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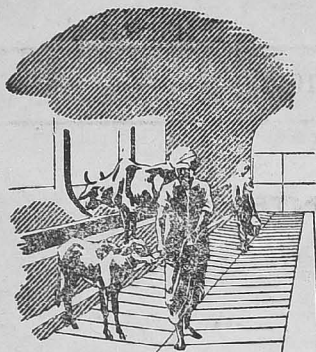
No. 7

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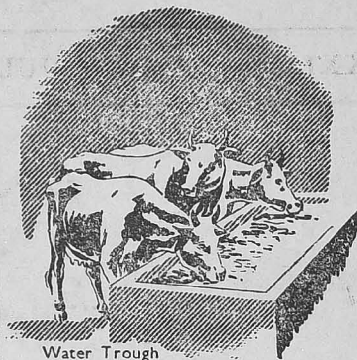
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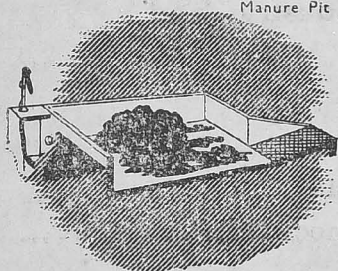
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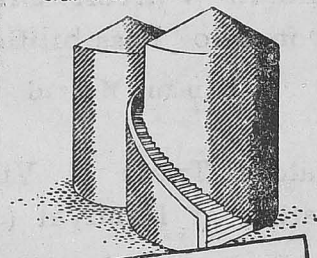
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The Madras Agricultural Journal

Vol. XXXIX

July 1952

No. 7

Editorial

A notable event during this month at Coimbatore was the inauguration of an International Training Centre on Soil Fertility at the Agricultural Research Institute, under the auspices of the Food and Agricultural Organization, Rome. This was a logical development of the decision arrived at by the Food and Agricultural Organization in their meeting at Bandoeng in May last. Pursuant to their policy of fostering a better knowledge of soil-crop relationships, the Food and Agricultural Organization have instituted this new venture of bringing together trainees and trainers from different parts of the world in order to develop a better understanding of the World's food problem, with special reference to Eastern Asia.

The Training Centre was inaugurated on the 15th July by Sri Nityanand Kanungo, Member of Parliament, who was gracious enough to come down for the occasion from Delhi, at very short notice. It was appropriate that this inauguration should have been done by the same person who acted as the leader of the Indian delegation to the Bandoeng Conference in May. The Food and Agricultural Organization was represented by Dr. H. G. Dion, from Rome.

The trainees who are themselves workers in agricultural sciences are drawn from eight different countries of Eastern Asia and in addition a number of distinguished workers in soil science have been requested to give the lectures and demonstration classes for the benefit of the trainees.

As a complement of this International Training Centre at Coimbatore, the Food and Agricultural Organization has also programmed to run a similar course of three months' duration in Rice Breeding at the Central Rice Research Institute at Cuttack, starting from September 1952. For this centre, too, trainees will be drawn from various countries of Eastern Asia and the lectures would be delivered by distinguished workers in different aspect of Rice Breeding and Research.

It is a matter for real satisfaction that the Agricultural Research Institute at Coimbatore should have been singled out as the venue of the International Training Centre in Soil Fertility as it indicates that Coimbatore is achieving recognition in the world of agricultural research. As pointed out by one of the principal speakers at the inauguration ceremony, the time is now past when for anything and everything people used to look to the West, for inspiration, guidance and even in the matter of execution. And especially with regard to problems of soil fertility in relation to tropical soils in countries like India, Burma, Pakistan, Siam and Indonesia the local knowledge and experience necessary can be expected only from those who have been actively engaged in the investigation of such problems in tropical regions.

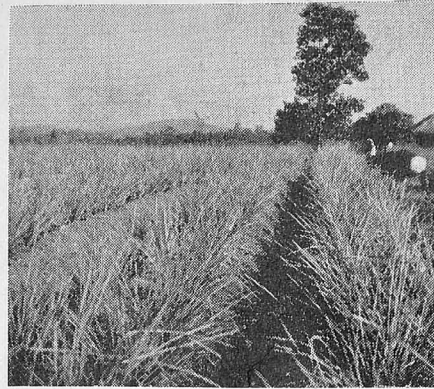
In a subject like agriculture, many sciences are involved; though all have, in some way or a other, interests that pertain directly or indirectly to the growth of plants in soil. The basic training and general scientific background required of those studying soil science for instance, may have little in common with that required of persons who are interested in genetical studies on crop plants, or of those engaged in analytical work, but all these three fields are interlinked in the work of developing a proper fertilizer recommendation for profitable production of adapted varieties of a particular crop on various soil types.

It is in this aspect of bringing together workers engaged in different aspects of food production that the Food and Agricultural Organization deserves to be congratulated on their well-directed activities.

The Indian Vetiver Oil Industry and Its Economic Possibilities



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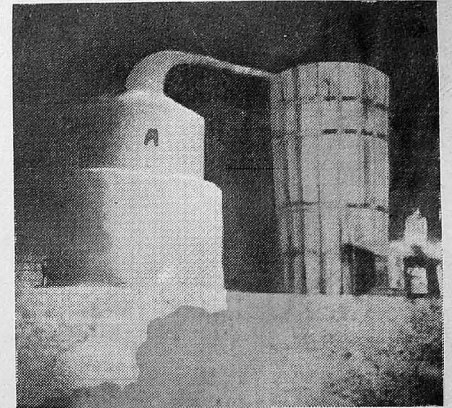
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(6)

The Indian Vetivert Oil Industry and Its Economic Possibilities

By

C. RAMAN MOOSAD, B. Sc., (Ag.),
(Assistant Marketing Officer)
Coimbatore

(a) **Historical:** (*Vetiveria Zizanioides*, Nash) formerly called *Andropogon squarrosus* Hack is perhaps one of the most important among the Indian essential-oil bearing plants. Its medicinal and perfumery values have been known in India from time immemorial as evidenced by various references in the ancient Ayurvedic treatises. Its economic importance was realised at least as early as the 12th century A. D as seen from the copper plate inscriptions dated 1103 and 1174 A. D. found near Etawah, wherein vetivert is mentioned as one of the articles on which the King of Kanauj levied import duty.

(b) **Occurrence:** This plant is found growing wild in parts of the East and West coasts of India, on the wastelands at Cuttack, in the forests of Central India especially in Bharathpur and in the Punjab ascending into Kumaon up to 2000 feet in elevation.

Cultivation: Apart from utilising the natural growths found in some parts of the country like Bharathpur and some sort of indifferent cultivation for production of roots for hot weather thatties and fans in Ponnani Taluk of the Malabar district no attempt seems to have been made either for its cultivation on a field scale or for any scientific study of this crop up to 1943 when the first serious attempt was made for its cultivation and study by the Kerala Soap Institute, Kozhikode. The demand for vetivert oil which forms an essential ingredient in all highclass soap perfumes has been growing steadily in India. This increasing demand for vetivert oil was being met by increasing imports from foreign countries like Java, Reunion and Haiti islands until these imports came to a sudden stop with the occupation of Java and Reunion Islands by the Japanese during the Second World War. As vetivert oil happened to be an indispensable ingredient as a perfume fixer for all high class soaps, the soap industry throughout India was faced with the problem of finding an alternate source of supply for this essential commodity.

It was under these conditions that the Kerala Soap Institute which was the pioneer in building up the modern soap industry in India came forward with a scheme for the large-scale cultivation and study of Indian vetivert and other important essential oil bearing plants. It was also thought, with the knowledge then available that the sandy soils of the

coastal belt would be the ideal soil for its cultivation. It was therefore proposed in the scheme to confine the cultivation to the available vacant Government lands attached to the various fish-curing yards of the West Coast.

In July 1943, the author of this note was deputed to work the scheme under the guidance of the Superintendent, Kerala Soap Institute. This study went on for three years and the area increased from 7 acres in 1943 to over 30 acres in 1946, and covered also other essential oil bearing plants like lemongrass, sweet basil, geranium, peppermint, cinnamon, artemesia, etc. A great deal of knowledge about the cultivation and distillation of the oil was gathered, on the best type of soil, maturity, season of harvest and the effect of manuring on the yield of raw material and the oil content. The information so gathered was published in the form of a paper in the *American Perfumer and Essential Oil Review* of August 1949 under the joint authorship of Dr. K. S. Murti, Oil Technologist, Kerala Soap and the present author. As the present note is intended more for the practical farmer than for the research worker it is proposed to give only a summary of the conclusions arrived at the large number of experiments conducted.

1. *Soil*: The nature of the soil plays an important part in altering the oil content of the roots. The white sandy soil which was considered best for vetiver at the beginning proved to be the poorest in regard to the oil content of the roots, while laterite loam gave roots of highest oil content, the range of variation being so wide as between 0.18% for white sandy soil to 1.02% for laterite loam.

2. *Maturity*: The optimum maturity of the crop under West Coast conditions was found to be 15 to 18 months, i.e., when planting is done at the beginning of the South-West monsoon in one year, the crop is ready for harvest by the end of the North-East monsoon of the next year and the oil content increases up to the beginning of the next South-West monsoon and then declines. The actual variation from the crop in the same soil ranged from 0.10% for ten months to 0.79% for 17 months. Regular field experiments are in progress at Pattambi and Ambalavayal Farms to determine the optimum maturity.

3. *Season of harvest*: Roots should not be harvested either during heavy rains or immediately after the rainy season since these give a lower yield of oil, partly due to the high proportion of immature roots containing very little oil and partly due to leaching out of a portion of the oil even from mature roots during the heavy rains. The higher proportion of immature roots during the rainy season is due to the fact that the crop which has been subjected to a long period of droughty conditions puts forth numerous fresh roots after the rains.

4. *Effect of Manuring*: From the preliminary trials conducted there are indications to show that manuring with ammonium sulphate, groundnut cake or brine manure (residue left in the brine in which fish is cured) would increase the yield of roots as well as the oil content, but the optimum dose of these are yet to be worked out. This aspect is now being investigated by the Agricultural Department at the Research Stations at Pattambi and Ambalavayal under the guidance of the Government Lecturing and Systematic Botanist, Coimbatore.

Further work on vetiver at Nilambur: Based on the practical results obtained at the Kerala Soap Institute, a few persons ventured on the cultivation of this crop at Nilambur (South Malabar) in a 40 acre block of laterite loamy soil in 1948. The results of this venture have added much to our knowledge about this industry and has also shown that the vetiver industry has immense scope for development on the waste lands and dry *Modan* lands on the West Coast. They have been able to produce on an average about 12 lb. of oil per acre from a crop of 15 to 18 months, the value of which at Rs. 130/- per pound at the present market rate accounts to Rs. 1560/-. Though the cultivator has to toil hard for nearly a year and a half to reap the harvest, the result when it is achieved is well worth the labour, as no other crop grown on this type of land is capable of giving such handsome profit and engaging such a large number of labourers. The details of cultivation and distillation methods employed at Nilambur are furnished below.

Preparatory Cultivation: The area which is first cleared of scrub jungle is dug deep with mammuties and laid out in long ridges $2\frac{1}{4}$ feet wide, 1 foot high and $1\frac{1}{2}$ feet apart. In an acre of land usually about 4,800 running koles (Kole— $2\frac{1}{4}$ feet) of ridges are formed.

Planting: Slips separated from the uprooted clumps with their rhizome portion intact but without the fibrous roots and having 6" to 8" of shoot portion are planted on these ridges 9" apart in two rows on each ridge. Three to four slips are planted in each hole when slips are readily available on the spot to provide for failures and to obtain a thick stand. In the case of first planting when slips have to be purchased and transported over long distances only 1 or 2 slips are planted in each hole.

Illustration No. 1 shows the ridges immediately after planting.

An acre will require about 28,000 clumps of 2 to 3 slips each. Planting is usually done from June to September when the rainfall is highest and most regular on the West Coast.

After Cultivation: This consists in weeding the area once in October—November just before the weeds begin to set seed.

Harvesting: The crop is usually harvested 15 to 18 months after planting and it is done between the months of November and May, except when slips are required for replanting, in which case harvesting is done during the rainy season itself even at the risk of reduced oil yields. About 300 koles of ridges give about 280 to 300 lb. of fresh clean roots which makes one charge for an ordinary still and yields 12 to 13 oz. of oil on distillation which is continued for 28 hours. It is found that highest percentage of oil is obtained when roots are harvested and distilled quite fresh, between the months of November and February. Drying and storing of roots before distillation leads to loss of nearly 25% of the oil content, which incidentally refutes the accepted notion that roots should be well dried before distillation. Illustration No. 2 shows the vegetative portion of the full-grown crop being cut prior to harvesting of roots and illustration No. 3 shows the harvesting in progress with digging forks.

Distillation: The cleaned roots are chopped into bits 1" to 2" long and directly charged into the still barrel (A) for distillation. Thirty-six gallons of water is poured into the still along with charging of the roots, over and above 12 gallons always retained in the still below the false bottom. Distillation actually starts 4 hours after starting the fire at the base of the still and is allowed to continue for another 24 hours without break. The oil vapour which comes along with steam is condensed in a copper coil immersed in a column of cold water and falls into a series of three receivers. The water that comes out is also measured and poured into a tub and when 36 gallons come out another 36 gallons are added and distillation continued till the whole of this quantity also comes out. It is found that about 8 oz. of oil comes out along with the 1st charge of water and 4 to 6 oz. along with the second charge. One complete distillation which takes nearly 28 hours in all consumes on an average half a ton of fuel which costs at present Rs. 12—8—0 at Nilambur. Illustration No. 4 shows the village smiths at work for fitting up the still. The circular sheet with a number of holes on it is the false bottom of the still barrel.

Illustration No. 5 shows the distillation in progress as also the filtration of the oil with the aid of a double-walled funnel. The labourers are pouring cold water into the cooling tanks in which the condensing coils are immersed. The cooling tanks of a set of three stills are seen in a row. Illustration No. 6 shows one still with the cooling tanks and filtering system complete.

The Working of the Still: When the water in the still barrel begins to boil the roots get cooked and the oil globules come out along with steam. The mixture of steam and oil vapour now rises to the still head and comes out through the copper coil which is immersed in a column of

cold water contained in a cooling barrel. In the coil the oil and water vapours condense into oil and water which drip down through the spouted end of the coil into a series of receivers with bent spouts connected at the bottom to carry the excess water to the next receiver. As the oil that comes out at different stages vary slightly in density a thin muslin cloth is allowed to float over each receiver to catch even oil which sinks in water. As the oil accumulates over the muslin pieces over the receivers it is carefully taken out with spoons and poured into separating funnels. To make even denser portions of the oil float and thereby facilitate easy separation, common salt is put into the water in the separating funnel and shaken. This increases the density of the water in the funnel and makes even oil of higher density float. The water column is then drawn off as much as possible and the oil is poured into a clean tinned vessel and heated over a water bath. To remove even the last traces of water from the oil, anhydrous sodium sulphate is added to the oil at 1 tola per pound of oil and stirred well. This oil is finally filtered using a double-walled funnel with hot water circulating between the two walls which arrangement heats the oil and enables it to filter down easily. Vetivert oil at ordinary temperature will be too thick to pass through the filter paper easily. For convenience circulation of hot water can be arranged from the top portion. The filtered oil is now ready for the market and has a golden yellow colour.

Economics : Cost of cultivation and distillation for one acre.

	Rs.	AS.	PS.
1. Preparatory Cultivation ;			
Digging with Mammuty 40 men @ Rs. 1—8—0 per day	...	60	0 0
Making ridges on contract @ Rs. 1—8—0 per 100 Koles (1 Kole = 27") - 4,800 koles per acre	...	72	0 0
2. Seeds and Sowing :			
Preparing slips, carrying to the field and planting 20 women @ 12 as.	...	15	0 0
Cost of 75,000 slips at a nominal cost of Rs. 2/- per 1,000 (the need for purchasing slips will arise only for the 1st planting) and hence only a nominal cost is charged for this	...	150	0 0
After Cultivation :			
Weeding once in October—November, 125 to 135 women at 12 as.	...	100	0 0
Harvesting :			
Digging roots and shaking off the earth, 64 men @ Rs. 1—8—0	...	96	0 0

	Rs.	AS.	PS.
Transporting cleaning, washing and chopping of roots for distillation, 320 women @ 12 as (20 women for each charge of the still and 16 charges for one acre) ...	240	0	0
Cost of 8 tons of fuel for distilling 16 charges ...	200	0	0
Attendance at the still-firing, charging water etc. men @ Rs. 1—8—0 and 32 women @ 12 as. ...	72	0	0
Cost of supervising staff, interest on capital outlay ...	225	0	0
Total ...	1,230	0	0
Cost of 12 lb. of oil @ Rs 130/- per lb. (Foreign oils are now quoted @ Rs. 150/- per lb. and hence the rate of Rs. 130/- adopted for this calculation is on the safe side) ...	1,560	0	0
Net Profit per acre ...	330	0	0

As the crop remains in the field for 15 to 16 months it will be possible to take only two crops in three years and the annual profit per acre will be only $\frac{2}{3}$ of the amount given above. But even this is a fairly good return from the average dry lands of the West Coast. Provided the quality of the produce is scrupulously maintained marketing of the oil will not be a problem for a long time to come, as India is not producing even 5% of her requirements of vetivert oil at present. All the major soap factories in the country would be requiring this oil and they will be only too glad to purchase local produce provided the quality compares favourably with the imported stuff. This industry also enjoys $31\frac{1}{4}\%$ protective duty on the imported oils. The organisers of the "Ramachathottam" at Nilambur would be glad to help people who are interested in starting this cultivation. The author is indebted to the proprietors of "The Ramachathottam" at Nilambur, for the data and other details supplied by them.

SUMMARY

1. Vetivert can be successfully cultivated under rainfed conditions in most regions, provided the soil is fairly well-drained and loamy and the rainfall is not less than 40" to 50 inches.
2. The optimum maturity of the crop is 15 to 18 months.
3. To get the maximum quantity of oil the roots must be harvested during dry weather (November to May) and distilled fresh.

4. Application of organic and chemical manures increases the yield of roots as well as their oil content as seen from preliminary trials.

5. With the present price of oil, the crop is capable of yielding a much higher profit per acre than most other crops now grown under similar soil and climatic conditions and is at the same time capable of providing employment for a much larger number of people.

6. As the country is not producing even 5% of its requirements of vetivert oil there is bound to be a ready demand for genuine oil for a long time to come. The home-made oil also enjoys a protective duty of 31½% on the imported stuff.

Exploratory Trials of Virginia Tobacco Cultivation at Nandyal (Kurnool District)

By

B. RAMAKRISHNA REDDI, B. SC. (Ag.)

(Personal Assistant to the District Agricultural Officer, Kurnool)

Introduction: In Guntur district more than 80,000 acres are cultivated with Virginia tobacco. The cultivation of this variety has spread over 12,000 acres in East Godavari, 19,000 acres in West Godavari and 15,000 acres in Kistna, which form the coastal districts north of Guntur. In order to explore the possibilities of extending its cultivation to other areas of the Madras State, a scheme was sanctioned in 1948 with financial aid from the Indian Central Tobacco Committee, for an initial period of two years, with five centres of work at Yellamanchili, Nandyal, Salem, Eliyarampannai and Cuddalore. This article deals with the work at Nandyal Exploratory Station, where the scheme was worked for one year more than the initial period of two years.

Soils and Climate: Nandyal represents clayey soils of medium fertility. The tract receives an annual rainfall of about 28 inches of which 18 inches are received in the South-West Monsoon period, 6 inches in the North-East Monsoon and 4 inches in the Hot-Weather period. The soils and rainfall therefore do not substantially differ from those

found in the neighbouring district of Guntur, which accounts for 75% of the Virginia tobacco grown in the State. Nevertheless, one factor, which finally decides the fate of the spread of the tobacco, was found to be humidity, the lack of which during the curing season was the greatest stumbling block.

Materials and Methods: Nurseries of H. S. 9 Virginia tobacco, an improved strain finding favour in Guntur district, were raised on the Agricultural Research Station, Nandyal and seedlings utilised for the exploratory trials each year. Ten acres was taken on lease adjacent to the Agricultural Research Station for these exploratory trials. Every year six acres were planted to tobacco and the remaining four acres were put under the rotation crop of cholam (Sorghum). Thus during the second and third year tobacco followed cholam in 2 acres, while tobacco followed cholam in all the 6 acres during the first year.

The rotation of Virginia tobacco after cholam has been found to be the most suitable under Nandyal conditions. Its cultivation after chillies, which is followed in certain parts of Guntur can also be adopted. It is however, believed that Virginia tobacco following a cereal crop gives leaf of a higher grade. Being a rainfed tract with a lower rainfall only one crop per year is possible.

During the two seasons of 1948—'49, and 1949—'50, the transplanting of the crop was done in October as followed in Guntur district, the nurseries having been sown in the first fortnight of September. This resulted in the curing starting from the third week of January and ending by the middle of March. From February onwards the atmospheric humidity fell below 75 maximum and 35 minimum, affecting curing and bundling of the tobacco leaves. To get over this difficulty the plantings were advanced to September by sowing the nurseries in the first week of August. Although advancing the season for the nursery and early transplantation is bound up with two adverse factors in Guntur tract such as (1) heavy rains of the early part of the North-East Monsoon washing out the crop and necessitating replanting on a large scale and (2) optimum conditions for curing connected with the prevalence of the humid South-East winds, occurring only from January - February, this advancement has been found to be advantageous under Nandyal conditions. Here the North-East Monsoon is generally weak with light rains and the humid South-East wind has optimum humidity during December - January, gradually decreasing as days pass by. Thus while the second half of October is the optimum for planting in the Guntur tract to produce leaf of the best quality in regard to body, texture etc., the optimum planting period for Nandyal conditions was found to be earlier than October. By this the crop started giving leaf for curing from the middle of December till the end of February. The

leaves cured in December and January were found to lend themselves well for handling, although not as satisfactorily as in Guntur district, where the moisture-laden *pyru gali* (South-Easterly wind) softens the leaf and facilitates easy handling. When the leaves were carried and carefully kept over flowing channels or between paddy fields overnight, it was found that they could absorb enough moisture to become soft for bundling. It was therefore concluded that the difficulties in curing can be overcome by constructing the tobacco curing barns near water sources such as on tank bunds or along the Kurnool - Cuddapah canal, so that the humidity in the atmosphere there, could enable easier bulking. Keeping the cured leaf in underground cellars is also practised.

Growth and Yield of Crop: Due to the annual lease of the land taken for exploratory trials, it was not practicable to manure the fields. This reflected badly on the yields.

The growth of the crop was really good during the first year. An average yield of 507 lb. of flue-cured leaf was obtained per acre. The leaf was also of good size and quality and the number of leaves per plant fit for flue-curing was also above average. The yields however decreased appreciably during the next two years, due to inadequate manuring. A statement of the manures applied and the yields obtained is given below for the three years of trial.

1948—'49 (6 acres)

<i>Manures applied:</i>	<i>Yields obtained:</i>	
1. At the rate of 3 tons of cattle manure per acre.	Flue-cured leaf	3,044 lb.
	Sun-cured leaf	795 lb.
	Total	3,839 lb.
	Average per acre	639.5 lb.

1949—'50 (6 acres)

No manure was applied.	Flue-cured leaf	1,948 lb.
	Sun-cured leaf	740 lb.
	Total	2,680 lb.
	Average per acre	448 lb.

1950—'51 (6 acres)

No manure was applied.	Flue-cured leaf	1,677 lb.
	Sun-cured leaf	880 lb.
	Total	2,557 lb.
	Average per acre	439 lb.

Due to the higher rainfall and the depleted nature of the soils in Guntur tract heavy manuring is practised there. But in the Nandyal tract which is comparatively new to this crop, the manuring may be as follows:

Basal: Farmyard manure 10 cart-loads.

Subsequently: 112 lb. of Tobacco mixture. Heavier dosage than the above will adversely affect the quality of the leaf.

Pests and Diseases: No major pests or diseases were noticed during the three years of cropping. The absence of the plant parasite "*Orobanchae*" otherwise known as '*Tokra*' was one of the redeeming features here.

Future Prospects: The exploratory trials have shown that the crop can be successfully cultivated in the Nandyal tract. Given proper facilities, flue-curing can also be successfully managed. Otherwise sun-curing is the only alternative. During 1950-'51, enterprising cultivators in Cumbum taluk grew an area of nearly 300 acres under this crop. They experienced the same difficulty in matter of humidity for flue-curing purposes. The Imperial Leaf Tobacco Development Company—the premier purchasers of Virginia tobacco have already opened their branch at Nandyal and seem to be assuring a guaranteed purchase for sun-cured Virginia tobacco. The prospects of expansion of this crop therefore seem to be bright, especially when groundnuts, the main industrial crop of this district, is of late giving diminishing returns due to various pests and diseases.

Regular research work may have to be taken up in the years to come as the area under the crop expands and new problems arise.

Use of 'Cut Sets' and 'Whole Seed' for Planting Potato

By

K. SAPTHARISHI, B. sc. (Ag.)

and

M. D. AZARIAH, B. sc. (Ag.)

(Agricultural Research Station, Nanjanad)

Introduction: The use of cut sets, i.e., seed tubers cut into two or three bits according to size, for planting the crop, has been common since the early days of the introduction of the potato as a cultivable food crop. The earliest record of this dates back to the year 1834 when Lindley (8) reported the development of seedlings even from mere potato peelings.

While a good amount of work on the use of cut sets has been done in the important potato growing countries, analysis of the data of the various workers reveals the difficulty of forming a definite conclusion of the superiority or otherwise of the whole seed over the cut set, since the yield from both these kinds of seed material seems to be conditioned by the nature of the soil, climate, facilities for irrigation, the variety used, size of the whole seed or cut set and possibly other factors.

During the years 1938 to 1941 trials were conducted at this station using whole seed and two kinds of cut sets viz., (1) tubers cut transversely with crown ends and heel ends. The findings of these earlier investigations, in relation to the more recent experiments conducted during the two years 1949 - '50 and 1950 - '51 reported in this paper, are discussed under the head ‘Experimental Data and Results’. The trials were concluded in 1951.

Review of Literature: Working on irrigated conditions, Aicher (1) recorded better total yields with the use of whole seed, though the cut sets returned more marketable tubers, a finding which was confirmed by Welch (11).

Using the variety *Majestic*, Brandreth (4) found that the whole seed significantly outyielded the cut set in both total yield and yield of ware; while Rhynehart (10) reported that if sets cut on the day of planting were used, there would be no such loss in yields.

Arnold (2) has advocated the use of big cut sets weighing at least three to four ounces for hot and dry conditions prevailing in Rhodesia. Laumont and Robert (7) concluded that the economy effected by use of the cut set did not compensate for the fall in the crop, since the yields from the medium-sized whole seeds were consistently higher by 20%. Kapoor (6) preferred, in actual practice the use of cut sets of larger seed tubers.

Discussing the curing of cut sets before planting, Priestley and Woffenden (9) and Bell (3) stressed the need for healing of the cut surface by the deposition of a suberine layer, with avoidance of dry conditions and free access to atmospheric oxygen after cutting.

Delaney (5) described that the varieties that responded well to cutting had, in general, round tubers.

The object of the experiments at Nanjanad was to obtain data that would settle questions relative to the advisability of using whole or cut seed for planting. The trials were confined to the main and the second crops of the year 1950 and the main crop of 1951. Because of the close agreement of the results obtained during the two years for the main crop and in view of the greatest possible care taken to insure uniform soil conditions and provide uniform cultural methods, it was felt desirable to present in this paper only the average of the two seasons.

Experimental Data and Results: The potato variety used for the work was *Great Scot*, which is the most popular and the best suited for the Nilgiris because of its high yield, good round shape, earliness, good keeping quality and hardness when cooked. Four levels for size of seed, viz., half, one, one-and-a-half and two ounces by weight were used. Cut seed also conformed to the above weight levels and were made out of the apical end of the seed material, the transverse cutting being effected a week before planting. Directly after cutting, to prevent undue loss of moisture and to promote the deposition of suberin from the sap, the cut pieces were kept covered by wet hessian away from light in racks, for 48 hours. The treatments were replicated four times and, directly after sowing, were manured uniformly with Nanjanad mixture, providing 80 lb. nitrogen, 120 lb. potash and 200 lb. phosphoric acid, at the recommended dose of 1610 lb. by weight per acre, which has been found the right dose for optimum yield on the hills.

Detailed studies were made for germination counts, tillering, crop growth and the number of tubers per hill for the different treatments. The combined values for the two main crops of the years 1950 and 1951, are presented hereunder.

TABLE I.
Record of germination, growth and number of tubers per hill
(Average of the main crop, 1950 and 1951)

S. No.	Treatments	Percentage of germination	Mean number of tillers per seed	Mean number of tubers per hill
1	A. Whole seed $\frac{1}{2}$ oz.	78.1	1.9	7.9
2	B. do. 1 oz.	89.9	2.3	8.0
3	C. do. $1\frac{1}{2}$ oz.	86.2	3.3	10.4
4	D. do. 2 oz.	82.4	4.1	11.0
5	E. Cut set $\frac{1}{2}$ oz.	81.2	1.3	5.0
6	F. do. 1 oz.	81.6	1.9	6.2
7	G. do. $1\frac{1}{2}$ oz.	76.2	1.9	6.5
8	H. do. 2 oz.	84.0	3.2	9.4

(Cut set = Seed tuber cut transversely and only apical ends used)

It is found that while the germination of the whole seed and cut sets was about equal, tillering and the number of tubers per hill were markedly greater for the whole seed. For both the whole and the cut seed, tillering and number of tubers increased with increase in the weight of seed used.

The yield figures, which were statistically significant in all cases, are given in the following.

TABLE II
Acre yield data for the treatments

Season	Treatments								General Mean	'Z' test	Standard error	Critical difference (P=0.05)
	A.	B.	C.	D. (control)	E.	F.	G.	H.				
Main crop (1950—1951): acre yield in lb. ...	10,700	13,000	17,000	18,100	10,300	12,600	10,400	12,900	1,138	Satisfied	1,386	2,385
Percentage on (D) control (2 oz. whole seed) ...	59.1	72.4	93.9	100.0	56.9	69.6	57.5	71.3	72.6		7.5	12.9
Second crop (1950): yield in lb. ...	3,400	3,800	5,500	6,300	2,100	3,500	5,000	5,600	4,400	Satisfied	840	1,747
Percentage on (D) control (2 oz. whole seed) ...	54.0	60.3	87.3	100.0	33.3	55.6	79.4	88.9	69.8		13.1	27.3

Note: Main crop: Sown in April.
Second crop: Sown in September.

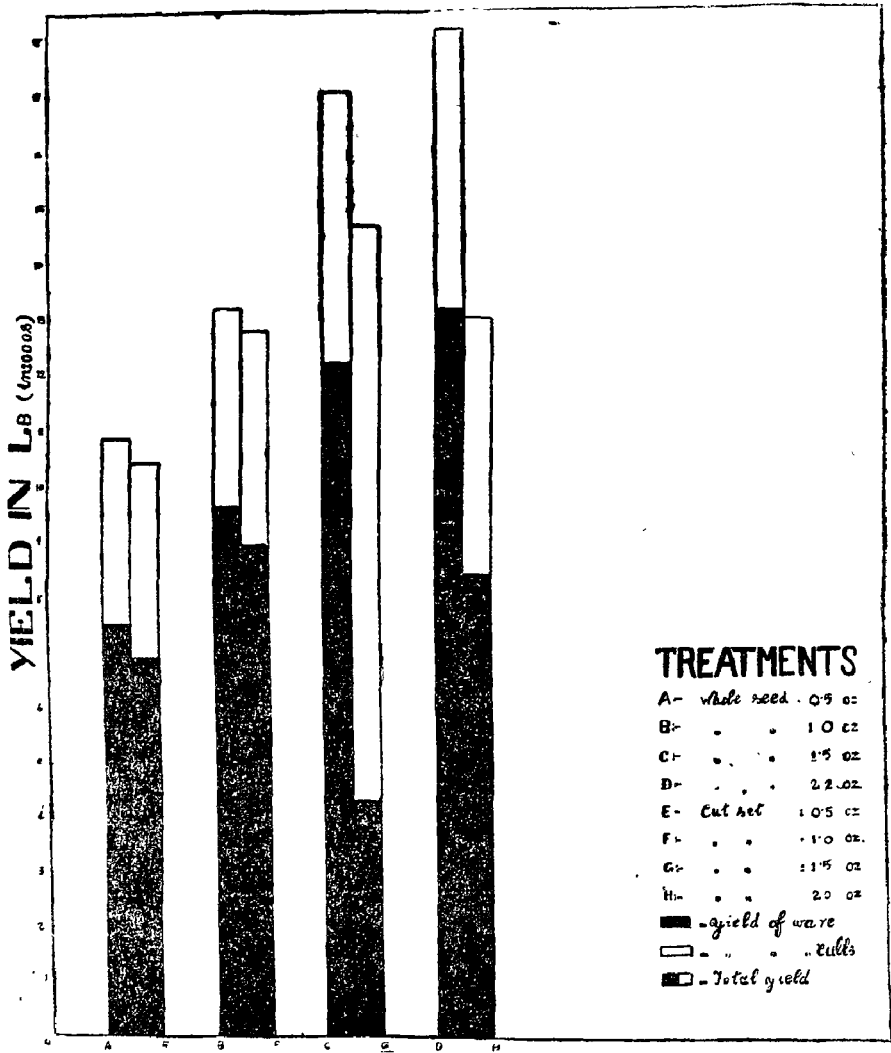
Conclusion:

(Main crop):

D, C, B, H, F, A, G, E

(Second crop):

D, H, C, G, B, F, A, E



A progressive increase in yield with increase in size of yield is evident with increase in size of seed, whether whole or cut. The highest yields were obtained with the seed material, cut or whole, weighing two ounces, which is the practice recommended for general adoption. Again, whole seeds invariably proved their definite superiority over cut sets, from the point of total yield.

The yields of ware and culls, are shown separately in the diagram. From this it is clear that not only the total yield, but the proportion of ware to total, is higher in the treatments with whole seed, in comparison to those raised from cut sets.

In the light of the above findings it is considered desirable to discuss the results of the work conducted earlier at Nanjanad during the four-year period 1938 - '39 to 1941 - '42.

For the irrigated crop in 1931 - '39, three types of seed material were used, viz., (A) whole seed; (B) transversely cut sets with crown only; and (C) transversely cut sets with heel ends only. The result was significantly in favour of the cut sets with crown ends (B). But, in the next year (1939 - '40), there were no significant differences among the three treatments in the main crop. For the second crop of the same year, a fourth treatment (D), cut sets with both the crown and the heel ends effected by cutting the tuber longitudinally, was included. The results disclosed that, while there were no differences among treatments A, B and D, all the three of them were significantly superior to treatment C.

During 1940 - 41, for the main and the irrigated crops, the results were significantly in favour of cut sets with crown ends only (B), but planting of the whole seed proved best for the second crop. In 1941 - '42, the last year of these early trials, treatment (B) proved its superiority for yield.

For all the above four years and during all the seasons, transversely cut sets with heel ends (C) returned the lowest values.

In all these earlier trials the quantity of seed material in terms of weight, was kept uniform and constant for every treatment, while in the later trials (1949 - '50 and 1950 - '51), four different levels for the weights of whole seed and cut set (the cut being effected transversely with the crown end for planting, since this proved best in the earlier work,) viz., half, one, one-and-a-half and two ounces, were employed.

Summary: The experiments were conducted for two years over three crops. The results are in close agreement and as follow :

The crop from the whole seed, in general, had better tillering and number of tubers per hill than the ones from the set transversely cut to include the crown end, though there was little

difference in germination. For both the kinds of seed material, increase in tillering and tuber population followed the rise in weight of seed.

Total yield exhibited a progressive increase with the weight of seed, whole seed proved better for total return and yield of ware.

Under conditions which prevail on the average potato holdings in the Nilgiri hills, the planting of whole tubers averaging two ounces in weight is advisable to secure optimum returns. Economising seed material by utilising cut seed is not desirable, unless a dearth of seed compels the farmer to have recourse to it.

There exists a ready and profitable market for ware (larger-sized table potato) and hence the necessity to use it for seed after cutting is not great. Besides, cutting has to be done carefully, under controlled conditions of temperature and storage, to ensure optimum germination in the field, which are beyond the ordinary ryot. Hence, it is suggested that the whole seed, graded to conform to the recommended weight and size, will prove easier to handle by the farmer for growing the crop.

Acknowledgment: The earlier trials were started by Sri V. K. Subramanya Mudaliar, the then Superintendent in 1938 and followed up during the next three years, 1940 to 1942, under the direction of Mr. P. A. Nathan, Curator and District Agricultural Officer, Ooty, and the data relating to these periods refer to their valuable work recorded in the respective Station Reports. The more recent work, for the crop-years 1949-'50 and 1950-'51, was conducted under the guidance of Sri P. Uttaman, who was the Superintendent of this Station. The authors wish to acknowledge all their help in the conduct of these investigations.

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Research Note

Gliricidia maculata H. B. & K.

A Good Source of Nectar

This is one of the quick-growing perennial shrubs, the cultivation of which is being actively popularised by the Department for the sake of the plentiful supply of green leaf it affords. The flowers of this shrub are also freely visited by honey bees for nectar.

The shrubs begin to bloom by December and continue upto March. A flowering branch has, on an average, over 20 racemes, each bearing about 200 flowers. It takes about a fortnight for an individual bud to develop to its full size and open out as a flower. The actual blossoming takes place during the afternoon between 3 and 5 P. M. and the flowers remain open for about 3 or 4 days. The nectary is situated at the base of the corolla surrounding the ovary. The freshly opened flowers generally contain little or no nectar on the first day, but appear to secrete appreciable quantities on the subsequent days. It is interesting to note that bees, by virtue of their selective capacity, favour only such flowers which contain this sweet fluid. The average quantity of nectar contained in a flower was 0.0016 grams. The secretion contains 9.62% of reducing sugars and 35.67% of sucrose. Bees visit these flowers practically throughout the day, with the maximum activity between 10 A. M. and 12 noon. The honey elaborated from this source was red yellow in colour with an agreeable taste and a mild aroma. The chemical composition of a sample consisted of 63.95% of reducing sugars, 7.95% of sucrose, 0.09% of free acid with a moisture content of 33.57%, the last mentioned being a high figure. The specific gravity was 1.206.

M. S. SUBBIAH, B. A., B. Sc. (Ag.), Apiculturist,
and
V. MAHADEVAN, Assistant.

Weather Review — For June 1952

RAINFALL DATA

Division	Station	Total rain-fall for the month	Departure from normal in inches	Total since January 1st in inches	Division	Station	Total rain-fall for the month	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalpur	1.5	-4.0	5.8	Central Contd.	Coimbatore			
	Calinga-patnam	2.1	-2.6	7.1		A.M.O.*	0.2	-0.7	1.9
	Visakha-patnam	3.4	-0.7	8.8		Coimbatore	0.2	-1.3	2.1
	Arakuvalley*	2.8	-2.9 @	14.1	South	Tiruchirapalli	0.0	-1.8	2.7
	Anakapalle*	2.9	-0.4	10.0		Naga-pattinam	0.3	-0.9	7.1
	Samalkot*	9.8	+6.1	12.8		Aduthuari*	0.8	-0.2	7.1
	Kakinada	7.0	+2.3	15.7		Pattukottai*	1.2	-0.3	6.4
	Maruteru*	5.7	+2.0	7.7		Madurai	1.4	-0.2	7.5
	Masulipatnam	3.1	-1.1	7.1		Pamban	0.1	-0.1	10.3
	Guntur*	1.9	-2.0	6.1		Koilpatti*	0.0	-0.3	5.7
	Agri. College, Bapatla*	0.4	-2.1	8.8		Palayam-cottai	0.0	-0.4	6.5
	Agri. College Farru Bapatla*	0.1	X	7.8		Amba-samudram*	0.4	-1.2	11.8
Rentachintala	0.5	-3.1	5.2						
Ceded Dists.	Kurnool	4.4	+1.5	19.7	West Coast	Trivandrum	9.9	-3.3	28.9
	Nandyal*	2.5	-1.4	20.7		Fort Cochin	27.4	-1.1	49.3
	Hagari*	0.7	-1.4	5.5		Kozhikode	31.3	-3.5	41.4
	Siruguppa*	0.4	-2.2	7.9		Pattambi*	18.6	-10.6	24.9
	Bellary	0.1	-1.6	4.6		Taliparamba*	37.1	-4.7	43.9
	Cuddapah	2.0	-1.0	11.3		Nileshwar*	48.2	+9.8	53.8
	Kodur*	1.7	-0.7	10.0		Pilicode*	43.0	+1.1	46.4
	Anantapur	0.8	-1.3	4.0		Mangalore	42.4	+2.2	48.9
						Kankanady*	42.6	+0.6	48.4
Carnatic	Nellore	0.9	-0.4	15.8	Mysore & Coorg.	Chitaldrug	0.8	-1.8	4.3
	Buchireddipalem*	1.2	-0.2	12.4		Bangalore	3.8	+0.9	8.1
	Madras (Meenam-bakkam)	1.4	-0.5	17.5		Mysore	1.4	-1.1	8.0
	Tirurkuppam*	1.3	-1.4 @	13.6		Mercara	18.3	-7.2	28.7
	Palur*	1.4	-0.2	4.5	Hills	Kodaikanal	0.7	-3.5	16.6
	Tindivanam*	0.7	-1.0	7.4		Coonor*	2.8	+0.4	19.0
	Cuddalore	1.0	-0.4	4.5		Ootacamund*	1.9	-2.5	8.0
						Nanjanad*	2.5	-3.7	11.7
Central	Arogyavaram (Chittoor Dt.)	2.0	-0.2	5.8					
	Vellore	1.1	-1.7	5.6					
	Gudiyatham*	1.4	-1.0	4.2					
	Salem	2.8	-0.3	6.5					

- Note:—**
1. * Meteorological stations of the Madras Agricultural Department.
 2. @ Average of nine years' data for Tirurkuppam and seven years' data for Araku Valley is given as normal.
 3. Average of ten years' data is taken as normal.
 4. X - The farm was started only last year.

Weather Review for June, 1952.

A feeble cyclonic circulation remained over the Gangetic West Bengal on 2-6-1952, but soon became unimportant. On the next day the seasonal 'trough' became more marked and conditions became unsettled in the North-West Bay of Bengal causing revival of the monsoon along the West Coast. The unsettled conditions in the Bay of Bengal persisted for two days and became less marked on 5-6-1952. In the meanwhile, on 4-6-1952 a shallow 'trough' developed off the South-Konkan-Kanara coast and on the same day a low appeared over Orissa and the adjoining areas, which became unimportant on 7-6-1952. The monsoon along the West Coast weakened on 7-6-1952 and remained so for two days. The Arabian Sea branch of the monsoon strengthened on 9-6-1952, due to the development of unsettled conditions, which remained for three days and became less marked on 12-6-1952, over the north Bay of Bengal. A cyclonic circulation also persisted over South-Konkan and the neighbouring areas. The monsoon was moderately active along the West Coast upto 13-6-1952. Under the influence of the unsettled conditions in the Bay of Bengal on 14-6-1952, the monsoon became vigorous along the West Coast and kept up its vigour for two days. A cyclonic circulation persisted over Saurashtra and Kutch and the adjoining areas from 17-6-1952 to 21-6-1952, where monsoon continued to be vigorous. A low pressure area existed over Vindhya Pradesh and neighbourhood on 22-6-1952 which moved towards the north and became unimportant over south-west-Uttar Pradesh on 26-6-1952. Under its influence the monsoon was active over the central parts of India and extended into further north. In the meanwhile, on 23-6-1952, unsettled conditions were observed over north Bay of Bengal, which concentrated into a shallow depression on the very next day, moved westwards and crossed the coast near Midnapore on 26-6-1952. Under its influence the Bay of Bengal branch of the monsoon strengthened over Orissa and the adjoining areas. The depression which crossed the coast, moved further westwards, weakened and persisted upto the end of the month over South-West Uttar Pradesh, increasing the activity of the monsoon over that area. The monsoon was active along the West Coast throughout the second fortnight of the month, where widespread and locally heavy rains occurred.

Two western disturbances passed over North-West India during this month.

The noteworthy falls during the month and the zonal rainfall are furnished below :

S. No.	Date	Name of place	Rainfall for the past 24 hours
1.	2-6-1952	Bangalore	3.0"
2.	5-6-1952	Kakinada	4.3"
3.	14-6-1952	Mangalore	4.9"
4.	do.	Nileshwar	6.7"
5.	do.	Pilicode	6.3"
6.	27-6-1952	Kozhikode	5.4"
7.	do.	Fort Cochin	4.4"
8.	do.	Alleppey	5.2"
9.	do.	Pattambi	4.2"

ZONAL RAINFALL.

S. No.	Name of Zone	Average Rainfall	Departure from normal	Remarks
1.	Orissa and Circars	3.28	-0.54	Below normal
2.	Ceded Districts	1.58	-1.01	Far below normal
3.	Carnatic	1.20	-0.51	Below normal
4.	Central	1.10	-1.00	Far below normal
5.	South	0.53	-0.45	Far below normal
6.	Malabar and United States of Travancore and Cochin	24.86	-4.64	Below normal
7.	South Kanara	44.05	+3.43	Just above normal
8.	Mysore and Coorg	6.08	-2.30	Below normal
9.	Hills	1.98	-1.83	Far below normal

Departmental Notifications—July 1952
GAZETTED SERVICE—POSTINGS AND TRANSFERS

Name of officers	From	To
Sri Annaswami Iyer, A. K.,	D. A. O., Cuddapah,	D. A. O., Guntur
„ Krishna Reddy, T.,	On leave,	D. A. O., Cuddapah
„ Krishnamurthi Iyer, K. S.,	On leave,	Addl. D. A. (Manures) Tanjore
„ Lakshmanan, T. S.,	On leave,	Asst. Agrl. Chemist, Coimbatore
„ Narayana, G. V.,	On leave,	Oilseeds Specialist and Vice-Principal, A. C. and R. I., Coimbatore
„ Nagarajan, K. R.,	Asst. in Entomology Agrl. College, Bapatla,	Gazetted Asst. Lecturer in Entomology, Bapatla
„ Neelakantan, L.,	Asst. Cotton Specialist, Chillies Scheme, Guntur,	Asst. Cotton Specialist, Koilpatti

Name of officers	From	To
„ Raghunatha Reddy, K.,	Special D. A. O., Tanjore	Special D. A. O. (Crop Sampling) Vijayawada
„ Ramachandran, S.,	On leave,	Govt. Entomologist, Agrl. College, Coimbatore
„ Raghava Rao, N.,	Gazetted Asst. Lecturer in Entomology, Agrl. College, Bapatla,	Lecturer in Entomology Agricultural College, Bapatla
„ Srinivasan, V.,	Asst. in Pulses Agrl. College, Coimbatore	Asst. Res. Officer, in charge Chillies Scheme, Guntur
„ Thirumala Rao, V.,	Govt. Entomologist, Agrl. College, Coimbatore	Crop and Plant Protection Officer, Bapatla

SUBORDINATE SERVICE

Name of officers	From	To
Sri Alagiriswami, M. A.,	A. D., Trichy,	A. D., Kulitalai
„ Anantha Rao, K.,	Millet Asst., Coimbatore	Regional Millet Asst., Narasapatam
„ Anantha Krishnan, N.,	Asst. in Entomology, Kodaikanal,	Plant Quarantine Inspector, Sembaganr
„ Bharathan, P.,	Asst. A. R. S., Tindivanam,	P. P. A., Chingleput
„ Balasubramaniam, K. R.,	A. D., Attur	S. D. A. (Paddy), Salem
„ Bakthavathsalu, C. M.,	Statistical Asst. Meteorological Scheme, Coimbatore,	Fruit Assistant, Banana Res. Station, Aduthurai
„ Chandrasekharan, S.,	P. P. A., Guindy,	Ento-Mycology Asst. A. R. S., Tindivanam
„ Dharma Rao, M.,	Cotton Asst., Siruguppa.	Asst., in cotton, Chillies Scheme, Lam, Guntur
„ Jagannatha Rao, P.,	Soil Conservation Asst. Chittoor,	Soil Conservation Asst., Guntakal
„ Job Servai, J.,	P. P. A., Nellore,	P. P. A. (Myco), Vellore
„ Kasiviwanathan, M.,	Special A. D., Cotton, Tirupur,	P. A., to D. A. O., Coimbatore
„ Krishnamurthi, K.,	Asst. in Agronomy, Anakapalle,	F. M., A. R. S., Gudiyattam
„ Lakshminarayana Rao, M.,	On leave,	Cotton Asst., Siruguppa
„ Lakshmanan, V.,	S. D. A. Guindy,	A. D., Cotton, Tiruppur
„ Lakshmiopathi, S.	A. D., Hindupur,	Special A. D., (Manures) Peddapuram
„ Manmadha Kishen,		A. D., Kurnool
„ Muthukrishnan, C. R.,	Fruit Asst., Banana Res. Station, Aduthurai,	Annamalai University

Name of officers	From	To
Sri Narasimha Rao, P.,		Special A. D., (Manures) Guntur
„ Narayanaswami, V.,	Conservation Asst., Chittoor,	A. D., Anantapur
„ Narayanamurthi, R.,	Chillies Asst., Guntur,	F. M., Botanic Gardens, Bapatla
„ Nanjappa Manigar, V.,	On leave,	Special A. D., Tiruppur
„ Periaswami, S.,	Plant Quarantine Inspec- tor, Shanbaganur,	Asst. in Oilseeds, A. R. S., Tindivanam
„ Ramachandran, M.,	S. D. A. (Paddy), Salem,	A. D., Attur
„ Ramu, S.,		A. D., Kollegal
„ Ramakrishna Reddy, B.,	P. A., to D. A. O., Kurnool,	Technical Asst., D. A's Office, Madras
„ Ramanujam, K. M.,	A. D., Manjeri,	A. D., Lalgudi
„ Ramamohan Rao, R. M. V.,	A. D., Sethennapalli,	A. D., Masulipatam
„ Ranga Rao, K.,	Teaching Asst., in Agrl. Agrl. College, Bapatla,	P. P. A., (Entomology), Nellore
„ Raghava Rao, N.,	A. D., Dhone,	A. D., Hindupur
„ Subramaniam, D.,		Asst. in Oilseeds, Tindivanam
„ Srinivasan, K. M.,	Asst. in Chemistry, Coimbatore,	Asst. in Millets, Coimbatore
„ Sivasubramaniam, K. M.,	A. D., Mannargudi,	A. D., Pattukottai
„ Sankaram, C.,	A. D., Lalgudi,	A. D., Trichy
„ Satyanarayanarajum, V.,	Agrl. Engineering Super- visor, Chittoor,	Soil Conservation Asst., Chittoor
„ Sundara Singh, M.,	Agrl. Engineering Super- visor, Chittoor,	do.
„ Satyanarayana Rao, K.,	A. D., Pulivendla,	Special A. D., (Manures), E. Godavari
„ Thirumaleshwar Bhat, N.,	A. D., Manjeri,	Asst. in Oilseeds, Nileshtar
„ Thirumal Rao, W.,	Asst. Agrl. Chemist, Coimbatore,	Asst. in Chemistry, Coimbatore
„ Venkataswami, T.,	A. D., Kollegal,	Asst. in Chemistry, Coimbatore
„ Venkateswara Rao, L.,		A. D., Kandukur
„ Venkatasubbaiah, T.,		A. D., Pulivendla
„ Venkateswara Rao, P.,		Cotton Asst., Siruguppa
„ Venkataramanan, V. G.,	P. A. to D. A. O., Chingleput,	Technical Asst. D. A's Office, Madras