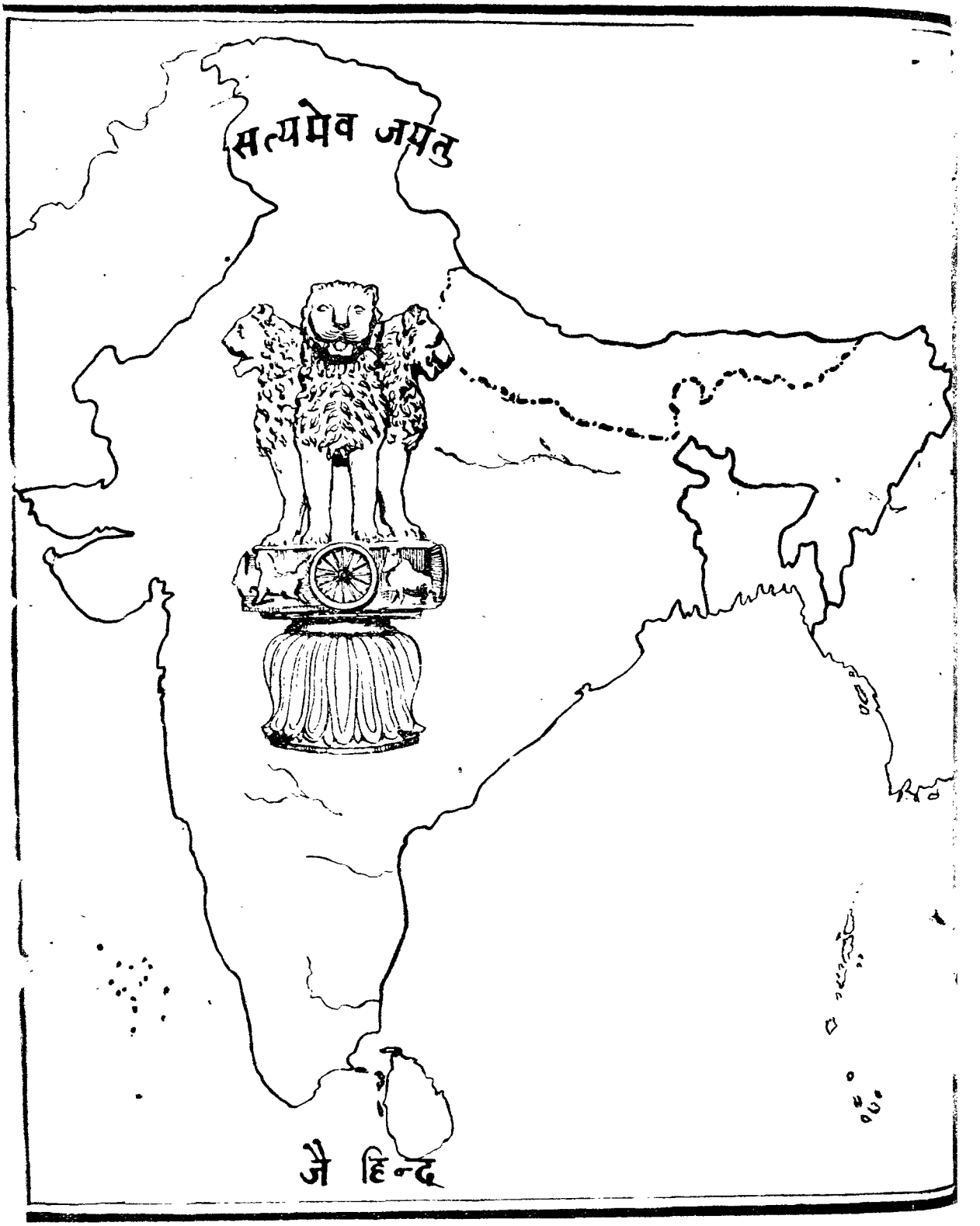
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Editorial

INDIA, A REPUBLIC: On the 26th of January 1950 the nation rejoiced at the fulfilment of her long cherished hopes and the realisation of her dreams. The struggle of half a century for political freedom is over and with the inaguration of the Republic of India, the country's political emancipation is complete and India has stepped into her rightful place among the great nations of the world. But in the words of her Prime Minister, the consummation of one phase of the nation's struggle marks but the beginning of another phase, one which is beset with greater difficulties and dangers. The maintenance of this newly attained freedom and the building up of a New India under the stress of various disintegrating forces in a world surcharged with a spirit of suspicion, rivalry and hatred is a task of such staggering magnitude as to make the ablest and boldest minds of the land quail at facing it with optimism. Nevertheless, it is a task to be done and if our nation is to survive, the people of this land have to face it with courage and determination and work hard in the coming years to see it accomplished. Our leaders have exhorted us to cease dwelling on unessentials and direct our thoughts and energies to things that matter, namely, the economic rehabilitation of the country and freeing the people from the grip of want.

The first step in the task of reconstruction; as has been stressed time out of number during the last six years, is the augmentation of our food supply to meet the needs of our growing population and make us less dependent on other countries for the supply of the basic needs of our country. It has to be admitted that despite the strenuous efforts of the government and the people during the last six years, the Grow More Food Campaign has met with only partial success and the country is yet a long way off from the goal of self sufficiency envisaged by her administrators and leaders. It is a sorry fact that our cultivators in general have

not yet sufficiently realised the great possibilities of increasing production by adoption of proved methods of scientific agriculture in their cultivation practices. We are aware that there are many reasons for this and the ordinary cultivator is governed by circumstances which are not favourable for changing his conservative outlook rapidly. His general poverty puts him on his guard against what he considers speculative enterprises and while the better class of farmers who could afford to experiment, venture and, as a rule, benefit by their innovations the poorer ryot who represents the majority of the cultivators remains where he was and is content to draw from the land the minimum it can give. This outlook must be changed and in this direction the readers of this journal have a great part to play and it is up to them to make the average Indian Cultivator realise the immense benefits that modern science has to offer him in increasing the output from his land.

Another factor which hinders the farmer from bestowing a thought on increased production is the uncertainty of the monsoon on which he is mainly dependent for his water supply. In recent years the failure of successive monsoons has made him apathetic to all appeals for increased efforts on his part. It is therefore of utmost importance that the state should concentrate on augmenting the irrigation sources of the country in the immediate future both as a long range and short range programme in order to ensure the maximum utilisation of the rains that are received during the year. All our economic troubles according to an eminent financial expert centres round food and the first charge on state funds should be the building up of a sound agricultural economy and no question of finance should stand in the way of undertaking irrigation enterprises however costly they may be in the first instance. The problem was viewed from this angle by the ancient Kings of this land and thanks to their endeavours, India can boast of an irrigation system which has been in existence for centuries and which now stands in good stead in averting wholesale famine in the country.

If the uncertainty of supply is removed from greater part of this land, the cultivator would be in a better position to appreciate the benefits derived by the application of scientific methods of agriculture, such as soil conservation, drainage, afforestation, growing of better strains of crops, application of fertilizers, protection against pests and diseases and in general respond to the advice of the organised Agricultural Departments of the country and adjust

his cropping practices to ensure maximum return for his labours and investment. In this connection we are gratified to note that the Provincial and Central Governments have taken up this question in right earnest and are devising ways and means to implement the proposals for extending the irrigation sources of the country.

It is the fashion in some quarters to decry every modern innovation as foreign to our genius and praise the virtues of conservation especially in regard to agriculture. While we are one with this school of thought in so far as it gives credit to the Indian cultivator for his basic commonsense and his general knowledge of the art of growing crops, we are definitely of opinion that it is gravely determental to our future agricultural economy to shut our eyes to the tremendous progress made in other countries in regard to crop production and to the possibilities of emulating their example. It behoves men with influence to infuse among the agricultural classes a progressive outlook and a desire to improve themselves which will make them receptive to new ideas and adopt them in practice.

With a progressive and prosperous agricultural commnnity our economic ills will disappear of their own accord and the new born republic will have justified the sacrifices of the countless number of men and women of this land who have helped to usher in its existence.

Republic Day Messages

THE HON'BLE SRI A. B. SHETTY, M. L. A.,
Minister for Agriculture, Govt. of Madras.

The efforts made in this province in the first year of the "Food Drive" have been largely nullified on account of the cyclone havoc in the Circars and the failure of monsoon in the Tamil districts. Madras is faced this year with a serious food crisis on account of the decision of the Government of India to curtail further imports from abroad and reduce the allocation of cereals to this province to 3 lakhs tons. We have, therefore, to make the best of a bad situtation. Government are spending large sums of money on schemes for providing more water, better manure, improved seeds and machinery for land reclamation work. There is no doubt that agricultural

output can be increased by scientific farming on modern lines. We have to remember, however, that agriculture is carried on in our country by millions of small farmers who cultivate small plots of land with the limited resources they have. It is out of the small margin of their savings in foodgrains that the nation has to be fed. No substantial result can be achieved in stepping up food production unless we can change the outlook of the peasant and make him put to the best use the aid and advise which Government are giving him at present. The Governing body of the I. C. A. R. seem to have discussed this month in New Delhi the formulation of a plan for familiarising the farmer with the latest results of agricultural research. The results of research must be given to the cultivator in a form which he can understand and adopt with the limited means at his disposal. Ocular demonstration on Government farms or, better still, on the cultivators' own land is admittedly the most effective means of propagandist work. The agricultural staff should see that the help and advice they give is such as the ordinary cultivator with his small holdings and limited resources can make use of. The cultivators should change their angle of vision. Farming should not only become a profitable business for the benefit of the individual ryot but it should also be looked upon as a service rendered to the nation, and every ounce of surplus food grain produced should be made available for the non-producing consumers. They should understand that procurement, rationing and control are essential when there is a shortage of food supplies. It is wrong to resort to black-marketing and complain against the measures which Government are obliged to adopt for efficient procurement and equitable distribution.

SRI R. M. SUNDARAM, I. C. S.,
Director of Agriculture.

On this auspicious day in the history of our nation, I wish the Madras Agricultural Journal all success. Our country's stability depends foremost on her economic prospertity which in turn can come only out of increased production of all agricultural produce. Not only self sufficiency in food, but raising the standard of living of our masses, 80% of whom depend on agriculture, can be achieved only by the Agriculturists. I appeal therefore to all interested in the Nation's welfare to work hard and Grow More Foood

Green leaf manuring and green manuring

By

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Introduction: The terms "Green Leaf Manuring" and "Green Manuring" convey technically different meanings, though the ultimate object is the same in both cases. The practice of lopping green leaves from trees like Pungam, Neem etc., and applying them to paddy fields is called "Green Leaf Manuring." When crops like Pillipesra, Daincha, Sunnhemp, Indigo and Wild Indigo (Kolinji or Vempali) are raised in a field for ploughing in, it is termed "Green Manuring."

Experiments conducted both in this Province and elsewhere have definitely proved that application of green leaf to paddy fields is beneficial and the yield thereby can be increased by 10—15 per cent (i.e., one to two bags of paddy per acre). The quantity normally recommended for application is about 5,000 lb. (roughly four cart loads) per acre. This should be applied in addition to cattle manure, oil cakes or chemical manures.

Green Leaf Manuring: The possibilities of green leaf manuring will be examined first, as it is not complicated with unsurmountable limiting factors. There are various trees whose leaves are suitable for green leaf manuring. Compared with all of them "Gliricidia" is a very quick growing one. The lopping of leaves can begin when the tree is about 3 years old. Each tree when fully grown i.e., after 5 years can be expected to give on an average about 200 lb. of green leaf per lopping (lopping should be done only once a year). On this basis about 25 trees are necessary to supply the required quantity (5,000 lb.) of green leaf per acre.

Gliricidia trees are best raised by transplanting seedlings. The suitable periods for raising nursery and transplanting seedlings are indicated below:

	Raise nursery in	Transplant Seedlings
(a) Places wherein rainy season commences in June — July	April — May	July — August
(b) Places wherein rainy season commences in September — October	June — July	September — October

The seedlings should be transplanted 4 to 5 feet apart. They will have to be carefully watered during the first year and protected with a "tree guard" till they are well over 6 ft. high. One pound of Gliricidia seed will cost about Rs. 5/- and there will be over 3,000 seeds in that quantity. It has already been estimated that 25 trees are required per acre and the cost of 35 seeds (allowing 10 trees for casuality) will be less than two annas. Can this amount be considered expensive? Gliricidia was introduced in 1935 in Hagari Farm from Ceylon (vide 1938—1939 Agricultural Research Station Report). It is very probable that the beautiful colour of the flowers attracted Mr. Edmonds, Ex-Deputy Director, who was responsible for its introduction. It has not spread widely because of lack of sufficient quantity of seed. In 1949 all the available quantity, about 300 lb. of seeds (i.e., 9 lakhs seed) were distributed. Only a part of the demand was met. The position is bond to improve in the years to come.

The three limiting factors involved in adopting this practice are: (a) finding suitable site (vacant back-yards etc.,) to plant the tree; (b) watering them regularly during the first year of their growth; (c) putting up "tree guards" to protect them against goats and cattle till they are over 6 ft. high. Such of the ryots who have necessary facilities to get over these factors should adopt them in their own interest—to obtain an increased yield from the paddy crop.

Green Manuring: The position with regard to raising green manuring crops is entirely different. Since the crop has to be raised right in the cultivated field, many limiting factors have to be over come.

(i) ***Single Crop Wet Lands:*** Let us first take the single crop paddy fields and examine the possibilites of raising green manure crops. The paddy planting seasons vary form tract to tract according to time of receipt of water in the irrigation sources, as indicated below:

	Planting	Harvesting
(a) West Coast (Malabar and S. Kanara)	June — July	October — November
(b) Circars (Vizag, Godavaries, Guntur and Kistna)	July — August	November — December
(c) Central (Ceded Southern Districts)	July — October	November — February

The land will lie fallow for about six months. The green manure crops that can remain without becoming woody and fibrous and thereby rendered unfit for green manuring purpose, are Indigo and Wild Indigo.

The seeds require some amount of moisture in the soil to facilitate germination and growth during the first two months. Such conditions exist only from October to December. In practice this would mean in single crop wet lands harvested in January and after, green manure crops cannot be raised successfully. Even in lands where harvesting takes place between October -- December, a good stand of the crop can be obtained provided sufficient summer rains are received. In places where the summer showers are not received or inadequate quantity is received, the stand of the crop will be very poor.

Further, lands where harvesting takes place between October — December, if they are of heavy clay and develop wide cracks in summer, green manure crops cannot be expected to come up satisfactorily. In view of these limiting factors, it is possible to raise green manure crops — Indigo and Wild Indigo — in single crop wet lands provided (a) the harvest takes place before December; (b) the land is not heavy clay and does not develop cracks in summer; (c) some appreciable quantity of summer showers are received.

(ii) *Double Crop Wet Lands:* In the case of double crop wet lands, the fallow period will be from March — April to June — July. The green manure crops that can successfully come up during this short period, are Pillipesara, Sunnhemp and Daincha. The seeds will have to be sown in March — April after receipt of summer showers. If during the period of growth, further rains are not received, the crop will have to be irrigated at least once in two or three weeks, if sufficient quantity of green leaf is required. Owing to dearth of green forage, in this hot season the crop raised will be the main target of attack by stray cattle and goats. Careful watch has to be kept and this is possible only, if all the ryots in any particular area combine together. This is the main drawback limiting the extension of this practice.

In places, where summer showers are absent or negligible, the crop will have to be raised and maintained only with irrigation, The water will have to be drawn only from wells since no river channel or tank will then be functioning, probably with the exception of a few spring channels. The demand for irrigation water for the other standing crops would be great during this part of the year, due to excessive heat. Further there must be adequate supply of water in the wells. Invariably the wells fail in most of the cases. Under such circumstances is it any wonder that the ryots try to save the standing crops by judicious usage of failing supply of water in the wells, rather than venturing to raise green manure crop?

Conclusion: In the above paragraphs, I have made an attempt to present the limiting factors from a Provincial point of view and therefore, they do not relate to any particular region or tract. It is very likely

that in some places the limiting factors may not exist and even if they exist, the ryots would be taking special steps to overcome them. Some striking instanees, I am aware of, are :—

(a) Sugarcane is planted in February—March. Two months after i.e., April—May sunnhemp seeds are dibbled over the ridge, a little away from the base of the plant. The green manure crop is pulled out in June—July, applied near the base of the plant and earthed up.

NOTE : (The sunnhemp seed should not be sown before two months, after planting the cane, otherwise cane crop will be affected).

(b) Ragi is raised as an irrigated crop in January—February. A month after transplanting seedlings, while hoeing, Indigo seeds are dibbled. The ragi crop is harvested in April—May leaving the Indigo plants behind. With the aid of summer showers and a few irrigations given irregularly, a good crop of Indigo is obtained by about July—September. It is pulled and applied to paddy fields.

(c) Scientists do not advocate growing green manure crops in dry lands and ploughing it in, the reason being, the moisture available in dry lands is limited. If a green manure crop is ploughed in, the small quantity available will be utilised by it during decomposition and there will be nothing left for the main crops cultivated afterwards. In Nandigama taluk, Kistna District, green gram is raised in April—May and ploughed in August. The main crops Jonna (Cholam), Chillies, Tobacco, are raised in September without any adverse effect on the yield. The only explanation that can possibly be given is that during August, the rainfall is heavy in the tract and it facilitates quick decomposition without drawing supply from the soil.

(d) In some parts of Pulivendla taluk, Cuddapah District, the ryots after harvesting paddy in December raise sunnhemp, cut it in March, remove the green stuff and put in pits (this is called composting) and the decomposed stuff is applied to the paddy fields in July. In some taluks, inter-space avaliable in mango topes and coconut gardens are cultivated in August—October and sown with wild Kolinji. The crop is utilised as green manure for paddy fields next year. Do these attempts not show that where there is a will, there is a way ?

(e) In some places, ryots go even as far as twenty miles to the nearest forest and bring green leaf to be applied to paddy fields, at considerable cost and inconvenience. Does this not confirm the statement that the ryots are aware of the benefits claimed for this practice ?

If these practices are not universally adopted it is not because the ryots are not aware of the benefits but because of the operation of the limiting factors. Each ryot as his own problems and he should think about methods of getting over them.

Fish manures and their importance to soil fertility*

By

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Fish Manures have been classified as concentrated organic manures and their use as a fertiliser to various crops is very well known. In the days of the Oil Sardine Fishery of the West coast of this Presidency, the Fish Scrap, after cooking and pressing for oil — popularly known as Fish Guano — was in wide use as a manure for coconut trees, coffee, tea and tobacco plantations locally and the surplus amounting to many thousands of tons of this manure were exported. But the sardine fishery is almost a feature of the past and so the people here look to other kinds of fish manures.

Various kinds of manures are generally prepared during seasonal gluts of the fishery and are immediately utilised in the nearby coffee, tea and tobacco plantations, so much so there is not sufficient manure left for use in the interior parts of the coastal strip. The types of manure manufactured at present can be broadly classified as beach—dried fish manure, pit fish manure and prawn shell manure.

Beach dried manure as the very name indicated is prepared from either whole round fish during surplus catches, or from wastes of fish like guts and gills, head, fins, etc. The whole fish or the waste are merely thrown on the sands of the beach and allowed to dry in the hot sun for about two or three days after which the fishermen collect them at their leisure and store for use. The manure thus obtained contains a high percentage of sand, about 30% and attempts should always be made by the manufacturer to see that the manure is not wilfully adulterated with sand to increase weight.

The other type of manure viz., pit fish manure is prepared by burying fish or the wastes in pits about 4ft. by 4ft. having an inner lining of cudjan leaves and covered up with earth on the top. After about 35 to 60 days, the pits are opened, contents removed and dried for two or three days. Here again there is a high percentage of sand due to obvious reasons and more than that, the Nitrogen of the fresh components is lost due to the action of bacteria present in the soils and subsequent absorption in the soil. Prawn shell manure is obtained as a bye-product when prawns are cooked, dried and shelled during the preparation of prawn pulp for edible purposes. On an average these shells contain Moisture 15%, Nitrogen 5 to 6%, Phosphate 2 to 5%, lime 13% and Insolubles 15%. In addition to Nitrogen and Posphorous, it also contains

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a high percentage of lime which makes it as one of the best suited organic manures for acid soils. A few experiments on lines similar to the methods of preparation of the manures as adopted locally were conducted and the products obtained from each method of preparation was subjected to careful analyses. The table below gives the average analytical data to bring out the comparative merits of the method of preparation of the different types of manures.

Table 1 Analysis of Fish Manures.

Particulars	Analysis on fresh basis						Analysis on moisture free basis				
	H_2O %	N %	P_2O_5 %	CaO %	K_2O %	Insol. %	N %	P_2O_5 %	CaO %	K_2O %	Insol. %
Fresh Mackerel fish analysed whole	75·4	3·5	1·9	1·7	0·3	0·3	14·0	7·6	6·6	1·2	1·2
Beach dried Mackerel manure A	11·3	6·8	5·9	5·2	0·9	8·2	7·7	6·7	5·8	1·0	9·3
Do. B	13·1	5·7	3·9	3·3	0·5	27·0	6·6	4·5	3·7	0·6	31·08
Pit fish manure Mackerel A	15·6	3·1	4·9	5·2	0·8	11·1	3·67	5·81	6·2	0·95	13·15
Do. B	6·5	1·9	5·5	3·3	0·4	45·6	2·0	5·9	4·0	0·4	48·77
Guts and gills fresh	75·3	2·2	0·7	0·52	0·12	2·25	8·8	2·8	2·1	0.5	9·1
Beach dried guts and gills manure A	14·1	4·7	2·1	1·7	0·3	3·8	5·4	2·4	1·9	0·4	4·4
Do. B	10·5	4·4	1·1	1·0	0·2	16·9	4·9	1·2	1·1	0·2	18·9
Pit manure guts & gills A	10·2	2·8	1·6	1·0	0·1	9·6	3·1	1·8	1·1	0·1	10·7
Do. B	10·2	1·1	2·0	0·9	0·08	22·9	1·2	2·2	1·0	0·1	23·3
Guts and gills cooked, pressed and dried	11·6	4·9	2·3	2·6	0·6	5·3	5·5	2·6	2·9	0·7	6·0

A: Prepared under control and care. **B**: Prepared under conditions as adopted by the Trade.

Discussion: It can be seen from the above table that the sand content in the A sample (exercising control and strict supervision) has been kept to the barest possible minimum ranging from 3·8% to 11·1% whereas B samples (prepared under conditions similar to that adopted by the fishermen) usually contained varying quantities of sand ranging from 16·9 to 45·6% with detrimental effect on the nitrogen value. Even

in the A samples there is a reduction of the nitrogen content as compared with the original raw material which is inevitable under the circumstances of the method of preparation. But it must be borne in mind that increase in the sand content either by wilful adulteration, carelessness or otherwise is sure to to bring down the value of the maure and it can be seen from the above Table that if sufficient care is exercised a product of high manurial value can be obtained. Beach dried fish manure contains on an average 5 to 7% percent of nitrogen, 5 to 6% of phosphate and calcium and varying quantities of sand. This is a highly variable factor and to assess the value of the fish manures this variable should be taken always into consideration.

Pit fish manure gives on the average 3 to 5% of nitrogen, 2 to 6% of phosphate, 1 to 5% of line and 10 to 45% of sand. In the beach—dried manure some control can be exercised in the admixture with sand whereas in the case of the pit fish manure there is bound to be some sand. However, about 15% insolubles should be the maximum limit that can be allowed. In general fish manures are not considered to be potassic manures and this is quite evident from the results of the analysis. All the A samples of manure show a sand content of less than 10% and this was possibly due to the care in the collection of the wastes free from sand by throwing them in trays or old four-gallon open tin containers, instead of on the sands. Further, if the material is dried on raised wooden platforms, or over coir mattings spread over the ground, a much better product results.

General properties and values of fish manure: Fish manures are good sources of nitrogen and phosphorous. Besides they are also important in that they supply to the soil what is known as "humus" which is essential to maintain the soil fertility and to maintain the organic balance of the soil. Cattle manure, green manure and oil cakes, besides fish manure come under the group which supply "humus" to the soil. When the soil is normally rich in organic matter, the application of artificial manures is the best and increased yield of crops result. At one time after the famous experiments of Liebig and Lawes, it was thought that artificial manures would revolutionise the course of agricultural practice, but nature has tried to assert herself. Organic manures supply the standard plant food, keep up the supply of organic matter which plays a very important part in absorption and exchange processes of plant life, impart desirable physical properties to the soil and influence the moisture content of the soil. Thus the importance of fish manures as fertilisers is obvious.

It was mentioned above that the prawn shell manure contains a high percentage of calcium besides a fair percentages in nitrogen and phosphorus. In the words of Sir. A. Hall, "of all soil factors making fertility, lime should be the first since the action of lime on different soils is

physical, chemical and biological". Physical in the sense it improves the soil texture. Chemically, liming of the soil tends to correct its acidity, regenerating inorganic plant foods from combination in the soil and thus making them available to the plant. Use of a limy manure, controls the undesirable micro-organisms and encourages beneficial ones, an example of which is the process of nitrification by certain types of bacteria which will not be able to thrive and carry on its work in an acid medium. So prawn shell manure is a naturally available organic manure rich in lime content and this should prove very useful for certain types of soil.

Experiments on the manuring of soils with fish manures have been conducted at the various Agricultural Research Stations of the Madras Government and increased yield of crops due to fish manure have also been reported in some stations. However, there seems to be a dearth of detailed systematic investigations for the various crops and soils of this Presidency, and it is to be hoped that this type of investigations will be taken up by the Agricultural Department.

Conclusions: Beach-dried fish manures contain about 5 to 7% of nitrogen, 4 to 6% of phosphate and an equal amount of C_aO with sand varying from about 10 to 30%. Pit fish manures prepared out of whole fish and out of wastes contain about 3 to 5% nitrogen and 2 to 6% phosphate and 1 to 5% lime. In all these cases sand, i.e., the percentage of insolubles is an important factor in deciding the quality of a manure since it is found to be anywhere between 20 to 45%. It is possible to bring down the high sand content by observing a few precautions during preparation. Fish manures are concentrated organic manures and should be of high value to the various types of crops though at present they are popular with only tobacco, tea and coffee planters. Experimental data on all important crops is lacking and it is hoped that ere long the Agricultural Department will be in a position to take up this problem.

Manurial Experiments on Rice*

2. *Effects of season and continuous green leaf manuring on yield*

By

C. HANUMANTHA RAO, B. SC. (Ag.)

Introduction: Rice growers of this Province, by traditional experience resort to green leaf manuring with a view to obtain increased yields. Investigations to assess its effect were for some time past in

*Part 1 was published in Madras Agricultural Journal XXXV 1948 p. 144.

progress in this and other provinces. Two schools of thought were developed, the one attributing the beneficial effect of green leaf manuring to Nitrogen and its influence on the biological reactions in the soil and the other laying stress on the physical effects of the organic matter and also the possible influence on the solubility of soil phosphates. However, the literature on the cumulative effects of green leaf manuring over long periods is scanty. Irrespective of the nature of its action, green leaf manuring is an accepted practice among farmers to increase rice yields. Twenty five years ago two experiments on continuous green leaf manuring were laid out at Palur and Manganallur. At Palur in one experiment on rice, green leaf was applied to alluvial soils. The rice was grown in the *samba* season (September—January) irrigated by a perennial spring channel of Gadilam river. Green leaf at 4,800 lb. per acre of "*Calotropis gigantea*" and tree leaves (*Pongamia glabra* and *Azadirachta indica*) along with other bulky organic manures were applied from 1908 to 1921. In another experiment "*Dhaincha*" (*Sesbania aculeata*) was applied over a period of fourteen years to a saline soil. In the first experiment green leaf manuring increased the yield of rice but failed to show any cumulative effect which in the second experiment was evident for the first nine years but none thereafter. At Manganallur, the experiment was conducted on heavy clay soils of single crop wetlands. The supply of water was constant and commenced from the last week of July or in the first week of August. Green leaf (Sunnhemp) at 2,000 lb. per acre alone and in combination with bone-super was tried from 1914 to 1919. The results are similar to the first experiment at Palur cited above. Due to the change in varieties during the course of the experiment and in the absence of a modern statistical layout, the results can be taken as only indicative. In the Vizagapatam district the conditions of rice growing are quite different, since there is no regular irrigation system and the crop is frequently subject to seasonal vicissitudes, the plantings are often delayed and the growth periods are consequently reduced resulting in poor yields. The average yields of rice for the district are the lowest for the Presidency, ranging between 1,100 to 1,400 lb. of grain per acre. The nursery is sown in the first week of July under rainfed conditions but the age of seedling at planting differ widely from year to year due to the transplantation depending upon the receipt of the South-West Monsoon. The transplantation may thus come off early in August or be delayed till late in September. To assess the value of green leaf manure to rice under these conditions a long-range experiment was laid out at the Agricultural Research Station, Anakapalle in 1927 and continued for a period of twenty years.

2. **Material and Method**: The experiment consisted of two variants viz. (i) the application of 3,000 lb. of green leaf (sunnhemp) per acre and (ii) no manure. G. E. B. 24 was the only variety raised throughout the

course of the experiment. The experiment was laid out on AB—AB pattern. In 1938–39 the same layout was changed into AB—BA layout to conform to the modern methods of field technique. This was done by splitting each plot into two and allowing a suitable margin in between. The change in layout was so effected that the plots continued to receive the same treatments as before. The yields of grain and straw are represented in Table I and rainfall data in Table II.

Statistical Analysis: The data on yield of grain from manured and un-manured plots for the twenty years given in Table I may be taken up for detailed study. The yields from manured as well as un-manured plots show peaks and troughs in alternate years with only very few exceptions. Except for the year 1936, manured plots give greater yields than unmanured plots. Wide fluctuations in yield from year to year are prominent in the data. Hence it will be interesting to study the data under the following heads. (a) Periodicity, (b) Effect of manure, (c) Causes of seasonal variations.

(a) *Periodicity:* Since the same variety G. E. B. 24 was tried in the same field under identical conditions of manuring the yield factor due to varietal and soil effects may be taken to be constant throughout the trial period and the fluctuations observed in the values may be assigned to seasonal effect i. e., time of planting, meteorological conditions etc., and random causes. Hence the model for the yield may be set up as $Y=m+s+e$.....(1) where the component 'm' may be estimated as the the mean of the twenty values, 's' the effect due to season and 'e' random error. Thus for studying seasonal effects, it may be sufficient to observe the trend of 'Y' itself, because Y—m when graphically represented means only a parallel displacement of the 'x' axis of the graph of 'y' and 'e', the random error will be removed by a smoothing of the observed data. With this model in view the study of periodicity in the data will simply mean the study of seasonal cycles.

The search for periodicity was made with the yield data of 20 years. The result of the investigation is that two years is the most probable period. But for the search of the periodicity the values for the first four years are excluded because of the irregularity of peaks and troughs. The same period of two years is obtained for yields from both the manured and un-manured plots. But in both cases though the period is two the successive waves differ widely, the periods of the cycles are the same but the amplitudes are different. Hence it is impossible to predict the values for the future with the information available. That there is a period of two is also evident by obtaining a moving average for two-year periods or with periods which are multiples of two. The eight-year moving averages for both the manured and un-manured data for the eight years from 1935–1942 are given in Table III. They show that the irregular deviations

can be smoothed out by a period which is a multiple of two and that a period of years is possible. But since the values cannot be predicted by any curve due to irregularity of amplitudes, it is better to study the peaks and troughs separately.

TABLE III. Centred Eight-Year moving averages of yields

Year	Manured	Un-manured
1935	2750	2476
1936	2724	2457
1937	2748	2477
1938	2761	2467
1939	2757	2436
1940	2711	2343
1941	2748	2336
1942	2742	2322

Since the peaks and troughs are observed in alternate years, considering the values of yields from 1931 onwards there are 8 peaks and 8 troughs each for the manured and un-manured plots. The data show that a period of 8 for the peaks as well as troughs is probable, but the insufficiency of the data prevents any theoretical establishment of the same. It may be that the peaks and troughs are repeated after eight years. However, sine-cosine curves of the form

$$Yr = a_0 + a_1 \cos \theta r + a_2 \text{Cos}_2 \theta r + \ldots\ldots \qquad (2)$$
$$+ b_1 \text{Sin } \theta r + b_2 \text{Sin}_2 \theta r + \ldots\ldots$$

may be fitted to the data of the troughs and peaks separately where Ys stands for the yield for the year and $\theta r = 2\pi r/p$ where p is the period and r takes values from 0—p–1, a's and c's being constants. Table IV gives the values of a_0, a_1, b_1, b_2 for the sine-cosine curves fitted to the 8 troughs and peaks each of the manured and un-manured plots.

TABLE IV

Values of constants in (2) for peaks and troughs of yields from manured and un-manured plots (Period 8)

Constants.	Manured		Un-manured	
	peaks	troughs	peaks	throughs
a_0	3151·3750	2331·8750	2865·6250	1936·6250
a_1	—330·9896	390·3936	—358·2173	424·3611
a_2	—52·7500	—294·5000	—1110·0000	—369·5000
b_1	233·0760	—78·5516	329·2244	109·4940
b_2	70·0000	230·7500	74·2500	268·2500

Ordinates obtained from the curves for the peaks and troughs may be compared with the observed values given in Table V. The ordinates considering the first harmonic term only and first and second harmonic terms are given separately.

TABLE V.

Observed values (peaks)	Manured Ordinates I.H.T.	I & II H.T.S.	lb. Troughs.	Ordinates I. H.T.	I&II H.T.	Obser. (Peaks)	Un-manured Ordinates. I H.T.	I&II H.T.	Obs. (trough)	Ordinates. I H.T.	I & II H.T.
2600	2820	2768	2300	2722	2428	2200	2507	2397	1925	2361	1991
3375	3082	3152	2750	2552	2783	3075	2845	2919	2500	2314	2582
3125	3385	2480	2625	2000	2548	3150	3195	3305	2585	2046	2415
3865	3550	3480	1791	2000	1770	3473	3352	3277	1447	1714	1446
3033	3482	3429	1442	1941	1647	2860	3224	3114	958	1512	1143
3632	3220	3290	2708	2111	2342	3256	2886	2960	2161	1560	1827
2719	2918	2971	2295	2410	2705	2350	2536	2646	1836	1827	2197
2862	2752	2612	2744	2653	2463	2561	2380	2305	2141	2159	1891

NOTE: I. H. T. denotes 1st Harmonic term i. e.

$a_0 + a_1$ as $\theta r + U_1 \sin \theta r$.

I & II H. T. denotes I. H. T. $+ a_2$ as $2\theta r + U_2 \sin 2\theta r$.

The observed values and the curves for the "Manured" and the "un-manured" are almost similar in their nature. One remarkable feature of the curves is that the peak curves reach a maximum and fall down but the trough curves reach a minimum and go up and the respective maxima and minima correspond to consecutive years. This, of course, accounts for the variation between the values of the amplitudes of different waves.

(b) *Effect of manure:* It has been observed that the yields from un-manured plots are invariably smaller than those of the manured plots. But it has to be determined whether the former values are significantly different from the latter. Analysis of variance based on all the pairs of values has been done according to the scheme of a randomized block of two treatments and 20 replications. The results are given in Table VI. F. test in Table VI shows that there is significant difference between "Un-manured" and "Manured" yields.

TABLE VI. Analysis of Variance of the Yield of Manured and Un-manured Plots.

Source		Degrees of freedom	Sum of squares	Mean square	F.
Total	...	39	145,59333·97		
Years	...	19	131,98035·47	694638·45	48·65 (Significant)
Treatments	...	1	10,89990·22	108990·22	76·33 (Significant)
Error	...	19	2,71308·28	14279·38	

That there is no significant effect of manure for the improvement of the soil year after year has been revealed from the results of the soil analyses conducted in 1926 and 1937 with an interval of eleven years, kindly furnished by the Government Agricultural Chemist, Coimbatore, as in Table VII.

TABLE VII. Results of Soil Analysis Conducted in 1926 and 1937.

Year	Total Nitrogen %		Available Phosphorus %		Available Potash %	
	Manured	Unmanured	Manured	Unmanured	Manured	Unmanured
1926	0·054	0·054	0·0525	0·0513	0.01240	0·01260
1937	0·071	0·068	0·0522	0·0480	6·01203	0·01165

(c) *Causes of seasonal variations:* The Analysis of variance in Table VIII shows that F for years is significant so that there are considerable variations between yields of different years. The possible factors for the wide fluctuations in the yields of rice are in general the quantity and distribution of rainfall at the time of planting. It is within the experience of the cultivators of this tract that the above two factors have a profound effect on the final yield. As already pointed out the dry nursery is invariably sown in the first week of July while the transplantation is dependent upon the receipt of water in the irrigation sources which may take place from the first week of August to last week of September causing the delay of eight weeks. Records indicate that temperature and humidity do not play any role in influencing the yields of grain and straw.

A scrutiny of the rainfall data presented in Table II, shows that the total rainfall and the rainfall during the crop period have a similar relationship to the yield. The values of correlation co-efficient between rainfall and yield are presented Table VIII.

TABLE VIII. Values of the Correlation Co-efficients between Rain and Yield**

Correlation between 1	Values of (r) 2	Significance 3
1. Yield from unmanured plots and total rain-fall ...	0·1680	N O
2. Yield from manured plots and total rain-fall ...	0·0082	N O
3. Increase in yield of manured plots over unmanured plots ...	0·0531	N O
4. Yield from unmanured plots and rain-fall received during the crop growth ...	0·1080	N O
5. Yield from manured plots and rain-fall received during the crop growth ...	0·0980	N O
6. Percentage increase in yield of manured plots over unmanured plots ...	0·0300	N O

** The correlation co-efficients are tested using the transformation of Fisher, $Z' = \frac{1}{2} \log_e \frac{1+r}{1-r}$ which is a normal Variate with SD $= \frac{1}{\sqrt{n-3}}$

The above data show that in general while the crop yield is dependent on rainfall, there is no significant correlation between the two. This is due to the fact that irrespective of the quantity of rainfall there is yet another important factor which effects the yields significantly. Irrespective of the quantity of rainfall received, the time of transplantation may vary as already pointed out. As the variety under test is a season-bound one, which comes to harvest invariably by the first week of December, later planting shortens the growth period and this in turn is reflected in the yield. The correlation between the yields from manured and un-manured plots and the percentage increase in yields of manured over the un-manured plots on the one hand and the post transplantation period (from the time of planting to flowering) on the other shows the pronounced effect of the latter over the yields. The values of (r) are presented in Table IX below :

TABLE IX

Values of correlation cœfficient between the Post-transplantation Period and Yield

Correlation between	(r)	Significance.
1. Yield from unmanured plots and post-transplantation period in days.	0·593	Yes.
2. Yield from manured plots and post-transplantation period in days.	0·507	Yes.
3. Percentage increase in yield of manured plots over unmanured plots and post transplantation period in days.	—0·480	Yes.

The significant positive correlation between the yield and the post transplantation period indicates the pronounced effect of the time of planting on the yield. The significant negative correlation between the percentage increase of manured over un-manured and the post transplantation period indicates that the green leaf manure has a pronounced effect when the transplantation is late. The twenty-year period of the experiment may be arbitrarily grouped into three categories as in Table X.

TABLE X

Yield in relation to post-transplantation period

Time of planting.	Rainfall in inches	Yield in lb. per acre.			
		manured		Unmanured	
		grain	straw	grain	straw
GROUP I.					
July 1927	15·88	2925	4700	2850	4400
July 1936	15·49	3125	6496	3150	5738
Average	15·69	3025	5598	3000	5069

Time of planting.	Rainfall in inches	Yield in lb. per acre.			
		Manured		Un-manured	
GROUP II.					
August 1928	36·89	2650	5857	2500	4849
,, 1931	23·78	2300	3066	1925	2201
,, 1932	9·79	2600	3573	2200	2752
,, 1933	22·87	2750	3425	2520	2953
,, 1934	15·10	3375	3538	3075	3237
,, 1938	25·39	3865	6341	3473	5191
,, 1940	11·83	3033	3969	2860	3416
,, 1942	11·85	3632	4411	3256	3961
,, 1944	15·90	2719	4205	2350	3580
,, 1945	20·38	2744	3818	2141	3244
,, 1946	11·29	2862	3971	2561	3041
Average	18·64	2957	4198	2624	3457
GROUP III.					
Sept. 1929	13·91	2375	2406	1825	1850
,, 1930	9·33	2475	2263	2075	1891
,, 1935	8·93	2625	3132	2525	2812
,, 1937	12·96	1791	1897	1447	1556
,, 1939	15·96	1442	2022	958	1331
,, 1941	17·38	2708	3275	2161	2766
,, 1943	14·46	2295	2686	1836	3249
Average	13·29	2244	2526	1832	2066

Irrspective of the quantity of rainfall it is seen that there is a a critical post-transplantation period below which the yields are lowered. The average yield for post-transplantation in periods of (1) below 60 days, (2) 60 to 80 days, (3) above 80 days are presented in Table XI.

TABLE XI

Yield of grain in lb. per acre	Less than 60 days	60—80 Days	Above 80 days
Manured ...	2246	2950	2994
Un-manured ...	1824	2589	2761

The data reveal that though the cultivation of paddy is dependent on rainfall the yield is closely related to the time of planting and the increase due to green leaf manuring is more pronounced in seasons of late planting than in early ones.

The data as classified in Table X are useful for the study of the differences in yield due to different times of planting. Since group 1 contains only two values, it has not been taken up for study. Considering group two and three it has been found that between "manured" in the different groups there is a significant difference and so also in the case of "Un-manured". The tests are given in Table XII.

TABLE XII
Tests of significance for yields regarding different time of planting

Treatment	Means		Mean square				
	G. II.	G. III.	G. II.	G. III.	F. Least Estimate of S.D.		T.
Manured	2957·27	4444·43	276282·21	213665·28	1·368 (Not sig.)	471·02	31·3 (Significant)
Unmanured	2623·73	1832·43	238522·41	259950·02	1·089 (Not sig.)	496·61	3·30 (Significant)

First, the mean squares for the two samples are tested and since they do not differ significantly the best estimate of the standard deviation is given by the formula $S^2 = (S_1^2+S_2^2) / n_1+n_2-2)$ where the S_1^2 and S_2^2 are the respective sums of squares of deviations from the respective means and n_1 and n_2 are the different sample sizes. For T. test the formula is $(d/s.)\sqrt{(n_1 n_2)}. (n_1+n_2-2) / (n_1+n_2)$, d being the difference between the two means. Since T's in Table XIV are significant the two group means for the manured as well as the unmanured are significantly different and it may be inferred that the times of planting are responsible for the difference in yields, between groups. But the variation within groups has to be traced by fitting curves to the data of yields in Table 10 there being four sets of data, manured and unmanured for the two groups. The sine-cosine curve given in (2) has again been chosen for the purpose. The constants for the four different curves are given in Table XIII and the trend values in Table XIV.

TABLE XIII Constants of the Sine-Cosine Curves of Manured and Unmanured plots for the Groups II and III

Constants	Group II		Group III	
	Manured	Unmanured	Manured	Unmanured
a_0	2957·2737	2623·7273	2244·4286	1832·4286
a_1	—504·1659	—516·0407	356·9951	301·1096
a_2	155·1215	231·7813	—421·5918	—507·9268
b_1	—66·1762	—15·6360	60·2537	215·3991
a_2	—149·8553	—133·4703	—17·5311	—87·7825

TABLE XIV Trend Values of Manured and Unmanured for the Groups II and III

	Manured			Unmanured			Manured			Unanured	
Observed values	Ordinates I H.T.	Ordinates I & II H.T.	Ob. Vs.	Ordinates I H.T.	Ordinates I & II H.T.	Ob. Vs.	Ordinates I H.T.	Ordinates I & II H.T.	Ob. Vs.	Ordinates I H.T.	Ordinates I & II H.T.
2650	2453	2608	2500	2108	2340	2375	2601	2180	1825	2134	1626
2300	2497	2425	1925	2181	2156	2475	2515	2591	2075	2189	2216
2600	2688	2473	2200	2395	2142	2625	2223	2611	2525	1975	2471
2750	2964	2857	2520	2682	2497	1791	1949	1700	1447	1655	1407
3375	3237	3364	3075	2950	3049	1442	1897	1620	958	1478	1082
3865	3422	3634	3473	3114	3382	2708	2106	2478	2161	1555	1975
3033	3459	3509	2860	3123	3246	2295	2420	2531	1836	1852	2050
3632	3337	3167	3256	2973	2808	...	...	...	...	...	...
2719	3095	2903	2350	2713	2453	...	...	...	...	...	...
2744	2808	2820	2141	2424	2373	...	...	...	...	...	...
2862	2569	2770	2561	2198	2416	...	...	...	...	...	...

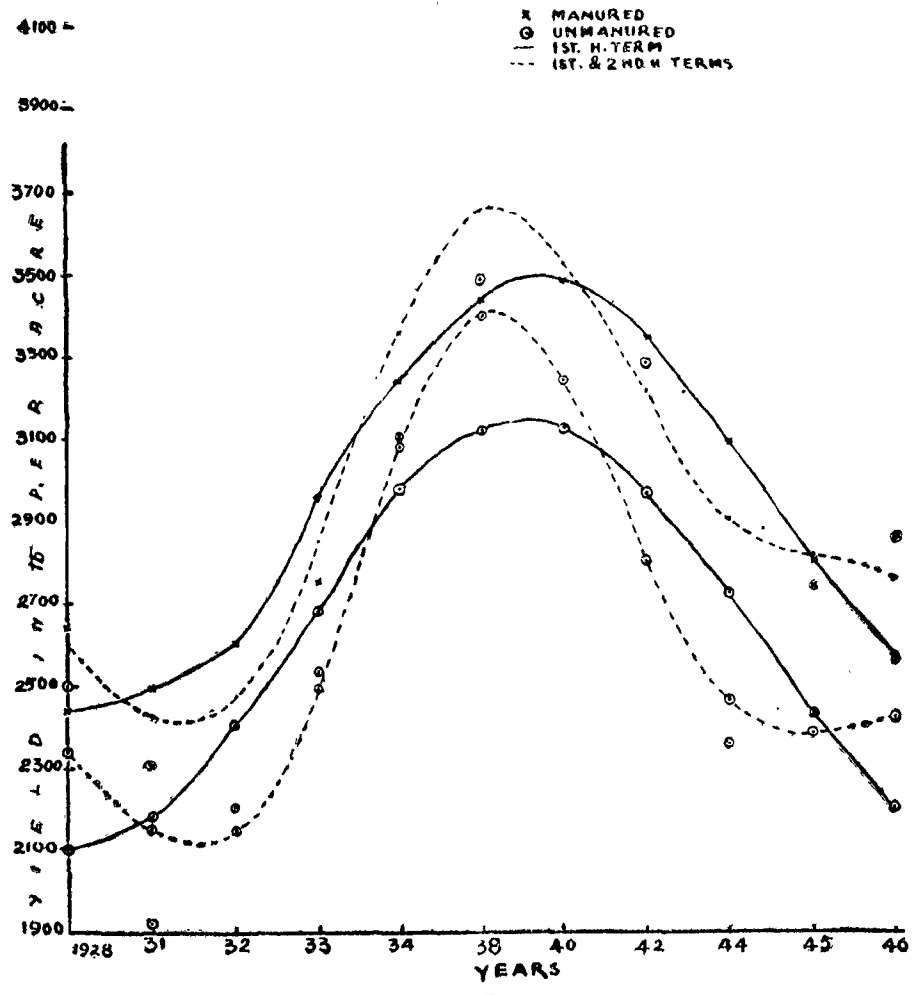


FIG. 3

TREND VALUES OF MANURED & UNMANURED FOR THE GROUPS II

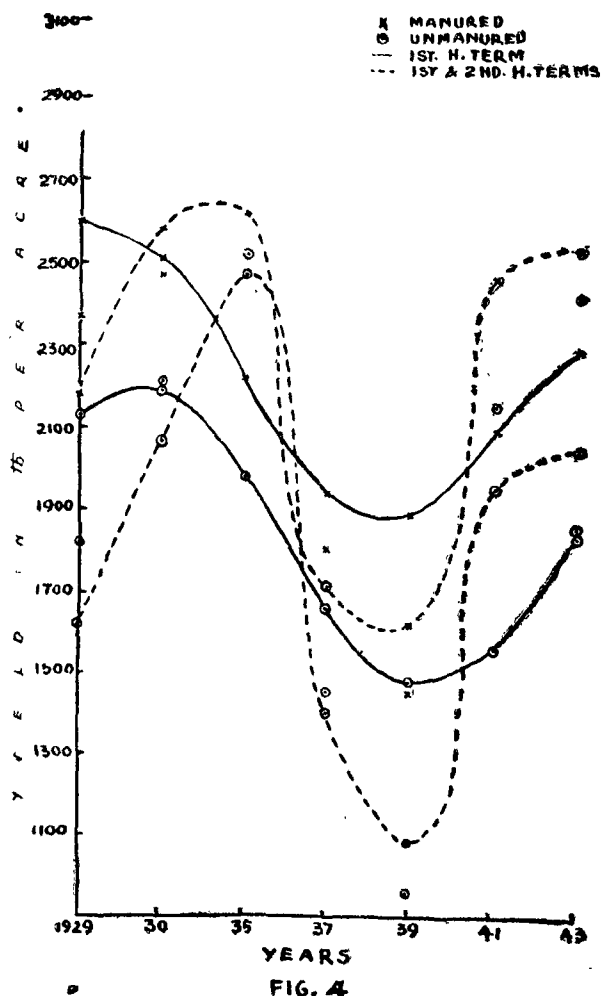
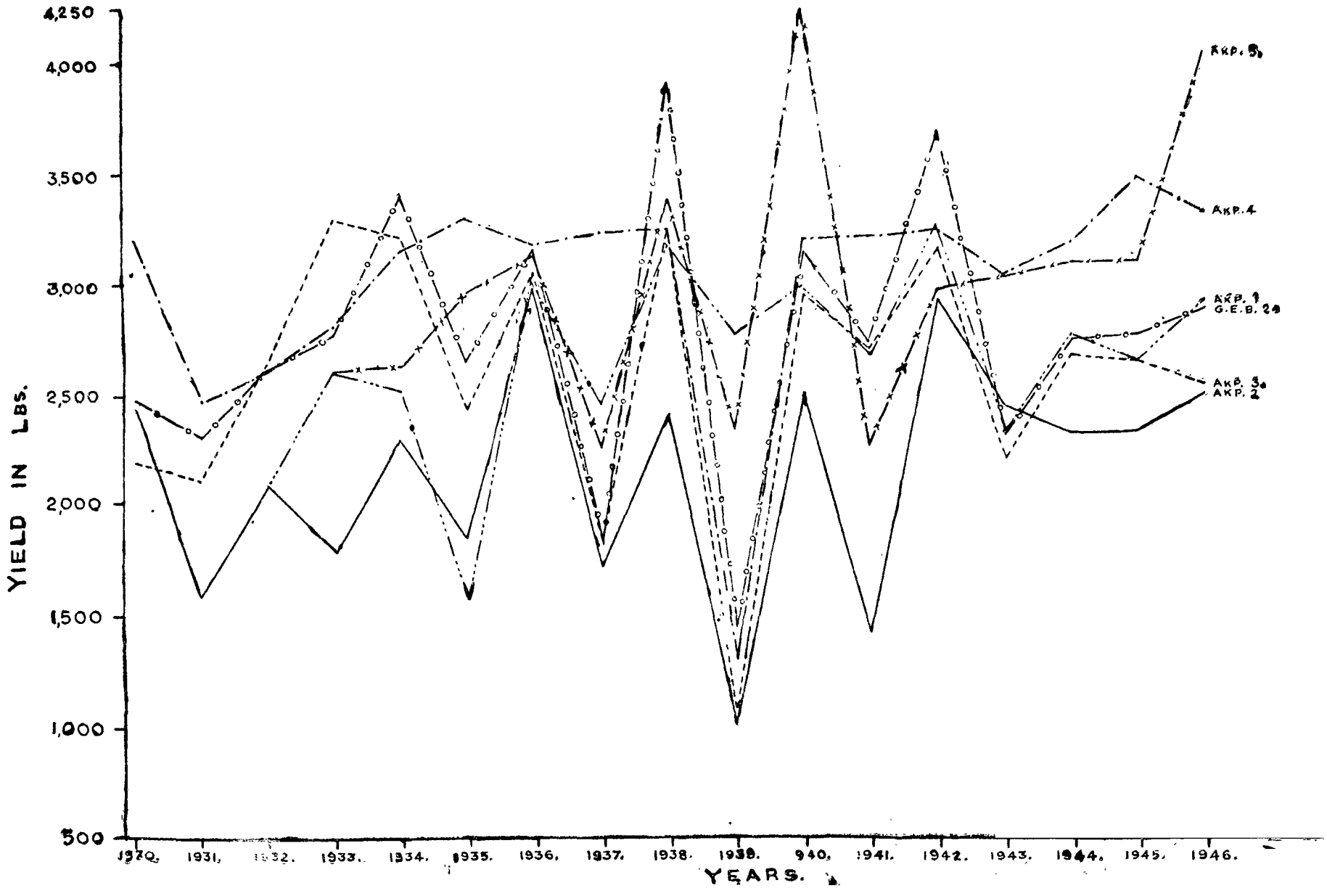


FIG. 4

TREND VALUES OF MANURED & UNMANURED FOR THE GROUP III

F.0

YIELD TRENDS OF SOME EXTENSIVELY GROWN PURE LINES OF THE DISTRICT.



The curves of trends based on values in Table XIV are shown in figures III and IV. The nature of the respective curves are similar to those of the curves in figures I and II, but it may be observed that most of values in each group fall on alternate years and this may be a reason for the alternate peaks and troughs.

It is interesting to study whether the above conclusions are applicable only to G. E. B. 24 which was the variety under test or it will be a general feature for all the varieties cultivated in this tract. For examining this point, fluctuations in the yields of some important early, medium and late strains released from Agricultural Research Station Anakapalle are graphically represented in figure No. 6. The yield trends indicate that essentially all the varieties are similar and therefore the conclusions drawn from the experiment can be safely extended to other varieties also. However there is an interesting exception in the strain AKP. 4. which is a drought-resistant variety of long duration and on account of this fact, the yields are always maintained high with low fluctuations even during years of later planting.

SUMMARY

The study of periodicity on the data of yield obtained from the manured as well as un-manured plots showed a probable period of 2 years but the amplitudes of the successive waves vary considerably.

Peaks and troughs of the data have been considered separately and sine-cosine curves were fitted to the data. The movements of the peaks and troughs were observed to be entirely different.

Significant effect of manure was observed as regards the yield in each year. But the soil analysis did not show any improvement in the conditions of the soil year.

The reason for the seasonal fluctuations of the data is found in the different times of transplanting rather than in rainfall or other meteorological conditions. The yields of earlier transplanting are significantly different from those of later transplanting. Under transplanting the yields were low.

The seasonal trends of the August group and September group have been determined by means of the sine-cosine curves.

The conclusions based on the variety (G. E. B. 24) raised in the experiment, are applicable to other important varieties of the tract, with AKP. 4. as an exception.

Acknowledgement: I am indebted to Sri K. Ramaiah, Director, Central Rice Research Institute, Cuttack and K. S. Nair, Professor of Statistics, Travancore University, for the valuable help rendered in the preparation of this paper.

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TABLE No. 1. Yield of grain & Straw in lb. per acre.

S. No.	Year.	Yield of grain in lb. per acre				Yield of straw in lb. per acre			
		Manured	Unmanured	% increase over no manure.	Significance	Manured	Unmanured	% increase over no manure.	Singinificance
1	1927	2.925	2,850	2·82	Not Sig.	4,700	4.400	7·05	Yes
2	1928	2.650	2,500	6·00	Yes	5,857	4,849	20·78	Yes
3	1929	2,375	1,825	22'90	Yes	2,406	1,860	22·31	Yes
4	1930	2,475	2,075	19'70	Yes	2,263	1,891	19·68	Yes
5	1931	2,300	1,925	20·60	Yes	3,066	2.201	39·28	Yes
6	1932	2,600	2,200	16·90	Yes	3,573	2,752	29·84	Yes
7	1933	2,750	2,500	10·40	Yes	3.425	2.953	15·97	Yes
8	1934	3.375	3.075	9·37	Yes	3,538	3,237	9·29	Yes
9	1935	2,625	2,525	3·84	No	3,132	2,812	11·39	Yes
10	1936	3,125	3,150	0·25	No	6'496	5,738	13·20	Yes
11	1937	1,791	1,447	23·76	Yes	1,897	1,556	21·90	Yes
12	1938	3,865	3,473	13·47	Yes	6,341	5,191	22·15	Yes
13	1939	1,442	958	50·40	Yes	2,022	1,331	51·91	Yes
14	1940	3.033	2,860	6·00	Yes	3,969	3,416	16·20	Yes
15	1941	2,708	2,161	25·30	Yes	3,275	2,766	18·40	Yes
16	1942	3,632	3,256	11·56	Yes	4,411	3,961	11·39	Yes
17	1943	2,295	1,836	25·00	Yes	2,686	2,249	19·43	Yes
18	1944	2,719	2,350	15·64	Yes	4,205	3,580	17,49	Yes
19	1945	2,744	2.141	28·10	Yes	3,818	3,244	17·70	Yes
20	1946	2,162	2,561	11·74	Yes	3,371	3.041	35·20	Yes

TABLE II. Rainfall.

Year.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.	Rainfall during crop growth from sowing to flowering	Remarks
1927	1·01	1·29	2·59		1·42	9·64	7·13	6·13	5·62	0·20	2·94		37·97	15·88	
1928				4·48	0·60	4·47	8·52	4·68	19·15	13·06			54·96	36·89	Heavy rains in Sept. Oct—(32")
1929		4·65			1·66	12·80	0·73	5·32	4·06	9·85		1·35	40·42	13·91	Late planting.
1930		2·67			7·33	4·02	2·63	3·75	2·88	6·45	8·19		37·92	9·33	do.
1931				0·38	3·10	6·06	5·41	2·00	5·17	16·76	4·64		43·52	23·78	Early planting with 11" rainfall at flowering—floods.
1932			0·30	2·59	1·21	2·85	7·40	1·08	7·24	2·40	8·46		33·53	9·79	Medium time of planting.
1933			0·08	3·54	4·10	4·37	7·52	4·54	11·12	9·39	1·52	0·11	46·29	22·87	Early planting.
1934			0·08	0·35	0·37	1·94	11·62	8·78	5·01	3·07	3·56		34·78	15·20	do.
1935				0·55		1·29	4·36	2·21	7·30	6·40	0·11		22·22	8·93	Late planting.
1936	1·44	4·61	0·35		7·93	4·52	3·60	4·55	2·62	7·05	2·19	1·81	40·67	15·49	Very early planting.
1937		2·94	2·65	5·73	0·96	2·63	4·88	7·04	10·68	2·28	0·28		40·07	12·96	Late planting. Failure of water in the channel in November.
1938		1·36		0·07	2·49	8·55	3·42	7·11	17·30	2·44	8·16		50·30	25·39	Earlier planting, floods in November.
1939	0·15		1·48	0·03	0·56	3·01	2·92	1·95	12·03	13·59	3·87	0·75	40·34	18·96	Very late planting.
1940	0·15	2·17	4·55	0·31	9·79	5·59	3·61	3·89	6·73	5·10	0·39		39·61	11·83	Medium time of planting.
1941			0·34		0·44	2·56	3·02	2·89	6·88	12·67	5·63		34·43	17·38	Late planting.
1942		0·20		3·19	1·51	4·99	0·74	6·04	4·84	7·01	3·35	0·38	32·85	11·85	Medium time of planting.
1943	0·98	1·33	2·72	1·30	1·72	5·85	3·47	2·80	7·54	8·53	1·55		37·79	14·56	Late planting.
1944	0·30			2·63	1·41	6·64	5·26	2·61	6·48	7·80	1·14		33·82	15·90	Early planting.
1945	0·02			1·30	0·99	1·14	6·84	6·11	9·84	9·07	0·91	0·23	36·52	20·38	do.
1946		0·39		0·70	0·23	2·19	6·52	3·89	5·19	2·21	2·37		23·69	11·29	do.

Some experiences with Gammexane (BHC) and DDT in the control of crop pests

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The Entomological section has been engaged for some time in studying the effect of the two new insecticides Gammexane (B.H.C.) and D. D. T. on a wide range of crops and pests. The results in most cases have been far beyond expectations. In fact some of the tentative data have been so convincing in the case of a number of major pests like the paddy grasshopper *(Hieroglyphus banian)*, the paddy jassid (*Nephotettix bipunctatus*), the paddy swarming caterpillar *(Spodoptera mauritia)*, the rice bug *(Leptocorisa acuta)*, etc., that the information could be passed on straight away to the ryots even without any further confirmatory tests. What is more interesting is that the two chemicals appear to have a definite selective action, each being effective only against a certain group or category of insects. The response from the ryots also has been very encouraging as a keen demand for these chemicals has now sprung up from farming public. These trials have revealed the possibilities of warding off the damage by many a crop pest, control measures for which were till now either imperfect or non-existent. The insecticides, apart from their high potency, are fairly cheap and easily available with some of the local firms.

I. *Amsacta albistriga— The red-hairy caterpilllar.* This is one of the serious pests of dry crops and is prevalent in most of the dry red soil tracts of this Presidency. The full-grown larvæ are about 2" in length, red in colour with a hairy body. They are polyphagous in habits and capable of thriving on anything green but rainfed crops like groundnut, cumbu, cotton, sometimes cowpea, castor, cholam, etc., are some of the worst affected. In the absence of cultivated crops they freely take to wild vegetation such as Jatropha, Calotropis, Tridax and sometimes even grasses. In cases of severe infestation, millions of these caterpillars occur in definite broods and march from field to field leaving a trail of destruction behined.

Life-history. The life-history of this pest is briefly as follows. Heavy infestation of the caterpillars occurs generally after the South-West monsoon in July and continues upto September in two or three distinct waves. The full-grown larvae seek shady places under trees, or hedges, sandy corners of fields, etc., to pupate. They burrow under to about 6" in the soil, excavate small oval chambers and line the sides with their own hairs woven together with silken threads. They subsequently cast off their skin and turn into dark brown pupae which remain quiescent till the next season. With the receipt of the first summer showers during the next May or June, the contents of the pupae which are first in a liquid

condition, transform themselves into the shape of the adults, the pupal skin gets soft and the moths are thus ready to come out of the soil at the next opportunity. With the Moistening of the soil after the next sharp shower, they wriggle out of their shells and burrow their way up with the help of the two spurs provided on the first pair of legs. Over 10,000 moths have been observed to emerge within a limited area of about 10 sq. yards in the course of a couple of hours. The emergence commences exactly on the third evening after a shower by about 5 P. M. and may continue till late in the evening. The moths begin mating very soon and lay hundreds of creamy, white eggs in masses the same night anywhere on the soil, clods of earth, pieces of stone, etc. When there is a standing crop, the lower surface of the leaf is preferred for egg-laying. Individual females have been recorded to lay 800 to 1,300 eggs in the course of three days and the average capacity may, therefore, be computed to be a thousand. Tiny dark-coloured caterpillars hatch out in the course of three to four days and live gregariously for a similar period scraping and feeding on the green matter from the leaves. They gradually increase in size as they feed and restrict their activities to the neighbouring plants for about ten days. By this time they are ashy coloured and about $\frac{3}{4}$" in length and the real trouble starts from this stage. They develop a voracious appetite showing a special partiality for the flowers and begin to disperse generally in particular directions. They march on from field to field devouring all vegetation and develop the characteristic reddish colour in about 20 days and get fullgrown to a length of about 2" in another ten days. On receipt of the next heavy showers and the consequent wetting of the soil, they again seek favourable spots, burrow down to pupate and emerge as adults in the next season. The number of emergences during a particular season corresponds to that of the different broods of the caterpillars which had gone down to pupate during the previous year:

Habits, nature and extent of damage, etc.: The natural habitats of this pest being essentially the dry red soil areas, a periodical rainfall is necessary for the progress of the host crop as well as for the proper development of the pest. The failure of the thunder showers for long periods after the sowing not only affects the growth of the young crop but also renders the soil too hard for the moths to emerge from below. Secondly, if the rains fail again at the time when the caterpillars are full-grown and ready to pupate they are unable to burrow into the soil, which is quite hard when it is dry. The caterpillars stop feeding, wander about aimlessly in search of suitable places for pupation and ultimately die in their millions. Instances have been noted where scores of the carter-pillars were struggling to get into the soil round about smalls pots moistened by the exudation of the plant sap from roots of trees, which were cut accidentally. There are a few other aspects in the habits of the pest which are worth mentioning here. In South Arcot, where the sun is

particularly severe during June and July, emergences taking place before the sowing of the crop are capable of little or no damage. The summer showers do effect enormous emergences but the moths lay their eggs anywhere on the soil, weeds, pieces of stones, etc., and the eggs as well as the young caterpillars, if the latter manage to hatch out, perish either due to extreme heat or want of food and it is only the subsequent emergences which are of any serious consequence. On the other hand, conditions are different in tracts, where the climate is mild as in Punganur, etc., situated in the Mysore Plateau. Moths emerging with the sowing rains lay their eggs on the soil, weeds, etc., and the young caterpillars on hatching infest the tender germinating dry ragi crop. Sprouting young seedlings of other dry crops like cotton also share a similar fate. While a severe loss is inevitable in cases like germinating ragi, cotton, etc., and in cumbu, were the entire flowers are eaten, the damage is not so serious on groundnut which is more hardy and capable of recovering after the next rain. Another interesting point is that fields where there have been heavy emergences of the moths suffer very little from the pest for the reason that the caterpillars invariably disperse by the time they attain the damaging stage.

Control measures in vogue: So far a systematic hand-picking of the moths as they emerge and subsequently the egg-masses, young caterpillars and later the grown-up ones as well is in practice. The overall cost of the operation worked out to Rs. 2/- per acre and the money value of the additional yield according to the prevalent rates was Rs. 25—8—0 in the case of mixed cumbu and Rs. 52—8—0 in the case of groundnut. A common practice of digging trenches across the line of progress of the caterpillars is also in vogue to prevent their spread from the infested fields to fresh areas. Light traps have been found to attract the moths in very large numbers, but the majority were only males, the number caught being directly proportionate to the intensity of the light.

Work done: *Insecticidal trials — material and methods:* A report was received from the Assistant Cotton Specialist, Adoni during 1948 about the severe incidence of the pest on cotton seedlings, frequently necessitating a resowing of entire areas and about the spectacular effects he had by spraying M.K.E. — D.D.T. emulsion at 1·25%. The present experiments were taken up at Adoni during July, 1949 to confirm the above results and also to see whether the treatments could be simplified. DDT and BHC were tried as dusts and sprays and the DDT emulsion as spray only. The experiments were conducted in plots 28′ × 28′ replicated four times with adequate controls. The concentrations used were (1) 3, 4 and 5% dusts of the two chemicals, (2) Sprays of DDT at 0·1% and 0·25%, (3) of Gammexane P. 520 at 0·05% and 0·1% and (4) 0·16, 0·32, 0·48 and 0·64% (1 to 4 ozs. in a gallon of water) of the kerosene emulsion. The aqueous spray of DDT at 0·1% was not found effective at the first instance

and as such the next higher dosage of 0·25% was tried. The dusts and sprays were applied in the field with the requisite appliances, the quantity being approximately 30 lb. per acre in the case of the dusts and 30 to 40 gallons in the case of the spray fluid. The two chemicals (5%) strength were also applied in trenches dug across the line of progress of the caterpillars and the results of the contact with the chemicals observed. The effects in all these cases were assessed twenty-four hours after the treatments by taking counts of the dead caterpillars. It has, however, to be admitted that in the case of these active creatures which are always on the move, certain allowances have to be made for the invaders from outside as well as the escape of the treated larvae to other areas. The figures as such cannot, therefore, claim a very high degree of accuracy but this defect has been a common factor in all the treatments. The percentages of mortality may, therefore, be taken as indicative of the repective efficacy of the different chemicals. The data of the treatments were analysed statistically and the figures are furnished in the statement No. 1.

Results: *Dusts — DDT 3, 4, and 5%*: The application of the dusts under the local conditions appears to have some limitations. The cotton plants were about 3 to 4 inches in height with a few leaves and as such a thorough treatment involved in an inordinate waste of the material, the high winds prevalent at the period aggravating the trouble. The mortality figures also were not very convincing as the mean averages ranged from 17·75 to 39·00%.

(b) *BHC 3, 4 and 5%*: The same limitations were applicable in this case also but the mortality was more encouraging as it ranged from 26·75 to 48·00%, the highest being in the case of 5% BHC.

Sprays: (a) *DDT*: In spite of the fact that the plants were drenched with the caterpillars *in situ*, the mortality recorded was only 50·75% in the case of 0·1%.

(b) *BHC*: The results in this case were better as a higher mortality of 60·75% and 63·25% has been recorded for the 0·05% and 0·1% concentrations respectively.

(c) *DDT kerosene emulsion. (0·16, 0·32, 0·48 and 0·64%)* The results in this case also are not very convincing since the means ranged from 28·5% to 38·5%.

Exploratory trials were conducted to study whether the emulsion has any phytocidal action. Different concentrations from 0·16, 0·32, 0·64, 0·96, 1·27 and 2·56% of the emulsion were sprayed on a week-old Karunganni and Cambodia seedlings. The results indicate that the last mentioned three strengths caused an almost immediate withering of about 75% of the plants, which completely dried up in the course of three days Cambodia being more susceptible. The lower dilutions at 0·32 and 0·64% although not so fatal, were still found to cause about 10% mortality. Most of the surviving plants showed definite symptoms of scorching. Leaving

aside the phytocidal risk, the ingredients of the emulsion are beyond the reach of the ordinary ryot both by way of their high cost as well as their non-availability.

Trenching: Trenches about 9" wide and 1' deep and 20' long were dug across the direction of the progress of the caterpillars and one pound of the 5% concentration of each of the chemicals was applied in four replications. The effect of the contact of the chemicals on the caterpillars which had dropped in the trenches in their onward progress was observed after 24 hours. The mortality figures are 62% in the case of DDT and 86·5% for BHC. From general observations, the chemicals appear to have a quicker knock down effect on the younger stages as a good number of them were found dead in the trenches themselves, while the full-grown ones died more leisurely in the field after crossing the barrier.

Conclusion: Both BHC and DDT definitely indicate their lethal action against the caterpillars by contact. The first symptom of discomfort is perceptible in about 6 hours when the caterpillars get moribund and lie curled up, neither moving nor feeding and the actual death takes place in about 24 hours. The young caterpillars appear to be more susceptible. Between the two chemicals, DDT both as spray and dust appears to be slow in action, while BHC is quicker.

Taking into consideration, the previous experience and the current data on hand, it still looks as if the time-honoured method of prompt hand-picking of the moths and the other stages is the simplest and most efficient. While dealing with pests as the present one, the local conditions as well as the human material deserve the first consideration before advocating any new method. The ryots of these tracts are proverbially poor and any method involving even a small expenditure is not likely to have a warm reception. But with the present attractive prices of agricultural products, high cost of labour and the consequent insecticide-minded attitude of the ryots, it is likely that this chemical warfare might find favour with them. In experimental stations, where the valuable strains of plants have to be saved at any cost, the treatment is well-worth the trial. Discussing the relative merits of the different preparations BHC P. 520 spray at 0·05% was quite effective. The quantity of the spray fluid required and the consequent cost of the application naturally depend upon the severity of the incidence. One and a quarter ounces of the chemical have to be dissolved in a gallon of water to give the above concentration and the cost of the same works out to annas 2/-. For reasons already mentioned, it is not considered desirable to advocate the use of either the dusts or DDT emulsion.

The experiments were conducted by Messrs. T.S.Muthukrishnan, Assistant in Entomology and M. Ranganathan, Fieldman, with the kind facilities provided by the Assistant Cotton Specialist, Adoni.

STATEMENT I. Percentages of Mortality

No.	Treatment	Replications				Total	Mean
		I	II	III	IV		
1.	DDT 3% ...	32	32	32	20	117	29·25
2.	DDT 4% ...	15	25	20	11	71	17·75
3.	DDT 5% ...	72	38	14	32	156	39·00
4.	DDT 0·1% spray ...	61	59	40	43	203	50·75
5.	DDT 0·25% spray ...	36	60	27	57	180	45·00
6.	BHC 3% ...	39	36	36	15	126	31·50
7.	BHC 4% ...	17	38	35	17	107	26·75
8.	BHC 5% ...	70	59	33	30	192	48·00
9.	BHC 0·05% spray ...	67	67	50	59	243	60·75
10.	BHC 0·1% spray ...	59	77	80	37	253	63·25
11.	MKE Emulsion—1 oz. in 1 gallon of water ...	23	36	36	19	114	28·50
12.	MKE Emulsion—2 ozs. in 1 gallon of water ...	25	25	32	31	118	28·25
13.	MKE Emulsion—3 ozs. in 1 gallon of water ...	57	55	17	25	154	38·50
14.	MKE Emulsion—4 ozs. in 1 gallon of water ...	25	43	17	31	116	29·00
15.	Control ...	13	6	6	6	31	7·75
	Total ...	612	656	475	433	2176	544·00

Conclusion

10 9 4 8 5 3 13 6 1 14 11 12 7 2 15

STATEMENT II. Average percentage of mortality in trenches

No.	Treatment	Replications.			
		I.	II.	III.	IV.
1.	DDT 5%	56·6	48·6	67·6	73·3
2.	BHC 5%	64·6	30·6	68·0	72·0
3.	Control	23·3	8·3	16·6	8·3

Pyrethrum cultivation at Nanjanad

By

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Introduction: Pyrethrum (*Chrysanthemum cinerarifolium*) belonging to the family *Compositae* is a glaucous perennial 18″ to 24″ high. The stems are unbranched and slightly hairy. The leaves are petioled and finely cut. The insecticidal property of this plant is known as "Pyrethrin", which is obtained mainly from its flowers the stamens and pistils, having insecticidal principle, in its most concentrated form. The original home of the plant seems to be in Persia. During the early part of the 19th century, Europe used to import both the plant itself and flower powder from Persia to meet a widespread demand for an effective vermifuge. Later on, in about 1850—60 a new species of the plant was produced in Dalmatia which gradually proved to be superior in quality to the Persian stuff. Long after this period the plant found its way to other places like Japan, Kenya etc.,. In pre-war period Japan used to produce 25 million pounds of dried pyrethrum flowers per annum and 90% of the output went to the United States. Since Japan started hostilities, the only supply for the allied countries has been from Kenya where pyrethrum is regarded as one of the most flourishing industries. Hence efforts were made to increase the area under this crop. From the year 1937 the Imperial (now Indian) Council of Agricultural Research seriously considered the introduction of pyrethrum into India and after a number of experiments fonnd that places like the Punjab, Shillong in Assam, Kashmir and in certain parts of the Madras Presidency namely Nilgiris and Kodaikanal were suitable for its cultivation. During the World War II the area under this crop increased extensively to supply dried flowers to the military.

Cultivation: The plants can be propagated either from seedlings raised from seeds or from slips obtained from old plants. Three pounds of seeds sown over three cents of well prepared seed bed area give enough seedlings to plant one acre of land. The seeds are soaked in water for 24 hours before sowing and the seed beds are mulched after sowing and watered daily. Seeds take 10–21 days to germinate and the seedlings are ready for transplanting in four months. The field to be planted is given two deep ploughings. Ridges and furrows are formed 2′ apart along contour. The seedlings are planted on the ridges 1½′ apart in the months of June and July. One or two weedings are given as and when necessary. The plants begin to flower in about 10 months after planting and the flowering continues from May—July. There is also a second flush in October and November. When two whorls of disc florets open, the flowers are harvested without stalks and dried under shade. The correct stage of drying is reached within 8–10 days

when a flower squeezed between the finger and thumb, does not break. An average yield of 125 lb. of dried flowers per acre may be expected. Though pyrethrum is a perennial crop, it was observed that there was mortality in plants after the third year and therefore the maintenance of the plantation requires periodic filling up of gaps with fresh seedlings. A few experiments both cultural and manurial laid out at the Agricultural Research Station, Nanjanad to study the optimum conditions necessary for the maximum production of pyrethrum flowers are reviewed below :

(1) ***Method of propagation :*** A considerable diversity of opinion exists on the merits of propagation through (1) seed and (2) slips obtained from old plants. With a view to find out the relative merits of these two systems, an experiment was laid out with seedlings vs. slips in A B B A replications (Table I). The results of the trials indicate that seedlings are significantly better than slips even though slips flowered earlier by six months.

(2) ***Spacing :*** Different spacing are adopted between rows and in the rows in different countries. A considerable amount of experimental work has been carried out in other countries on the correct spacing to be adopted. An experiment was therefore laid out in 1944 to determine the optimum spacing to be adopted. The results are given to Table II. Though the treatments have not given any significant increased yields, there are indications to show that a spacing of 2′ between rows and 1½′ in the row is the optimum that could be adopted. This spacing facilitates intercultivation by bullock power.

(3) ***Effect of pruning :*** At the end of the flowering seasons the plants have a number of dead stems and in many countries these are generally cut back before the onset of the next growing season. Experiments were therefore laid out to study the effect of different methods of pruning in different seasons on the yield of flowers and the results obtained are furnished in Table III. Though there was no significance between treatments, yet root pruning done in May before the onset of monsoon recorded the highest yield of flowers and where the plants were cut to ground level gave the lowest yield. This is in general agreement with results obtained in Kenya.

(4) ***Effect of manuring on flower production and pyrethrin content :*** The yield of flowers and the pyrethrin content of flowers are very important in the economics of pyrethrum cultivation. The pyrethrin content varies greatly. Dalmatian flowers contain 0·7% to 0·9%, Japanese flowers contain 0·9% to 1·1% and Kenya flowers contain 1·3% to 1·4%. Since pyrethrin content of the pyrethrum flowers varies from locality to locality the factors responsible for this difference had to be investigated. One factor that might be responsible for increase in pyrethrin content and

also for increased flower production is the application of manure. With this view manurial experiments were conducted in different countries. In Colorado experimental station manurial experiments were conducted during 1932—33 with ammonium sulphate, super phosphate and potassium chloride. These three ingredients were tried in different combinations. None of these treatments had any significant effect in increasing the pyrethrin content. Ripert reports that in favourable years fertilizers increase the yield of flowers but in poor years maintains satisfactory yields. Fertilizers do not affect the pyrethrin content. Martin and Tetterfield came to the same conclusion after experimenting with potted plants treated with different manurial ingredients. Culbertson found that pyrethrin content is not influenced by fertilizer treatment. It is also said that excessive nitrogenous manure will result in excessive vegetative growth with no flowers. In Rhodesia ammonium sulphate seemed to increase the yield of flowers considerably. In Japan fish scrap is used as a fertilizer. In order to find out the effect of manures on the yield and pyrethrin content of flowers two experiments were laid out namely phosphatic trials and prawn dust trials. The treatments and results are furnished in Tables IV and V respectively. From the results it is seen that manuring does not increase the yield of flowers appreciably and this is in general agreement with other workers. Pyrethrum does not respond to manuring. This may be due to the fact that pyrethrum crop does not remove heavy quantities of plant foods. A 1000 lb. crop of dried flowers removes 17 lb. nitrogen, 25¾ lb. of potash and 5¾ lb. of phosphoric acid and 4¼ lb. of lime. Regarding the pyrethrin content a dressing of super phosphate and bonemeal to snpply 50 lb. of $P_2 0_5$ per acre in equal quantities has given the maximum.

Summary and Conclusions: A few experiments conducted to find out the correct spacing to be adopted, the effect of pruning plants and roots at different periods, the best method of propagation and the effect of the application of manures like prawn dust, super phosphate and bonemeal gave the following indications:

(1) That spacing of 2′ between rows and 1½′ in the row was the optimum to be adopted.

(2) That root pruning done in May increased the yield of flowers.

(3) That propagation by seedlings was significantly better than by slips.

(4) That application of ½ ton of prawn dust and 1 ton of lime has beneficial effect.

(5) That there was no response due to the application of phosphatic manures like super phosphate and bonemeal. Analysis of pyrethrum flowers produced at Nanjanad showed a very high content of pyrethrin as compared with foreign samples.

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TABLE—I. Yield of Fresh Flowers in lb. per acre.

S. No,	Treatments	1st year 1944—45	2nd year 1945—46	3rd year 1246—47	4th year 1947—48
1.	Seedlings A (control)	71·4	7163·0	376·0	86·0
2.	Slips B	54·0	899·2	178·0	28·0
3.	Mean	62·7	1031·1	276·0	57·0
4.	Standard error	...	0·57	0·8	0·29
5.	Critical difference	...	1·2	85 lb. per acre	30 lb. per acre
6.	Whether significant by 'Z' test ...		Yes	Yes	Yes

TABLE—II. Yields of Fresh Flowers in lb. per acre.

1.	2½' between rows and 2½' in the row A.	18·0	498·2	1088·0	172·0
2.	2½' " " 2' B.	14·1	555·0	1220·0	215·0
3.	2½' " " 1½' C.	18·0	591·14	1213·0	197·0
4.	2½' " " 1' D.	17·2	551·4	1238·0	209·0
5.	2' " " 2½' E.	14·8	525·15	1116·0	194·0
6.	2' " " 2' F.	19·5	627·8	1227·0	209·0
7.	2' " " 1½' G.	24·2	675·5	1379·0	238·0
8.	2' " " 1' H.	17·2	690·0	1352·0	224·0
9.	1½' " " 2½' I.	23·4	577·8	1103·0	167·0
10.	1½' " " 2' J.	14·1	615·15	1224·0	233·0
11.	1½' " " 1½' K.	21·9	570·10	1213·0	206·0
12.	1½' " " 1' L.	22·7	680·1	1288·0	281·0
13.	Mean	18·78	596·45	1222·0	212·0
14.	Standard error		21·5	16	12·04
15.	Critical difference		44	38	307 lbs. per acre.
16.	Whether significant by 'Z' test	only two were done.	No	No	No.

TABLE III. Yields of Fresh Flowers in lb. per acre

S. No.	Treatments	1st year 1944—45	2nd year 1945—46	3rd year 1046—47	4th year 1947—1948
1.	A Plants left unpruned	...	217·0	1407·0	300·0
2.	B Root pruning alone	...	235·0	1534·0	312·0
3.	C Plants pruned to half their size	...	155·0	1076·0	253·0
4.	D Plants pruned to ground level	...	122·0	963·0	257·0
5.	E Same as A	...	155·0	951·0	148·0
6.	F ,, B	...	160·0	1039·0	230·0
7.	G ,, C	...	148·0	935·0	207·0
8.	H ,, D	...	108·0	795·0	180·0
9.	I ,, A	...	200·0	1277·0	277·0
10.	J ,, B	...	183·0	1179·0	224·0
11.	K ,, C	...	175·0	1097·0	232·0
12.	L ,, D	...	143·0	1019·0	289·0
13.	M ,, A	...	179·0	1148·0	212·0
14.	N ,, B	...	205·0	1296·0	270·0
15.	O ,, C	...	125·0	924·0	244·0
16.	P ,, D	...	107·0	895·0	243·0
17.	Mean	...	not analysed statistically	1096·0	242·0
18.	Standard error	...	...	10·6	23·04
19.	Critical difference	...	...	21·7	582 lb. per acre.
20.	Whether significant by 'Z' test	...		No.	No.

TABLE IV. Phosphatic Trials

S. No.	Treatments		Yields of fresh flowers in lbs. per acre				
			1st year	2nd year	3rd year	4th year	pyrethrum content
1.	No manure control	A	109·5	2237·1	649	285	1·5475
2.	Super phosphate to supply 50 lb. of P_2O_5 per acre	B	75·0	979·1	404	197	1·7375
3.	Bone meal to supply 50 lb. of P_2O_5 per acre	C	49·2	983·9	481	237	1·875
4.	Super phosphate to supply 25 lb. of P_2O_5 per acre plus bonameal to supply 25 lb. of P_2O_5 per acre	D	68·0	885·8	421	183	2·2375
5.	Super phosphate to supply 100 lb. of P_2O_5 per acre	E	60·7	916·4	378	157	1·6485
6.	Bonemeal to supply 100 lb. of P_2O_5 per acre	F	74·6	1110·6	576	238	1·8815

S. No.	Treatments		Yields of fresh flowers in lb. per acre				
			1st year	2nd year	3rd year	4th year	Pyrethrum content
7.	Super phosphate to supply 50 lb. of P_2O_5 per acre plus bone-meal to supply 50 lb. P_2O_5 per acre	G	71·5	119·8	555	253	1·28
8.	Mean		72·6	1018·1	495	221	
9.	Standard error			0·1	10	12·1	
10.	Critical difference			0·21	21	320 lb.	per acre.
11.	Whether significant by 'Z'-test.			No	No	No	

TABLE—V. Prawn Dust Experiment

S. No.	Treatments		Yields of fresh flowers in lb. per acre.				
			1st year 1943—44	2nd year 1944—45	3rd year 1945—46	4th year 1946—47	5th year 1947—48
1.	No manure	A.	337·88	273·6	33·0	449·25	438
2.	Prawn dust @ ½ ton per acre	B.	329·13	336·6	39·75	475·50	448
3.	Prawn dust @ ½ ton per acre plus 1 ton lime per acre	C.	308·50	459·4	32·25	518·5	509
4.	Mean		325·17	356·5	35·0	481·0	415
5.	Standard error		19·44	17·5	...	4·2	4·086
6.	Critical difference		27·49	42·97	...	9·4	114 lb. per acre.
7.	Whether significant by 'Z' test		No	No	...	No	No

Pedigree seed of rice—its rapid extension in the country

By

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Temporary increase in production could be obtained by crop management but as a long-term policy, efficiency of production must be increased by breeding. For, in the management of crop, the question of cost comes in, and a certain treatment ceases to have value if it is uneconomical. That the use of seed, improved by breeding, is a sure and cheap way of augmenting seed supply is an indisputable point. It has been found that pedigree seed is able to give increased yield anywhere from 10 to 30 per cent depending upon the variety. It has also been

found that certain seeds besides yield, quality etc., are also valuable for their other characteristics such as resistance to lack or excess water, pests and diseases etc. The use of pedigree seed is thus an insurance against losses. It has also been found from some preliminary investigations that pedigree seed is more efficient in utilising soil nutrients.

More productive crop strains have been developed after numerous trials, and failures and persistent efforts of a number of scientists and it is necessary therefore that the public should get as much help as possible to derive all quick benefits from them. The primary function of seed distribution is increased production, increased value of the produce and introduction into new areas. The full benefits of an improved strain are realised in proportion to the progress made under (1) rapidity of extension, (2) the maintenance of its purity and (3) the soundness of seed itself in viability.

It has been found that differences upto 20 per cent exist between crops grown from "elite" seed of a strain and seed of the same strain which had deteriorated. These occur when seed requirements of a particular region are too large to permit a research station to exercise the necessary supervision at all stages of seed production. A new strain should, therefore, be made available to the farmers as fast as it is possible to increase the seed, at the same time maintaining it in a state of high purity.

It may not be out of place here to describe briefly how seed distribution is organised in foreign countries. It must be admitted that some of these countries have reached a high stage of economic advancement and all the methods described below may not fit into our conditions in India. But certainly it would help by giving us an idea of the practical aspects in the scheme, so that we might benefit by adopting those aspects that are suited to our conditions.

In the U. S. A. the first stage is the production of nucleus seed on the research station. A chain of research stations produces enough seed to sow atleast 1000 acres of the strain. This is given to about 50 growers who are 'certified' growers so that the crop may be kept in a state of high purity. The produce from this area furnishes the foundation for further rapid spread. From this stage the seed gets into commercial production and it is at this stage that there is the danger of admixture, which occurs in the several phases of raising the crop, threshing and storage operations. But it has been recognised that the responsibility of the Agricultural Department is not over, with the mere development of superior strains, but also extends to the multiplication and maintenance of an assured supply of the strain. There are private seedsmen in every country but the Government employs about 80 to 100 Extension

Agronomists and 2000 to 3000 country agents, who check the purity of the seed. There are also private bodies such as Pure Seed Association and Better Farming Co-operative Societies engaged in this work. The supervision in the field and the inspection in the 'Sack' which are done by the Department ensure a thorough check on the seed purity. The inspection activities are financed through a small certification fee and sales tax on the seed.

In Canada, one of the biggest of seed unions in the world called "The Canadian Seed Growers' Ascociation" employs provincial officers for field inspection who certify the seed both after the "field" and "sack" inspection. This Association grows nearly a million acres of wheat, forming about 5 per cent of the total area and from the produce of this area the whole tract under wheat in Canada is covered.

The Swedish Union at Swalof which has also its own Research Station works on similar lines. The station later developed into one of the most famous of Breeding Institutes of the world. In Australia, the Department deals directly with the farmers. A list of growers of pure seed is published in the Agricultural Gezette. The list is compiled after inspection of the standing crop and seed in the bin or sack. In Japan, before the war, seed distribution was so throughly organised that any but the use of certified seed was illegal. Pedigree seeds where made available at every 'Prefecture' in requisite quantity at reasonable rates through the Government agencies and in some places through private organisations such as Better Farming Societies.

Coming nearer home, the distribution of pure rice seed formed one of the most important items of work of the Agricultural Department in Burma, before the war. Besides the departmental farms, a large number of seed farms engage themselves in this work. There are major and minor seed farms. The 'major' seed farms, owned by Government are situated at the head-quarters of the district and are equipped with buildings for storing the produce. There were 24 such farms in 1939—40 with a total area of 2800 acres. Scattered round about each of these major seed farms are the minor ones. These were usually Government porambokes reclaimed and leased out to tenants on certain conditions and usually they got special concessions by way of subsidy in the shape of seed, manures etc. These minor farms 153 of which occupied 9500 acres in 1939—40 are inspected thoroughly by the State and the whole produce is bought by Government and sold to people. There are also a number of private organisations to which seeds are first distributed from the minor seed farms who maintain registers showing the names of those to whom they distribute the seed. The total seed thus distributed is sufficient for nearly one million acres every year. A similar procedure as above obtains in the Punjab with regard to wheat.

In Bengal, 10 lb. packets of improved seed had been distributed one season free to 12,000 people. It immediately struck root and further purity etc., was maintained through seed farms at central places in each district which also have two or three registered seed growers. These are under the direct supervision of Departmental staff. Seed is given free to them from the large number of godowns situated in central places all over the country. The District Village Improvement Committees of Bombay who run seed farms, the registered seed unions of the Central Provinces where each member deposits a part of his income at the time of harvest supervised by the Government may be of some interest to us in Madras. There were 23,000 such private seed farms in the Central Provinces in 1938—39 and twelve million pounds of rice seeds sufficient for 3 laks of acres were sold by them excluding wheat, sugarcane etc. In Sind, there are permanent registered departmental rice-seed growers in each Thana or district.

In regard to the actual method of distribution and sale, there are variations from country to country and province to province. In the U. S. A. the cost of certified 'pedigree' seed is at least two times that of the seed for consumption. But this extra cost does not in any way prevent the growers from going in for this seed, because they are convinced of its definite superiority over the local seed. In Bombay, seed from the seed farms was being distributed on exchange basis in most of the cases, the differences in price being written off. In Bengal and United Provinces, there is the "Sawai" system, the grower obtaining the seed from the Gvernment godowns and returning the quantity at harvest time with 25 per cent more; he contracts to sell if required to the Government upto three times the quantity he has taken. In some districts, the seed is given in exchange for equal quantities of the ryots' seed as the Dhan Prabhandkaran Sabhas of Sind. In the Punjab, the sale of Departmental seed is in the hands of non-official commision agents who get usually a commission of two annas to three annas per maund of seed. When the seed farms are run by the Co-operative Societies, sales to non-members are usually charged 10 per cent extra.

Seed production in our country will have to be in the hands of the Agricultural Department for some time to come, with adequate supervision at each and every stage. If private seed agents are encouraged, a form of certification will be necessary. Financial regulations must be relaxed to permit maxium turn-over in one season. Co-operative organisations may be encouraged to take up the distribution of seed. The price of seed should be at a higher rate (but not very high) so that there may not be misuse. It may be worthwhile to consider the feasibility of introducing legislation to prevent the use of bad or uncertified seed. For the poorer sections of cultivators, the seed may be given in exchange if necessary with a small percentage of extra seed to be collected at harvest time.

Police thanas and villages officers may be utilised for seed distribution to small ryots. A system of seed distribution at a fixed rate like the selling of quinine at Post Offices, during the sowing season may be useful for smaller ryots when a new strain has to be quickly substituted. Thakkavi loans should be given freely to taluk associations and the like, stipulating the purchase of their seed requirements from approved seed growers, while seed lent to small agriculturists on loan may be made recoverable in kind at harvest plus a reasonable rate of interest in kind. Better Farming Societies must be encouraged to be established and improved types grown for seed purposes and inspection is to be freely given by the Agricultural Departmental Officers. Blocks of cultivable wastes may be given free of assessment and also some subsidy to persons who undertake to grow approved departmental strains. The growth of large pedigree seed farms managed by private individuals but controlled and supervised by the Department must be encouraged. Hand bills, pamphlets, posters and local dailies may also be fully utilised for making known to ryots the availability of improved types at particular centres.

Government may permit the sanction of seed advances to co-operative credit societies which may arrange with one or more of its cultivating members to raise the improved types under joint supervision. The produce may be handed back to the Society who may organise for its proper distribution to both members and non-members either by cash sales.

Establishment of grain banks may be encouraged. This is what the State may do to help in seed organisation. But the improvement of a crop requires the joint efforts of the scientists and the practical men. The study and application of genetic factors is the work of the breeder : the study of the non-genetic factors, as also the choice between varieties with different combinations of genetic factors produced by the breeder must remain in the hands of 'practical' men. Thus without the active co-operation of the producer, not much progress can be achieved. It is estimated by an experienced worker that the contribution towards production may be divided between the following :

The producer, his knowledge, application and skill. ...	40%
Soil fertility, natural and physical prospects. ...	20%
Moisture including artificial irrigation	20%
Climate, pest and disease control	10%
Seed	10%

A few practical hints on the stages of seed production and maintaining its purity and yield at high level are given below :—

(1) First, in the selection plot, the heaviest fraction of seed with good germination capacity is used – best plants are chosen at harvest time and this gives rise to –

(2) ***The seed plot:*** Here the crop is subject to negative selection, i.e., roguing etc., and this gives rise to – (3) The seed multiplication plot – seed from this gives rise to – (4) 'Elite' seed plot.

Good seed must not only mean vital seed, but it must be fixed in type, must have a good germination capacity and adapted to the locality. My exhortation to my cultivator friends is: Select in the field; Take good plants; Cut big heads; Discard light grain; Save this seed; Grow this seed in the seed plot the most fertile of your fields; for good seed cannot be produced on bad land. Select every year and step up production for all-round plenty and prosperity.

Short Notes

Wild Ducks a Paddy Pest: (*Anas crecca* or the common teals). Whoever had occasion to tour the tail end of the Tanjore delta, must have noticed the havoc caused, by the wild ducks, '*Anas crecca*' (Siravi in Tamil), during the winter season. The Mirasdars, keep awake the whole nights, beating drums or whistling, to drive the wild ducks, which swarm in hundreds, dropping into the paddy fields causing destruction to the semi ripe sheafs. These ducks are regular migrators from their haunts in interior lakes, in the winter season and their stay continues as long as the swamps and lagoons in the coastal areas of these parts have sufficient water and supply of fish, (*Geres Koii* Tam. Colia–Thovi, Therapon–Killi, Mugil–Madava. Eng. Cat–Fishes), that breed in saline swamps. What attracts them most, is the enormous multiplication of fish, in these lagoons, and these fish in turn find large quantities of vegetable and other materials carried down by the rivers or by the drainage water, getting stagnated in the lagoons.

It is not the wild duck alone that makes this journey, the Pelican (*Pelican erythrorhynchus*) and the stork (*Ciconia ciconiforms*), and the flamingo, (*Phoenicoptrus rubes*) all migrate here anxious to swallow the fish and other aquatic animals. But none of these is destructive to paddy. The lagoons on the sea coast are shallow and wide and abound with mud and slush, with plenty of shrubs which give them shelter and hiding ground. During the day time, the lagoons are filled with these ducks and their play and noise is heard furlongs away, and it is a pleasant sight to see thousannds of these birds wallowing in the miry water, during the sunny hours. But at dusk, they swim to the low lying ground, flutter their wings, and take to flight in batches, and the paddy crops in distant places miles away are destroyed in no time. As the winter crops are about to become ripe, and are partly under water on account of rains, they are easily accessible, to the beaks of these birds. As the crops do not uniformly mature, to harvest them all together, the ducks find a rich pasture, by peeling the sheafs of paddy, with their beaks, swallowing partly, and pulling the rest to the water, where the fish are waiting to take their share of the spoil. Small landholders who solely depend upon a few acres, are ruined and apply for remission. They often find while harvesting, only a few grains, and often they abandon the harvest altogether. Shooting down the birds are only partially effective, as they come in hundreds. Further their movements are mostly during nights and hunters often miss their aim. Occasionally, during moonlight nights, in their marches, they mistake the white sandy grounds, for a water spread, swoop down for settling and are killed.

Fishermen in these areas move in these lagoons, for catching these ducks, which fetch good price and duck shooting is sometimes done. These fishermen, knowing the ways of these birds and their march during nights, create artificial mounds of small size in these lagoons, and spread framed nets on either side of these mounds, and keep them submerged in water. Long ropes are attached to the ends of these frames, and behind a distant shrub, he hides, with lever peg ready to drag the nets. The birds towards the dusk, land on these mounds, and at a given signal by the watcher, the rope is pulled over the lever and the nets on the either side close over the mound, and the birds, are caught under the net. They are immediately rushed to the market which are often miles away, from where they are transported to other places. However these catches do not diminish the number while the destruction caused to essential food crops continues to be really heavy. Attempts to use the lagoons either as paddy fields or as fish rearing stations, have not been contemplated; the difficulty of the ryots continues unabated, while very valuable fish is wasted, and the paddy crop is lost. Both the fish and the crop can be saved, if only these lagoons which dry during the months of July to September are provided with water for irrigation and can be made to grow a Kuruvai crop, and harvest it before the rains commence. Here is a problem for the irrigation, agriculture and the fisheries department to meet and save valuable income for the people, of these areas.

Agricultural Demonstrator,
Kodawasal, Tanjore Dist.
5—8—1949.

S. KANNAN.

Gleanings

Coconut shells as an industrial raw material, (Dr. R, Child, Ind. Coconut Jourl. Vol. II No. 4 1949): Coconut shells are similar in composition to the hard woods, but they have a higher content of lignin, total pentosans and a lower cellulose content. The nature of the products obtained by dry distillation show considerable quantitative differences from those of woods and it is likely that those differences point to features in the composition of coconut shells not indicated by existing analytical methods. It is believed that further investigation of the various fractions, lignin. cellulose, pentosan etc., would yield results of interest in the chemistry of cell wall substances. Apart from their industrial uses coconut shells find also a wide variety of domestic and ornamental uses, some of which are mentioned below. To go no further back the seventeenth century, Robert Knox relates how the Sinhalese make a bottle of the nut by boring a little hole in one end and removing the meat inside, coconut leaf-shells are still in use as drinking cups in toddy taverns, as receptecles for collecting rubber larex, as scoops and ladles after fitting with a bamboo handle and as begging bowls. Bennet (1843) refers to the employment in Ceylon of a coconut shell as a resonant back for a musical instrument a stringed Sinhalese Vinah. Watt (1889) says that the dried shell is widely used as the water bowl of smoklng pipes or *hukahs*. In Madras the shells are made into elegantly carved ornamental vases, lamps, spoons, sugar pots, tea pots etc. He also gives a list of 83 different articles prepared from the coconut palm, exhibited at the Colonial and Indian exhibition in the 1880's which included several shell articles. Burkill (1935) has some interesting particulars of coconut shell vessels used in Malaya. The measure of capacity known as "Chalok" is what a coconut scoop will hold. In Java, the coconut shell is held to be the appropriate vessel for medicines. In Sarawak. medicinal preparations in connection with births must be given in coconut shell. Among the Malayas a coconut shell vessel is used in a "Rice ceremony" because evil spirit must be confronted with objects which they recognise. In the Nicobar Islands, a baby until two months old must only be washed in water from the shell of a young coconut.

Coconut shell is hard and takes a high polish; it can be carved though with some difficulty, decorated with lacquer and inlaid with silver or other metals. Local craftsmanship is able to produce articles of very attractive appearance, characteristic of the native art of various countries of origin. Some of these are of course more ornamental than useful, such as a complete tea set including pots, six cups and sugar bowl but things like buttons studs are quite practical affairs.

However out of enormous quantities of shells produced in coconut producing countries the uses mentioned above account for only a very negligible fraction. Undoubtedly the bulk of shells produced have been and still are in most countries used only as fuel, as they do provide for many purposes an excellent fuel. Especially in countries where well developed plantation industry exists shells are largely used for firing copra drying kilns. According to Burkill, it is the destiny of 70 per cent of the coconut shells in Malaya to be burned for drying copra. When the shells are dried before use, a clean burning, almost smoke-free fires are given by these shells. On small holdings as in South India and Ceylon shells are for the most part used as domestic fuel. In recent years Ceylon has developed a considerable export business in coconut shell charcoal and the price of shells largely depend on the export price of charcoal, being frequently as high as Rs. 5/- per 1000. At the time of writing the price of whole shells at estates is round about Rs. 2/- per 1000. Though precise data do not appear to have been recorded on the calorific value of shells, it is likely to be over 7,500 British thermal units per pound. Shells are not favoured as a boiler fuel, there seems to be a rapid corrosive effect of the vapours on fire bars etc., due partly to the high temperature reached and to the acid nature of the cumbustion products when air intake is insufficient. There is also in Ceylon, a slight prejudice against their use in the cooking of food, especially meat, which the "Creosotic vapours" are alleged to render tough and indigestible. (T. R. N.)

Agricultural College and Research Institute, Coimbatore.

LIST OF ADDITIONS TO LIBRARY FOR DECEMBER 1949.

1. BAILEY (L. H.): Manual of Cultivated plants most commonly grown in the continental United States and Canada, Revised Edition—1949 (Mac. Millan & Co., New York)

2. BATCHELOR (L. D.) and WEBBER (H. J.): Citrus Industry Vol. 2. Production of the Crop. Edn. 1. 1949: (University of California Press, Berkely Los Angeles)

3. KAPP (R. O.): Presentation of technical information: 1948. (Constable & Co., Ltd., 10, Orange Street, London)

4. SAM HIGGINBOTTOM FARMER: Our autobiography. 1949 (New York: Charles Scribbner's Sons)

D. B. K.

Weather Review — For December 1949

RAINFALL DATA

Division	Station	Total for the month in inches	Departure from normal in inches	Total since January 1st in inches	Division	Station	Total for the month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalpore	Nil	—0·5	37·7	South.	Negapatam	0·1	—10·9	26·4
	Calinga-patam	Nil	—0·5	33·6		Aduturai*	Nil	—0.9	33·1
	Vizagapatam	0·1	—0·5	38·8		Pattukottai*	Nil @	—4·8	26·0
	Anakapalle*	Nil	—0·9	49·1		Mathurai	Nil	—2·0	38.5
	Samalkot*	Nil**	—0·3	45·1		Pamban	8·1	—0·5	39·5
	Kakinada	0·1	—0 6	57·7		Koilpatti*	0·1	—3·0	24·6
	Maruteru*	Nil	—0·6	48·8		Palamcottah	1·0	—3·2	21·5
	Masulipatam	Nil	—0·7	64·8		Amba-samudram*	1·5	—7·6	22·4
	Guntur*	Nil	—0·3	38·2					
	Agrl. College, Bapatla*	Nil	—1·1	51·7	West Coast.	Trivandrum	0·2	—2·3	57·0
	Veeravanam* (College Farm)	Nil	(x)	51·3		Fort Cochin	Nil	—1·6	128·9
						Calicut	Nil	—1·5	138·5
Ceded Dists.						Pattambi*	Nil	—1·8	98·7
	Kurnool	Nil	—0·2	41·9		Taliparamba*	Nil	—1·7	164·5
	Nandyal*	Nil	—0·4	39·4		Nileshwar*	Nil	—1·9	169·4
	Hagari*	Nil	—0·3	18·6		Pilicode*	Nil	—2·5y	160·2
	Siruguppa*	Nil	—0·1 z	31·4		Mangalore	Nil	—0·7	159·7
	Bellary	Nil	—0·1	19·1		Kankanady*	Nil	—0·6	161·8
	Rentichintala	Nil	—0·1	30·7					
	Cuddapah	Nil	—0·8	34·2	Mysore & Coorg.	Chitaldrug	Nil	—0·5	17·3
	Anantha-rajpet*	Nil	—4·9	48·3		Bangalore	Nil	—0·4	42·1
						Mysore	Nil	—0·4	28·4
Carnatic.	Nellore	Nil	—2·8	39·7		Mercara	Nil	—0·7	120·9
	Buchireddi-palem*	Nil	—3·6	34·3	Hills.	Kodaikanal	0·1	—5·2	50·2
	Madras	Tr.	—5·5	38·2		Coonoor*	Nil	—6·4	48·7
	Tirurkuppam*	Nil	—7·1y	54·2		Ootacamund*	Nil	—2·8	41·5
	Palur*	Nil	—6·8	31·8		Nanjanad*	Nil	—1·7	48·7
	Tindivanam*	Nil	—4·5	25·0					
	Cuddalore	0·3	—7·2	29·6					
Central.	Vellore	Nil	—2·6	41·3					
	Gudiyatham*	Nil	—2·3	40·1					
	Salem	Nil	—1·0	32·3					
	Coimbatore (A. C. R. I.)*	Nil	—1·9	16·5					
	Coimbatore (C. B. S.)*	Nil	—1·9	16·8					
	Coimbatore	Nil	—1·4	18·4					
	Tiruchirapalli	Nil	—2·6	38·4					

Note :—

(1) * Meteorological Stations of the Madras Agricultural Department.

(2) Average of ten years data is taken as the normal.

(3) (y) Average of six years data for Tirurkuppam and seven years data for Pilicode is given as normal.

(4) ** Actual rainfall is 0·04".

@ Actual rainfnll is 0·03".

It is given in the above table as Nil since data are presented only correct to one decimal place.

(5) (z) Taluk office rainfall is also Nil and normal is 0·14".

(6) (x) Readings are being recorded only from February 1948.

(7) Tr. Trace.

Weather Review for December, 1949

The month began with practically dry weather throughout the Peninsula. On 4—12—1949 the North-East Monsoon became slightly strengthened to the East of Ceylon. Three days hence conditions became unsettled in the South-West Bay of Bengal, East of Ceylon. A number of low pressure waves and mild western disturbances happened to be the characteristics of weather in the first fortnight of the month, without much rain. The North-East Monsoon strengthened on 18—12—1949 in the extreme South-West Bay of Bengal and became active three days hence giving some good rains. Again on 26—12—1949, the North-East Monsoon became active in Ceylon and the moisture contents of air at all levels over South Malabar got considerably increased. On this day the air over Madras also became moist especially in upper levels.

In the first 26 days of the month, the weather was almost dry except for a few slight showers in isolated places and a very few localised showers of some magnitude, say as for instance Pamban recording 1·5″ on 7—12—1949. On 27—12—1949 a few showers were received in the coastal districts of Tamilnad and in the extreme South Kerala. Afterwards the weather was dry. In Pamban fairly moderate showers occurred on four days in quantities ranging from 0·9″ to 1·7″. Alleppey and Cuddalore had respectively 0·7″ and 0·3″ of rain. In other places only very slight showers occurred. In almost all districts, the rainfall for the month happened to be below their respective normals. In short, it can be said that the general performance of the North-East Monsoon this year is far from being satisfactory, particularly from the point of view of the agriculturists.

On majority of days night temperature happened to be below normal.

Agricultural Meteorology Section,
Lawley Road P. O., Coimbatore
Dated 17—1—1950.

C. BALASUBRAMANIAM.

Departmental Notifications

GAZETTED SERVICE.

Name of Officers	From	To
Sri Bhushanam, K.	Special D. A. O. Vijayavada,	Special D. A. O. Arakuvalley.
,, Chidambaram Pillai, V.	P. A. to D. A. O. Tinnevelly,	D. A. O. Mathurai.
,, Krishna Reddy, T.	Special D. A. O. Arakuvalley,	Special D. A. O. Vijayavada.
,, Ramaswami, K.	D. A. O. Madras,	Gazetted Asst. in Agri. Coll. Coimbatore.
,, Thirumalacharya, N. C.	P. A. to D. A. O. Mathurai,	Special D. A. O. Sugar Factory Aera, Amanayanaickanur.

SUBORDINATE SERVICE.

Messrs. Appa Rao, V. — A. D. Nandigama, A. A. D. Narasapur; Abdulla Haji, P. — A. D. Manantody, A. D. Cannanore; Annaswami Iyer, N. — F. M. Central Farm, Coimbatore, A. D. Avanashi; Dharmalingaswami, P. — Seed Development Asst. Bellary, F. M. Hagari; Dhamodara Prabu, M. — A. D. Puthur, A. D. Peruntalmanna; Krishnamurthi Rao, S. — Special A. D. Tungabhadra Project Area, P. A. to D. A. O. Bellary; Kuppuswami, B. S. Fruit Asst. Mettupalayam, Horticultural Inspector Diploma Course, Madras;

Kalyanasundaram, N. V. — on leave, P. A. to D. A. O. Pudukottai; Krishnaswami Iyer, A. — P. A. to D. A. O. Pudukottai, Paddy Asst. Seed Development Scheme Trichy; Kunhikannan, K. — A. A. D. Wynad, F. M. Wynad; Kadar Razak — A. D. Vinukonda, Seed Development Scheme Cuddapah; Mahimaidoss, V. — A. D. Kollegal, A. D. Virdachalam; Meenakshisundaram, D. — Paddy Asst. Seed Development Scheme Trichy, Asst. in Paddy A. R. S. Ambasamudaram; Meenakshisundaram, M. M. — A. D. Sugarcane Area Nilakottai, A. D. Mathurai; Muthuswami, S. — Fruit Asst. Fruit Farm, Aduthurai, Fruit Asst. Wynad; Narasimhamurthi, G. — P. A. to D. A. O. Bellary, Seed Development Asst. Bellary; Nambiar, P. K. — A. D. Cannanore, A. D. Manantody; Narasimha Rao, M. — A. D. Rajampet, A. M. Rapalle; Prabhuswami, C. R. — A. D. Virdachalam, A. D. Kollegal; Prabhakara Reddy, G. — Fruit Asst. Siruguppa, A. D. Anantapur; Ramakrishna Sastry, K. — A. D. Amalapuram, F. M., A. R. S. Lam Guntur; Raghavendrachar, C. — on leave, Asst. in Chemlstry, Coimbatore; Ramadoss, A. — A. D. Mathurai, P. A. to D. A. O. Mathurai; Ramamohana Rao, S. — A, D. Anantapur, A. D. Kadiri; Sivasankaran Nair, V. T. — F. M., A. R. S. Taliparamba, F. M. Wynad Colonisation Scheme; Santanaraman, T. — on leave, Plant Quaratain Inspector, Mettupalayam; Srinivasan, P. R. — A. D. Sugarcane Scheme Vellore, A. D. Polur; Solayappan, B. — A. D. Polur, Sugarcane Scheme, Vellore; Srimathi Sabaranjanamma — Chillies Asst. A. R. S. Lam Guntur, Teaching Asst. in Entomology, Agri. Coll. Bapatla; Sobhanadri, N. — Teaching Asst. in Entomology, Bapatla, Asst. Fertilizer Inspector, Cuddapah; Srinivasa Rao, M. — A. D. Rajamundry, A. D. Amalapuram; Seethapathi Rao, S. — A. D. Pithapuram, A. D. Rajahmundry; Sreemathi Seethalakshmi — Teaching Asst. in Chemistry, Bapatla, Asst. in Mycology, Bapatla; Subramaniam, C. L. — Asst. in Mycology, Bapatla, Asst. in Mycology, Coimbatore; Thomas, M, — F. M. Wynad, F. M. Taliparamba; Ummameshwara Rao, P. — A. A. D. Narasapur, A. D. Nandigamma; Venkata Naidu, C. — Asst. in Chemistry, Coimbatore, Teaching Asst. in Chemistry, Bapatla; Venkatasubramaniam, P. S. — F. M., A. R. S. Tindivanam, P. A. to D. A. O. Tirunelvelli; Venkataraman, T. V. — Asst. in pepper, Malabar; Veera Reddy, C. — A. D. Kalahasti, A. D. Vinugonda.

The following subordinates are appointed as Upper subordinates and posted to the vacancies shown against each :—

Bindumadhava Rao, R. S. — A. A. D. Puthur; Narayanan Nair, N. — Pepper Asst. Malabar; Ramakrishna Rao, K. Bh. V. — A. A. D. Kalahashti; Ramakrishna Paramahamsa, B. — Chillies Asst. A. R. S. Guntur.

The following promotions of lower subordinates in the scale of Rupees 80—5—100 E. B. 5—130 as upper subordinates in the scale of Rupees 100—5—140 E. B. — 10—220 are ordered with effect from 1—4—1948.

Bhuktha, N. M. — A. A. D. Ichapur — 100 Rs. ; Cheriyaku, T. V. — Asst. in Mycology Kalpata — Rs. 120; Kunhikannan Nambiar, A. K. — F. M. Live Stock Research Station Hosur — Rs. 105; Kannan Nambiar, P. — Asst. A. D. Peruntalmanna — Rs. 105; Narasimha Sastri, M. V. — F. M. Agricultural College Bapatla — Rs. 105; Puranalingam Pillai, M. S. — Agricultural Instructor Central Jail, Palamcota Rs. 115 ; Rajaratnam, S. — Journal Asst. in Tamil, Madras — Rs. 120; Subramaniya Iyer, G. K. — Asst. A. D. Wallajah — Rs. 105; Subramania Iyer, R. — Asst. Mannargudi Rs. 105; Satyanarayana, P. — Asst. A. D. Sattanapalle — Rs. 105 ; Srinivasa Rao, U. L. — F. M., A. R. S. Nanjanad — Rs. 105; Visvam, K. E. — Asst. A. D. Mathurai — Rs. 115; Venkatachalam, K. M. — Asst. A. D. Cuddalore—Rs. 105.

REPUBLIC DAY CELEBRATIONS.

College Estate: On the 26th at day break the staff and residents of the estate gathered in front of the Institute when after the National Anthem the flag was hoisted by the Principal. With a short speech by the Principal stressing on the necessity of each and one to strive to maintain the ideals of Mahatma Gandhi and work for the Mother country the function terminated. At 7-30 A. M. the Vice-Principal unfurled the National flag at the students' Club Pavilion before a full gathering of students. The club was gaily decorated for the occasion. The solemnity of the occasion and the necessity to maintain descipline and train themselves as the future citizens of the Republic were impressed on the students. The meeting came to a close with the singing of national anthem and national flag song in Tamil.

The officers club held flag salutation ceremony at 8-15 A. M. the President unfurling the flag. Matches in indoor games were held and prizes distributed in the evening. A Bhajana procession was taken out in the morning by some of the residents to celebrate the occasion. Some friendly matches were held between the students and officers.

On the evenings of the 26th and 27th the Institute, the Students' Club and several residential buildings were lit up which attracted a number of visitors from the town.

At the Ladies' Club the National flag was unfurled by the President followed by indoor games and tea. A small variety entertainment, dancing, music and a tableau were got up by the members. The function was well attended by the resident members.

At the Paddy Breeding Station the function commenced on the 26th with unfurling of the flag by the Paddy Specialist before a gathering of Farm labourers and farm staff. The significance of the occasion was explained to them. There were small sports arranged for the benefit of the labourers and the function ended with prize distribution and light refreshments. At the Millet Breeding Station also the National flag was hoisted by the Millets Specialist. The farm labourers and the residents at the station attended the meeting.