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Editorial

The Vanamahothsava launched by Sri K. M. Munshi in 1950 has become an annual feature. It has been the aim to celebrate this as a National Festival and the readers are aware that "Vanamahothsava" ("Arbor week") is celebrated every year beginning from the first of July. A lot of enthusiasm has been evinced in the country in tree planting during this period. In the last eleven years, efforts have also been taken to bring in a consciousness of the usefulness of trees as national wealth and the need for planting more and caring after them. However there is still much to be achieved.

The important occupation of the rural population being farming, the many more urgent problems pressing the farmer are probably mostly responsible for the lack of appreciable progress in tree plantings. Besides, the smallness of the holdings, the lack of incentives, and of supply of proper planting material at the right time may have contributed to the cause of slow progress, apart from climatic and topographic conditions not being quite conducive. The vandalism played by the many for fuel and for fodder for goats has yet been another important cause for the retarded progress. Inspite of these difficulties, the steps taken for augmenting tree planting and their aftercare are to be appreciated.

The importance of developing arboreta near cities and towns for recreation and educative purposes is, nowadays, being fully realized. Arrangements are being made to supply seeds, seedlings and plants suited for different purposes at reduced rates for private planting. The active and effective part of planting road-side avenues is attempted by the Highways Department; this is further being intensified by the formation of taluk committees for the preservation of these avenues among local officials and non-officials. The programme of Farm Forestry taken up by the state governments has a great potentiality in developing economical and local tree growths in government and private lands in villages.

Farm Forestry is agri-silviculture in which tree culture by individual farmers or groups of farmers is taken up with special reference to agriculture, animal husbandry and soil conservation.

Elsewhere in this issue is given some hints on the choice of a few fruit trees a farmer can plant and particulars of how to plant them. Aiming at self sufficiency as regards the farmers' requirements of fuel, timber, fodder, leaf manure, shelter belt etc., suitable choice of trees could be made for planting. Vanamahothsava should be celebrated not only as individual efforts but also on a collective and consolidated scale so as to produce compact but yet beneficial and beautiful patches or groups of plantations. The trees would provide extra-income to the farmer, ameliorate adverse climatic influences, and provide raw materials for industries. The trees not only produce and protect but add to the scenic beauty. It is often said that "If we take care of trees, the trees will take care of us"; while the above maxim is true, there is still another aspect, namely the realisation of duty for the country and that a vital one too.

A New Method of Planting Sugarcane

by

S. V. PARTHASARATHY *

Introduction: In the south Madras, the monsoon is active from July to November with occasional showers upto mid January, the heaviest rain fall being in October and November months. In lighter sandy soils, preparatory operations like deep ploughing could be carried on with some difficulty by the end of January and February. In heavy soils, particularly in the eastern Tanjore delta, the soil is too wet and it is not ready for any ploughing operations till late in February or March. The delay is greater, particularly when the fields are surrounded by swamp paddy crop varieties like late 'samba', which come for harvest by February – March. Planting of sugarcane under such soil conditions is generally not possible till March or April.

This late planting has many disadvantages. The age of crop at next harvest by January – February is barely 10 or 11 months. The young sprouts have to face severe summer temperature and drought from March to May before the sprouts are well established on the ground. The early stem borer *(Chilotroea infuscatellus)* is severe in late planted crops of sugarcane. Due to irregular water supply, particularly due to closure of canals for annual repairs, the sprouting of planted setts is poor and the plots become gappy with thin population. Germination percentages as low as 25 have been recorded even in research stations (1).

In the Arooran Sugar Factory's own farm, various trials were in progress to plant sugarcane early in the season. Mechanical handling of soil, by tractors to liberally aerate the soil by the use of special types of implements, has been developed. A technique to start the crop early is the new planting method described here.

Earlier Work: Germination of normally planted buds varies from 25 to 75 percent depending upon variety and soil conditions. Buds planted deep into soil fail to sprout up and germination percentage in such cases is generally poor, being only 25 to 45 percent. Apart from the physiological condition of bud and the physical condition of soil, the soil pathogens to a large extent affect the

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planted setts and cause failure of germination. Hence, under all conditions of planting, the soil is thoroughly prepared to fine tilth and the setts pretreated with fungicides.

Usually, cane stalks are cut into two or three budded bits and used as planting material. In Java, a technique was evolved for sprouting the buds on standing cane stalks and the seedling bit was planted at one seedling per hole (5). This method is called 'Rayungan' (i. e. sprouted bud) planting. In Kolhapur sugar factory farm, the shoot-setts were developed in a special nursery and the seed bits with two shoots attached were transplanted in a well prepared field (3).

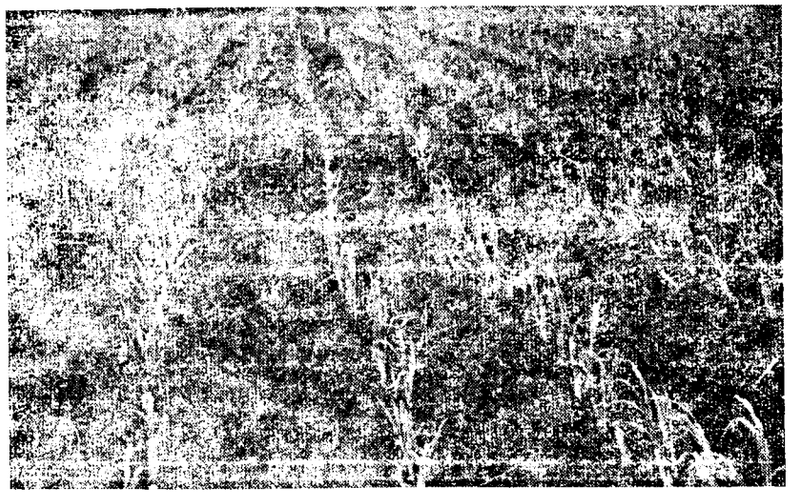
The normal seed rate is 15,000 three budded setts in Madras State and it is sometimes as low as 8,000 to 10,000 three budded setts in Bombay-Deccan. It is as high as 40,000 two budded setts in the Punjab (2). The higher seed rate is generally adopted under soil conditions that lead to poor germination. Studies at Anakapalle Sugarcane Research Station have indicated that 8,000 single buds per acre can yield as much as the high seed rate usually adopted.

Germination and subsequent tillering are important factors deciding final population of millable canes at harvest and the latter is a major factor for yield per acre. In achieving good yields, earlier planting is ideal (2). Generally in Madras State and more so in the wet land area, the harvest of rice crop and the too-moist soil conditions do not permit of early planting. Non-availability of assured and adequate water for irrigation in summer is another major obstacle for starting an early crop.

The problem: The Arooran Sugar factory farm is over 6,200 acres in extent and is located in heavy clay soil of eastern cauvery delta in Tanjore district of Madras State. This region is subject to prolonged north east monsoon till mid January. The overflowing cauvery canals and the vast surrounding areas of swamp paddy generally cause the surface and subsoil to be too wet and unfit for agricultural operations like ploughing or digging till mid summer months. From early February, the canals are closed and there is great scarcity for irrigation water till mid summer months. From early February, the canals are closed and there is great scarcity for irrigation water till mid June and this period is marked by severe drought. In the past five seasons, planting of sugarcane was delayed upto April-May and the irregular water supply caused great

damages to planted setts by large scale failure of sprouting. The problem was enhanced in saline soils where higher soil moisture is required to sustain the sprouts.

Earlier trials here with 'rayungan' planting proved a failure due to lack of trained and skilled staff in handling the same and also due to irregular and uncertain supply of irrigation water which later is most essential in establishing the seedlings in the planted field.



'Partha' Planting method. Note the setts in vertical position.

The new method: A new technique was developed to meet the local adverse conditions of soil. The new method was tried in one acre in 1959—'60 season and it is now extended to 400 acres with great success in November–December planting in 1960—'61 season.

The land is prepared by August–September and laid into ridges and furrows. Field drains are opened at frequent intervals of 15 to 20 feet to facilitate quick draining. The fields are efficiently connected to the drainage pumping station, which latter is a new technique developed here for mechanically draining the fields under locally fabricated low lift wooden pumps. During heavy monsoon rains, the fields remain under water.

When the beating heavy showers are over by November, planting is taken up. Three budded setts are cut in the usual manner and pre-treated with organic mercurial fungicides. The setts are thrust with the bottom one node only into the soil. The planting is done half way down the slope of ridge, in order to avoid any direct contact with the possible stagnant water in the furrow. The setts

are slanted with 40° to the ground and the two upper buds are kept lateral and out of contact with the ground. The soil round the base of planted sett is compacted well by pressing with hand.

The seed rate adopted is only 10,000 setts per acre and this is now found to be too much and may be reduced to 8,000 setts per acre. In the new method the top two buds sprout and grow up vigorously. This sprouting and early growth is irrespective of the adverse soil condition immediately below. The first lower bud in the soil is sacrificed under these conditions. Even with slushy overmoist condition of soil below, or even with light showers continuing, the top two buds sprout up normally. The aerial location of the top two sprouts keeps off any possible attack from soil pathogens and insects. There is adequate aeration and moisture for sprouting. For such reasons, initial sprouting, growth and survival of seedlings is great. This earlier growth is irrespective of the immensely adverse soil condition below and to some extent even irrespective of atmospheric condition like heavy rain or bright sun. By normal method of planting the seed rate is 15,000 setts per acre and some farmers here have been adopting 20,000 setts, to ensure good population. Many fields still remain gappy due to failure of germination.

When the seedlings are sufficiently grown up and are about 9″ tall, water is let into the furrow if required and the setts are pressed horizontally down into the soil *in situ*. Ammonium sulphate is applied by pocketing near the sprouts to supply 45 lbs Nitrogen per acre. The pressing down is carried out preferably under wet conditions and the water is drained immediately. The pressing down can be done even under dry conditions, in which case the soil is opened in front of the sett with a hand hoe, the setts pressed horizontally down, covered and compacted with moist soil. It is preferable to irrigate the crop again after 4 or 5 days or usually there will be light showers or rain during this period. The seedlings also take a slanting position at pressing down, but usually attain erect position within a week. They root from the base and start growing up normally. This new method of planting ia called "*Partha*" method.

When the seedlings are established, and when the soil comes to condition, the field is ploughed up between rows and the soil opened up and weathered. The absence of mechanical handling of soil immediately preceding planting, by way of preparatory operations is made good by way of deep and frequent interculture. Further top dressings of nitrogenous and phosphatic fertilisers are carried out at the right stage of growth of the cane crop.

The above method of planting setts has been found to be efficient even for filling up gaps in the ratoons. Usually, the row is dug up and setts planted in the gaps. By normal planting, the buds under the soil are affected by extra moisture in the dug up pit. By the "*Partha*" method of planting, the sprouting is efficient and ensured.

Advantage by the new method: The land is prepared into ridges and furrows before the heavy showers of North East monsoon commences. When sugarcane follows rice, a short duration rice variety is raised by planting in rows. After rice is harvested, the sugarcane crop is planted in rows by the "*Partha*" method in November–December. When the soil comes to condition, the setts are pressed down and digging and other cultural operations, including opening up field drains at desired intervals are carried out. The planting is done in other cases half way up the ridge. Even under the most adverse condition of soil or climate, the new method ensures earlier starting of the crop. This ensures high yield and good recovery. By earlier planting, the crop tillers profusely and this habit is very much lacking in later planted crops. The crop also escapes the ravages of early stem borer *(Chilotroea infuscatellus)*. The crop is uniform in growth. Such early planted crops resist drought of summer better than late planted ones, in which germination and tillering are poor and are generally gappy with poor stalk population at harvest. This method is of greater benefit in areas where the crop is liable to waterlogged conditions during the monsoon period. Researches at Anakapalle (4) have indicated that early planting is essential in cases where water-logging is to be expected in October – December period.

Summary: Planting by normal method under monsoon or very wet conditions of soil is not possible due to sett rot and failure of buds to sprout, The seed rate under normal methods of planting is generally high. In the method of planting, the field is prepared into ridges and furrows before the commencement of north east monsoon rains. In the alternative, in case rice precedes sugarcane, a short duration rice crop is planted in rows and harvested in November–December and sugarcane setts are planted immediately thereafter by the new method under rice stubble. In this method, the setts are planted slanting, with one bud in the soil and two buds above ground. This new method of planting is called "*Partha*" method of planting sugarcane. When the buds sprout up into shoots of 9″ – 10″ length, the setts are horizontally pressed down *in situ* and the base of shoots covered with soil. Normal interculture operations and manuring are followed up. This method confers many advantages, particularly

when planted under adverse conditions of soil or climate. By such early planting (a) high yields and better recovery are recorded, (b) the sprouts escape the ravages of early stem borer (c) planting is completed before the commencement of severe summer drought and as such better sprouting, tillering and high shoot population are made feasible (d) the crop is prepared better for resisting drought (e) this planting method is of great advantage where the crop is liable for swamp condition during north east monsoon, as the crop by then is fully grown up to resist water logging (f) it is suitable for adoption with all Co. canes.

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Effect of Plant Growth Regulators on the Hardwood cuttings of *Hibiscus rosasinensis* L.

by

K. G. SHANMUGAVELU

One of the important uses of plant growth regulators in agriculture is to hasten the rooting of cuttings of horticultural plants. Several plants have been tested with many growth regulators so far and highly encouraging results obtained. With a view to examine the effect of the plant growth regulators on harwood cuttings of *Hibiscus rosasinensis* L., investigations were undertaken in the Department of Agriculture, Annamalai University and the results are presented here.

Materials and Methods: Three of the common plant growth regulators, viz., indole acetic acid (IAA), indole butyric acid (IBA), and naphthalene acetic acid (NAA) were selected for the studies.

One year old harwood cuttings of *H. rosasinensis* L., were selected and cut into uniform size of 6 inches in length with two or three leaves on them. Twenty cuttings in each were then treated with the plant regulators by the following three methods.

1. *Soak method:* The chemicals were first dissolved in small quantities of alcohol and then diluted with water to obtain the required concentration. The cuttings were dipped in the solution so as to immerse the basal portion up to one inch and allowed there for 24 hours, by the end of which they were washed thoroughly with water and planted.

2. *Quick Dip method:* The treatment was given as in the above case, except that the cuttings were dipped in the solution for only five seconds and planted immediately.

3. *Dust method:* The required quantity of the chemical was dissolved in small quantities of alcohol and made into a paste by adding talc. The paste was dried in the dark. The lower portions of the cuttings were first made wet and then dipped into the dust up to one inch and planted.

The treated cuttings were planted on raised beds with a spacing of 6″ × 6″ in the Horticultural Nursery and maintained by periodical pot watering. The cuttings were carefully removed at regular intervals and examined for the root development.

Experimental Results: The results obtained with the three chemicals are summarized in Table.

Of the three chemicals tested NAA was found to be the best, as it gave a rooting percentage of 85 to 95 as against 75 to 90 per cent in IBA and 50 to 75 per cent in IAA. NAA also gave the maximum average root length of 47.7 to 95.8 cms as against 19.8 to 67.0 cms in IBA, and 8.5 to 25.6 cms in IAA.

Of the three methods of treatment, soak method appears to be better than the other two as the maximum rooting, number of roots and length of roots were obtained in this method. There was no difference between the quick dip and dust methods of treatments.

Of the various concentrations tested IAA at 50 ppm, IBA at 100 ppm, and NAA at 50 ppm, by the soak method gave the best results. By the quick dip and dust methods there was no difference in the effect of three concentrations of the chemical tested.

TABLE I.

Effect of three growth regulators applied in three different methods on the rooting of hardwood cuttings of *H. rosasinensis* L.

Method of treatment	Concn., in ppm.	IAA			IBA			NAA		
		No. cuttings rooted	Av. No. roots	Av. L. of roots	No. cuttings rooted	Av. No. roots	Av. L. of roots	No. cuttings rooted	Av. No. roots	Av. L. of roots
Soak method	25	10	5	19·4 cm.	17	9	24·1 cm.	17	19	76·5 cm.
	50	10	5	21·1 ,,	19	8	32·0 ,,	19	15	95·8 ,,
	100	...	...	...	18	18	67·0 ,,	18	16	78·4 ,,
Quick Dip. method	6000	12	3	8·5 ,,	15	5	26·7 ,,	18	11	69·3 ,,
	7000	11	5	13·2 ,,	...	...	...	...	...	...
	8000	15	5	14·8 ,,	12	9	27·4 ,,	17	14	54·8 ,,
	10000	...	...	...	18	11	39·6 ,,	18	13	64·9 ,,
Dust method	10000	15	5	13·0 ,,	15	5	24·4 ,,	19	10	51·3 ,,
	15000	15	9	25·4 ,,	16	5	19·8 ,,	17	13	62·5 ,,
	20000	14	12	25·6 ,,	16	7	38·5 ,,	17	8	47·7 ,,
Control	...	6	2	4·7 ,,	...	Nil	...	2	2	4·5 ,,

The results show that for hardwood cuttings of *H. rosasinensis L.* NAA at 50 ppm by the soak method seems to be the best. According to Maxon *et al* (1940) IBA at 20 ppm gave 41 per cent rooting of *H. rosasinensis* cuttings.

The cuttings treated with NAA produced thicker and stouter roots copiously. Thicker and stouter roots were produced in the cuttings of Mannolia and Golden Rod treated with NAA as reported by Samantarai (1955) and Hammer and Marth (1943) respectively. It is found that NAA gave better results in all the methods than the other two acids of indole compounds. This is in agreement with the statement of Hitchock and Zimmerman (1937) who reported that naphthalene compounds were more effective than the indole compounds in inducing rooting capacity.

Summary : NAA gave good results among the three chemicals used and the percentage of rooting ranged from 85 to 95. NAA at 50 ppm in the soak method was found to be the best. NAA produced more copious, stouter, thicker and longer roots than the indole compounds.

Acknowledgment : I wish to express my grateful thanks to the Annamalai University for the facilities provided for conducting the study and my deep sense of gratitude and sincere thanks to Dr. S. Krishnamoorthi, the then Professor of Agriculture, Annamalai University, under whose valuable guidance this study was undertaken and to Prof. G. Rangaswamy, Head of the Department of Agriculture, Annamalai University for having gone through the manuscript and for his helpful suggestions in preparing this article.

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Review Article

Phosphorus Fixation and Availability in Soils

by

C. K. RAJAGOPAL

The problem of phosphorus fixation and availability has been attracting the attention of soil scientists, throughout the world for many decades and its complexity is such that the last word as to its nature and form has not yet been spoken. The hundreds of investigations reported in literature and the many, apparently contradictory, results obtained in the experiments conducted on various types of soils, furnish ample evidence about the multiplicity of factors involved in this phenomenon and the danger of advancing any explanations or predictions, based on limited observations.

Theories Regarding Fixation of Phosphorus: The term 'Fixation of Phosphorus' usually implies conversion of phosphorus to a more insoluble form (Dean 1949). The constituents of the soil that markedly restrict the mobility of phosphate ions in the soil are (i) the soil colloids, (ii) the active sesquioxides and (iii) lime. The nature of fixation of phosphorus by these agents is greatly influenced by the pH, organic matter content, kind of clay present in the soil and other environmental factors. An elaborate review of the various factors that are responsible for fixation and availability of phosphorus in soil is not the purpose of this dissertation. What is being attempted is to present an overall picture of the phenomenon with suggestions about possible methods of tackling the problem or at least some aspects of it.

(i) **Soil colloid and Phosphate Fixation:** One of the most convincing deductions that can be arrived at from an acquaintance of the problem is the major influence exerted by the nature of the soil and its colloidal content. The capacity of soil particle to 'sorb' phosphorus gets treamendously enhanced with diminuition in their size, because of the increased surface area (Hibbard 1935). A mere increase in soil colloid would, therefore, increase the capacity of soil to fix phosphorus.

As regards the exact mechanism through which the fixation is effected, by the soil colloid, there are several postulates:

From X-ray diffraction data for phosphated kaolinite and halloyiste, Stout (1939) indicated that phosphate ions replaced hydroxyl ions between crystal units, at cleavage points. This was

supported by the observations of many workers, notably Kelly and Midgley (1943) and Dean and Rubins (1947). In the anion exchange reactions of this kind, where adsorbed negative ion on the soil colloid gets replaced by the phosphate ion, very little of the phosphate ion on the colloid can be again replaced by other anions. The phosphate ion, which is thought to be adsorbed initially, seems to penetrate the clay micelle and get absorbed by the clay. When this happens the availability of the phosphate ion to plant roots gets very much reduced.

It is also possible to have chemical combination on the surface of the clay article whereby one or more constituents on the clay surface, mostly iron and aluminium, chemically combine with the phosphate ion and immobilise it. This form of phosphate sorption is called 'chemisorption'. The phosphorus thus combined is not readily available to plants.

In another class of reactions termed 'isomorphous replacement reactions' an ion in the crystal lattice of the clay gets replaced by a phosphate ion. In all such reactions the phosphate ion that gets into the lattice, gets firmly entrenched and is extremely difficult to be ejected out. The phosphate ion thus "fixed", seems to be identical with the 'colloid bound' phosphorus of Mattson and Karlsson (1938). These workers defined "colloid bound phosphorus" as phosphate ion that has become non-diffusible structural units in the colloidal aggregate.

Another possible mechanism whereby phosphate gets adsorbed on the clay is due to calcium present in it as exchangeable calcium. Experiments have shown that there is greater fixation of phosphorus by calcium-saturated clay compared to sodium-saturated clay (Russell 1951). According to Ravikovitch (1934) phosphate ions are held by calcium present in the clay as exchangeable calcium. It is possible that what Mattson and Karlsson (1938) have termed as 'Saloid bound phosphorus' may be the mechanism that takes place in certain cases, where the calcium ions share their valencies with clay micelles and phosphate ions. Phosphate ions adsorbed in this manner are easily available to plant roots.

From reactions involving the soil colloid, explained above it is obvious that clay has a profound influence on phosphate fixation. Due to different structural arrangement in the different classes of clays, the kind of the clay present in the soil affects the nature and amount of fixation. From a consideration of the structural arrangement

of hydroxyl ions, Chatterjee and Dutta (1951) concluded that the phosphate fixation in Kaolinite minerals may be due to exchange between phosphate in solution and hydroxyl ion in the crystal lattice. The decrease in phosphate fixing capacity of kaolinites with increase in pH (which tends to ionise the acid groups in the clay lattice, was cited in support of this view. Due to the difference in the structure of the montmorillonitic groups of clays, where the majority of the hydroxyl ions are inaccessible to phosphate ions for exchange, the fixation in these types of clays was attributed to precipitation reactions.

(ii) **Sesquioxides and Phosphate fixation :** Chemical precipitation of soluble phosphate as insoluble phosphate of iron and aluminium, accounts for the greater part of fixation in a large variety of soils. As large quantities of active iron and alumina will be present in solution at and below pH 5.5, soluble phosphate applied to such soils become precipitated as insoluble iron and aluminium phosphate. Thus crops growing on very acid soils often show symptoms of phosphate starvation (Collings 1955). The phosphate fixing power of acid soils was considerably reduced when chemical deactivation of iron and alumina in the soil was made (Chandler 1941, Ghani 1942, Rajagopal 1958); but the fact that soils from which active iron and alumina have been removed, still sorb phosphates as observed by Dean (1949); Chatterjee and Dutta (1951), Leaver and Russell (1957); Rajagopal (1958), is further proof that besides the sesquioxides, clay is also a powerful factor to be reckoned with in phosphate fixation reactions. Dean (1949) is of the opinion that some of the iron oxides exist as coatings on clay particles masking the phospate fixing properties of the clays themselves.

(iii) **Lime and Phosphate fixation :** When the soil reaction goes above pH 8, the calcium ion assumes the major role in phosphate fixation. Of the three forms of calcium phosphate, the monocalcium phosphate which is soluble in water is readily available to plants; the other two form, dicalcium and tricalcium phosphates are not soluble in water. Dicalcium phosphate which is soluble in neutral citrate solution is available to plant roots while the availability of tri-calcium phosphate is very limited though experiments have shown that 'freshly precipitated' tricalcium phosphate is taken up by plants (Collings 1955).

In all the reactions of the phosphate ion in the soil it has been found that time exerts a profound influence. That freshly precipitated calcium, iron and aluminium phosphates may be available under

certain conditions has been demonstrated by the work of Truog (1916), Marias (1922), Parker (1931) and others. The conversion of phosphates of iron and aluminium into hydrated compounds of low solubility and of calcium into the fluorapatite form, by the passage of time, have been put forward as reasons for the low availability of these compounds in the soil.

It is obvious from what has been stated, that the fixation of phosphorus in soil cannot be explained by any simple chemical or other process but that physical, chemical and physicochemical nature of the soil are factors that influence it and that the extent and intensity of fixation are dependent upon the predominance of these factors under particular soil conditions.

By using radio active isotopes, it has been possible to confirm the existence of a disorderly and continuous shifting of phosphate ions in soil. Amongst the phosphate ions in the soil, some are fixed and immobile while others are continuously animated, in damp soil, by spontaneous movements which displace them within all the space occupied by soil water, from the internal or external surfaces of solid particles to the outside limits of thin films of water adhering to these surfaces and vice versa. In such a system at equilibrium, the electrochemical potential of phosphorus is uniform. The moment this is altered by either withdrawal of phosphate ions by plant roots or supply of phosphate ions by fertiliser application, the whole system reacts to reestablish equilibrium, as in a "pool" in which all parts of the component play the same role to attain equilibrium (Barbier 1959).

"Phosphate Potential": A new angle on the problem of phosphate availability has been revealed by Schofield (1955) with the postulation of the concept of 'Phosphate Potential'. This has put the relationship between soil phosphate and absorption by plant roots on an energy basis just as in the case of absorption of soil water by plant. According to Schofield, it is not the amount of soluble phosphorus in the soil that primarily controls the uptake of phosphorus by plants, but the work needed to withdraw the phophorus from the "phosphorus pool" (described in the preceding paragraph) in the soil and also the rate at which the concentration of the soil solution is maintained. Good progress of research in this direction can be expected in the near future.

Methods of lessening phosphorus fixation : Resort to several methods of lessening phosphorus fixation has been made to increase the availability of phosphorus to plants. One of the most general

practices is that of 'placement' of fertilisers. This localised application of concentrated fertiliser is sought to prevent the bulk of the phosphorus in the fertiliser from coming into contact with the fixing agents in the soil. From theoretical aspects, this method is quite sound and should give promising results; but this involves extra labour and is time consuming so that it is not found economical in all cases.

Another method attempted is the use of silicates (Hall and Morrison 1906, McGeorge and Breazeale 1931, Gokhale *et al* 1954 Mariakulandai *et al* 1955). In these cases it is believed that the fixed phosphate ions get released by the action of silicate ions which replace them in the 'fixation complex'. Whether this method could prove an economic success on large scale ventures is still to be demonstrated.

The most promising picture of the solution of the problem of phosphate fixation comes from organic matter and its role in the soil. Organic matter can influence the phosphate status of the soil in two ways:

(1) through direct effect due to mineralisation of phosphorus contained in it.

(2) through indirect effect of various compounds formed by the action of organic matter on compounds in the soil which are active agents in phosphorus fixation.

The greater availability of phosphorus in the manure, compared to phosphorus added as fertiliser has been reported in very many cases.

The indirect effect of organic matter, whereby phosphate fixation is reduced and availability increased, can be summarised as follows:

1. **Generation of organic ions:** In adsorption reactions organic compounds being dominantly anionic in character would be expected to compete with the phosphate anion and hence decrease fixation. (Dean and Rubins 1947).

2. **Formation of complex organic compounds:** Some organic compounds modify the adsorption of phosphorus by soils. The decomposition of crop residues and soil organic matter releases various organic acids, such as isocitric acid and tartaric acid, which react with iron and aluminium to form soluble, complex metal-organic ions

called "chelated compounds" (Ghani 1943, Leaver & Russell 1957, Olsen & Fried 1957). These complex ions have but slight tendency to combine with phosphorus.

3. **Blocking Action of Organic Compounds:** Other decomposition products not well defined, may be adsorbed on the same sites on the clay micelle that could hold the phosphate ion and thereby prevent the phosphorus form being adsorbed. Leaver and Russell (1957) found that when soils that have been treated to remove free iron oxides are further treated with 'blocking agents' like fulvic acid (extracted from farm yard manure) the phosphate fixing power of such soils gets considerably reduced.

4. **Carbon Dioxide Production:** In calcareous and other well aerated soils, decomposition organic matter and production of carbon dioxide aid in the solubilisation of insoluble phosphates. (Jensen 1917; Miller & Turk 1951; Gustafson 1941; Russell 1951).

5. **Protective Action:** Protective action of organic colloid or gross organic matter helps to prevent the soluble phosphate from coming into contact with active iron and aluminium in the soil. (Midgley *et al* 1945, Pierre 1948, Swenson *et al* 1949).

Lessening of Phosphate Fixation by Liming: Fixation of phosphate is especially troblesome under acidic conditions, when liming can be resorted to for producing beneficial effects. One effect of lime is to reduce the solubility of iron and aluminium in the soil with the result that phosphate gets precipitated as the more soluble dicalcium or tricalcium phosphate or compounds closely related thereto. Another effect is to increase the number of hydroxyl ions which tend to compete with the phosphoric acid ions for a position on the adsorption complex.

On tropical and sub tropical acid soils, heavy liming is not always feasible, nor is it desirable in certain cases, due to the consequent alteration of the ionic balance in soils. In these soils placement of fertiliser and use of organic matter must be resorted to, for getting increased yields from the application of super phosphate and other soluble forms of phosphate fertilisers. (Russell 1951)

Crop Rotation: Species of plants differ markedly in their capacity to absorb phosphorus. Phosphorus from phosphate rock was found to be most available to buck wheat. Legumes extracted more phosphorus from phosphate rock than grasses (Olsen & Fried 1957). The change in the exchange capacities of the plant roots and

alteration in carbon dioxide production by the roots of different plants, have been put forward as plausible reasons for this (Russell 1951 : Olsen & Fried 1957). Thus crop with a low capacity to absorb phosphorus should benefit if it follows a crop with a high capacity, due to the greater phosphate availability in the soil brought about by the previous crop.

Before concluding this paper, I would like to stress on a point which is of particular importance in the study of phosphorus availability in Indian soils. Several of the agronomic experiments conducted in different parts of the country show no significant results by application of phosphorus fertilisers ; but this does not justify the conclusion that our soils are well supplied with phosphorus. According to Stewart (1947) the view that Indian soils do not require phosphate appears to be held to a 'surprisingly and indeed dangerously large' extent. He attributes the failure to respond to phosphates to other factors, such as unbalanced nutrition, and not to a sufficiency of of phosphorus in Indian soils and believes that when soil is adequately fertilised with nigrogen and potash, the need for corresponding high fertilisation with phosphorus also would become evident.

Summary : A short review of the work that has been done on the problem of phosphate fixation and availabilty is attempted. The problem is complex, as several factors are involved. Among the factors that are known, fixation by soil colloid, sesquioxides and calcium are the most important and pH, time, organic matter and other environmental factors also affect fixation. The reaction of organic matter on clay is such that phosphorus fixation gets lessened and availability to plant roots gets increased. If the availability of phosphorus to plants is dealt with on an energy basis as in the case of 'phosphate potential' advocated by Schofield, a better yardstick, for measuring phosphorus availability to plants can be got.

Though some of the experiments conducted in India do not suggest any need for phosphorus fertilisatson it is suggested that, when optimum ionic balance is maintained in the soil, phosphorus fertilisation is certain to show response, provided there are no adverse soil conditions in the soil.

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Research Notes

Rachis branching in the "Finger Millet" *Eleusine coracana* Gaertn (Ragi).

The panicle of *Eleusine coracana* Gaertn. (Ragi) consists of a long peduncle and from the free end of it, four to six spikes radiate in a whorl. The spikes are called "Fingers" and the odd one, a little lower down very often attached to one end of the flattened peduncle, is known as "Thumb". Normally in each finger there are a number of spikelets (60 to 80) which are arranged alternately in two rows, attached to one side of the flattened rachis.

In this paper the occurrence of an abnormality, viz., rachis branching in the panicle of *Eleusine coracana* Gaertn, is described. These were noted by the author during the year 1958 in the bulk crops of Co. 2 and Co. 7 ragi raised at the Millet Breeding Station, Coimbatore. Several other panicle abnormalities have been recorded by previous workers.

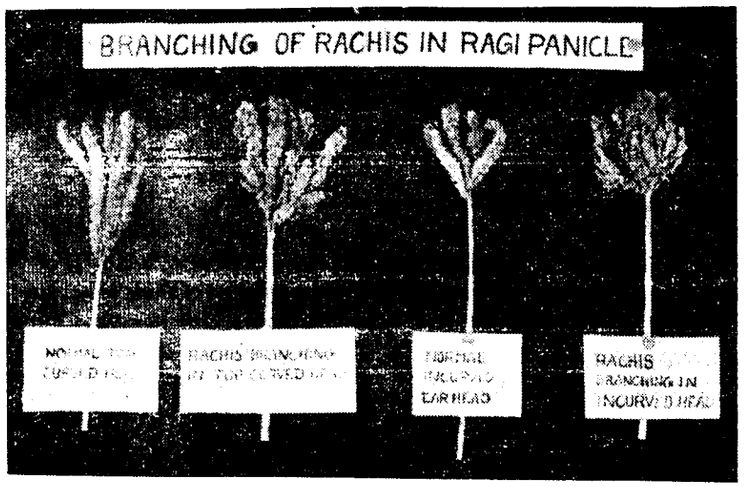

Fig. 1. Fig. 2. Fig. 3. Fig. 4.

The abnormal panicles recorded here consist of long peduncles and at the free end of them four to six fingers radiate in whorls. In both the cases, the main rachis gives rise to secondary rachis and bears fertile spikelets as in the main rachis. The arrangement of spikelets on the secondary rachis is in the same fashion as that of the normal one. Seeds were collected from the main rachis and from the secondary rachis and sown separately in pots. Both the seeds gave normal panicled Ragi plants true to the strains, viz., 'fisty' spike and 'incurved' spike in both the cases.

The same phenomenon was observed in a normal population of the Ragi Co. 1. ('Top curved' spike) raised at the Cotton Breeding Station, Coimbatore during 1959–'60. When the seeds from the main and from the secondary rachis were tested in pots as in the previous year, only normal panicled (i. e. Top curved spikes) plants were obtained. This sort of rachis branching habit was not repeated again in the progenies in the successive generations, in all these three cases. Hence this phenomenon is a non-heritable character, and is caused by environmental factors or external influences.

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Some New Records of *Alternaria* Species on Solanaceous Hosts in India

Alternaria leafspots of Solanaceous plants are of common occurrence in India. So far five species of *Alternaria*, viz., *A. longipes* (Ell. & Ev.) Mason, *A. solani* (Ell & Mart.) Jones and Grout, *A. tenuis* Nees., *A. tomato* Cke. and *A. violae* Gall. and Dors. and a few unidentified species of the genus have been reported. In our recent investigations on the occurrence of *Alternaria* spp. on Solanaceous hosts in this tract we found the incidence of two known species and a new species of *Alternaria* on the hosts, the details of which are given below :

1. *Alternaria tenuis* Nees. causing leafspot diseases of chilli (*Capsicum annuum* L.), datura (*Datura fastuosa* L.) and petunia (*Petunia hybrida* Vilm.)

On *C. annuum* the spots are found on both young and old leaves. Incipient spots are white or grey, and about 1 mm in diameter. Fully developed spots are about 5 mm in diameter, circumscribed by a thin, reddish-purple, irregularly circular band and grey or whitish-grey centre.

On *D. fastuosa* white pin-head sized circular spots are first seen, which when fully developed, are about 4 mm in diameter, almost circular and delimited by a thin purple ring from the surrounding healthy green

tissues. The necrotic tissues within the purple ring are white or light grey. Only a few spots are found on each leaf, the maximum number being five on any leaf.

On *P. hybrida* the fungus first manifests itself in the form of brown specks, which in course of time develop into spots of about 9 mm in diameter, almost perfectly circular in outline, grey in the centre and delimited by dark brown margins.

The only report in India of *A. tenuis* on any Solanaceous host seems to be that of Kapoor and Hingorani (1958) on brinjal (*Solanum melongena* L.). The occurrence of an unidentified species of *Alternaria* on chilli leaves in India has been reported by Dutt (1937) and also by Edwards and Shrivastawa (1954). There has been a single report of *A. tenuis* on *P. hybrida* from Costa Rica by Wellman (1949). There appears to be no report of *A. tenuis* on *D. fastuosa* from India or any other country.

2. *Alternaria crassa* (Sacc.) Rands causing leafspot and fruitscab of *Datura fastuosa* L. var. *alba* C. B. Clarke.

D. fastuosa var. *alba* is one of the common weeds in the gardenlands, drylands and uncultivated wastelands in this tract. The leafspots are found to occur all the year round, but more severely in the rainy seasons. Both young and old leaves are affected. Sometimes the calyx and young fruits are also found parasitized, the lesions being similar to those on the leaves. Young lesions appear as light grey spots of about 2 mm in diameter. By amphigenous extension the lesions attain a diameter of about 15 mm. Fully developed spots are light brown in colour, with concentric rings of roughly circular outline. Often the lesions coalesce to form contiguous patches of dead tissues, which easily get split into tiny bits.

A. crassa does not appear to have been reported on *D. fastuosa* var. *alba* or on the parent species, *D. fastuosa*, either from India or elsewhere. During the course of the present investigation, *A. crassa* was found only on *D. fastuosa* var. *alba* but not on *D. fastuosa* or *D. metel* both of which occur widely in this area.

3. *Alternaria melongenae* Rang. and Samb., causing leafspot and and fruitscab of brinjal (*Solanum melongena* L.) and fruit rot of chilli :

On *S. melongena* the disease first appears as light brown specks of of about 2 mm in diameter, mostly on the older leaves. Fully developed lesions are about 5 mm in diameter, circular, light brown and bound by a dark brown peripheral ring. Shot-hole symptoms due to the disintegration of dead tissues are also common. On the fruits of brinjal, the disease is found mainly on the fully matured ones and on these which are left to

ripen for seed collection. The lesions first appear as brown, circular, flat spots of about 4 mm in diameter. When fully developed the lesions are in the form of large scabs of circular or elliptical outline, with a diameter of 2–4 cm in the former case, and 5–7 cm long and 3–4 cm broad in the latter. The fruit skin at the affected portion is leathery and the flesh below hard and discoloured to a dirty brown to a depth of about 1 cm. In some cases the infection extends down to the seeds, which become discoloured to a dark brown, shrivelled and unviable.

On the fruits of chilli, the disease first manifests itself as white or light grey spots of elliptical or oval shape, about 5 mm long and 3 mm broad. Fully developed lesions sometimes form large, irregularly elliptical or oval patches, completely covering one side of the fruit and when the fungus fructifies a mass of dark, fluffy outgrowth covers the lesion.

Leafspots of brinjal caused by *A. solani* and *A. tenuis* f. *genuina* Una. have been reported from other countries (Neergaard 1945, Pucci 1947). In India Vasudeva (1954) reported a leaf-spot of brinjal caused by a fungus similar to *A. tenuis* morphologically but not pathologically; Kapoor and Hingorani (1958) reported a leafspot of brinjal caused by *A. tenuis* Auct. Fruit rots of brinjal caused by *A. tenuis*, *A. solani* and *A. tenuis* f. *genuina* have also been reported from other countries (Neergaard 1945, Pucci 1947), but the only report from India of *Alternaria* infections on brinjal fruits appears to be that of Kapoor and Hingorani (1958). *A. solani*, *A. tenuis*, *A. tenuis* f. *genuina* and *A. capsici-annui* Savalescu and Sandu have been reported to cause fruit rot of chilli in other countries (Neergaard 1945, Bremer 1945, Pucci 1947, Leyendecker 1954). In India Dutt (1937) reported an *Alternaria* sp. and Subramanian (1954) reported a strain of *A. solani* causing fruit rot of chilli. The detailed description of the new species, *A. melongenae*, and the influence of substrate on the spore size of the species, occurring on the above natural hosts are reported elsewhere (Rangaswami and Sambandam 1960 and 1961).

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Occurrence of Phyllody and Proliferation in *Momardica charantia* Linn. (Bitter gourd)

Phyllody is a teratological phenomenon in which the floral whorls become transformed into leaf-like structures and proliferation is one in which the floral axis continues its growth and forms an extension shoot. In the present instance the author has come across both the phenomena of phyllody and proliferation occurring in the staminate flower of *Momardica charantia* Linn. (Plate, Ib) and phyllody alone in the pistillate flower (Plate, Ia) of the same species. In the case of the staminate flower all the sepals, petals and the stamens were transformed into green foliar structures. The floral axis continued its growth pushing the dialysed and transformed stamens towards one side and produced a short shoot consisting of a reduced leaf, a tendril and an apical bud. In the abnormal pistillate flower only petals and sepals were modified into leaf-like structures, the style was rudimentary.

Similar teratological features were noticed and studied in detail in *Trichosanthes anguina* Linn. (Kausik, 1938). Phyllody of the sepals and petals and dialysis of the synandrium were reported in *Cucurbita maxima* Duch. (Gopalakrishnan, 1943). Although the exact cause for this abnormality could not be determined in the present case, the investigations carried out by the above authors have revealed that these abnormalities were developed due to virescence.

PLATE I.

(a) (b)

Plate I (a) Phyllody in the Pistillate Flower of *Momardica charantia* Linn.

Plate I (b) Phyllody & Proliferation in the Staminate Flower of *Momardica charantia* Linn.

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A Diaspidine Scale on Moringa in South India

Moringa or drumstick (*Moringa pterygosperma* Gaertn.) is grown generally in the kitchen gardens in South India for its leaf and pod which are used for culinary purposes. Several insects are known to cause considerable damage to the tree. Chief among these are the budworm *Noorda moringae* Tams. (Cherian & Basheer, 1939), the green leaf caterpillar *Noorda blitealis* W. and the hairy caterpillar *Eupterote mollifera* W. (Ramakrishna Ayyar, 1940). During 1958 and '59 a scale insect of the genus *Diaspidiotus* was noticed in a severe form in Madurai (Madras State). Since this is the first record of an injurious scale insect on this tree the details are given below.

Description of the Scale Insect & Damage Caused: The scale of the female is circular, light brown in colour and occurs in large numbers on the trunk as well as on tender branches. Since the colour is almost the same as that of the bark its presence cannot be easily detected. In the case of heavy infestation the tree presents a sickly appearance with few scattered yellowing leaves. The fruiting is also affected to a marked extent.

The adult female is yellow in colour and about 1·096 mm. in length and 0·996 mm. in breadth. It lays light yellow, oval shaped eggs measuring 0·215 to 0·216 mm. long and 0·116 to 0·117 mm. broad. The crawlers are also oval and yellow in colour and measure about 0·216 mm. long and 0·133 mm. broad.

Acknowledgment: I am very grateful to Dr. S. Kanakaraj David, for the valuable suggestions and guidance in the preparation of this note.

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Two New Hosts for *Striga lutea* Lour.

Striga lutea Lour. is a semiparasitic annual occurring as a root-parasite on many graminaceous plants. It has a wide distribution throughout India and causes considerable damage to Jowar *(Sorghum vulgare)*. The occurrence of *Striga lutea* Lour. on Bajra *(Pennisetum typhoides* Stapf and Hubbard) had been reported from Bombay. In December 1960, the author observed a mild infestation of *Striga lutea* Lour. in a rainfed crop of Bajra in the State Seed Farm, Satyamangalam, Coimbatore District.

A further examination of the above field with Bajra led to the observation of two new hosts viz. *Cyperus rotundus* Linn. (nutgrass) and *Brachiaria ramosa* Stapf. The host plants together with the parasite were dug out with the roots and were carefully washed and examined; it was found that *S. lutea* Lour. had well-formed haustorial connections with *C. rotundus* Linn. (Fig. 1) and *B. ramosa* Stapf. (Fig. 2)

Fig. 1.

Fig. 2.

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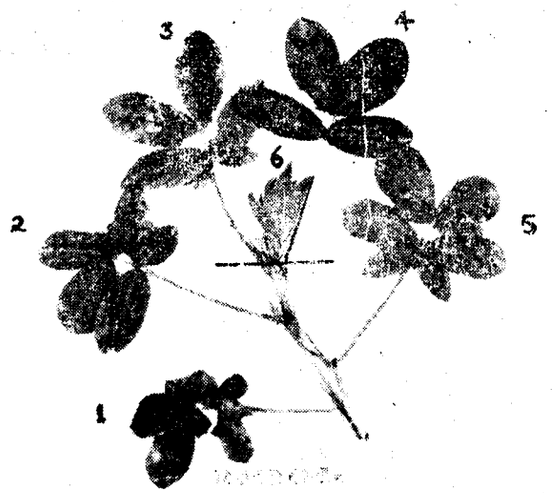
A Note on the Occurrence of Supernumerary Leaflets in Groundnut *(Arachis hypogaea* Linn.)

Normal groundnut plant possesses leaves each carrying two pairs of leaflets. The occurrence of extra leaflets is not uncommon and has been recorded earlier by Hayes (1933), Bhavanisankar Rao and Srinavasalu (1953) and Srinivasalu and Krishnaswamy (1956). The object of this note is to record the occurrence of a particular freak plant which manifested different types of foliar abnormalities all combined in one and the same plant.

In the Zonal Nucleus Seed Farm for groundnut at Srivilliputtur, the freak plant of Madras-1 groundnut possessing leaves with supernumerary leaflets ranging from 5 to 8 was observed. The extra leaflets were definitely smaller in size than the normal ones, the diminution in size being to the extent of small leafy appendages. (Pl. vide fig.)

Supernumerary Leaflets in Archis hypogaea.



1 & 5 — Eight Leaflets.
2 — Seven Leaflets.
3 — Six Leaflets.
4 & 6 — Five Leaflets.

A count was made on the number of leaflets borne per leaf and the data are furnished in the following table.

	Frequency of leaves with extra leaflets					
	4 (Normal)	5	6	7	8	Total
Freak Plant ...	63	5	9	1	2	80
* Normal Plant ...	60	...	...	...	...	60

* N. B :— Mean of 5 identical plants chosen at random.

Station : Srivilliputtur,
Date : 2—1—1961.

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ADDENDUM

Economics of cotton cultivation in the Madras State
(Vol. XLVIII April 1961 No. 4)

Page 127, between lines 4 and 5 — Read sub-zone and (4) Lower Bhavani Project Area. The late planted fertile.

Page 127, line 14 — Delete (4).

AGRICULTURAL JOTTINGS FOR JULY, 1961.

The month of July reminds us about the Vanamahothsava when the whole nation directs its attention to the sacred duty of planting trees. Fortunately for us weather conditions are favourable to take up this programme in earnest by one and all.

As was forecasted last month, the monsoon is on and is satisfactorily proceeding. Farmers are happy on the timely onset of the monsoon and this has resolved the water problem to a great extent. The low water levels recorded in the many reservoirs are gradually rising and we look forward to the timely opening of the canals. As we write these lines, the monsoon has strengthened further bringing in more rains and by the time these jottings reach your hands, the reservoirs will probably be full and over flowing.

The onset of the monsoon is the time for pushing on with the preparatory cultivation operation which were already delayed due to partial failure of the summer showers. We look forward to a good harvest.

Vanamahothsava :

For the farmer, trees are important in his economy. Many useful trees can be planted in a farm. They may be fruit trees to get a rich fruit harvest, or may be trees providing green leaf manure for the crops in his fields or sometimes even timber for his implements or at least some fuel for his home. In these ways a farmer can usefully remember to plant some useful trees in his farm for his own benefit, ultimately leading to the good of the nation. For this purpose, special attention is given in these jottings to give some particulars of the kinds of trees a farmer can plant for the purposes outlined above.

How to Plant Fruit Trees :

In the May jottings reference was made to the kind of fruit trees that could be successfully planted in a small fruit allotment in a farm. It was suggested that some good mango varieties, some good guava types, sapotas, limes etc. could be planted. These fruit trees are to permanently remain in a farm bearing a rich harvest and therefore it is essential to choose good plants for planting. Grafted or budded plants are the best for planting. It is important that the parents used for budding or grafting are themselves good bearers. Then only high production can be assured. The plants should therefore be purchased from a reliable source preferably from a Government nursery nearest to you.

For planting, pits should be dug in places where there is a good depth of well drained soil. The pit should be dug 3 feet long, 3 feet broad and 3 feet deep. The soil from the pit should be removed and refilled with rich, fertile top soil well mixed with bone meal and wood

ashes. It is important that manures like cattle manure or compost which attract white ants are avoided. Neem cake, castor cake etc. could be applied well mixed with the filling up soil. The plants removed from the nursery pits are put in the holes of the size of a ball made in the centre of the pit and the soil alround is packed firmly. A basin is subsequently made alround for watering. After setting the plant it should be well watered. This general principle of pitting and planting can be adopted for planting most kinds of fruit plants. It is a good practice to inter-crop between fruit trees, preferably with a green manure crop. The distance from tree to tree should vary according to kind of trees and the fertility of the field. Generally for mangoes, the spacing can be 40 ft. × 30 ft., for sapotas 25 ft. × 25 ft., for guavas 20 ft. × 20 ft. and for limes 20 ft. × 15 ft.

Loan Assistance to Fruit Growers:

Fruit cultivation is a very profitable venture where soil and climatic conditions are favourable. To encourage farmers to take up to fruit cultivation financial help is extended by Government. Horticultural Loans from minimum of Rs. 300/- per acre to a maximum of Rs. 2,000/- per individual are given to farmers. Generally good fruit plants are supplied in the beginning as part of the loan and the rest of the loan is given in cash from year to year. The loan carries 5% interest and is repayable to Government only from the sixth year of plantings, in ten annual instalments. Loans are also given to improve the productivity of existing orchards for short periods at Rs. 65/- per acre. Your nearest Horticultural Officer at District Head-quarters will be able to help you with more details and assist you in getting loans.

Plant Green Leaf Manure Yielding Trees or Shrubs:

The importance of applying green matter to fields either through green manuring or applying green leaf to build up soil fertility is known to every farmer. The problem is where to get this green matter, because every farmer is interested in applying as much green matter as possible. This problem of supplying green matter can be easily solved by growing green leaf yielding shrubs or trees along the boundaries, bunds, or any patch of waste land available in a farm. Where the area available is quite satisfactory pungam *(Pongamia glabra)* or some other trees can be grown. But in many small farms facilities to grow such trees are not available. The growing of gliricidia shrubs are therefore recommended. They grow very well all over our State and start yielding green leaves even from the second year though in small quantities. A well grown bush can give up to 250 lb. In a year or even more depending on the locality. When planted on bunds, these will go a long way in solving your green leaf problem. Grow *Gliricidia* during the Vanamahothsava week. Seeds and seedlings are always available with your nearest Gramsevak or Agricultural Extension Officer.

Plant Coconuts:

Coconut is a very useful tree in any farm and it is no wonder our ancients called it Kalpakavriksha. There is not enough coconuts in our State to meet all the demand, necessitating the import of coconut oil from neighbouring Kerala and Ceylon. There is therefore an urgent need to aim at self sufficiency in coconuts.

Good selected coconut seedlings are available from the coconut nurseries run by the Agricultural Department at the following centres, Nagercoil, Shencotta, Pamban, Uchipuli (Ramnad District), Sholavandan, Tirupathurai (Tiruchi District), Pattukottai, Tindivanam, Pattanam (Chingleput District), Gudiyatham and Coimbatore. You can get your seedling requirements in reasonable numbers from these nurseries. As was said for fruit plants, the source from where you get the seedlings will largely decide the success of getting a high yield.

Good coconut seedlings have a large girth at the collar, would have germinated early from the coconut, would have a large number of leaves and these leaves would start splitting early. There will be an alround better vigour in the seedlings and these alone should be chosen for planting. Indeed the department takes care to choose only such good seedlings and sell it to farmers.

Plant Cashewnuts:

Wherever some waste lands or lands of low fertility are available in a farm, they could be usefully planted with cashewnuts. Cashewnuts are in good demand now and the kernels are exported to America and other foreign countries fetching very good prices. The cultivation of cashewnuts is therefore a fairly profitable venture to make use of the land of low fertility.

With a view to encourage cultivation of cashewnut, Government are giving financial help to growers in the form of long term loans at the rate of Rs. 80/- per acre subject to a maximum of Rs. 200/- per individual. This loan carries interest at 5½% recoverable from the sixth year. The Cashewnut Development Officer, stationed at Thanjavur will give you information on these matters.

Plant Protection Schedule for the Rice Crop:

The rice crop is susceptible to quite a large number of pests and diseases which result in considerable loss in yields to the farmer. The farmer can take steps to prevent the incidence of these pests and diseases by adopting proper prophylactic measures. With this view the following schedule of prophylactic treatment in recommended after successful trials.

The prophylactic treatment begins with the treatment of paddy seeds with Agrosan G. N. at one ounce for 30 pounds of seeds. For this purpose the Agrosan and the paddy seeds are well mixed in a rotating drum before the seeds are sown in the nursery.

In the nursery a parathion compound (Folidol) and copper fungicide (Micop) are sprayed just one week before pulling out the seedlings. Here the fungicide and the parathion compound are mixed together in water before spraying to save labour cost.

In the main field a similar mixture of a parathion compound (Folidol) and a copper fungicide (Micop) can be sprayed three or four times depending upon the duration of the crop. The following timings are suggested.

1st spraying	2 to 3 weeks after planting.
2nd spraying	A month after first spray.
3rd spraying	A week before flowering.

The schedule of spraying can be altered and could be timed in such a way so that spraying could be done immediately a pest or disease is noted in the field or adjacent fields or in the locality. The spray mixture is prepared by adding 100 cc. of the parathion compound (Folidol) and one pound of the copper fungicide (Micop) in 40 gallons of water. The cost of this treatment is not very high when compared to the enormous loss that may occur without prophylactic treatments.

Boron trace element for Groundnut:

Agricultural Scientists have recognised the importance of about 16 elements that are essential for the growth and development of crop plants. More are getting added to the list. All these elements are found in nature. Three of them carbon, hydrogen and oxygen, occurring in the air and water are in amounts usually adequate for plant growth. The remaining 13 elements are found in the soils in varying quantities. Some soils may have adequate amounts of these essential elements for normal plant growth. In most cases the soil may be deficient in one or more of these elements. Nitrogen, Phosphorus and Potassium are the three elements deficient in most of the soils. They are often called the primary nutrients or major elements. Calcium, magnesium and sulphur, sometimes called the secondary nutrients, are also needed in fairly large quantities to crop plants; while iron, zinc, copper, manganese, molybdenum and boron are usually needed in small quantities or traces and therefore are called sometimes as trace elements. In many countries of the world, these trace elements are generally added in fertiliser mixtures under special conditions where there is evidence of such deficiency.

Some experiments conducted by the Oilseeds Specialist on the need for boron for the groundnut crop has indicated the trace element boron has proved to increase groundnut yields in many places. Boron is usually supplied as borax at the rate of about 10 lb. per acre. The borax is powdered and applied to the soil and ploughed before the crop is sown. Such field tests are now carried out in different places of the State to assess the response of the application of borax to the groundnut crop. If you are interested to test in your fields you may apply at the rate of 10 lb. of borax per acre in a small plot and see whether you get better yields than before. If you get a better crop, the practice can be extended to your other groundnut areas. The small trial can be easily carried out as borax is very cheap and is available at the grocery stores at about eight annas per pound. Increases in the yield upto 40% have been recorded in the trials conducted already.

Castor on field borders:

Castor oil is an important lubricant which has some special advantages over mineral lubricants and therefore is used for special purposes and it has a world wide demand as a lubricant. Therefore castor oil is exported in large quantities to outside countries and fetches a very good price. Farmers could easily grow this crop on borders of fields or on field bunds of dry lands and it has been estimated that an income of about 15 to 20 rupees per acre, can be obtained. There are good strains of castor evolved by the Oilseeds Specialist like TMV. 1, TMV. 2, TMV. 3 and Co. 1 etc. Of these, the last one Co. 1 is a perennial variety and a good yielder.

Ardhanari Avarai:

There has always been a problem for small house owners to erect a *pandal* for growing the domestic *Avarai* in their small compounds. To get over this difficulty a new variety of Avarai called Ardhanari Avarai has been evolved by Millets Specialist by crossing Avarai and Mochai. This Ardhanari Avarai has more or less an erect and bushy growth habit and produces sweet and edible pods unlike the mochai which has an outer leathery skin and therefore only the green seeds are generally used. Ardhanari Avarai praduces green pods quite similar to the pandal avarai and can be directly cooked and used. It can also be grown as a field crop like Mochai but the Ardhanari Avarai can be cultivated without much difficulty and very little of irrigation is needed. The seeds of this Ardhanari Avarai are available with Millets Specialist, Coimbatore.

(From the Extension Specialist, Agricultural College and Research Institute, Coimbatore).

Weather Review — for May, 1961.

RAINFALL DATA (IN INCHES)

Region	Station	Total rainfall for the month	Departure from normal	Total since 1st January
North	Madras (Meenambakkam) ...	0·2	— 0·8	2·5
	Tirurkuppam*	1·2	— 1·3	2·8
	Vellore	2·8	+ 0·5	3·1
	Gudiyatham*	7·4	+ 4·7	7·9
East Coast	Palur*	1·3	— 1·4	9·3
	Tindivanam*	0·9	— 1·1	6·2
	Cuddalore	0·7	— 0·3	10·3
	Nagapattinam	1·3	— 0·3	10·4
	Aduthurai*	4·0	+ 1·8	12·4
	Pattukkottai*	1·0	— 0·9	8·2
Central	Salem	3·0	— 1·7	6·1
	Coimbatore (A. M. O.)* ...	4·0	+ 1·3	7·0
	Coimbatore	5·5	+ 3·0	8·5
	Tiruchirapalli	3·1	+ 0·5	5·4
South	Madurai	7·0	+ 4·2	10·0
	Pamban	1·0	+ £	9·0
	Koilpatti*	2·3	+ 0·2	13·0
	Palayamcottai	0·4	— 1·3	10·4
	Ambasamudram*	3·8	+ 0·7	19·5
	Nagercoil*	4·7	— 2·6	10·0
	Capecomorin*	5·7	+ 1·5	15·4
Hills	Kodaikanal	2·1	+ 4·3	14·5
	Coonoor*	5·3	+ 0·4	26·2
	Ootacamund* ...	7·8	— 0·5	13·8
	Nanjanad*	12·3	+ 5·1	18·4

1. * Meteorological Stations of the Madras Agricultural Department.
2. £ = Actual value = + 0·02".

The month of May, 1961 began with scattered thundershowers throughout Madras State. The South-west Monsoon advanced temporarily in West Coast on 22—5—1961 with the result that localised heavy rains were received in Kerala and Coastal Mysore on this day. Local showers were received in Madras State from 22—5—1961.

In regard to the fluctuations of day temperatures there were no large changes.

Zonal Rainfalls (in inches)

Name of the Zone	Rainfall for May, 1961 (inches)	Departure from normal	Remarks
North	2·9	+ 0·8	Just above normal
East Coast	1·5	— 0·4	Just below normal
Central	3·9	+ 0·8	Above normal
South	3·6	+ 0·3	Just above normal
Hills	6·9	Nil	Just normal

From the Agricultural Meteorologist, A. C. & R. I., Coimbatore - 3.

Departmental Notifications

Gazetted Officers — Madras Agricultural Department
Postings and Transfers during the month of June 1961.

Name and Designation	Posted or Transferred to
Sri Job Servai, Coconut Development Assistant, Madras	Dist. Investigation Officer, Coimbatore
,, G. Venkataramana, District Investigation Officer, Coimbatore	Lecturer in Agriculture, A. C. & R. I. Coimbatore
Smt. Indira Raja, Assistant, Agricultural Chemist (now on leave)	Assistant Agricultural Chemist, Maximisation of Phosphate Potential Scheme, Coimbatore
Sri K. Shivarama Shetty, Assistant Agricultural Chemist, Maximisation of Phosphate Potential Scheme A. C. & R. I., Coimbatore	Lecturer in Chemistry, A. C. & R. I., Coimbatore.
,, K. R. Ramaswamy, Assistant to the Professor of Genetics, A. C. & R. I., Coimbatore	Algologist, A. C. & R. I., Coimbatore
,, V. Ramakrishnan, Algologist, A. C. & R. I. Coimbatore	Lecturer in Botany, A. C. & R. I., Coimbatore.
,, K. C. Chandy, Asst. in Entomology, A. C. & R. I., Coimbatore	Lecturer in Zoology, A. C. & R. I., Coimbatore
,, I. K. Sambasiva Rao, Assistant in Horticulture	Asst. Horticulturist, scheme for the improvement of apples in Madras State, Kodaikanal
,, D. A. Syed Mohammed, Agricultural Demonstrator, Madhavaram Milk Colony, Madras	District Agricultural Officer, Coimbatore
,, T. B. Krishnaswamy Rao, Gezetted Asst. to the Certification Officer, Rajapalayam	Reverted and posted as Res. Asst. under the Professor of Agronomy, Coimbatore-3

Upper Subordinates — Agricultural Department
Postings and Transfers during the month of June 1961.

Name and Designation	Posted or Transferred to
Sri Y. B. Morachan, Soil Conservation Asst., Ootacamund	Assistant Lecturer in Agronomy, Coimbatore
,, G. S. Thangamuthu, Res. Assistant under the Professor of Agronomy, Coimbatore	Asst. Lecturer in Agronomy, Coimbatore
,, R. Appadurai, Millet Asst., Koilpatti	Millet Assistant, Coimbatore
,, K. M. Balasubramaniam, Paddy Asst., A. R. S., Aduthurai	Paddy Asst. Peravurni, Thanjavur
,, J. Chandra Mohan, Asst. in Paddy	Paddy Asst. Coimbatore
,, K. Mahudeswaran, Millet Asst.	Millet Asst., Coimbatore
,, A. Chami, Farm Manager, State Seed Farm, Killur	Asst. Lecturer in Agriculture, A.C. & R.I., Coimbatore

Name and Designation	Posted or Transferred to
Sri B. Karunakara Shetty, Oilseeds Assistant	Assistant in Oilseeds, Salem
,, M. Mahalingam, Potato Assistant	Potato Assistant, A. R. S., Nanjanad
,, P. Senniyan, Cotton Asst., Koilpatti	Millet Assistant, A. R. S., Koilpatty
,, V. Srinivasan, Chemistry Assistant, Coimbatore	Asst. Lecturer in Agricultural Economics, Coimbatore
,, S. Jayaraj, Paddy Asst., Coimbatore	Research Assistant under the Reader in Entomology, A. C. & R. I., Coimbatore
,, G. J. Muthu, Assistant Lecturer in Agriculture, Coimbatore	Dairy Manager, Central Farm, Coimbatore
,, G. Sreedharan Pillai, Assistant in Oil Seeds, Salem	Agricultural Demonstrator, Madurai
,, B. Nanjan, Potato Asst., A. R. S., Nanjanad	Horticultural Development Assistant, Coonoor
,, M. Murugesan, Assistant Lecturer in Agrl. Economics, Coimbatore	Asst. under the District Investigator, Coimbatore
,, P. P. Vasudeva Menon, Research Asst. A. C. & R. I., Coimbatore	Entomology Assistant (Main), Coimbatore
,, B. Velayudham, Entomology Asst. Coimbatore	Entomology Assistant, (Rat Scheme), Aduthurai
,, T. Unnikannan, Assistant in Entomology, Coimbatore	Marketing Assistant, Coimbatore
,, L. Arunachalam, Marketing Asst., Coimbatore	Asst. in Oilseeds, Groundnut Research Station, Pollachi
,, M. Natarajan, Asst. in Mycology, Coimbatore	Millet Assistant, Coimbatore
,, T. V. Balasubramaniam, Mycology Assistant, Coimbatore	Soil Conservation Asst., Sathyamangalam
,, T. Kumaraswamy, Horticultural Development Asst., Periyakulam	Assistant Lecturer in Entomology, A. C. & R. I., Coimbatore
,, B. Vasantharaj David, Plant Protection Asst. (Entomology), Madurai	Entomology Assistant, A. C. & R. I., Coimbatore
,, R. Jayarajan, Mycology Assistant, Betelvin Scheme, Salem	Assistant in Mycology, Coimbatore
,, C. B. Krishna Ballal, Post Graduate Student	Asst. in Mycology, Banana Diseases Scheme, Coimbatore
,, M. A. Chinnadurai, Extension Officer for Agriculture, Kodumudi	Field Asst. Scheme for the Maximisation of Phosphates, Coimbatore
,, P. Kandaswamy, Oilseeds Assistant (Groundnut), Pollachi	Chemistry Assistant, Amaravathy Soil Survey Scheme, Coimbatore
,, T. S. Manickam, Agrl. Demonstrator, Velur	Assistant Lecturer in Chemistry, A. C. & R. I., Coimbatore
,, E. M. Balakrishnan, Post Graduate Student	Analytical Assistant (Compost Scheme), Coimbatore
,, M. Ramalingam, Soil Conservation Assistant, Ooty	Mycology Assistant, Coimbatore
,, M. M. Sankarankutty, Agricultural Demonstrator, Madras	Farm Manager, State Seed Farm, Kolandalore
,, C. R. Balakrishnan, Farm Manager, State Seed Farm, Kolandalore	Agricultural Demonstrator, Madras

Review of market conditions of commercial crops in the notified areas in the Madras State for the month of May 1961.

Cotton :

COIMBATORE DISTRICT : *Season :* During the month under report there were some scattered rains all over the district. Harvest of Cotton crop was over and the crop has been pulled out. Sowings of Cumbu, Cholam and Ragi were completed at Palladam and Dharapuram taluks. Preparation of land for sowings of groundnut (winter) were in progress in Avanashi and Coimbatore taluks. The rain-fall was favourable for the standing crops of groundnut.

Arrivals, Transactions and Prices : Kapas : The kapas market at Tiruppur opened with 34,449 quintals of Cambodia and 3465 quintals of Karunganni Karunganni Kapas and the totals arrivals were 66,761 quintals of Cambodia and 9,269 quintals of Cambodia and 7497 quintals of Karunganni kapas leaving a stock of 34,782 quintals of Cambodia and 5,237 quintals of Karunganni kapas.

Lint : The lint market opened with 25,560 quintals of Cambodia lint during the month. The total arrivals were 40,732 quintals of Cambodia and 554 quintals of Karunganni lint locally ginned. Despatches from Tiruppur were 31,373 quintals of Cambodia and 554 quintals of Karuganni lint leaving a balance of 34,919 quintals of Cambodia lint. The price of kapas ranged between Rs. 125 to 136 and for lint from Rs. 276 to 358 per quintal.

RAMANATHAPURAM DISTRICT : *Season :* There was severe summer, though the first fortnight witnessed a rainfall of 5.03 cms. Though it helped for the easy harvest of the summer groundnuts, it was not beneficial to the standing second crop Karunganni being belated.

Arrivals, Transactions and Prices: Kapas: During the month, 23,000 quintals of kapas were received and 24,000 quintals disposed of at prices ranging from Rs. 93 to Rs. 108 for Lakani, Rs. 92 to 102 for Karunganni and Rs. 67 to 90 for Tirunelveli.

Lint: During the month, 6720 quintals of Karunganni lint were received to add to the opening stock of 817 quintals and 6400 quintals were disposed of leaving a stock of 1137 quintals; at prices ranging from Rs. 282 to 300 for Karunganni.

TIRUNELVELI DISTRICT: *Arrivals, Transactions and Prices:* There was a tatal arrival of 10820 quintals of Karunganni kapas, adding to the opening stock of 445 quintals of which 3810 quintals were disposed of leaving a balance of 7285 quintals. Lint arrivals were 7200 quintals and disposals 4200 quintals. Karunganni kapas ranged in price from Rs. 166 to 108 and lint between Rs. 260 and 278.

Groundnut:

SOUTH ARCOT DISTRICT: *Season:* A rainfall of 10·16 cms. was received at Ulundurpet and lesser amounts at Tirukoilur and at Virudhachalam. The condition of standing crop was fair. Harvest of summer groundnut crop is in progress. Cotton arrivals were negligible.

Arrivals and Transactions: Arrivals improved as the harvest of summer peanuts was in progress. Arrivals of local produce amounted to 7078 tonnes. Arrivals from outside the district came to 134 tonnes. Despatches to other districts totalled 3510 tonnes. Export to Pondicherry State was 125 tonnes. Consumption by mill and Chekkus was 1759 and 328 tonnes respectively. The trade had a stock of 3357 tonnes at the end of the month.

RAMANATHAPURAM DISTRICT: *Arrivals and Transaction:*

Market	Opening stock	Arrivals	Sales	Closing stock
Groundnut pods				
Virudhunagar	Nil.	3,970	3,970	Nil.
Groundnut kernels				
Virudhunagar	5,200	6,825	5,325	6,700

The prices ranged from Rs. 22 to 25 for pods and Rs. 79 to 85 for Kernels per quintal. Groundnut oil prices ranged from Rs. 453 to 480 per candy and cake from Rs. 73 to 87.

NORTH ARCOT DISTRICT: *Season:* No rain was received in the district during the month under report and hot weather prevailed during the month. The harvest of summer irrigated groundnut in Arkonam and Tiruvannamalai came to a close during the month.

Arrivals and Transactions:

	Opening Stock	Arrivals	Disposals	Closing Stock
Groundnut pods in bag of 40 kg.	14,980	8,600	11,250	13,330
Groundnut kernels in bag of 40 kg.	4,185	6,900	7,495	3,590

TIRUCHIRAPALLI DISTRICT: *Season:* Light to moderate showers were received in many places of the district during the month under review with the result that the harvesting of summer groundnut crop was completed in a few places. Rains were however not adequate either for the standing summer groundnuts or for other crops.

Arrivals and Transactions: The Regulated Market, Jayankondan attracted more arrivals during the month and disposed of 2012 bags. Ariyalur received only 132 bags, others being inactive. The price of Groundnut kernels ranged between Rs. 225—255 per candy.

The arrivals of gingelly in South Arcot totalled 909 bags of 80 kg. each. Despatches to other districts came to 560 bags. The chekkus consumed 556 bags. The stock with the trade at the end of the month stood at 583 bags. The average prices per bag of 80 kg. ranged from Rs. 88·70 to 101·37 in the several markets.

Tobacco: COIMBATORE DISTRICT: *Arrivals and Transactions:* At the end of the month there was a stock of 29731 quintals of chewing and 2010 quintals of cheroot tobacco. About 5930 quintals of chewing and 870 quintals of cheroot tobacco were exported to places in Kerala and Mysore States and to Trichy, Madurai and North Arcot districts of Madras State. The price of Meenampalayam tobacco was around Rs. 242 per quintal, the price of cheroot tobacco around Rs. 232 and of pit-cured variety upto Rs. 205.

Cardamom: MADURAI DISTRICT: During the month under report there was fair to good rainfall in the cardamom plantations in Kerala hills and Madurai District. The standing crop was good. Arrivals were fair at Pattiveeranpatti and good at Bodinaickanur and Virudhunagar.

Prices—Bodinaickanur:

Medium bulk	...	Rs. 7·35 to 8·51
Inferior bulk	...	,, 6·32 to 7·51
Seeds	...	,, 9·25 to 10·36

Review of administrative activities of Market Committees in the State during the month of May 1961

Enforcement :

The Market Committees of South Arcot, North Arcot, Coimbatore, Tiruchirapalli, Tirunelveli and Ramanathapuram are functioning during the month under report.

Name of the Market Committee	Section 5 (1) A	Section 5 (1) B	Section 5 (3) A	Section 5 (3) B	Weighmen A	Weighmen B
South Arcot Market Committee	170	1312	75	833	62	745
North Arcot Market Committee	132	684	121	660	52	351
Coimbatore Market Committee	121	1079	111	855	40	481
Tiruchirapalli Market Committee	180	1182	173	1061	145	913
Tirunelveli Market Committee	30	151	14	81	24	141
Ramanathapuram Committee	51	427	38	371	36	391

A = Licences issued during the month.

B = Licences issued upto the month.

Meetings :

The first meeting of the Tirunelveli Market Committee, Koilpatti was held at Koilpatti on 10—5—1961. Seven subjects including the Audit report for 1961 were considered and approved. The first meeting of the Coimbatore Market Committee was held on 11—5—1961. Eighteen subjects were discussed by the committee and passed 15 subjects. An ordinary meeting of the Ramanathapuram Market Committee was held on 4—5—1961. In all 15 subjects were discussed by the Committee. A meeting of the South Arcot Market Committee was held on 30—5—1961 and 35 subjects were disposed of.

The Madras Agricultural Students' Union.

PATRONS

1. Dewan Bahadur C. Arunachala Mudaliar, Zamindar of Chunnampet, Chunnampet P. O.
2. Raja Sri Krishnachandra Gajapathi Narayana Dev, Parlakimidi P. O.
3. Sri V. C. Palaniswami Gounder, M. L. A., Vellakinar, Coimbatore Dist.
4. Dr. C. P. Ramaswami Iyer, Ootacamund
5. Sri Jeevandass, Varnasi, Parlakimidi P. O.
6. Sri Ramachandra Ananga Bhima Dev, Kesari Gajapathi, Raja Saheb of Budokhemidi, Berhampore, Ganjam Dist.
7. Rao Bahadur K. T. Alwa, Retd. Deputy Director of Agriculture, Mangalore
8. Sri R. K. Kandaswamy, "Brindavan", Tiruchi Road, Coimbatore
9. ,, G. D. Naidu, "Gopal Bagh", Avanashi Road, Coimbatore
10. ,, K. Thiruvenkata Mudaliar, 34, 2nd Main Road, Gandhinagar, Madras-20
11. ,, P. G. Karuthiruman, B. Sc., M. L. A., Nanjaipuliampatti, Thukkanaickenpalayam, P. O., (Via) Anthiyur, Coimbatore Dist.
12. ,, K. Venkataswami Naidu, B. A., B. L., Gopalapuram, Coimbatore
13. ,, M. S. Palaniappa Mudaliar, B. A., 125, Rajah Street, Coimbatore
14. ,, A. K. Balaramaraju, Land-Lord, Rajapalayam
15. ,, K. P. Amrithanatha Iyer, Monkompu P. O., Kerala State
16. ,, N. S. Vydianatha Iyer, Songalipuram, (Via) Kodavasal, Tanjore Dist.
17. ,, M. Subba Rao, B. Sc., (Ag.), Mango Range P. O., Nilgiris
18. ,, M. R. Balakrishnan, B. A., B. Sc. (Ag.), F. A. O., Irrigation Agronomist, Bangkok, Thailand
19. ,, S. Raja Iyengar, Land-Lord and Agriculturist, Madurai
20. ,, R. Ramakrishna Naidu, Palamalai Ranganathar Mills, Perianaickenpalayam P. O.
21. ,, C. M. John, B. A., Agricultural Technical Adviser, The Potash Scheme-India, 7, Lavelle Road, Bangalore-1
22. ,, S. N. Venkataraman, B. A., B. Sc (Ag.), Retd. Deputy Director of Agriculture (H. Q.), 33, Third Main Road, Gandhinagar, Madras
23. Dr. T. S. Sadasivan, Director, Botany Laboratory, Madras University, Triplicane, Madras-5
24. Sri W. P. A. Soundara Pandian & Sons., Pattiveeranpatti P. O., (Via) Kodai Road
25. ,, M. A. Ayee Gounder, Kasipalayam, (Via) Gobichettipalayam
26. ,, K. S. Vengu Chettiar, 'Kottachi House" Kornad, Mayuram
27. ,, V. P. K. Kayarohanam Pillai, Agriculturist & Businessman, Nagapattinam
28. ,, A. K. Subramania Odyar, Mirasdar, Attur Village, Nannilam Taluk
29. ,, R. V. Sundara Reddiar, B. A., B. L., Advocate, 'Bhaskara Vilas,' Cuddalore
30. ,, N. M. Rajaram Reddiar, Nathapet P. O., Cuddalore
31. ,, M. Arunachalam, B. Sc. (Ag.), C/o. Sri Muthunara Reddiar, Pagandai Village P. O., (Via) Panrutti
32. ,, S. D. Rama Reddiar, Purnasugaipalayam P. O., (Via) Pallianellur, Villupuram
33. ,, S. Kothandapani Pillai, Purnasugaipalayam, Pallianellur, P. O., Villupuram
34. ,, G. Venkatamuni, B. Sc. (Ag.), Partner, Mysore Fertiliser, 34, North Beach Road, Madras
35. ,, C. K. N. S. Nagarajan, Valavanoor, S. Arcot Dist.
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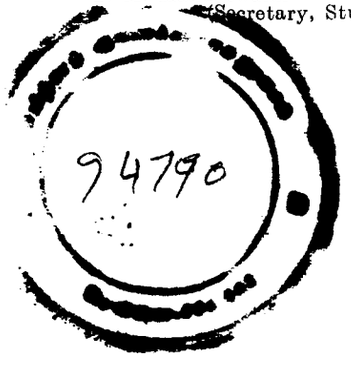

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