captured, of which 3473 represented catches for 100 lines of 1·5 acres.

Estimation of the residuals and the incidence of hopper nymphs per acre. Unless it was exactly known how many were actually left behind, it will not be possible to arrive at a correct estimate of the incidence of the pest. Moreover, without an idea of the residual population it will not be possible to judge whether a control method was promising or not. If the residual out-numbered the catches it would speak very poorly of the method. Hence the residual population was determined separately for each row. For this the trap was run forward on the first run; the nymphs so caught were immediately counted; the trap was reversed on the 2nd run and the number caught in the reverse run would give the residual population for that

line. In the first run 30 nymphs were secured; in the reverse run 12 more were secured; of these, a few might represent the immigrants from the adjacent line to which the persons have to keep close when dragging the trap in front. Several such trials indicated that roughly 75% population was easily secured in the first run itself.

A rough estimate of the severity of infection is certainly possible by multiplying the average population per line by the total lines in the field. On this basis, Narasappa's field of 4 acres containing 285 lines would give approximately a population of 10,000 nymphs. An occurrence of 2500 nymphs per acre, then, should be considered as a case of severe infestation, knowing full well how badly the crop was attacked.

Economics of working the trap. From a series of trials, it was computed that the trap could easily cover 20 lines per hour, at this rate a four acre field of 285 lines could be covered in two days. A ryot usually works from 6 a. m. to 1 p. m. in the Ceded Districts and does not work in the afternoons. He puts in 7 hours at a stretch and on this basis it should be possible to finish the 4 acre plot in two days.

Labour charges come to about a rupee for two days for two men but no ryot actually incurs this expenditure as his own family takes to the work.

The cost of adhesive comes to about 6 annas per acre as per the details—2 annas for the groundnut oil; 3 annas for resin; $\frac{1}{2}$ anna for fire and $\frac{1}{2}$ anna for mud pot. The adhesive was prepared in the ratio of 1:2 of oil and resin, by weight. The expenditure on the trap todate including all improvements comes to Rs. 5/— including the cost of a painter's brush; the trap could be used over and over again for a minimum of four seasons as not much is lost in the wear and tear.

Future of trapping as a method in the control of nymphs in the Ceded Districts. There is little doubt that trapping of this kind may have good future for the following reasons. It obviates the killing since the nymphs on the adhesive die a slow death and the general prejudice of the ryots against killing is overcome. Being light, handy and efficient, it is easy to operate. Boys can manage it and adults may attend to hardier work. No subsequent trapping is necessary as a high percentage of population is secured in the first run itself. The trap is durable and will serve for a minimum of four seasons for a small holder. Well organised demonstrations may be necessary for the ryot to get to know the utility of this method.

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AGRICULTURE IN ANCIENT GREECE

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What we know of ancient Greece relates more to its political institutions, its arts, its architecture, its literature, its history, its philosophy, etc., but very little about its agriculture. This is because the ideas concerning the rural life in ancient Greece are dispersed in a few fragments of its literature, particularly in its pastorals. About eight decades ago, Mr. St. John's *History of the Manners and Customs of Ancient Greece* was published in which the author had collected all that could possibly be known on the subject. Based on this work, a lengthy account of the "Rural Life in Greece" was given in No. 34 of "Chambers's Repository" published in the fifties of the last century. The material for the following account of agriculture in ancient Greece has been taken from the latter publication.

In olden days the mountains and hills of Greece were clothed richly with wood and as a result of this there were numerous streams and brooks by which the land became fertile. The fields were generally separated from each other by hedgerows; from farm to farm there were small pathways with rustic stiles and seats at intervals to assist women of the different farms to visit each other and between the several estates ran small roads or green lanes generally shaded with trees.

In the earlier ages, no doubt, varieties of cultivation and the animals bred were few but as civilisation advanced, "the arts of the husbandmen were multiplied and refined, new breeds of animals were introduced; the economy of the farmyard became more complicated; the introduction of one new fruit followed that of another; gardens were constructed, partly for profit, partly for pleasure; and all the beautiful varieties of trees, shrubs and flowers, known to the climate, were planted for use or luxury".

It was common to erect farmhouses in the midst of plantations of silver-fir, which in winter gave protection from cold, and in summer attracted breeze. Towards the centre of the grove, with a spacious court in front, and a garden behind, stood the house, sometimes with flat and sometimes with pointed roof. There were numerous outhouses, such as the stables, sheds for cattle, hen-roosts, pigsties, etc. which extended round the court, while the back-front opened upon the garden or the orchard. Great care was taken in selecting the site of the farmhouse. The houses were generally large and roomy.

The breeding of birds was considered very important; geese, ducks, pigeons, peacocks, pheasants, partridges and the common

barnyard fowl were bred on most farms besides goats, pigs and dogs. Sheep and cattle commanded a large share of attention. Horses were not numerous in Greece and they were not employed in agriculture but were used chiefly for military purposes, for religious pomps and processions and for chariot races at Olympia. The mule and the ass were much used. The oxen were useful in ploughing, treading out the corn, drawing manure to the fields and bringing the produce home, although mules were also sometimes used at the cart and the plough. The milch-cows were generally fed on cytisus and clover. The milking time was usually in the morning, immediately after the peep of dawn and in the evening, just when the twilight closed; though occasionally cows, sheep and goats were milked several times in the course of a day. Butter was little used but of cheese many varieties were manufactured. The milkwomen, churners, and cheese makers were adepts in all the arts of their profession. To detect the presence of water in the milk they used to dip a pointed reed into the milk, and if the milk ran off easily, it had been diluted, or if a few drops of the milk were poured on thumb-nail, that which was pure would remain there while the adulterated milk would speedily make its escape.

Bee-keeping was one of the important employments of the farmers. Owing to the climate and soil, bees throve better and produced more honey than in many other parts of the world. In the Homeric age bees had not been accomodated with hives but were forced to search for their own dwellings in hollow rocks. In course of time, many persons devoted even their whole lives to studying the natural history of the bee, "living alone in sequestered spots, where, at their ease, they might watch its habits, observe it busy through 'the shining hours' enjoy the delicious taste of its honey, and breathe with this the rich fragrance of the flowers on which it loves to feed".

The bee-keeper who tended the insect for profit devoted great care and attention. "In a sheltered spot, generally on the slope of hill, covered by thyme, the hives were arranged in the midst of flowers, delicate plants and odoriferous shrubs; and if nature had not scattered there the necessary kinds, the gardener planted and cultivated them. Experience soon taught them what blossoms yielded the best honey and were most agreeable to the bees. These, in Attica, were supposed to be the wild pear tree, the bean, the clover, a pale coloured vetch, the Syrian myrtle, wild poppy, wild thyme, and almond tree. To these may be added the rose, balm-gentle, the galingale or odoriferous rush, the basil-royal, and above all the cytisus, which begins to flower at the vernal equinox and blooms until the end of September. Of all the plants, however, affected by the bees, none is so grateful as is the thyme, which, in Attica and Messinia, so extensively abounds as to perfume the whole atmoshere. × × × × Great care was taken to conduct near the assemblage of hives small runnels of the purest

water, not exceeding two or three inches in depth, with shells and pebbles just rising dry above the surface, whereon the bees might alight to drink. When, of necessity, the apiary was situated in the margin of a large stream or lake, other contrivances were resorted to for the convenience and safety of the airy labourers. × × × × The hives were of various kinds, some made of the supple bark of trees, others of hollow trunks; while there was one sort constructed with *Lapis secularis* which being almost as transparent as glass, enabled the curious owner to contemplate the movement and work of the bees".

The cultivation of flowers and shrubs of delicate foliage was widely practised because these were being constantly required for forming garlands, crowns and wreaths made use of by the Greeks on innumerable occasions. "When they offered sacrifice to the Gods, when they were present at the Olympian, Isthmian, or Nemean games, when they went to the theatre, when they attended at the banquets or when they visited their mistresses their heads were habitually crowned with flowers. These also were piled on altars and the doors of temples; and frequently the whole front of the houses of the women they loved appeared like one blaze of garlands. For this reason the cultivation of flowers was as much attended to in most parts of Greece as that of fruit trees or the vegetables most commonly in use". "They were worn at some of the ceremonies attending the birth of infants, many of the games of youth, during courtship, marriages, and at every religious festival and private banquet or public procession. And lastly, the corpse, before being placed in the coffin, was crowned with a chaplet; garlands and ever-lastings were laid on the tomb, mourners, when they came to visit the grave, wore wreaths of flowers upon their brows. This taste is still prevalent in Greece; and on May-day every door in Athens is decorated with a garland".

As will be seen from the following extracts several flower plants and herbs were known to the Greeks and were cultivated.

"Copses of *Agnus castus*, roses myrtles, and other sweet-smelling shrubs, intermingled with a pomegranate tree in the midst, were usually planted on elevated spots, that being thus exposed to the winds, they might the more freely diffuse their fragrance. The spaces between these masses of foliage, were sometimes filled with roses and lilies, and violets and golden crocuses, and sometimes presented a breadth of smooth close green-sward, sprinkled with flowers, such as the violet, the blue veronica, the pink and the pale primroses, the golden mother-wort, the cowslip, the daisy, the pimpernel and the periwinkle".

"Bowers and arbours were often formed entirely of myrtles. Occasionally these were intertwisted with the honeysuckle, the eglantine, the jasmine, and the broad-leaved philyrea, whose yellow tufts

mingling with jasmine and myrtle constituted one of the most graceful adornments of the Greek gardens. Thickets composed of other beautiful shrubs, lay between the bowers and the copses, the flower beds, and the turfy slopes, with those loftier piles of verdure consisting of the pine-tress, the smilax, the cedar, the carob, the maple, the ash, the elm-tree, the platane, and the ever-green oak, which here and there waved their stately foliage over the ground ".

" A netting of wild thyme, tufted with sweet mint and marjoram which, when crushed by the foot, yielded the most delicious fragrance was spread over the stony hillocks; while here and there, singly or in beds, grew a multitude of other herbs and flowers, some prized for their medicinal virtues, others for their beautiful colour, others for their delicate odours—as the geranium, the spike-lavender, the rosemary, with its white and purple flowers, the basil, the flower-gentle, the hyssop, the white privet, the cytisus, the sweet-marjoram, the rose-campion or columbine, the yellow amaryllis and the celandine".

Besides roses, lotus and lily, the pansy, the purple cyperos, the iris, the water-mint, the hyacinth, the narcissus, the willow-herb, the blue speedwell, the marsh marigold, or brave bassinet and the jacinths and early daffodil also flowered profusely.

There were also some other plants of minor importance. A very considerable trade was carried on in herbs and plants which were exported to all the countries lying on the shores of the Mediterranean.

The gathering, drying and preserving of medicinal herbs and roots which required much study and toil, were done by professional herbalists who travelled, at the proper seasons of the year, through mountainous provinces etc.

The orchard, which lay beyond the garden, was usually surrounded by close hedges of black and white thorn, and sometimes by rows of olives. The trees were numerous, the following being the more important:—the apple, the pear, the cherry, the plum, the quince, the apricot, the peach, the nectarine, the walnut, the chestnut, the filbert, the hazel-nut, the medlar, the mulberry, the fig-white, purple and red, the pomegranate, the orange, the citron and the lime, the date-palm, the pistachio, the almond and the cornel tree.

Many vegetables were grown—the radishes, turnips, asparagus, broccoli, garlic, peas, beans, gourds, cucumbers, and lentils being the more important.

The fruits, vegetables and flowers were taken to the market for sale. The space allotted for the sale of agricultural produce was in most cities very considerable. There were fruit booths, green-grocers' stalls, stands for flower-sellers, etc.

The cultivation of vine was one of the ordinary occupations of life among the Greek farmers. They knew what soils would produce

the best vine and enable them to make the most money. In this branch of industry they displayed great intelligence and skill.

After selecting the soil it was enclosed with a hedge sufficiently thick and strong to keep out goats and foxes which loved to prey upon the vine. The next thing was to grub up the hazel-bush and the oleaster, after which the ground was trenched and thrown into lofty ridges, which by the operation of the summer sun and the rains and winds and the frosts of winter, were rendered mellow and genial. Occasionally a species of manure of pounded acorns, lentils and other vegetable substances was dug in, for the purpose of giving the soil that warmth and fertility required to nourish the vine. After the ground remained in this state for a whole year, its surface was levelled and a series of shallow furrows traced for the slips to be planted.

There were three kinds of vine, *first*, that which was supported on short props, *second*, the vine which climbed over trees, and *third*, that which being planted in stony places, on mounds or on the steep sides of hills, was suffered to spread over the ground and to ripen the grapes in that situation.

Stout reeds were used as props and when reeds were not obtainable ash props were substituted, having been first carefully barked and smeared at top with pitch, to prevent their being decayed by rain. The vines in rich lands were allowed to attain a height of six feet while in the case of lighter soils and on the slopes of hills they were allowed to reach only three feet.

The trees commonly used for training the vines were the black poplar, the ash, the maple, the elm, and probably also platane. These were planted in straight lines and rising behind each other, terrace above terrace, at intervals of 23 or 24 feet. The face of the trees along which the vine climbed was cut down smooth like a wall against which the purple or golden clusters hung thickly suspended; while the young branches crept along the boughs or over bridges of reeds, uniting tree with tree. The lower boughs of the trees were, however, carefully lopped off. Winding of the vine round the trunk of the tree was carefully avoided by inserting wooden wedges here and there between the stem and the tree. The space between the trees was ploughed and sown with beans, gourds, cucumbers and lentils. Sometimes the ground was used for growing pomegranate, olive, quince and apple.

While the grapes were growing they were shaded by a thick crop of leaves; but as soon as they began to turn colour the leaves, which of themselves then shrivelled, were carefully stripped off, to allow the full force of the sun's rays to pour upon the fruit and hasten the ripening. Such clusters that ripened before others were cut off.

The season for vintage operations was determined by law and only when the magistrate declared that the season of vintage was come,

the operations were started. The vintage season was one of boisterous and frolicsome mirth to those engaged in the several operations.

Immediately after the vintage, the country-people turned their attention to the gathering of the olives and the making of oil, which constituted an important branch of their husbandry. Both the oil and the olives themselves formed important articles of trade with many other fruits, such as figs, quinces, pears, apples, grapes and currants, almonds and walnuts.

The cultivation of field crops was also an important feature of ancient Greek agriculture. They adapted the grain to the soil. They chose rich plains for wheat, and cropped them at intervals with vegetables. Barley was sown where the ground was "oily and soft" while "thin and hungry" tracts they gave up to lentils, vetches, lupines and other pulses, which were cultivated on a large scale. Beans and peas were supposed to thrive best on "level and fat lands".

In light soils, they had recourse to a sort of spade-husbandry. Where ploughing was resorted to, they usually repeated the process thrice; and the third time the ploughman cast the grain into the furrow as he advanced, while a lad, following behind, broke the clods and covered the seed, to secure it against the birds.

In very hot weather, they often laboured all night, thus protecting themselves and the oxen against the sun, as well as profiting by the dew, which rendered the soil more moist and pliable. This practice might well be tried in our country. In choosing the ploughman, they carefully fixed upon one of great vigour and stature that he might be able to wield the implement easily; nor would they have him under forty years of age lest he should be unsteady in the performance of his duties. This is a sound advice which might be adopted by those who engage hired labour for agriculture.

The principal sowing season was in autumn; for as soon as the equinotical rains had moistened the earth, the sower went forth to sow, and committed to the ground the hopes of the future year. The time for wheat was September. In sowing they took care to distribute the seed equally over the field. They often made use of a sowing sieve made of wolf's hide, pierced with thirty holes, as large as the tip of fingers. To protect the seed from birds they set up scarecrows of various kinds, and had recourse to charms and enchantments.

The crops were generally weeded twice and the weeding was carefully done. When the harvest was to commence labourers collected in the market-place where they stood arranged in bands till persons hired them. They then, with sharp sickles and lightly clad, proceeded to the fields, where, dividing into two parties they commenced reaping at either end of an expanse of standing corn, each party striving which should reach the middle first. Women, in many

parts of Greece, joined in these labours. The produce of the harvest was never considered safe until it had been lodged behind strong walls in the farmyard. The implements used were the sickle and the scythe ; the former for wheat and the latter for barley and inferior grains.

As a long succession of fine weather could generally be counted on, thrashing-floors were constructed in the open fields, where the grain was separated from the straw by the oxen. In winnowing, they trusted, on windy days, entirely to the breeze ; but in calm weather, they made use of a machine, which, though turned by hand, would seem to have possessed great power, as we may infer from its having been used in cleansing vetches and beans. To save the chaff which was too valuable to be lost, pits were sunk all round the thrashing-floor, which, for the passage of men and cattle would appear to have been covered, except in the direction of the wind.

For immediate use the grain was sufficiently cleaned by one winnowing; but when designed to be laid up in granaries, it underwent a second cleaning process. " In the construction of granaries, they displayed great skill, and were successful in proportion ; insomuch that by their method wheat could be preserved for fifty, and millet for a hundred years. The contrivances varied in various countries, but throughout antiquity, so much care was bestowed on this object that famines rarely made their appearance; and even during war the inhabitants of fortresses and besieged cities were not often compelled to surrender through lack of provisions ".

The agriculturists of Greece often evinced considerable interest in the theoretical studies about the subject although they were more guided in their agricultural operations by the past experience. Naturally, rules of husbandry were transmitted from father to son. Although most of the instructions were given orally, there were some writers who occasionally produced treatises on the subject. But many of the poets embodied the ideas in their works. Besides the instructions in the various operations of agriculture studies were made on the following subjects also by the agriculturists of ancient Greece. " Observing the variations of the year; the influence of the sun and moon ; the rising and setting of stars; the motion of the winds; the generation and effects of dews, clouds, meteors, showers and tempests; origin of springs and fountains; and migration of birds and other animals. All information connected with springs was peculiarly valuable in Attica, which was chiefly watered by means of wells. These, in long and dry summers, often failed, and caused among the citizens of the democracy a scarcity of vegetables, which, owing to their peculiar tastes and habits, was regarded as a national calamity ". A careful observation of the weather and of all those signs by which its changes are foreshown formed an important study of the agriculturist.

SOME NEW METHODS OF SOIL ANALYSIS*

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The present communication relates to some new methods which have been recently developed in the laboratories of the Indian Institute of Science. They have been successfully applied in the study of biochemical problems relating to soils. They combine accuracy with rapidity and ease of handling and are capable of adoption in routine practice.

Carbonate, Organic Carbon and Total Nitrogen. In recent years, large number of methods have been developed for the estimation of these important constituents. Many of them are individually highly efficient, but none of them can be adopted for all the three determinations on the same sample. The method developed by Bhaskaran, Harihara Iyer and Rajagopalan fulfils that condition in addition to being extremely simple and rapid. The procedure may be outlined as follows:—

Carbonate. The soil (10 g.) is weighed out into a round bottomed flask (capacity, 300—500 c. c.), treated with 15 c. c. of water and the suspension well shaken. Syrupy phosphoric acid (sp gr., 1·8; 10 c. c.) is introduced, from above, through a thistle funnel and the suspension raised to gentle boil. The vapours pass through a wide tube (about 8″ long and 1″ wide) which acts as an air condenser. Water vapour is cooled in the condenser and drops back into the distilling flask. Carbon dioxide passes over into an absorption system which consists of a water cooled straight condenser filled with glass beads, over which standard alkali (2N) is kept steadily trickling from above. The cooling combined with the large surface exposed by the glass beads facilitates quantitative absorption of the carbon dioxide.

After boiling for about 20 minutes, the heating is stopped and the alkali adhering to the glass beads washed down into a receiving flask. The unused alkali is titrated against standard acid (2N) after treatment with excess of barium chloride (10 per cent.; 20 c. c.). The end-point is sharpened by either finishing the titration against weaker acid (N/10) or back titrating against dilute alkali until the phenolpthalein colour is just regained.

Sulphuric acid is unsuitable for the above estimation because in presence of alkaline earth carbonates—which are present in many soils—the entire quantity is not decomposed even after prolonged boiling The insoluble sulphate which is first formed, protects the

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unattacked carbonate from reaction with the acid so that low and incorrect estimates are generally obtained. Hydrochloric acid is effective in decomposing the carbonate, but the residue is unsuitable for the estimation of organic carbon. On the other hand, phosphoric acid, if added in sufficient excess, decomposes all the carbonates (including those of alkaline earths) forming the soluble acid phosphate. The acid itself is nonvolatile and does not interfere with the subsequent estimations of organic carbon and total nitrogen.

Organic Carbon. To the residue after the estimation of carbonate, mercuric oxide (red or yellow, 2g.) is added, followed by treatment with concentrated sulphuric acid (nitrogen-free, 40 c. c.). The mixture is then just raised to boil and treated with chromic acid (sat. aq. solution, 5 c. c.) the latter being introduced through the funnel. (Care should be taken to see that none of the gases escapes through the funnel itself. If the pressure of the gas inside the flask is high, it may be necessary to blow in the chromic acid. A rubber tube extension provided with soda-lime guard is useful for the purpose). The boiling is then resumed and the water vapour together with traces of nitric acid which pass over condensed as before. Carbon di oxide is absorbed by the alkali trickling over the glass beads in the condenser. The unused alkali is titrated in the manner described above.

Total Nitrogen. The residue after digestion of organic carbon contains the entire quantity of nitrogen originally present in the soil. The major part is present as ammonium sulphate. Small proportions also occur (a) in combination with the chromium and the mercury in the digest and (b) as nitric acid, (in addition to any that may have been originally present as nitrate). The nitrogen in the former condition is released and that present in the latter reduced to ammonia by treatment with excess of alkali sulphite followed by boiling (5—10 minutes) with zinc (2 g.). (5—7 g. of pure sodium sulphite is usually required for the reductiou. The sulphite need not be weighed, but may be added in small instalments until the colour changes from emerald green to a dirty blue. There will also be the characteristic separation of the black precipitate containing mercury. Zinc should be added after the mixture has been boiling for 1 or 2 mins. for, otherwise, there may be the undesirable formation of hydrogen sulphide). After cooling, the reduced digest is distilled with excess of alkali and the resulting ammonia estimated in the usual way.

Harihara Iyer and Rajagopalan have drawn attention to the loss of nitrogen in the elementary form if chromic acid is added to a cold or moderately hot mixture of the material to be digested, with sulphuric acid. This is due to the intermediary formation of ammonium dichromate, which, on further heating, undergoes spontaneous decompcsition forming elementary nitrogen. (The decomposition occurs at between 120° and 150° C.). By adding chromic acid to the boiling mixture with

2:1 acid (temp. 170°) the formation of the intermediary compound and the subsequent loss of nitrogen are avoided.

It is well known that the presence of halides (generally chlorides) in the soil or any of the reagents causes the formation of the corresponding free halogen and consequent loss of nitrogen. This is prevented, however, by addition of a mercury salt (preferably the oxide). The efficiency of the added mercury salt varies with different soils, but ordinarily, interference of halides upto 2 per cent. can be prevented by the treatment.

The advantages of the foregoing method may be enumerated as follows. (1) The procedure is very simple and rapid. (2) The determinations are carried out on the same sample so that undue wastage of chemicals and apparatus is avoided. (3) Interfering substances are eliminated and the accuracy of the estimate greatly increased. Given a number of sets of apparatus, an average worker can carry out 10 to 12 determinations of all the three constituents in the course of a working day.

Nitrites and Nitrates. There are several methods for the estimation of these two important constituents. A few of them are volumetric methods and yield accurate estimates, but the majority are of the colorimetric type and are generally applicable for only small quantities. Of the two constituents, the nitrite is the more difficult to estimate, largely because of its instability in presence of air and other reacting substances. As the result of this, the nitrite contents of many soils and biological materials are generally under-estimated. It has been recently observed by Pandalai that the stability of the nitrite is largely determined by the reaction of the medium ; that if the soil is first rendered slightly alkaline and then clarified to remove interfering organic matter, the resulting filtrate contains all the original nitrite. The procedure may be outlined as follows. The soil (wet or dry, 50 g.) is treated with sufficient quantity of slaked lime in the form of suspension until the medium is distinctly alkaline. It is then treated with solutions of copper sulphate (10 per cent., 5—10 c. c.) and basic lead acetate, (sp. gr., 1·24 ; 1—2 c. c.) and well shaken. This is followed by addition of a further quantity of slaked lime (with frequent shaking) until the supernatant is no longer blue, but is quite clear and colourless. The suspension is then filtered and washed frequently with water.

The filtrate is quite colourless and can be used as such for the two estimations. If there is even a faint colour, the clarification should be repeated until a clear, colourless extract is obtained. The extract is then divided into two portions one of which is used for the estimation of nitrite and the other, nitrate. If so desired, the same sample of extract can also be used for both the estimations.

Nitrite. The extract is treated with excess of standard permanganate followed by addition of dilute sulphuric acid. The mixture is well shaken and the unused permanganate titrated either directly against ferrous ammonium sulphate or indirectly (after addition of potassium iodide) against standard thiosulphate.

Direct estimation of nitrite is rendered possible by the efficient clarification which removes all interfering substances. Nitrite is the only reducing agent in the medium so that the quantity of permanganate used up gives the correct estimate of that form of nitrogen.

The estimation can also be conducted after addition of excess of standard hydrogen peroxide solution, the unused part being subsequently titrated against standard permanganate. Hydrogen peroxide is comparatively stable in dilute acid solutions, but the strength of the reagent will, nevertheless, have to be checked from time to time. On the other hand, direct titration of the acidified extract against permanganate (from the burette) yields inaccurate estimates. Nitrous vapours (NO and NO_2) are partly lost from the system so that the resulting values are generally low. Nitrites do not react in the cold with dichromate, so that it is necessary to heat the acidified solution with excess of dichromate (60—80°). Even, then, the reaction may not always be complete.

Nitrates. A further portion of the original extract is treated with slight excess of alkaline permanganate and boiled for about 15 minutes. Ammonia is removed and traces of albuminoids, if any, oxidised and driven out as ammonia. The residue, which contains only the nitrate (together with the nitrite) is then distilled with Devarda's alloy in the usual way.

An interesting feature about the foregoing estimation is the effect of minute quantities of lead (or any other heavy metal) on the smoothness of reduction with Devarda's alloy. Ordinarily, reduction with Devarda's alloy or aluminium in alkaline medium proceeds very vigorously with the result that minute quantities of alkali are often mechanically carried over with the spray. This necessitates redistillation. On the other hand, presence of minute quantities of heavy metals leads to light protective coats of those metals (or their hydrides) being found around the reducing agent so that the reduction proceeds smoothly and quantitatively. Excess of metallic salts should be avoided, for, the reaction is then so much retarded that the reduction is not complete even after several hours. In the present method, the small quantity of lead passing into the filtrate is just sufficient to render the reaction smooth and quantitative.

The foregoing method has been utilised for the determination of nitrites and nitrates in a number of tropical soils. It is also eminently suitable for the study of the changes in different seasons and at various stages both before and after manuring. The transformations in

the swamp soils, especially in the earlier stages of puddling (when the conditions are favourable for reduction of the nitrite) will also be of much practical value.

Manganese. Among the various methods for the estimation of manganese, those involving the use of bismuthate are the most rapid and, in many respects, the most convenient. The procedure consists in first extracting the manganese and then converting it into permanganate, which can be quantitatively estimated. The actual working is, however, more difficult and often less accurate than is generally recognised. In the first place, many of the commoner reagents used for the extraction—hydrogen peroxide, ferrous sulphate, zinc, reduced iron, oxalic acid and such like—do not extract quantitatively, so that a small portion of the manganese is always left behind. Secondly, the extractants themselves react with the bismuthate thus involving considerable wastage of that rather costly chemical. There is also interference from extracted organic matter, which, if present in more than minute quantities, leads to low estimates of manganese being obtained. These and other defects are obviated in the procedure developed by Harihara Iyer and Rajagopalan which may be described as follows:— The soil (10 g. or more) together with mercuric oxide (2 g.) is weighed into a conical flask (cap., 250 c. c.) and treated with excess of 2—4 N sulphuric acid, followed by pure sodium sulphite (5 g.). After the vigorous initial reaction has subsided, the suspension is raised to boil and excess of sulphite driven off as sulphur di oxide. The soil suspension is then filtered and the extract treated with sodium bismuthate (0·5 to 1·0 g.) and raised to boil. After boiling for about 1 min., the flask is momentarily taken out to see if the suspension has assumed a definite pink colour. If the colour is either not formed, or disappears rapidly after formation, more bismuthate is added (0·5 g. at a time) followed by further heating. When the colour is finally established, the suspension is filtered through gooch or Jena glass filter. The filtrate is treated with excess of ferrous ammonium sulphate and the unused portion back titrated against standard potassium permanganate in the usual way.

Chlorides interfere with the accuracy of the estimation. On treatment with bismuthate, free chlorine is formed to some extent and reacts with ferrous ammonium sulphate, thus giving exaggerated estimates of manganese. This defect is eliminated by the addition of the mercury salt (preferably the oxide) which prevents the formation of chlorine. Another source of error is the bismuthate itself which contains minute quantities of some water soluble constituent which reacts with ferrous ammonium sulphate. The error due to this, is however, generally small, being the order of 0·1 to 0·2 c. c. of N/10 solution. It is proportionate to the quantity of bismuthate used so that the necessary correction can be applied by using weighed quantities of that reagent.

The foregoing method has been successfully applied to the estimation of manganese in a large number of tropical soils. The procedure is also adapted for the study of the transformations of manganese under different conditions in dry as well as wet cultivated soils. The method can be extended to the estimation of manganese in plant and animal products after destroying the organic matter by some suitable method.

Aluminium. Although this element is one of the most abundant of soil constituents, yet it is mostly present in the insoluble form and generally inactive in the ordinary type of soils. Under certain abnormal conditions however—such as high acidity or alkalinity—its solubility is increased with the result that certain adverse effects are observed. It is yet difficult to state whether the toxicity to plants is directly traceable to the aluminium ion, but there is no doubt that its presence in abnormally large quantities often indicates such a condition.

The older methods for the estimation of aluminium in soils and biological materials are elaborate and tedious. The discovery of the new reagent, 8—hydroxyquinoline (oxine), has, however, greatly simplified the procedure and increased the accuracy of the estimation. Oxine is, not however, specific to aluminium so that care has to be taken to remove iron and other heavy metals which are generally associated with the soil. Silicon and organic matter interfere with the precipitation of the aluminium salt and must also be removed. The modified procedure developed by Govindarajan may be outlined as follows.— The material (soil, 1-2 g,) is ignited at low red heat for 2-3 hours. It is then cooled and extracted with alkali (2—4 N). The extraction must be repeated a few times so as to facilitate all the aluminium passing into solution. (Heating with alkali is undesirable, as it will increase the solubility of silica). The extract is treated with a solution of a ferric salt, (sulphate or chloride. 0 5 g.) and the resulting suspension just raised to boil. It is then cooled and filtered, a suspension of iron hydroxide in alkali being used for washing. The filtrate is rendered faintly acid and treated with a solution of oxine in acetic acid. The mixture is warmed to 70° to facilitate the precipitation of the aluminium compound and then filtered followed by washing with warm water. The precipitate is dissolved in excess of hydrochloric acid (20—30 c. c. ; 1 : 4) and titrated against bromide-bromate mixture (N/10) with indigo carmine as indicator. Alternatively, excess of the bromide-bromate mixture may be added and the unused portion determined by addition of potassium iodide followed by titration against standard thiosulphate.

The novel features in the foregoing method are that (1) the organic matter is first destroyed by ignition and (2) silicon is removed by adsorption with ferric hydroxide. The method has been successfully

fully applied for the estimation of aluminium in soils and a variety of biological materials. It has also been extended to a study of the distribution of aluminium under different conditions in the swamp soil.

Summary. (1) Elegant and rapid methods for the estimation of some important soil constituents—carbonate, organic carbon, total nitrogen (including nitrate), nitrite, nitrate, manganese and aluminium —have been described.

(2) Estimation of carbonate, organic carbon and total nitrogen (including nitrate) can be carried out on the same sample. The carbonate is first decomposed by excess of phosphoric acid and the resulting carbon dioxide absorbed in a flowing stream of alkali in a condenser filled with glass beads. The residue can be used for the wet combustion of organic carbon, chromic acid being used for the purpose. By adding the oxidising agent to a boiling mixture of the soil with 2:1 sulphuric acid, intermediary formation of ammonium dichromate and consequent loss of nitrogen are avoided. The residue contains the entire quantity of the original nitrogen mostly as ammonium sulphate, but small portions also exist (a) in combination with mercury and chromium and (2) as nitric acid. The nitrogen in the two latter forms is converted to ammonia by treatment with alkali sulphite followed by boiling with zinc. The digest is then cooled and distilled with excess of alkali in the usual way.

(3) A direct volumetric method for the estimation of nitrite and nitrate in the same sample has been described. By first treating the soil with a small quantity of slaked lime, the nitrite is first stabilised. By adding a clarifying mixture consisting of copper sulphate and lead acetate together with excess of slaked lime, organic matter and other interfering substances are removed. The nitrite in the filtrate is estimated by addition of excess of permanganate or hydrogen peroxide and back titrating the unused portion. Nitrate is determined by boiling with alkaline permanganate followed by distillation with Devarda's alloy.

(4) Manganese is extracted by treatment with sulphite in acid medium. The extract is then treated with bismuthate in presence of a mercury salt (preferably the oxide) and the resulting permanganate determined in the usual way.

(5) For the estimation of aluminium, the organic matter of the soil is first destroyed by ignition at a low red heat. The residue is extracted repeatedly with alkali. The extract is treated with an iron salt (to absorb the silica) and the resulting suspension filtered. The filtrate is treated with hydroxyquinoline (oxine) reagent in a faintly acid medium. The resulting precipitate is dissolved in hydrochloric acid and titrated against bromide-bromate mixture.

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A PRELIMINARY NOTE ON THE VARYING RESPONSE OF DIFFERENT MILLET STRAINS TO LOCAL AREAS

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The wide extent to which *Jonna* and *Korra* crops are cultivated in the Cuddapah and Kurnool districts on account of their being the staple food crops of the area, amply justify the need for effecting improvement in the productive power of these crops. A detailed examination of the existing agronomic practices in the locality reveals that apart from the essential principles underlying the system of cultivation, there exist many differences in the several agronomic aspects of raising these crops, mainly due to soil and environmental variation. The several modifications of agricultural practices adopted in these two districts, with special reference to time of sowing, spacing, seed-rate, rotation and other factors, form an interesting subject of study to the agronomist. The many varieties of *Jonna* and *Korra* grown in the tract, though they are essentially "*Pacha Jonnas*" and "*Sena Korras*" differ in their characters, with these variations in soil fertility and environmental factors.

Five strains of *Cheruku Pacha Jonna* and *Sena Korra*, varieties evolved at the Agricultural Research Station, Nandyal, were grown in several places in these two districts, in comparison with the respective locals during the 1935—36 season, with a view to ascertain the reaction of these strains to the changes in environmental conditions. The layout adopted in all the cases was randomised blocks, with six replications. The following tables give the percentage yields of the several strains in *Jonna* and *Korra* in the different localities. Their statistical significance has been worked.

Summary of the results of Jonna trial plots in Kurnool and Cuddapah districts 1935—36.

Percentage yield of grain over control.

Taluk	Place	Strains.						Whether significant or not	Critical difference
		Local (control)	Type 6.	25/102	25/106	28/3	29/68		
Nandyal.	Kanala	100	124·0	108·0	113·0	126·5	120·0	Yes.	10·65
do.	Ayalur	100	83·0	103·0	111 0	95·5	102·0	Yes.	10·00
Allagadda	Chagalamuri	100	135 0	116·0	131·5	110·5	122·0	Yes.	23 87
Koilkuntla	Koilkuntla	100	93·0	105 0	108·5	92·0	99·5	No.	
do.	Dornipad	100	91·5	108·0	97·5	86·5	88·7	No.	
Kurnool	Nanoor	100	118·0	121·5	106·0	103·0	119 0	No.	
Cuddapah	Ramaraja palli	100	105·0	68·0	152·5	107·0	118·5	Yes.	10·51
Rajampet	Kuchuvari palli	100	154·5	152 5	130·0	140·0	140 0	Yes.	16·31
,,	Noonavari palli	100	135·5	132·0	126·0	132·0	141·5	Yes.	20·44
Proddatur	Chinnadandlur	100	107 0	103·0	103·0	107·0	103·0	No.	
Giddalur	Giddalur	100	101·0	116·0	105·5	95·5	121·0	No.	

Summary of the results of the Korra trial plots in Kurnool and Cuddapah districts.—1935—'36.

Percentage yield of grain over control.

Taluk.	Place.	Strains.						Whether significant or not.	Critical difference.
		Local (control).	No. 43.	No. 69.	No. 125.	No. 132.	No. 140.		
Nandyal.	Kanala.	100	112·0	120·0	129 0	143·5	118·5	Yes.	20·55
Giddalur.		100	77 0	81·0	92·5	82·0	68·0	Yes.	19·38
do.	Cumbum.	100	82·5	111·0	123·0	125·0	125·0	No.	
Kurnool.	Gudur.	100	130·0	92·0	137·0	107·0	76·0	Yes.	16·73
Cuddapah.	Allanikhanpalli.	100	95·0	141 0	139·0	156·0	125 5	Yes.	6·46
Nandalur.	Hastavaram.	100	181·0	169 0	178·5	178·5	202 5	Yes.	16·50
Proddatur.	Korrapad.	100	91·7	101·7	101·7	92·0	92 0	No.	
do.	Peddasettipalli.	100	144·5	81·0	111·0	36·5	103 0	Yes.	13·22

Out of the 11 trials conducted, in *Jonna* and eight trials in *Korra*, there was a significant difference in six cases in the former and six in the latter. These results would indicate the variations in yields of the different strains due to variations in soil fertility. The differential response of the same strain at the different centres is also apparent in both the crops. It is clear from these results that in both *Korra* and *Jonna* crops, a cosmopolitan type of strain satisfying the requirements of both the districts, covering a wide range of soil variation, is practically a difficult object to achieve. But on the other hand by a study of the results of systematically conducted trial plots of the several strains, it might be possible to fix a type, suited to each of the localities. In addition to this, these trials would mark out the different Zones of varying cropping powers; armed with this knowledge of the relation of the several strains to the different localities, the question of spreading and popularising a strain in such well-established zones, is much simplified.

The above results are only those of one year. It is proposed to conduct these trials for two more seasons with a view to acquire information regarding the relation of these strains not only to changes in soil variation but also their relation to seasonal variation.

Research Notes.

A Note on the occurrence of *Pempheres Affinis* on *Hibiscus esculentus* in Malabar.

During my work at the Agricultural Research Station, Taliparamba in 1933, I observed the presence of *Pempheres affinis* adults on almost all *Hibiscus esculentus* plants found on the Farm. By keeping the stems, adult insects were also reared out. With a view to ascertain whether the insect was attacking cotton or was only a casual visitor to the *Hibiscus esculentus* plants a minute examination of all the varieties of cotton—*Uganda, Buganda, Durango, Zululand Hybrid*, and *Karunganni*—was made. It was an agreeble surprise to find that all the cotton varieties showed complete immunity from *Pempheres* infestation.

An experiment was conducted recently to study the normal intensity, of infestation in *H. esculentus*. Six mature *H. esculentus* plants, each averaging about 50" in height were enclosed in a bell-jar after being cut into pieces of about 10" length. The cage was started on 15—12—35; the first emergence of *Pempheres* was recorded on 19—12—'35. The emergence of adults continued till 25—1—'36 and gave a total of 96 males and 121 females.

The emergence indicates that *H. esculentus* is a host plant for *Pempheres affinis*. I have observed the insect in other places also on the West Coast, infesting the same crop. The factors responsible for the absence of the pest on cotton here have yet to be studied.

Agricultural Research Station,
Taliparamba. 17—3—'36.

E. R. Gopala Menon,
Entomology Assistant.

Gleanings.

New dust replaces Arsenic. Search for a non-poisonous insecticide that might be substituted for arsenic and that, at the same time, would give effective control of insect pests of vegetables, has been rewarded by the discovery of *derris*, a tropical plant from which a dust possessing marked insecticidal properties can be produced. Entomologists at the State Experiment Station at Geneva, New York, have tried out this new material against worms on cauliflower and against the Mexican bean-beetle, with a high degree of success.

"Although *derris* is commonly referred to as a new insecticide, it is well to remember that centuries ago natives of Borneo and the Malay States used this plant as a source of poison for fish and for their arrow heads," says a statement from the Experiment Station on this subject. "The fact that it is non-poisonous to man when taken through the mouth has recently given impetus to its development as an insecticide. The dust is made from the ground roots, and it is generally agreed that the chief active ingredient is a substance known as rotenone. A good grade of powdered *derris* root will contain 4 or 5 per cent. of rotenone." In tests carried on by the Station specialists, ground *derris* root diluted with talc so as to give a dust containing 0·5 per cent. of rotenone has given effective control of caterpillars on cauliflower and of the Mexican bean beetle. The method and frequency of application should follow much the same programme as that employed in the use of arsenical dusts. "In general, it will probably be more satisfactory to purchase the material ready mixed unless the grower has good facilities for mixing dusts," concludes the statement from the Experiment Station. "Owing to the fact that *derris* deteriorates rapidly on exposure to air and light, the container might be kept tightly closed between applications. Dusting should be at the rate of 25 or 30 pounds per acre, and the material can be applied with a power duster or with a good rotary hand duster. In gardens or small plantings, the dust may be placed in a cheesecloth sack and sifted over the plants." (*Scient. Amer.*, Vol. 154, No. 4).

Zinc Sulphate for Citrus trees. Dr. A. F. Camp, Horticulturist at the Florida Agricultural Experiment Station, Gainesville, Florida, has obtained striking results in the use of zinc sulphate sprays on citrus trees affected with frenching. Frenching is distinguished by a yellowing between the veins of the leaves, with the areas along the veins and the edge of the leaf remaining green. If the trouble is severe, the leaves are very small and the twigs short, giving a bushy appearance to the tree. The twigs die back from the tip and are particularly susceptible to cold damage, even in mild cold spells. In the severest forms of frenching,

large twigs and even branches die and the trees become progressively smaller, giving an extremely low yield of small hard fruit.

On a rather heavy soil, orange trees which had been carefully manured and cultivated, had never grown satisfactorily, but applications to the soil of one quarter to one half of a pound of zinc sulphate twice a year, gave a marked response, and normal growth and fruiting resulted in a short time. On the lighter soils of the Florida grapefruit area, however, the soil applications failed to give satisfactory results, and it was thought for a time that a different type of frenching was responsible for the poor growth. It was eventually discovered that the trees responded with exceptional rapidity to zinc sulphate sprays, giving vigorous growth in less than six weeks after the application. The most reliable spray was found to be a zinc-lime mixture of the following composition:—

5 lb. zinc sulphate (89 per cent. pure).
2½ lb. finely ground hydrated lime.
50 gallons of water.
Calcium caseinate or blood added as spreader.

The zinc sulphate is dissolved separately by adding it slowly to a small amount of water with vigorous stirring. The hydrated lime is added gradually to the main bulk of water to make a good suspension, and the zinc sulphate added slowly to this, with thorough mixing. The spreader is either screened into the zinc-lime mixture or mixed separately with water, according to special instructions by Dr. Camp, from whom a copy of the complete circular on the subject of zinc sulphate and water can sometimes be used successfully, but burning frequently results, and such a spray is not recommended. The amount of lime specified above is about the minimum that is thoroughly safe at all times. (*Tropical Agriculture*, Vol. XIII, No. 4).

Milking as an Art. Milking might be defined as an art, inasmuch as some persons are more fitted temperamentally for the work. A person who is rough in manner and irritable in temper can never establish tue sympathy between the cow and the milker that is necessary for good results. The milk yield is adversely affected by rough treatment, and the capacity of production over the lactation period is reduced accordingly. Good herdmasters are very careful in the selection of milkers, and will not employ persons who are manifestly bad-tempered or even who profess a dislike for the work. The secretion of milk entails the expenditure of a large amount of nervous energy on the part of the cow. Noise or disturbance, ill handling of cows, roughness in the work, and even spasmodic or intermittent application all tend to check the flow of milk. In the course of a few days decline in production is evident. The system of recording the weight of milk at each milking is an excellent one, and well worth the amount of time the recording occupies. A careful herdmaster will be quick to note any decline in production, and will want to find the reason for it. (*Queensland Agricultural Journal*, Vol. XLV, Part 3).

A new method of making clarified butter. In the older methods and in the method used in most countries today butter is prepared and clarified later. It has been pointed above that the ripening of cream cannot be controlled very easily owing to the risk of contamination by undesirable types of bacteria. These unwanted bacteria give rise to many side products which though present in minute amounts detract from the flavour of the butter produced. Also over-ripening of the cream with a large production of acid results in a butter of poor-keeping qualities. Further, even when clarified, butter from highly acid cream is more liable to autoxidation than if made from cream of the right acidity.

Also the butter has to be churned correctly otherwise efficient washing is impossible and the resulting clarified butter possesses some of the rancidity developed during the ripening of the cream.

If there is to be any large production of clarified butter much of the work will have to be left to natives. This means that the less skilled the work, the more capable will the native be to carry it out. The making and washing of butter is a skilled business, but turning a separator is mechanical. Clarifying butter has been regarded as an art, though, as shown earlier, if certain observations are made then it loses its right to be regarded as such.

In any case the boiling process cannot be eliminated.

In an effort to simplify the production of clarified butter so that a first class article could always be turned out, the direct boiling of cream was tried. Cream contains very much more protein and water than butter and the only reason for making butter as intermediate step in all the older processes is to reduce the quantities of these before boiling.

As was to be expected, both in the laboratory and creamery tests on the boiling of fresh cream, the direct boiling was not a success.

The large amount of protein present caused some to stick to the bottom of the pan and char, thus reducing the quality of the final product.

An attempt was then made to reduce the amount of protein present by washing the cream with water. This was accomplished by mixing the cream with water so as to make a volume equal to half that of the original milk separated. This cream emulsion was then reseparated. By this means the protein content was reduced to about the same percentage as is found in butter. Laboratory trials showed that this washed cream could be clarified without difficulty. Further trials on this method have been made on the Government Dairy Farm and on a large scale in one creamery. All the reports show that this method is working perfectly satisfactorily under creamery conditions.

In this washed cream method the small amount of rancidity present in the freshly-separated cream from native milk is partially removed by washing. The small amount left in the washed cream disappears during boiling. The result is that the product can be guaranteed absolutely free from rancidity. Further, since it is made from fresh cream its keeping qualities are better than that from butter produced from acid cream.

By general consent this clarified butter is graded as the best turned out in the Territory. It has a good colour, is always solid below 30°C and in my opinion is better than the best Indian-made article. Its taste resembles butter very closely. The Vitamin A content of this fresh cream clarified butter is much (3 times) higher than in the normal creamery product.

The loss of butter fat in reseparating the milk will not be more than is lost in the buttermilk, the butter left in the churn and on the butter-working table. Yields from the creamery confirm the small scale laboratory tests that there is no appreciable difference in yield of clarified butter between the standard and the new methods.

The washing of the cream and reseparating is absolutely mechanical and eliminates the need for an intelligent butter maker. This means that there is a saving on the utensils and skilled labour whilst a better product is turned out, (*Extract from the Bulletin of the Imperial Institute for January—March 1930.* Vol. XXXIV, No. 1, P. 42).

WEEKLY MENU

VEGETARIAN

	AT MINIMUM COST. Suitable for manual workers.				AT MODERATE COST. Suitable for brain workers.			
DAYS	7 A. M.	12 NOON	4 P. M.	8 P. M.	7 A. M.	9 A. M.	1-30 P. M.	8 P. M.
Mondays Wednesdays Fridays	Rice roti & nut-cake chutnee.	Kitchri & ghee, vegetable curry and curds.	Soya bean coffee.	Rice and dal, roti, butter. Salad of sprouted grams, vegetable curry, curds and papayya or banana.	Soya bean coffee.	Rice & dal, ghee, salad of sprouted grams, vegetable curry and curds.	Ladu, cocoanut chutnee.	Roti, butter, vegetable curry, curds and fruit.
Tuesdays Thursdays Saturdays	Do.	Roti, ghee, vegetable curry, raw onion & curds.	Do.	Rice and dal, ghee, salad, vegetable curry and curds.	Do.	Rice & dal, ghee, salad vegetable curry and curds.	Roti, nut-cake chutnee, banana.	Kitchri, roti, butter, vegetable curry, and curds.
Holidays *or* alternate Sundays	Soya bean coffee or tea.	Rice and dal, ghee, puri and some pudding, salad, vegetable curry, 'Usal' of sprouted seeds & curds.	—	Rice, vegetable curry and curds	Do.	Rice, dal & ghee, puri and some pudding, salad, vegetable curry, 'Usal' of sprouted seeds and curds.	—	Roti or rice, vegetable curry and curds.

NON-VEGETARIAN

Mondays Wednesdays Fridays	Rice roti & nut-cake chutnee.	Kitchri, egg and vegetable curry.	Do.	Rice and dal, roti, vegetable curry and salad.	Do.	Rice & dal, ghee, roti, egg & vegetable curry and salad.	Ladu, cocoanut chutnee.	Rice & dal, roti, vegetable curry and fruit.
Tuesdays Thursdays Saturdays	Do.	Roti, egg and vegetable curry and raw onion.	—	Kitchri, meat and vegetable curry, salad of sprouted grams, curds and fruit.	Do.	Do. With salad of sprouted grams and curds.	Roti, nut-cake chutnee, banana.	Kitchri, ghee, meat or fish and vegetable curry.
Holidays *or* alternate Sundays	Soya bean coffee or tea.	Rice & dal, puri and some pudding *or* meat or fish preparation, salad, vegetable curry, 'Usal' of sprouted seeds and curds.	—	Rice and vegetable curry.	Do. or tea.	Rice, dal & ghee, fish or meat preparation *or* puri and some pudding, salad, vegetable curry and curds.	—	Roti, vegetable curry and fruit.

Menu for Children.

Feeding times for children should generally be those mentioned for brain workers. They should be given a cup of milk or one egg and soya bean coffee extra at 4 P. M.

Directions.

1. The above are only specimen menus. Many other preparations and combinations of foods can be substituted for those recommended above provided they are done in keeping with the advice given in the pamphlet on 'Balanced Diets'. The meals recommended for morning and evening are interchangeable Where whole milk is cheap i. e., one anna and a half a lb, it should be used instead of skim milk and butter.

2. In the case of those taking the minimum cost diet 'Broken Rice' should be understood wherever 'Rice' is mentioned.

3. 'Kitchri' is usually made of rice and either tur dal or masoor dal (2 parts of rice and one of pulse).

4. Malted Jowar:--About 6 ounces of jowar should be malted and used in one week.

5. 'Rotis' are to be prepared of *mixed flour* of the following ingredients except bran. They should be mixed in the following proportion and sent to the local mill. Fresh bran should be added to the flour twice a week.

Malted jowar	about 15 per cent.			Malted jowar	about 15 per cent.	
Soya beans	„ 20	„	or	Soya beans	„ 25	„
Bran	„ 15	„		Bran	„ 10	„
Wheat	„ 50	„		Rice, bajri, or jowar	„ 50	„

6. 'Usal' is a cooked and spiced preparation of sprouted pulse seeds.

7. Soya Bean Coffee:—The beans are roasted like coffee beans and ground to a fine powder for use.

8. Some of the ground-nut cake should be used for chutnee and the rest should be mixed with dal, curries or 'usal'.

9. Salad:—Tomato, yellow carrots, cucumber, raddish, onion, cabbage etc., and some leafy vegetables can be used uncooked. Clean them in cold water and then in hot water so as to remove dirt and destroy insects etc., cut to pieces and add curds and condiments to taste. Sprouted horse grams should be used uncooked with or without the addition of salads given above.

10. Skim Milk Curds:—Churn the milk powder in water (1:9) and boil for five minutes. Prepare its curds just as you do of ordinary milk.

11. Lunches should be home-made and should be taken to the office or factory in a tiffin carrier.

(*The Bombay Presidency Baby and Health Week Association*)

Review.

Indian Forest Records: (New Series). *Entomology*: Vol. I., No. 6., "*On the Biology of the Braconidae*", pp. 105—138 (1935); No. 8, "*On the Biology of the Ichneumonidae*", pp. 151—168 (1935); No. 9, "*On the Biology of the Tachinidae*", pp. 169—184 (1935) By C. F. C. Beeson and N. C. Chatterjee. Messrs. Beeson and Chatterjee of the Forest Research Institute, Dehra Dun have done a distinct service in the cause of biological control in bringing to light the parasitic fauna on some important forest insects chiefly forest defoliators and borers, mostly Lepidopterous and Coleopterous ones. These parasites must be studied in conjunction with a paper on "The Biological Control of Teak Defoliators" by C. F. C. Beeson (Indian Forester, Vol. 60, pp. 672—683; October 1934), wherein the author discusses the theory of biological control in connection with the two teak defoliators

Hyblaea puera and *Hapalia machaeralis*; and in this contribution he makes a reference to his making a survey of the distribution of parasites and predators of teak insects.

A survey of the insect parasites is essential so that it may give one an idea as to the regions where they are abundant and places where either they are found in small numbers or completely absent. And this in its turn would afford a working knowledge as to the introduction of particular parasites into regions where they are absent. Therefore it is that even before one thinks of biological control, it is incumbent upon him to ascertain the parasitic fauna present in the different regions. And towards this end the authors have recorded in these three numbers the Braconid and Ichneumonids among the Hymenoptera and the Tachinids among the Diptera.

In the words of the authors the objects of the studies are: "a) to ascertain the composition and sequence of parasitism of the chief defoliators of trees such as teak, sal, shisham; and b) to determine the relative importance of parasites and other factors in the natural control of borers of timbers."

The treatment is similar in all the three cases. Each number begins with an abstract wherein the parasites and their hosts are cited. Then follows a foreword in which are given the implications of biological control in relation to the different parasites parasitic on the different hosts. The distribution of parasites and their hyperparasites is given regionally—the different regions being: I. the north-west region comprising Dehra Dun; II. the central region represented by Hosangabad, Central Provinces and parts of Orissa; III. the southern region represented by Nilambur plantations, Madras and South Coorg; and IV. the eastern region comprising records from Bengal, Burma and the Malaya Peninsula.

The authors bring about the import of the following aspects of biological control by a study of the regional distribution of the parasites and their hyperparasites:

i. the distribution of these parasites and their hyperparasites is very irregular and uneven;

ii. the irregular distribution in its turn makes biological control easy as it gives an idea as to where they are abundant and where absent, thereby making the "introduction and establishment of useful parasites in regions where they are at present absent" easy;

iii. it also gives an idea as to the presence or absence of the hyperparasites on which the failure or success of the introduction of new parasites depends;

iv. in some cases the authors have recorded them to be present even in Europe, thereby making it evident that the distribution is still wider;

v. by noting down the distribution, one is able to find out the factors responsible for any variation in the degree of incidence.

In the body of the paper the parasites are arranged in an alphabetical order with available notes on their hosts, distribution and bionomics.

Among the Braconids seventy species are recorded as being parasitic on "a) *Hapalia machaeralis* and *Hyblaea puera*; b) on *Dinoderus* boring bamboo, or *Lyctus* and other *Bostrychids* boring dry wood; c) parasites of various other defoliators; d) of Curculionid and Cerambycid wood borers."

The following may be said to be important from an agricultural aspect: *Apanteles glomeratus* on *Pieris brassicae*, L feeding on cabbage and mustard; *Apanteles obliquae* Wlkn., on *Amsacta* sp.; *Apanteles papilionis* Vier., on species of *Papilio* feeding on citrus; *Apanteles ruficrus* Hal., on *Spodoptera mauritia* Boisd., and *Microplitis maculipeanis* Szep., on the castor semilooper *Achaea janata* Linn.

Fifty species are recorded among the Ichneumids of which ten species are parasitic on the teak defoliators *Hapalia machaeralis* and *Hyblaea puera* Cram., with seven species of hyperparasites on the parasites of the teak defoliators; and a number of species of *Henicospilus* being primary parasites of Lymantridae. In addition, several species *Dioctes. Cremastus* etc., are also recorded. Of these the following are agriculturally important e. g., *Charops erythrogaster* Ashm., on *Achaea janata*, L., a pest of *Ricinus communis*, and *Eupterotis* sp.; *Cremastus flavo-orbitalis* Cam., on *Antigastra catalaunalis* Dup., feeding on *Sesamum indicum*, *Chilo simplex* Butl., a borer of rice, cholam etc., *Euzophera perticella* Rag., a borer of the shoots of Brinjal, tomato, chilli etc., *Leucinodes orbonalis* Guen., a borer of the shoot of brinjal and potato; *Dioctes argentipilosa* Cam., on *Laphygma exigua* Guen., a cosmopolitan feeder on agricultural crops especially in the earlier stages; *Melcha nursei* Cam., on *Earias fabia* Stoll., *Earias insulana* Boisd., the two cotton bollworms, and *Plusia orichalcea* F.; *Microtoridea lissonota* Vier and *Neo-pimploides sylepiae* Vier., on *Sylepta derogata* F. the common cotton leaf roller.

Now among the Tachinids forty-one species have been mentioned and the authors state "that several species of European Tachinidae have been reared from hosts in Indian region." Among the agriculturally important are *Erycia nymphalidophaga* Bar., on *Papilio demoleus* L., feeding on citrus; *Ptychomyia remota* Aldr., feeding on cotton; *Sturmia inconspicuella* Bar., on *Spodoptera mauritia* Boisd.; *Sturmia sericariae* Corn on *Papilio demoleus* L.

From these it can be seen that the parasitic fauna of forest insects are also important to an agricultural entomologist as the former are also parasitic on insect pests of agricultural crops. Therefore a study of the parasites in both cases is important because the two are woven together. And the importance of it is all the more in effecting biological control for one gets a wider scope for breeding parasites, which have got a number of hosts, for improving the rearing technique; in view of the presence of large number of hosts, it is possible that the parasites may be had in abundance right through the year on one host or another; and lastly their wide distribution gives ample scope for studying the factors responsible for their increase or decrease in the course of the year. In order that biological control may be successful, two points are essential viz., overlapping of generations in the case of the host so that the parasite may have the right stages for parasitising at all times; and the presence of a number of alternate hosts for the parasite so that they may be had right through the year. The latter is fulfilled by distributional studies.

Among the Braconids are mentioned species of the genus *Spathius*. A species of this genus also appears to attack the stem weevil of cotton viz., *Pempheres affinis* F., in South India, though only to a very negligible extent in nature. But it appears to be parasitic on the Bostrychids that attack the dried up cotton stalks which are dead on account of Pempheres. Therefore, if one comes across the correct host, then it is easy to get in at the alternate hosts of the parasite. For, in this case, species of *Spathius* are recorded as parasitic on the several Bostrychids, Scolytids and Curculionids. Thus breeding of the parasites right through the year is facilitated.

Therefore it is essential that a study of the parasites of insect pests of agricultural crops be done along the lines shown by the Forest Entomologist in these numbers. And this will go a long way in broadening our outlook with regard to control by natural enemies, instead of restricting ourselves to mere agricultural crops. The importance of a study of both is well exemplified in these numbers and the authors have given an impetus as it were, towards the mode of studying the parasitic fauna.

V. M.

Agricultural Jottings

BY THE DEPARTMENT OF AGRICULTURE, MADRAS

Rice Research Station, Berhampore. With the assistance given by the Imperial Council of Agricultural Research, the Rice Sub Station at Berhampore came into existence in March 1932. On account of the temporary nature of the station, the two most important lines of work namely, the survey of the tract with regard to its varieties and the improvement of the main varieties by evolving strains and the carrying out of the necessary cultural and manurial trials relating to the tract, were taken up first. Four years' work has finished and important results obtained are the following:—

120 varieties of the tract have been studied and pure lines have been evolved from all of these. Selection work was confined to half a dozen amongst these which are the most important in the tract. These selections from *bayyahunda, ratnachudi, boroponko, mypali*, etc. have undergone already two years' trial on the station and several of these have been found to give 15% and more of increased yield over the ryot's seed. With another year's trial on these at the station the best of them will have to be tried at different centres in the tract to gauge their suitability. It is expected that in another 2 or 3 seasons we would have arrived at the best of these for multiplication and distribution to the people.

As a preliminary to evolving strains mass selected bulks have been obtained in the two varieties, *bayyahunda* and *ratnachudy* and the seed distributed to the ryots has been very much appreciated.

A large number of cultural and manurial trials have been carried out during the last three seasons and some important results have been obtained with regard to the optimum spacing to be given to seedlings at planting, the optimum age of seedlings to be planted, and the comparative merits of broadcasting directly and transplanting, etc. With regard to manurial trials, green manuring has been found to be very economical, yield increase of 20% being obtained even with an application of 2 to 4 thousand pounds of green leaf. The trials with fertilisers, though some of them have been found to give a substantial increased yield either by themselves or in combination with green leaf, the value of the increased yield invariably does not cover the cost of the fertilisers. These trials will have to be continued sometime longer before any definite conclusions could be drawn from them.

Besides the above, certain crosses have also been made chiefly for studying the inheritance of fineness and texture of rice.

The House Fly Maggot Trap—An Effective Control of Flies. It is common knowledge that flies breed in manure and other refuse matter where their young ones—called maggots—find plenty of food for their growth and development. With a knowledge of the habits and life history of the fly it is possible to prevent its multiplication This is by the use of what are known as fly maggot traps which work on the principle of attracting flies to fresh manure in a receptacle for egglaying and trapping and destroying the maggots that hatch out, making use of their migratory instinct. The trap consists of a rectangular wooden frame 2′ × 2′ × 2′ fitted with ½″ mesh wire netting on all sides, open at the top and provided with a plank at the bottom about 6″ from the ground level. All round the trap at the level of the plank is a U-shaped drain of galvanised iron fitted with ledges on either side, slanting towards the drain. The drain is filled with water which can be drained when necessary through a hole at the

bottom on one side which is plugged with a cork. The trap is placed near cattle sheds or other places where flies abound and fresh manure is put into it daily in small quantities so that it gets filled in four or five days. Attracted by the fresh manure, flies come and lay eggs. The maggots that hatch out begin to wander about and move towards the outside and, in so doing, come out through the meshes of the wire netting and fall into the drain round the trap and are caught. These are collected daily and destroyed The water in the drain is also renewed. To provide a continuous supply of fresh cowdung for egglaying and also to ensure thereby continuous trapping of maggots every day, instead of a single trap, a set of three is used, the baits in each being put in one after the other so that by the time the third trap gets full the first one would have got exhausted and could be renewed.

Maggot traps may be made in any design provided the principles of their working are borne in mind. A simpler and cheaper trap working almost as efficiently as the one described above has been devised by making use of a galvanised sheet of iron 6′×3′. The sheet is bent along the length to form a trough and hung up a little above ground level. Manure is put in as in the case of the former trap in small quantities every day until it gets full. The maggots in the manure travel along the length of the trough and drop down at both the ends of the trough and are caught in two shallow wide basins (earthen basin will serve well) containing water placed exactly under the two open ends of the trough.

Fence substitutes for Prickly Pear. At the recent budget session, a member of the Legislative Council complained that while through the effort of the Agricultural Department prickly pear had been practically destroyed, the Department had taken no steps to suggest to ryots substitutes for prickly pear as a fence. The Department realising its responsibility has been for some time testing different live fences at several of its Agricultural Research Stations. In fact, an article in the Villagers' Calendar for 1936 contains useful information on this very subject.

The plants recommended in the article are—

Mullukiluvai (Balsamodendron berryi).
Chadurakalli (Euphorbia antiquorum).
Bonthakalli (Euphorbia royalena).
Tirukalli (Euphorbia tirucalli).
Kathalai (Agave Americana) Aloes.
Sisal Hemp (Agave sisalana).

These plants are available practically everywhere and it is left to the individual to choose what he considers suits his local conditions. Readers are advised to peruse the article referred to in the Villagers' Calendar and to apply to the nearest Agricultural Demonstrator for selection of the material most suitable for their locality.

Studies of the manurial reserves of the village. At Velacheri near Madras where farming on a co-operative scale is being attempted by the Agricultural and Co-operative Departments, the Agricultural Demonstrator in charge has been recently conducting a survey of the village. An enquiry into the manurial resources of the village revealed that out of the 699 houses in the village, 600 houses use cowdung as fuel. Each family burns 40 cowdung cakes daily and this is obtained from the droppings of 2 pairs of animals. At the above rate, the total consumed in the village is reckoned at 8000 cartloads of cowdung. This would be sufficient as manure for at least 1600 acres of dry land which are at present being raised with crops year after year without any manure at all. Besides, hundreds of cartloads of cowdung cake are daily sent to the Madras City from the surrounding villages for being burnt as fuel and the total annual loss of such a valuable manure is colossal seriously affecting the production of crops in the district. In

a country where soils are so deficient in organic matter it is essential that serious attention should be paid to the provision of fuel other than cowdung.

Lucerne. The Department recommends several fodder crops of which Lucerne is one. It will amply pay the growers near big towns and racing centres where a large number of horses are kept. For example, the Madras Race Club is said to consume in the neighbourhood of 400 lb. a day valued at Rs. 12—8—0. It is reported to be obtained all the way from Bangalore. Attempts are now being made to grow it at Velacheri, a village already mentioned above and situated near the Guindy race club. The crop, if grown under proper conditions, is expected to yield about 50,000 lbs. of green stuff annually. The gross value, estimated liberally at 100 lb. per rupee, will amount to Rs. 500 per acre while the cost of cultivation is not expected to be more than Rs. 200. Lucerne is a good succulent food not only for horses but also for cattle—working and milch, and poultry.

Fish Guano In the West Coast very large quantities of different varieties of fish are caught and used in the preparation of sardines and in the extraction of oil. The refuse after the extraction of oil is known as "fish guano." Some varieties of fish, particularly those which are small in size are simply dried in the sands on the beach. Such beach-dried sardines which cannot be used as food are used as manure.

One variety, "White bait" or known locally as *Kollataru* was recently sent to the Government Agricultural Chemist, Coimbatore, for analysis and was found to contain as much as 10·4% nitrogen and 4·4% phosphoric acid. It is already being used as manure for sugarcane with very good results.

College News and Notes.

The Principal of the College and ex-officio President of the Union Mr. R. C. Broadfoot is proceeding home on leave and Mr. R. W. Littlewood, Dy. Director, Live Stock is appointed officiating Principal of the Agricultural College.

College Day and Conference. The Hon. Sir K. V. Reddy will as officiating Governor of Madras inaugurate the Diamond Jubilee celebrations, and the Hon. Mr. P. T. Rajan will preside over the College Day and Conference. The proceedings will commence on Wednesday the 29th July and last for four days. It is likely that a conference of all the Gazetted Officers of the department will be arranged during the conference week, and it is expected that Mr. C. J. Paul, Development Secretary will preside over the Gazetted Officer's Conference. The Managing Committee of the Union extend their invitation to all the members of the department, and the readers of the Madras Agricultural Journal, to attend the Diamond Jubilee celebrations, and make the function a success.

The Late Sir M. Ramachandra Rao Garu. In the death of Sir M. Ramachandra Rao, South India loses one of its leading public men, and the Madras Agricultural Students' Union, one of its sincerest well wishers. His interest in the welfare of the ryot was sincere and real. and his contribution towards the co-operative and banking movements in the presidency is well-known. He was one of the distinguished presidents of our College Day Conference. We tender our heart-felt condolence to the members of his family.

Mr. M. Rajagopala Iyer. It is with deep regret that we announce the death of Mr. M. Rajagopala Iyer, assistant lecturer in chemistry on the 21st inst. Mr. M.

Rajagopala Iyer, was one of the active members of the Union, and was a member of the Managing Committee, as Treasurer for nearly seven years. We offer our sincere condolence to his relatives.

Research Engineer. Mr. M. Lakshmipathi Mudaliar, is in charge of the Research Engineer's Section, in the absence of Mr. N. G. Charley on leave.

Ramasastrulu Munagala Prize. The last date for submitting papers is 15th June.

B. Sc. Ag. Examination Results. Elsewhere in this issue is published the results of the B. Sc. Ag. examination held in 1936.

ANNOUNCEMENT

The Diamond Jubilee Celebrations of Agricultural Education in India and the 25th College Day and Conference will commence on the 29th July 1936. His Excellency the Governor of Madras will inaugurate the proceedings. The Hon. Mr. P. T. Rajan will preside over the conference. An Exhibition will be staged along with the Conference.

The annual general body meeting of the Union will be held on Sunday the 2nd August at 8-15 A.M., when the annual report and budget for the next year will be presented for adoption, and the office-bearers for 1936—37 elected.

Members desirous of moving propositions at the meeting are requested to give due notice, to the Secretary, to reach him not later than 1st July 1936.

Weather Review (APRIL 1936).

Summary of General Weather Conditions. Rainfall was general in the Presidency on the first day of the month, but thereafter weather was dry, with high day temperature. A depression formed in the centre of the Bay on the 23rd but it moved in a North Easterly direction after intensifying into a storm and crossed the Arakan coast. The depression did not influence weather in the Peninsula.

Rainfall was generally below normal throughout the Presidency and markedly so on the West coast, Mysore and Coorg, and the hills and in parts of the Circars and Deccan.

Day temperatures were high on the East coast between Nellore and Madras and in the Deccan, Nellore and Rentachintala recording maximum of 111°F on several occasions.

RAINFALL DATA

Division	Station	Actual for month	Departure from normal @	Total since January 1st	Division	Station	Actual for month	Departure from normal @	Total since January 1st
Circars	Gopalpore	0·0	−0·8	4·8	South	Negapatam	0·4	−0·2	8·8
	Berhampore *	0·0	−0·9	5·5		Aduthurai *	0·1	−0·9	5·7
	Calingapatam	0·2	−0·7	3·2		Madura	2·5	+0·4	7·8
	Vizagapatam	0·2	−0·5	5·1		Pamban	4·9	+3·3	8·0
	Anakapalli *	0·1	−1·3	0·0		Koilpatti *	1·4	−1·6	6·3
	Samalkota*	1·1	+0·5	9·7		Palamkottah	1·5	−1·0	5·7
	Maruteru *	0·3	−0·2	4·4					
	Cocanada	1·9	+1·3	6·6					
	Masulipatam	0·4	−0·2	4·8	West Coast	Trivandrum	0·1	−4·4	3·5
	Guntur*	1·3	+0·7	9·4		Cochin	2·1	−2·6	4·7
						Calicut	1·1	−2·2	11·5
Ceded Dists.	Kurnool	0·8	+0·2	2·5		Pattambi *	1·1	−2·2	6·4
	Nandyal *	0·1	−0·3	1·7		Taliparamba *	0·9	−1·7	1·9
	Hagari *	0·0	−0·9	1·7		Kasargode *	0·0	−3·5	2·4
	Bellary	0·1	−0·7	0·4		Nileshwar *	0·7	−1·0	2·4
	Anantapur	0·8	+0·3	0·9		Mangalore	0·3	−1·0	4·0
	Rentachintala	—	—	—					
	Cuddapah	0·4	−0·1	1·1					
					Mysore and Coorg	Chitaldrug	0·3	−0·6	0·6
Carnatic	Nellore	0·3	−0·1	2·2		Bangalore	0·1	−1·2	1·1
	Madras	0·5	0·0	4·0		Mysore	0·5	−1·9	3·1
	Palur *	0·7	−0·7	4·4		Mercara	0·2	−2·4	4·1
	Tindivanam *	1·0	+0·1	4·6					
	Cuddalore	0·2	−0·4	4·3					
					Hills.	Kodaikanal	0·5	−3·8	7·3
Central	Vellore	0·7	−0·3	1·7		Coonoor*	8·5	—	23·3
	Salem	0·9	−0·9	4·9		Ootacamund *	0·0	0·0	0·0
	Coimbatore	0·4	−1·0	3·9		Nanjanad *	0·9	−2·1	6·1
	Coimbatore Res. Inst.*	0·8	−1·4	3·7					
	Trichinopoly	4·0	+2·3	6·0					

* Meteorological Stations of the Madras Agricultural Department.

@ From average rainfall for the month calculated upto 1935 (published in Fort St. George Gazette).

Weather Report for Research Institute Observatory.

Report No. 4/1936.

Absolute Maximum in shade	100·5°F
Absolute Minimum in shade	66·5°F
Mean Maximum in shade	95·5°F
Departure from normal	— 0·4°F
Mean Minimum in shade	72·8°F
Departure from normal	— 0·1°F
Total Rainfall	0·81″
Departure from normal	— 1·35″
Heaviest fall in 24 hours	0·65″ (Recorded on 1–5–'36).
Total number of Rainy days	2
Mean daily wind velocity	1·3 M. P. H.
Mean Humidity at 8 hours	69·2%
Departure from normal	— 1·6%

Summary. Dry weather prevailed during this month. The rainfall was below normal by 1·35″. The mean humidity was in defect by 1·6%. The highest maximum temperature recorded was 100·5°F. Skies were moderately clouded.

Departmental Notifications.

Gazette. Mr. R. N. Sundaram to officiate as Dy. Director, II Circle. Mr. C. R. Srinivasan to officiate as Paddy Specialist vice Mr. K. Ramiah on leave. Messrs. U. Vittal Rao, A. Ramaswami Iyer and V. T. Subbiah Mudaliar to officiate as Asst. Directors of Agriculture in IV, II and VI circles respectively.

Subordinate Service. Leave. Mr. D. S. Subramania Iyer, A. D., Rasipuram, l. a. p. for 3 months from 1—5—36. Mr. S. Kuppuswami Iyengar, A. D., St. Thomas Mt., l. a. p. for 3 months and 29 days from 11—1—36. Mr. G. L. Narasimha Rao, A. D., Gannavarum, l. a. p. for two months from 11—5—36. Mr. K. V. Natesa Iyer, A. D., Trivellore, l. a. p. for two months from 13—5—36. Mr. R. Venkatarama Iyer, A. D., Vridhachallam, l. a. p. for two months.

Transfer. Mr. K. Sivasankara Menon, A. D., Cannanore to be F. M., Taliparamba. Mr. S. Muthuswami, Demonstrator, to Srivalliputtur.

1936 B. Sc. Ag. Examination Results.

LIST OF SUCCESSFUL CANDIDATES

Adinarayana Reddi, Y. Albuquerque, S. D. S. Annaswami, S. Arunachalam, T. Colaca, J. Hanumantha Rao, C.* Ittyachen, C. T. James Albert Rajiah, J. D.* Jayaram, K. Joshua, S. Kannayyan, K. Kelukutti Menon, M. Krishnamurthi, R. Krishnan, R. H. Lingayya, N. K. Murugesan, G. Parasuraman, N. A. Raghavan, A. Rajabapanayya, K. Rajaraman, S. Ramanarayana Menon, K. Ramanatha Rao, H. Ramanatha Rao, P. Ranganathachari, N. Rayadrug Ali Hyder. Sangameswara Sarma, S. Shanmugasundaram, R. Sridharan, N. V. Venkataramana, G. Venkataramana Rao, V. G. Narasimhamurti, G. Satyanarayana, D. Venkataramaya, M.

First Year Examination. Abdul Hafees. Aga Muhammad Bawker. Anantachary, P. S. Balasubramanian, A. Brahmanandam, V. Chellappa, G. V. Joseph Doss, S. V. Kothandiraman, E. S. Krishnaswami Nayudu, D. Marthappa Kini, T. Mohan Rao, B. K. Mohan Rao, M. Mohammad Fasiuddin. Mukundan, M. Nagaratnam, A. K. Narasinga Rao D. Narayanan, P. Pinto B. M. Purushotam, K Ramalingam, V. Ramanna, V. Ramanujam D. Rama Rao, D. Sankarasubrahmanyam, T. K. Santhanam, K. Seshadri, C. K. Seshu Ayyar, K. A. Shaik Hussain. Shanmuga Nainar, T. P. Sivaswami, E. G. Somasundaram, T. Srinivasan, K. V. Subrahmanyam, P. K. Suryanarayanan, J. V. V. Thothadri, P. Varisai Muhammad. Viswanatham, S.

Class II. Anantanarayanan, T. N. Ganeshsunder Rao, H. Hariharan, S. V. Khader Razaack. Krishnakumar, H. Krishnananda Sastri, S. Lakshminarayana, S. Mahadeva Ayyar, S. Parthasarathi, A. V. Pichumani, A. V. Raghottam Reddy J. Sattanathan, R. S. Sundararaman, S. Syed, P. K. Tobias, K. I. Venkatachalamayya Sastri, K. Venkayya, N. *Readmitted.* Vaithianathan, S. Narasimham, Y. B. Venkateswara Rao, P.

The following candidates have reference in the subjects mentioned.

III Year. Achanna Sastri, Agricultural Botany. Gitachari, Ref. in F. M. and Economics. Joseph Moncy, Farm Management & Economics. Krishnanunni Nayar, M., Farm Management & Economics. Narayana Nambiar, K. T., Agricultural Chemistry. Satyanarayanamurti, K. Agrl. F. M. & Economics. Shanmugasundaram, Farm Management & Economics. Shivasankar Rao, G., Farm Management & Economics.

II Year. Adiseshayya Herbert, Zoology. Brahmayya, G. V., Zoology and Animal Hygiene Gopalakrishna Kamath, Zoology. Rajagopalan, P. V., Ag. Engineering. Brahmayya, C. V., Zoology & Animal Hygiene. Sathianathan, S., Agl. Plant Husbandry. Srinivasamurti, Agl. Engineering. Sivaraman, Agrl. Plant Husbandry & Agrl. Engineering.

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*Passed in the final examination but not eligible for the degree.