ANNUAL REPORT

OF

THE CENTRAL ARECANUT RESEARCH STATION,

VITTAL, SOUTH KANARA DISTRICT,

MYSORE STATE

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For the period from 1—7—1962 to 30—6—1963.

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INDIAN CENTRAL ARECANUT COMMITTEE
CALICUT, KERALA STATE.

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CONTENTS

Annual Progress Report of the Central Arecanut Research Station, Vittal, Mysore State for the period from 1—7—1962 to 30—6—1963.

A. Introduction:

This is the seventh annual progress report of the Central Arecanut Research Station, Vittal, and covers the period from 1-7-1962 to 30-6-1963.

The station is located in Vittal Village, Buntwal Taluk of South Kanara District of Mysore State, 41.8 km. (26 miles) from Mangalore Railway Station on the Mangalore-Vittal-Puttur highway, and 51.5 km. (32 miles) from Kasaragod on the Kasaragod-Mangalore highway. It lies on 12° 15″ N. latitude and 75° 25″ E. longitude. The altitude of the station ranges from 73.00 to 91.44 m. (250 to 300 feet) above mean sea level.

The winding rivulet Vokkethur runs placidly along the north-eastern boundary and then through the middle of the Station, and is the main source of irrigation.

The Station was started with the main object of carrying out fundamental and applied investigations on Botany, Physiology, Agronomy and Pests and Diseases of the crop in addition to solving the regional problems of arecanut cultivation and production. The Station, which is the Central Research Institute for arecanut is also to plan and co-ordinate the work of the Regional Research Stations which are set up in the major arecanut tracts of India*. The Station also renders advisory work on various aspects of the crop.

The soil in the Station is typically lateritic and is admixed with sand, alluvium and gravel in varying proportions in different locations. The soils are generally acidic, with a mean P^H of 5.25.

The total area of the Station is 48.37 ha. (119.08 acres) and the same has been allotted to the following experimental and miscellaneous plantings.

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* 1) Hirehalli, Mysore, 2) Peechi, North Kerala, 3) Palode, South Kerala, 4) Mohitnagar, West Bengal & 5) Kahikuchi, Assam.

1)	Bulk garden for study of progeny behaviour of mother palms and conducting miscellaneous observations	... 2.230 ha.
2)	Spacing trial	... 0.882 ha.
3)	Manurial experiment (N P K)	... 2.028 ha.
4)	Exotic types and species collection	... 0.300 ha.
5)	Method of aligning garden	... 0.240 ha.
6)	Effect of organic and inorganic forms of NPK and effect of improved cultivation practices	... 0.362 ha.
7)	Indigenous types collection and irradiated materials	... 0.140 ha.
8)	Effect of age of types, order of bunches etc. (Study in mainfield)	... 0.080 ha.
9)	Experiment with banana as intercrop	... 1.220 ha.
10)	Miscellaneous observations	... 0.348 ha.
11)	Bulk and experimental nurseries	... 1.800 ha.
12)	Coconut	... 2.392 ha.
13)	Cashew	... 4.050 ha.
14)	Pepper (Proposed)	... 2.020 ha.
15)	Fruit plants etc.	... 4.050 ha.
16)	Green manure crops and fallow	...22.250 ha.
17)	Buildings, Road etc.	... 3.982 ha.
	Total	... 48.374 ha.

B. Summary of work done:

The following is an account of work done at the Central and Regional Arecanut Research Stations.

1. Botany:

At the Central Station, seedlings of the exotic types and species of *Areca* planted in the main field during the previous year were under detailed observation. A total of 19 exotic species and types introduced from nine countries were represented in this collection block. Seednuts of three more exotic types and one exotic species were introduced during the year from Suva Fiji, Saigon and Andaman. In addition to *Areca triandra* which had commenced suckering during the the previous year, *A. Concinna* from Ceylon also suckered during the year. One palm introduced from Indonesia produced a small inflorescence but failed to set fruits. Six selfed nuts of Andaman type and 12 from each of Indonesia-1 and Indonesia-2 were sent to each Regional Arecanut Research Station as additions to the existing

collections. Ten seedlings in each of the eight ecotypes collected from diffierent parts of the country were planted in the main field. Three more indigenous types, from Orissa, Hirehalli (Mysore) and Mahuva (Gujarat) were also introduced at the Station. Similar collection of indigenous types was made at the Regional Research Stations also.

Selfing was continued in four exotic palms and taken up in two palms of the local type at the Central Station for the production of inbred lines. Crosses effected between distinct types as well as between selected palms of the local type showed that (a) the degree of compatibility between different palms varies to some extent, (b) there is reciprocal difference in the extent of nut-set of certain combinations, (c) in general open pollination gives a much higher set than controlled pollination, (d) certain trees give a very poor set even under open pollinated conditions and (e) the exotic palms when used as pollen parents give very high nut-set with certain palms of the local type. Studies on floral biology were continued in the main garden of the Station. It was observed that at the Central Station the number of inflorescences produced in a tree ranged from nil to nine and the largest number of trees produced inflorescences ranging from four to eight. Studies on the month-wise variation in flowering showed that the maximum percentage of inflorescences was produced in the months of January to April. Similar studies on floral biology were either commenced or continued at at the Regional Research Stations. At the Central Station, germination studies of pollen grains of arecanut were continued during the year. Sucrose solution of 0.5 per cent concentration was found to be a suitable medium for germination of pollen grains. Pollen produced in the months of January to June gave a higher percentage of germination than that produced in the other months. Studies on the storage of pollen initiated during the year have brought out that pollen can be stored without any considerable loss of viability up to a period of 28 days, and that the maximum germination is obtained after seven days of storage. Studies on the standardisation of crossing technique have shown that bags made of Trayophane could be used with advantage for covering the inflorescences, and that artificial pollination can be quickly and efficiently done by spraying the female flowers with a suspension of the required pollen in a 0.5 per cent sucrose solution. It was also found that a higher set of fruits than what is obtained by open pollination can be obtained when open pollination is supplemented by this method. Preliminary studies on the progeny behaviour of mother palms were continued and the data gathered have brought out that the production of female flowers as well as the set are high in the case of inflorescences produced in

the months of October to April. Trials with growth regulators have indicated that fruit-set can be increased considerably by the application of NAA at 10,000 ppm, in a lanolin medium to the female flowers. However the fruits resulting from flowers so treated were showing different rates of development. Ninety eight seedlings obtained from the seednuts irradiated with Thermal neutron were planted in the mainfield. Out of 60 sprouts irradiated with X-ray, seven sprouts survived and they were being maintained in good condition. Some of the seedlings obtained from the Colchicine treated sprouts showed early splitting of leaves. Examination of the leaves of seedlings showing formative effects revealed that the stomata in these in general were larger than those of the leaves of the control plants.

2. Agronomy:

Experiments to determine the criteria for selection of seednuts and optimum nursery practices were continued during the year both at the Central and the Regional Research Stations. At the former, germination data gathered showed that seednuts collected from young and middle-aged palms and from the second and third bunches gave higher percentage of germination. Seedlings raised from the first and second bunches of young and middle-aged palms had more girth, height and number of leaves than the rest. Almost similar results were obtained from the experiments at the Regional Research Stations also. Trials laid out at all the Stations did not show any significant difference between seednuts possessing different floating habits, either in regard to germination percentage or morphological features of the seedlings raised from these nuts. As regards the occurrence of nuts of different floating habits, the data gathered at the Central Station revealed that floating habit is a tree charactor and the frequency of occurrence of nuts of different habits is more or less constant in different bunches of the same tree as well as from year to year. Studies also revealed that nuts with vertically floating habits are the heaviest in the bunches, both in regard to the weight of the entire nut and the kernel. Seednuts collected at different stages of maturity (nine, nine and-a-half, ten and ten-and-a- half months) did not differ significantly in regard to germination but the resulting seedlings were found to differ significantly with reference to all morphological features, seedlings obtained from ten-month-old seednuts being superior to the rest. Results obtained at the Regional Research Station at Hirehalli were however slightly at variance with the above finding. In respect of germination, seednuts of ten and eleven months maturity were found superior to the rest, and no significant difference was observed in the

morphological characters of the seedlings obtained from nuts of different maturity.

At the Central Station, seednuts collected from the second and third bunches of the tree, when the second bunch was fully ripe, did not show any significant difference in regard to germination percentage, but the seedlings resulting from fully tree-ripe nuts were found to have produced significantly larger number of leaves. Similar results in respect of germination were obtained from the trials laid out at the Regional Arecanut Research Station at Mohitnagar. As regards the quality of 'Chali' or cured produce prepared from these nuts, it was observed at the Central Station that the 'Chali' obtained from the nuts collected from the third bunch was considerably inferior to that obtained from the fully tree-ripe bunch. Trials to determine the ideal position of sowing seednuts and the optimum depth of sowing showed that the effect of depth alone was significant. Sowing seednuts at depths of zero and one inch gave significantly higher germination than at two and three inches. Results of similar trials laid out at the Regional Arecanut Research Stations did not show any significant difference in germination between different depths, except at Hirehalli where sowing at one and two inch depths was found to be superior to the rest. In the trial intended to compare the growth rate of seedlings resulting from seednuts sown *in situ* in the transplanting bed and from pre-germinated seed (sprout) planted in the transplanting bed at different levels of spacing, the latter recorded greater height growth at spacings of 15" x 15" and 18" x 18". Treatment differences were found to be significant in the same experiment laid out at the Regional Arecanut Research Stations also. At Peechi and Kahikuchi, nuts sown *in situ* produced seedlings with greater vigour. Trials on the effect of different intensities of shade on seednut germination did not reveal any significant difference between the treatments. Similar results were obtained from trials laid out at the Regional Arecanut Research Stations at Peechi, Mohitnagar and Kahikuchi. Morphological charactors of seedlings recorded in the secondary nursery of the same experiment showed significant difference between the treatments, partial and complete shade being better than no shade. In the trial with the different media for sowing seednuts, soil and sand media were found to be significantly better than the rest. Similar experiment laid out at the Regional Arecanut Research Station, Mohitnagar gave identical result. Different pre-sowing treatments of seeds did not make any significant difference on the germination percentage or on the growth characters of the resulting seedlings.

Almost identical results were obtained in respect of germination from similar experiments laid out at the Regional Arecanut Research Stations at Hirehalli and Kahikuchi. Observations made on the influence of transplanting seedlings in the nursery for varied number of times before planting in the main field revealed that transplanting has the effect of stunting the growth of seedlings considerably. There was no appreciable effect on the establishment of plants caused by packing the seedlings in different packing materials. In a similar experiment, seedlings packed in water hyacinth roots gave significantly better establishment at the Regional Arecanut Research Station at Kahikuchi. Trials on frequency of irrigation showed that increasing the interval between irrigations beyond two days significantly reduced germination. Of the different methods that were tried at the Regional Arecanut Research Stations for storing seed arecanuts, packing seednuts after treatment with 1% Bordeaux mixture either in baskets with cushioning material or in gunnies also treated with 1% Bordeaux mixture was found to be the best from the point of view of germination.

In the spacing trial planted in 1958 at the Central Station it was observed that as the spacing increased there was a progressive increase in the number of plants affected by sun-scorch. Plants spaced at 6'x6' and 6'x9' were also found to have less girth at the last node. These plants also produced larger number of nodes and made greather height growth. Similar trials laid out at Peechi also showed a decrease in height growth with increase of spacing. Observations on the growth behaviour of different green manure and cover crops as well as inter and associate crops were continued at all the Stations and a few more green manure crops were added on to the collection. At the Central Station the mainfield for laying out the experiment intended for studying the effect of growing banana as intercrop in arecanut garden was got ready. Palms under the experiment to determine the optimum manurial requirement of arecanut palm in the mainfield were manured as per schedule. A similar experiment extending over an area of 2.03 ha. was laid out at the Regional Arecanut Research Station, Hirehalli. An experiment to determine the optimum intervals of irrigation and depths of planting, was planted out at Peechi and Mohitnagar. A mixed garden of coconut and arecanut was raised at the Regional Arecanut Research Station, Kahikuchi. Another experiment laid out at the same Station in order to study the influence of inter and associate crops in arecanut garden showed that planting banana as an intercrop has the effect of reducing the

girth of the arecanut plants significantly. Bulk gardens of one to two hectares were planted at the Research Stations at Hirehalli, Palode and Mohitnagar for super-imposing trials on intercultural operations and inter and associate crops. At the Central Station collection of yield data from marked palms for determining the shape and size of plots for field experimentation was continued. Statistical analysis of the yield data for the years 1960–'61 and 1961–'62 revealed that 12 to 16 tree plots give low co-efficient of variation.

3. Pests and Diseases:

Investigations on the control of the different diseases and pests of arecanut were continued both at the Central and the Regional Arecanut Research Stations. Chlorocide–Malathion liquid, Akar–338 and Kelthane E. C., all having ovicidal property were found to be very effective in the control of mite on arecanut. In the trials on the control of 'Koleroga', the comparative efficacy of the fungicides could not be evaluated due to non-incidence of the disease. Copper injury to varying extents was observed on nuts sprayed with oxychlorides. Investigations undertaken during the year to find out the causes and methods of control of button shedding and tendernut fall have shown that nuts which had shed prematurely had minute cuts or punctures on the tender basal portion, evidently caused by an insect. The punctures had extended upto the surface of the kernel. A fungus and a bacterium were isolated from these kernels. Studies on the extent of retention of fungicide on the nut surface were continued. Trials to determine the maturity of fruits and extent of susceptibility to *Phytophthora arecae* showed that there is a decrease in susceptibility of nuts to fungal infection with increasing maturity. Field trials laid out to determine the effect of macro-micro nutrients on some of the common diseases of arecanut palm were continued. Trials were initiated with nickel chloride to find out its efficacy as an eradicant fungicide against *Phytophthora arecae*. At the Palode Research Station transmission trials with sap collected from yellow leaf affected plants to healthy palms and indicator plants, and estimation of the soil microfloral population from healthy and diseased gardens were in progress. Study of the fungus causing the 'Anabe' disease of arecanut palm was also carried out *in vitro* at this station. Some fungi and becteria were found to be antagonistic to *Ganoderma lucidum*. Studies on tissue culture were also initiated here. At Hirehalli, spraying the bunches with 5% solution of Zinc phosphide was found to be very effective in the control of squirrel attack on tender nuts.

4. Farm management:

At the Central station the total area under arecanut at the close of the year was 6.8 hectares (16.85 acres). The gardens were given the usual cultural, manurial and plant protection treatments as per schedule. The first garden covering an area of 2.2 hectares planted in the Station in 1957 yielded 2,09,788 fruits valued at Rs. 8,770-21 nP. during year. The percentage of trees that came to bearing in the above garden increased from 54.0 in 1961-'62 to 78.9 during the year. A total number of 43,706 and 124991 arecanut seedlings were sold to the growers during the year from the Central and Regional Arecanut Research Stations respectively. The nursery of the current year was sown with 94,376 seednuts at the Central Station and 2,46,175 at the Regional Stations. The resources of green manure crops were augmented by planting cuttings of *Gliricidia* on all the vacant corners of the farm. The construction work of Field Laboratory taken up departmentally was completed during the year.

The major construction works of the Central Station under the charge of the Central Public Works Department satisfactorily progressed. The approach road connecting Vittal-Puttur highway was formed and macadamised. The Station also obtained electrical connections during the year and the motors with pumpsets installed in the Station were commissioned for work.

An area of 1.5 ha. was cleared of jungle growth and terraced for accommodating one of the major field experiments.

The officers and staff of the Central as well as the Regional Research Stations were in intimate touch with the growers and curers. The work of answering enquiries from arecanut planters and spot-inspections for advisory work were on the increase. The Stations continued to be the centres for suggesting or finding out solutions to the numerous problems confronting the arecanut growers.

Results of research which are of practical utility to the cultivators:

A few important results which are an out-come of research carried out at the Central and Regional Stations and which are expected to be of practical utility to the arecanut grower are given below:

1. Nursery technique:

i) For obtaining high percentage and early germination, seed arecanuts should be sown in sand or ordinary light soil only. The existing

practice of tying them in straw bundles or placing them in baskets for germination found to be inferior to the above method.

ii) Similarly, for obtaining high percentage of germination and early germination the seednuts should be sown vertically at a depth of not more than two inches. The prevailing practice of sowing at deeper levels than this gives poor results.

iii) For long distance transport seed arecanuts should be treated with one per cent Bordeaux mixture and then packed in gunnies similarly treated with Bordeaux mixture. Seednuts treated and packed in the above manner retain their viability for longer periods than when packed without any treatment as is the prevailing practice.

2. Control of premature nut-fall:

Premature nut-fall is a common feature in arecanut garden in all the States. Trials carried out in the earlier years had brought out that spraying the bunches in the months of February and March with a combination spray of Bordeaux mixture and Endrex effectively reduces the shedding. These findings were confirmed during the following years by further observations within the farm and in growers' gardens. This treatment is estimated to reduce crop losses by as much as 26.6 per cent. The spray consists of one per cent Bordeaux mixture to which Endrex is added at 125 cc. per 100 litres of Bordeaux mixture.

3. Influence of maturity level of fruits and harvest on final product:

It is a common practice among arecanut growers to harvest the fully ripe bunch on the tree as well as the next higher bunch simultaneously for preparation of 'Biligotu' or 'Chali.' Studies carried out at the Station have indicated that the cured produce obtained from the fully ripe nuts is far superior in quality to that obtained from the next higher bunch. In the market the former fetched 81 per cent more price them the later. The necessity to harvest only fully tree-ripe nuts is thus clearly brought out.

4. Control of pests:

i) Repeated trials have indicated that spraying the plants with Chlorocide - Malathion liquid at 1 kg. in 640 litres of water or Akar-338 or Kelthane at 1 in 1000 is very effective in the control of mite, which is a major pest of arecanut nurseries and young gardens.

ii) A lepidopterous pest of the arecanut which is found to attack mostly the inflorescence of young palms and which causes as much as 50 to

60 per cent of crop loss in such palms can be effectively controlled by spraying the inflorescence with a 0.1% solution of Endrex.

iii) The white grup is another major pest which causes damage to the arecanut palms by eating away the roots. This pest is found to be particularly verulent in gardens under moist conditions. Treating the soil which 'Intox -8' liquid at 50 cc. per 100 litres of water has been found to be very effective in controlling the pest.

iv) Squirrel damage to arecanut bunches which is a common feature of all gardens in the Maidan tracts of Mysore State can be effectively reduced by spraying the bunches at the tender stage with a 5.0% solution of Zinc phosphide to which a small quantity of molasses is added to mask the smell of the chemical.

C. Seasonal Conditions:

A total rainfall of 4459.3 mm. was received on 156 rainy days during the period, as against an average of 4565.9 mm. received on 136 rainy days during the last five years. The rainfall was on the whole well distributed and this enabled reducing the number of irrigations given to the crop. The South-West monsoon of 1963 also broke out in time. Due to the even distribution of rain the incidence of diseases and pests was low and only few reports were received of incidence of major diseases like 'Koleroga' (fruit-rot). Mite infestation both in the nursery and on young palms was also very low. The crop in general was good both in the Central Station and in the ryots' gardens in and around Vittal.

The maximum temperature ranged between 27.08° C and 35.77° C, and minium between 18.08° C. and 23.31° C.

The monthwise distribution of rainfall and temperature are given in Appendix 1.

D. Technical Programme of work for the year 1962-'63.

Item No. in the Technical Programme	Name of the experiment	Year of commencement	Anticipated year of conclusion	Remarks
(1)	(2)	(3)	(4)	(5)
	BOTANY:			
	Crop improvement:			
I.	**Breeding and genetics of *Areca*.**			
1)	Introduction and maintenance of indigenous and exotic species and types of *Areca* for selection and hybridisation.	1958-'59	To be continued for several years	
2)	Survey of arecanut gardens to assess genetic variation and select superior types.	1958-'59	do	To be pursued after the sampling technique is worked out.
3)	Floral biology of *Areca*.			
a)	Study of the range of variation in flowering from tree to tree in the same garden.	1960-'61	do	—
b)	Study on the month-wise variation in flowering.	1960-'61	do	—

(1)	(2)	(3)	(4)	(5)
c)	The frequency distribution of number of palms flowering per week during all the weeks. The phenomenon of early flowering etc. to be correlated with fruit production.	1961-'62	To be continued for several years	Data to be collected in the bulk garden of the Station and in a 30-year-old private garden.
d)	Floral initiation.	1960-'61	do	Study of development of spadix and the effect of age and season on the production.
e)	Study of pollen.	1960-'61	do	Morphology and viability will be studied in the first instance.
4)	Hybridization and selection:			
a)	Standardisation of crossing technique.	1958-'59	do	
b)	Production of inbred lines of distinct types	1960-'61	do	For purification of the line.
c)	Hybridization between distinct types and selected palms to combine high-yield and regular bearing, and study of progenies.	1960-'61	do	To ascertain the degree of compatibility and to obtain desirable combinations.
d)	Hybridization between exotic and indigenous types.	1962-'63	do	do
5)	Preliminary studies on progeny behaviour of mother palms.	1960-'61	do	To study the extent of inheritance and seggregation of characters. Main-field experiment to be laid out.

(1)	(2)	(3)	(4)	(5)
II.	**Morphological studies of the palm:**			
a)	Root studies at different ages and under different soil conditions in adult palms.	1962-'63	To be continued for several years	Plants to be set out in the field for the study during 1962-'63.
III.	**Anatomical Studies:**			
a)	Structure and development of fruit in *Areca* growing under different conditions.	1962-'63	do	—
b)	Study of structure of roots in plants showing symptoms similar to 'Band'.	1962-'63	do	—
c)	Study of anatomy of roots of palms under different agronomical conditions.	1962-'63	do	—
IV.	**Physiological Studies:**			
1)	Studies on fruit-setting and shedding.	1959-'60	do	To investigate the causes of shedding of female flowers and green nuts and methods of their control.
2)	Inducing mutations in arecanut:			
a)	By irradiation of seednuts (Thermal and Pile neutrons, X-rays and Gamma rays).	1960-'61	do	—
b)	By chemicals (colchicine etc.)	1961-'62	do	—
3)	Effect of plant regulators on growth.	1961-'62	do	Chemicals like Giberellic acid, M. H. etc. to be tried.
4)	Role of micro-nutrients in arecanut.	1961-'62	do	—

(1)	(2)	(3)	(4)	(5)
V.	Vegetative propagation.	1961-'62	do	Inducing rooting in suckers and on the main stem; inducing suckers and multiple growing points by different methods.
	AGRONOMY:			
VI. A.	**Standardization of nursery practices:**			
1.	**Criteria for seednut selection:**			
(a, b and e)	Study of the effect of age of trees, order of bunches and position of seednuts in the seednut performance.	1958-'59	1961-'62	Plants to be set out in the mainfield to study future performance (Observation plot).
c)	To determine the frequency of occurrence of nuts possessing different floating habits, factors influencing such habits and their relative merits as seednuts.	1959-'60	1963-'64	do
d)	Studies on the performance of nuts gathered at different stages of maturity for seed purposes.	1959-'60	1963-'64	do
2.	**Sowing Experiments:**			
a, b)	Study of different positions-*cum*-depths of sowing seednuts.	1959-'60	1962-'63	—
c, f)	Effect of different spacing-*cum*-efficacy of sowing unsprouted and sprouted seeds on seedling performance.	1959-'60	1962-'63	—

(1)	(2)	(3)	(4)	(5)
e)	Effect of shade *vs.* no shade on seednut germination and growth of seedlings with particular reference to sun-scorch and pest (mite) attack.	1959-'60	1962-'63	—
d)	Standardization of media and methods for sprouting seednuts.	1959-'60	1962-'63	—
g)	Influence of pre-sowing treatments and period of sowing on seednut performance.	1959-'60	1962-'63	—
h)	Determination of the optimum age of transplanting seedling-*cum*-sowing *in situ* *vs.* transplanting of single, double and treble transplanted seedlings in the nursery.	1958-'59	To be continued	Observation plots
4.	Standardization of the method of packing seedlings.	1960-'61	1963-'64	—
VI. B.	**Cultural Experiments:**			
a) 1)	Determination of optimum spacing in the mainfield.	1958-'59	For a period of 15 years in the first instance	—
2)	Effect of depth of transplanting seedlings-*cum*-intervals of irrigation on growth and yield.	1963-'61	do	—
3)	Effect of different methods of intercultivations on the productivity of palms.	1963-'64	do	—

(1)	(2)	(3)	(4)	(5)
4)	Study of intercrops and associate crops in arecanut gardens.	1960-'61	do	Experiment to be restarted in October 1962.
5)	Relative performance of different green manure and cover crops in arecanut gardens.	1960-'61	To be continued for a number of years	Observational trial.
6)	Investigation on different types of *Areca* under rainfed and irrigated conditions.	1959-'60	do	do
7)	Effect of growing banana in arecanut gardens for different durations.	1962-'63	For a period of 15 years in the first instance	—
8)	Relative performance in the mainfield of plants of different ages at the time of planting and of single, double and treble transplants of the above ages.	1962-'63	do	—
9)	Drainage experiments in arecanut garden.	1962- 63	do	Observational trial to be planted in mainfield in October 1963
10)	Mixed garden of arecanut and coconut.	1962-'63	do	Observational plot.
VI. C.	**Manurial Experiments:**			
1)	Response of seedlings of varied time of germination to different levels of manuring.	1960-'61	1962-'63	—
2)	Determination of optimum requirements of N. P. K. in the mainfield.	1961-'62	To be continued	—

(1)	(2)	(3)	(4)	(5)
	3) Simple Manurial Trials on arecanut in ryots' gardens.	1960-'61	do	In collaboration with the Agricultural Officer, S.M.T. Indian Central Arecanut Committee, Kozhikode.
	4) Effect of applying N. P. K. in organic and inorganic forms on palm performance.	1962-'63	do	To be started in September 1963 in a standing garden in the Station.
	5) Relative merits of different nitrogenous fertilizers.	1962-'63	do	Planting will be done in October 1963.
VI. D.	**Miscellaneous:**			
	1) Uniformity trial .. Collection of yield data of palms.	1958-'59	do	—
	3) Trial to find out the weight ratio of the raw and processed arecanuts and cost of processing per pound of processed nuts.	1961-'62	1963-'64	—
	4) Influence of different strengths of alkali on the retting of arecanut husk.	1961-'62	1962-'63	—
	PESTS AND DISEASES:			
VII	2) Trial with proprietary fungicides and insecticides to find out effective control measures for all diseases and pests.			
	1) Control of mites on arecanut with different miticides, including systemics.	1959-'60	1963-'64	

(1)	(2)	(3)	(4)	(5)
2)	Trials with different soil insecticides in the control of white grub Lepidiota sp.	1959-'60	1963-'64	—
3)	Trials to find out cheap and effective fungicides against 'Koleroga' or 'Mahali' with and without adhesives.	1959-'60	1964-'65	Including Nickel chloride (eradicant fungicide) and organic fungicides.
4)	Study to find out the causes and methods of control of button shedding and tendernut fall.	1959-'60	1964-'65	Collaboration study with Botany section.
5)	Control of yellow leaf spot of arecanut.	1959-'60	1964-'65	Isolation and inoculation study and trials with Nickel chloride and organic fungicides.
7)	Study of collar-rot of seedlings and influence of soil micro-organisms.	1960-'61	1963-'64	—
8)	Studies in the control of sun scorching of stem.	1960-'61	1963-'64	—
11)	Studies on the retention of copper fungicides on sprayed fruits.	1961-'62	1964-'65	—
12)	Susceptibility of arecanut to 'Koleroga' at different stages of maturity.	1961-'62	1964-'65	—
13)	Observations on exploratory demonstration plots where Package treatments are laid out.	1961-'62	1964-'65	—

(1)	(2)	(3)	(4)	(5)
14)	Studies of organisms (other than phytophthora) that cause rotting of fruits and impair keeping quality.	1962-'63	1965-'66	—
15)	Study of spray injury to the palms.	1962-'63	1965-'66	—
16)	Study of the palms showing symptoms similar to 'Band' in the primary and secondary nurseries and their behaviour in the mainfield.	1960-'61	To be continued for a number of years	Attempts will be made to induce symptoms of 'Band' in the field by subjecting the trees to unfavourable conditions.
17)	Other problems evoked in the course of studies.			

D. Results:

BOTANY:

I. Crop improvement and genetics of *Areca*:

1) Indroduction and maintenance of indigenous and exotic species and types of *Areca* for selection and hybridisation:

Exotic types collection—1957 planting:

All the four palms *viz.*, Indonesia-1, Indonesia-2, Nicobar and Andaman continued to flower during the year. The data on leaf-fall and spathe production were regularly recorded on these. Two to three inflorescences in each of the palms were selfed to study the extent of self-compatibility and also for production of seed material for supply to the Regional Arecanut Research Stations.

Other morphological features such as height, girth, number of nodes etc. of the palms were also recorded. It is interesting to note that the internodal length in the case of the two Indonesian types was markedly less than in the other two types, the range being 7.0 to 7.5 cm. while in the case of the Nicobar type it was 19.67 cm., and in the Andaman type 11.67 cm. This character is reflected in the height growth of these palms, Indonesia-1 having a stem height of only 245 cm. as against 725 cm. of the Nicobar type.

1961–'62 planting:

The stock in the exotic collection block planted in July 1961 and July 1962 with 21 types introduced from Fiji, Ceylon, China, Mauritius, Indonesia, New Guinea, Saigon, Singapore and British Soloman Islands is growing well, excepting for *A. concinna*, introduced from Ceylon, which is found to be rather slow in growth. The annual morphological characters of the palms were recorded. Out of a total of 201 plants planted, only six failed to establish, these being four of *A. concinna* and one each of Indonesia and Br. Solomon Islands, and these were replaced from the stock of reserves.

Recording of data on the production of suckers in *Areca triandra* received from Indonesia and Mauritius was continued. *A. concinna* from Ceylon also suckered during the year. The mean rate of production of suckers in these varieties ranged from 2.2 to 4.5 suckers per palm.

One palm introduced from Indonesia produced a small inflorescence from one of its basal exposed nodes almost at the ground level, but this failed to set any fruits.

1961—'62 introductions:

Thirty four plants of *Areca normanbyi* introduced from Australia and one of *Areca* sp. obtained from Aden were in the nursery and were ready for planting in the collection block.

1962—'63 introductions:

During the year, fresh consignments of seednuts were received from Suva Fiji, Saigon and Andaman. The material was sown immediately on receipt at this end after preserving a few nuts in each type for feature comparison. Details regarding the introductions are given below:

Name of country	Name of type or species	No. of nuts received	No. of sprouts available	Remarks
Suva Fiji	*Areca catechu*	40	35	..
Saigon	*Areca* sp.	618	315	Of four types.
Andaman	*Areca* sp. and *A. triandra.*	105	Germination in progress.	Of seven types

Indigenous types collection:

Ten seedlings in each of the following eight ecotypes collected from different parts of the country were planted in the mainfield at a spacing of 9' x 9' for study of their performance.

1. Khasi and Jayantia Hills (Assam)
2. Mohitnagar (West Bengal)
3. Mettupalayam (Madras)
4. Chickamagalur (Mysore)
5. Hirehalli (Mysore)
6. Thirthahalli (Mysore)
7. Peechi (Kerala)
8. Vittal (local)

During the year, three indigenous types, one each from Puri (Orissa) Hirehalli (Mysore)—Dwarf palm and Mahuva (Gujarat) and one exotic type *Malayan wangi* from the Agricultural Research Station, Taliparamba were added to the existing collection of indigenous and exotic types.

2) Survey of arecanut gardens to assess genetic variation and select superior types:

Nothing to report.

3) **Floral biology of *Areca*:**

a) *Study of the range of variation in flowering from tree to tree in the same garden:*

The above study was undertaken in the bulk garden of the Station containing a population of about 3000 palms planted in 1957 and wherein the palms had been given uniform cultural and agronomic treatments. An abstract of the observations made on 200 palms marked for detailed study of flower production is given below:

Particulars.	No.	Percentage
Palms which produced:		
1. no spadices	24	12.0
2. one spadix	7	3.5
3. two spadices	9	4.5
4. three spadices	15	7.5
5. four spadices	28	14.0
6. five spadices	15	7.5
7. six spadices	26	13.0
8. seven spadices	31	15.5
9. eight spadices	30	15.0
10. nine spadices	15	7.5
Total	200	

It can be seen that the number of inflorescences produced ranged from nil to nine, and the largest number of trees produced inflorescences ranging from four to eight.

b) *Study on the month-wise variation in flowering:*

c) *The frequency distribution of number of palms flowering per week during all the weeks, the phenomenon of early, flowering etc. to be correlated with fruit production:*

The above studies were also carried out in the bulk garden of the Station referred to above. An abstract of the observations made in the current as well as the previous years is given below:

Months	Percentage of inflorescences produced to leaves shed		Percentage of monthly production of inflorescences to the total	
	1961–'62	1962–'63	1961–'62	1962'–63
July	11.20	45.35	2.7	4.7
August	21.80	52.45	5.6	5.9
September	35.80	71.96	6.2	5.0
October	54.00	74.80	9.5	6.9
November	61.97	84.64	9.5	8.8
December	76.19	84.76	13.8	7.9
January	89.03	90.64	8.2	10.3
February	87.45	94.06	10.5	11.9
March	58.13	90.00	12.0	11.6
April	69.68	83.81	10.7	11.8
May	37.47	67.60	5.9	7.2
June	35.26	79.20	5.4	8.0
Mean	48.40	77.35	—	—

From the above it can be seen that there is a mean increase of 29% in the percentage of inflorescences produced to leaves shed in 1962-'63 over that of the previous year. It is also seen that a very high percentage of leaves shed in the months of January to March had inflorescences in their axils. Of the inflorescences produced in different months, the maximum percentage to the total production is observed in the months of January to April.

d) Floral initiation:

The laboratory is being equipped to take up this item of work.

e) Study of pollen:

Viability during different months of the year:

Study of viability of the arecanut pollen *in vitro* which was initiated in 1961—'62 was continued during the year. The data of the germination of pollen obtained during the different months are given in appendix II, Table I.

It can be seen from the data that the germination percentage of pollen grains ranged from 5.6 to 52.4, and the mean from 10.8 to 43.9 in the

course of the year, the highest percentage being in May and the least in July.

The pollen grains collected during the humid months were also found to be highly contaminated with spores of fungi and bacteria.

These observations on pollen germination are more or less in conformity with the results obtained in the previous year.

Storage and longevity study:

Freshly collected pollen was stored in a dessicator containing calcium chloride for a study of viability, and the germination percentage was tested immediately after collection, and at intervals of seven days after collection employing 1% solution of sucrose as medium. The data collected are given below:

Storage life (Days)	Germination per cent. Range in three lots.	Mean.
Fresh	10.8 to 17.0	13.6
7	31.2 to 40.8	35.7
14	18.4 to 41.0	26.1
21	3.9 to 39.0	20.5
28	Nil to 38.0	19.2
35	Nil to 10.2	6.7
42	Nil to 2.3	0.8
49	Nil	Nil

It is seen that freshly collected pollen gives less germination than pollen stored for seven to twenty eight days, and that the germination is maximum after seven days storage and thereafter it declines. The germination becomes almost nil after 42 days' storage.

(4) Hybridisation and selection:

(a) Standardisation of crossing technique:

For controlled pollination work cloth bags are usually employed. The material, however, allows entry of minute insects like thrips which are capable of carrying pollen grains, and this can vitiate the results. The humidity inside the bag also often becomes high, or when the bag becomes wet it slumps on the inflorescence, both of these causing damage to the inflorescence. As an alternative material for bags, Trayophane—transparent

paper which allows passage of gases and moisture and which is water resistant was tried. This material was found to lend itself very well for the purpose. The material possesses a further advantage in that it is transparent and the progress of opening and set of flowers can be watched from outside without having to open the bags, a process necessary for cloth bags. The only limitation to the use of this material is that when long bags are made to cover large inflorescences the material tends to tear off in heavy winds. Trials are being carried out to find out methods of reinforcing the bags against such tearing off.

b) Production of inbred lines of distinct types:

i) In the local type:

For production of inbred material as the first step towards purification of the line, four inflorescences of two selected palms located in a private garden were selfed. From a total of 798 female flowers that were self-pollinated, only 52 fruits were obtained, the percentage of set being 6.5. Causes for the low set are being investigated.

ii) In exotic types:

Selfing was also done on four exotic palms planted in 1957 for production of inbreds for distributing to the Regional Arecanut Research Stations. The details of selfing done and results obtained are given below:

Type	No. of flowers selfed	No. set	Percentage set	Percentage set in open pollination
Andaman	1897	155	8.2	22.34
Nicobar	1574	25	1.6	34.66
Indonesia-1	390	137	35.7	28.07
Indonesia-2	534	75	14.1	37.32

From the above, it will be seen that Andaman, Nicobar and Indonesia-2 types have recorded low percentage of set on selfing as compared to open pollination. It is quite possible that this is due either to self incompatibility or pollen sterility. The exact cause is being ascertained through further studies.

iii) Distribution of inbred lines of exotics:

Seeds from bunches which were selfed in 1961–'62 in the above-mentioned three exotic palms were collected and six nuts of the Andaman type

and 12 from each of Indonesia-1 and Indonesia-2 were sent to each Regional Arecanut Research Station of the Committee and the State Regional Arecanut Research Station, Thirthahalli, Mysore, for sowing.

c) Hybridization between distinct types and selected palms to combine high yield and regular bearing, and study of progeny:

The above project was intiated in 1961-'62 with a set of four trees with a view to determine if there is any difference in the degree of compatibility between palms of the same type and different types, the existence of a high degree of which can be exploited to obtain high yield of nuts by interplanting such types. During the year the project was repeated with the same set of four trees as employed in the previous year as well as with a new set of four palms. The flowers on the inflorescences were divided into five groups and three of these were pollinated with the pollen from each of the other three trees after emasculation and bagging as usual, the fourth was selfed and the fifth was left for open pollination. The process was repeated in two or three inflorescences of each female parent utilizing the same palms as before as male parents. The data on the percentage set in each of the treatments (groups) were recorded three months after pollination. The results are given in Table II.

These results broadly indicate that.

1) the extent of fruit set varies considerably between different palms,

2) there are wide reciprocal differences in fruit set in the case of certain sets of crosses, as for example, between 471 and 593 and

3) in general open pollination gives a much higher set than controlled pollination.

d) Hybridization between exotic and indigenous types:

The above programme was initiated during the year to ascertain the degree of compatibility between the exotic and certain of the indigenous palms. The trial was carried out with ten palms of local type in the main garden and four exotics, namely, Indonesia-1, Indonesia-2, Nicobar and Andaman. A few reciprocal crosses were also made between Indonesia-2 and some of the local type palms. The results of the trial are presented in Table III.

The data give the following indications:

1) The extent of fruit-set varies considerably between different palms.

2) Certain indigenous palms, such as 1059 as female parents are capable of giving a very high set with these exotics.

3) Certain palms give no set at all or very poor set with these exotics, as for example, Palms No. 1097 and 594 as female parents, and Indonesia-2 as female parent for palms No. 360 and 1097.

4) Indonesia-2 as female parent has given higher set with certain palms such as 482 and 1098 than others.

5) Reciprocal differences with regard to fruit set exist in the case of certain sets of crosses.

The above conclusions are more or less similar to those obtained from the trials on crossing the local types reported in the foregoing section.

Such wide variations in fruit set are presumed to be due either to compatibility differences between different palms or to male and/or female sterility.

Further studies on this aspect are under way.

5) Preliminary studies on the progeny behaviour of mother palms:

These studies had been initiated in 1960–'61 in the progeny garden of the Station, and are intended to find out to what extent the mother-palm characters are inherited and the extent to which these charecters differ among the progenies. For the studies 20 progenies each of ten mother palms had been selected in the bulk garden referred to earlier. The morphological characters such as girth, internodal distance, rate of production and shedding of leaves and the productive characters such as number of inflorescences and female flowers produced, the extent of set and yield and the variation in fruit-size, shape and colour in each progeny group are being studied. These observations were continued during the period and the data collected are given in the Table IV.

It can be seen that there is wide variation between the different mother palms as regards both the percentage of inflorescences produced to leaves shed, and the number of female flowers produced in their progenies. The former ranges from 59.7 to 85 9 while the latter ranges from 588 to, as much as 1021. Mother palms KMJ-2, SDK-16 and SDK-14 have produced both larger number of inflorescences and larger number of female flowers per tree.

These data bring out the supreme importance of selection of mother palms for obtaining high level of productivity in the arecanut crop.

Observations recorded on female flower production also showed that out of the total inflorescences produced during the year, only 7.9% lacked in female flowers, as against 54·1% and 8.3% in respect of inflorescences produced in 1960—'61 and 1961—'62 respectively.

II. Morphological studies of the palm:

a) Root studies at different ages and under different soil conditions in adult palms:

At present comprehensive information on the rate of development and the pattern of growth of the root system of the *Areca* palms in different types of land and under different soil conditions is lacking. In order to elicit this information, it has been programmed to set out plants in each of the following types of land and study the development at periodic intervals.

1) 'Bettu' or single-crop paddy land.

2) Newly terraced hill-side.

3) Low lying land subject to occasional waterlogging.

These are the main types of land on which arecanut is planted in this tract.

In the first two types of land one set of plants are to be planted out at a depth of 1½ feet as is usually done, and another on the surface. In the last type of land one set will be planted on the surface and another on mounds also as practiced locally.

During the current year 85 plants were set out on "Bettu" land for the above studies. 70 at a depth of 1½ feet and 15 on the surface. The remaining planting will be taken up as soon as the required land comes into possession.

III. Anatomical studies:

The laboratory is being equipped to take up this item of work.

IV. Physiological studies:

i) Studies on fruit-setting and shedding:

i) Supplementing natural pollination by spray method to improve fruit set:

The above trial was initiated in 1961-62 to find out if a higher set of fruits can be obtained by supplementing natural pollination by spraying the

inflorescence with pollen held in suspension in a liquid medium, namely, 0.5% solution of sucrose. The trials were repeated on a much larger scale during 1962–'63 with the same treatments as before, namely, (1) open pollination plus pollination by the spray method, (2) open pollination plus spraying with 0.5% sucrose solution, and (3) control—open pollination.

The trial was conducted from October 1962 to May 1963 to cover the entire season of heavy flower production and to cover a large number of trees, the number being 63 per treatment. The spraying, either with the pollen suspension, or without it, was done thrice during the course of the female phase. The data on the number of flowers set apart for the different treatments and the extent of fruit set obtained are given in the Table V.

It can be seen from the Table that in all the months except January, a higher percentage of set of fruits was obtained when natural pollination was supplemented by spraying pollen on the female flowers. The overall production in the form of fruit-set almost doubled itself in the bunches sprayed with pollen held in suspension in sucrose solution. There was no appreciable difference in the set between the bunches left for open pollination and those left for open pollination and sprayed with sucrose alone.

In addition to the above, some trials on supplementing pollination had been carried out in a private garden adjoining the farm on one hundred palms. In this instance, as against a set of 48.14 *per cent* obtained in open pollination, a set of 60.43 per cent was obtained when natural pollination was supplemented, thus giving an overall increase in production of 25.5 percent.

It can thus be seen that by adopting the method described above, it will be possible for the grower to obtain a higher set of fruits on his trees and the plant breeder to hasten the pace of his work.

Large scale trials for working out the economics of the project will be taken up in the ensuing season.

ii) Growth regulators as aid to fruit-set:

The results of the trials on growth regulators conducted in 1961–'62 indicated that NAA had remarkable effect on inducing fruit-set in arecanut when the chemical was applied in a lanolin meduim. But in view of the fact that this method is tedious and time-taking an additional treatment, namely, applying the chemical in the form of a spray was included during the year. For spraying, three concentrations viz., 50, 100 and 1000 ppm were

employed. Three palms were employed for each of the treatments, and an equal number of palms was left for open pollination as control.

The data collected are given below:

Concentration	Method of application					
	Spray form			Lanolin paste form		
	No. of flowers treated	No. set	Percentage	No. of flowers treated	No. set	Percentage
50 ppm	845	139	16.45	—	—	—
100 ppm	861	88	10.22	826	159	19.23
1000 ppm	736	269	36.55	544	79	14.52
10000 ppm	—	—	—	536	466	86.94
Control	656	215	32.77	636	185	29.08

It can be seen that application of NAA at 10,000 ppm in a lanolin medium had a striking effect in increasing fruit set. Application in spray form had almost no beneficial effect on set.

It has however been found that the fruits so treated show different patterns of development. While some of them are growing normally, the others are lagging behind in growth within the same inflorescence. Similar pattern of development was noticed in the trials conducted during the last year also.

2) Inducing mutations in arecanut:

a) By irradiation of seednuts with Thermal neutrons:

During 1961, 108 seednuts were irradiated with Thermal neutron, at the 'Apsara' reactor, Atomic Energy Establishment, Trombay, Bombay with different flux. Ninety eight seedlings obtained from the treated material were planted in the mainfield along with controls adopting a Randomised Block design with eight replications.

Irradiation with X-ray:

During 1962, 60 sprouts were irradiated with X-ray at the Physics Laboratory of the Indian Institute of Science, Bangalore with an intensity of 30 K. W.—10 milliamperes for one, three and five minutes. Only seven of the treated seedlings withstood the treatment. Three out of the seven were initially showing stunted growth but subsequently reverted to normal

growth. The seedlings from the treated and control lots will be planted out in the field in early 1963-'64.

b) By chemicals (Colchicine)

Out of the 320 sprouts treated with Colchicine during 1961-'62 (concentrations and durations being 0.125, 0.25, 0.5 and 1.0% for six, 12, 24 and 36 hours), 86 survived, and 73 of these were transplanted in the nursery. The seedlings planted in the nursery showed earlier splitting of leaves than the controls.

Of the remaining thirteen, ten seedlings which were showing pronounced formative effects were examined for the size of stomata and cells of the lamina. The mean data collected in this regard are given below:

Material	Stomata		Cell	
	Average length (in μ)	Average breadth (in μ)	Average length (in)	Average breadth (in)
Colchicine treated	30.9175	14.3175	72.6250	15.5625
Control (untreated)	26.9750	12.4500	40.2550	18.4675

It is seen that the treated plants have larger stomata and cells than the untreated.

The trial was repeated during the current year with larger number of seeds using the same concentrations of the chemical but limiting the durations of treatment to 24, 36 and 48 hours. A total number of 544 sprouts were treated. The seeds had just commenced germination.

3) Effect of plant growth regulators on growth-Maleic Hydrazide:

Some trials were conducted during the year to find out the effect of MH (Maleic Hydrazide), which is known to suppress apical dominance and inhibit growth generally in many horticultural plants on the growth of arecanut seedlings. Concentrations of 250, 500, 1000 and 2000 ppm were sprayed to the plants employing ten plants per treatment. The spraying was done twice at an interval of 15 days. Growth data collected two months after the last set of spray did not indicate any difference in growth or produce any formative effect on the seedlings. The seedlings are under observation. The effect of this chemical on fruit-set is also being studied.

4) Role of micro-nutrients in arecanut:

Nothing to report.

V. Vegitative propagation:

(*a*) *Rooting and separation of suckers*:

Trials on inducing rooting in the suckers produced in some of the exotic arecanut palms indicated that certain special treatments made no difference in regard to success in rooting, but produced earlier rooting. The treatments consisted of (1) cincturing and tying copper wire, (2) cincturing, dusting IBA 20 ppm and tying copper wire and (3) control. The suckers are being separated for study of root system produced under different treatments and for studies on their establishment and subsequent performance.

b) *Poly-embryony*:

Poly-embryony is occasionally met with in arecanut. With a view to study the performance of poly-embryonic plants in the field, 19 twin seedlings found in the nursery were separated out into the two components and were planted out in the field.

VI) Miscellaneous

1) Elite seed Scheme:

This project, initiated in 1960–'61 was continued during the year limiting the work to the study of the germination of pollen grains wafted by wind to different heights and distances. For this purpose, pollen catches were made using (1) glycerine jelly, (2) Mayer's Egg Albumin, (3) vaseline and (4) honey as smears. The pollen collected on the slides hung on aeroscopes were tested for germination in sucrose media by the hanging drop method, but none of them gave any germination.

2. Study on the behaviour and performanee of Vittal type of arecanut under different ecological conditions:

The above study initiated during the year is intended to find out the effect of soil and climatic conditions on the performance of a given type of arecanut, in this instance, of Vittal type. One palm (No. 605 of C.A.R.S.) typical of the Vittal type was selected for this purpose and twenty fully tree-ripe seeds obtained from this tree were sent to each of the six Regional Arecanut Research Stations, including Regional Arecanut Research Station, Thirthahalli. An equal number of seednuts from the same tree and bunch were sown at this Station. The relative performance of the progenies will be studied at the different Stations.

AGRONOMY.

VI A. Standardisation of nursery practices:

1) Criteria for seednut selection:

a, b and e.) Study of the effect of age of trees, order of bunches and position of seednuts in the bunch on seednut performance:

This experiment, which was first laid out in 1958-'59 is intended to study the effect of age of mother-palms, order of bunches and position of seednuts in the bunch on germination and performance of the resulting seedlings. The experiment which had been laid out on a 3^3 factorial design confounded in 9 plot-block with four replications was conducted for three years with the following treatments.

Age of the mother-palms: Young, middle-aged and old (10-15 years), (30-35 years). (above 50 years).

Order of bunches: First, second and third.

Position of seednuts in the bunch: Top, middle and bottom.

The germination data gathered during the three years of the experiment showed that seednuts collected from young and middle-aged palms, and from the second and third bunches had given higher germination percentage. Location of seednuts at different positions in the bunch did not reveal any effect on germination. Regarding the morpological characters of the seedlings, it was found that seedlings raised from the first and second bunches of young and middle-aged palms had more girth, height and number of leaves than the rest.

The data on morphological characters of the seedlings collected in June 1962 from the stock obtained from the final set of sowings, namely that done in 1960-'61 were analysed and these are presented in Tables VI (a) and VI (b).

It can be seen from the data that the main effect of age of trees is found to be significant with reference to the girth and height of seedlings produced. Seedlings raised from seednuts obtained from middle-aged palms were found to be the most vigorous. Order of bunches or position of seednuts in the bunch are found to have no effect on these attributes.

The experiment has been concluded with these set of trials.

c) To determine the frequency of occurrence of nuts possessing different floating habits, Factors influencing such habits and their relative merits as seed nuts.

Seed arecanuts when allowed to float in water show different floating habits such as, vertical, slanting and horizontal. The common belief is that the nuts that float vertically are superior as seed material to others. This experiment was laid out to study the influence of such floating habits on seednut performance with the following three treatments replicated eight times in a randomised block design.

1. Vertically floating seednuts.
2. Slantingly floating seednuts.
3. Horizontally floating seednuts

The trial was first laid out in 1959-'60 and was repeated during the succeeding three years. The results of the germination data of the first two years on analysis did not show any significant difference between treatments. The germination data for 1961-'62 are given in Table VII (a). These again do not show any significant difference between treatments.

The germination data relating to the sowing made in 1962-63 are under examination. However, the germination data for the four sets of trials conducted from 1959-'60 to 1962-'63 did not show any appreciable difference between the treatments in different years.

The sprouts from the 1960-'61 sowings were planted in the secondary nursery and after one year's growth the morphological data were collected and statistically analysed. The results are given in the Table VII (b).

It will be seen from the Table that there is no significant difference between the treatments in respect of any of the characters.

The sprouts from 1961-'62 sowings were also similarly transplanted in the secondary nursery. The morphological data are under examination.

In 1960-'61 and 1961-'62 the percentage of occurrence of nuts with different floating tendencies in the three bunches of a few selected palms was studied. In both the years the frequency of occurrence of nuts with different floating tendencies was found to follow no definite pattern. During the current year also the pattern was studied. The data are presented in Table VII (c).

These data reveal that the floating habits of nuts in different bunches of the same tree varies to an appreciable extent. However, it is seen that in a given tree nuts possessing only two types of floating habits are found

to occur predominently, nuts with slanting floating habits being found to occur invariably among the trees.

Further, a comparison was made of the floating habits of nuts in different bunches harvested from the same two trees during 1960-'61, 1961-'62 and 1962-'63. The data are given in Table VII(d).

It can be seen from the above Table that floating habit of nuts is a tree character and is more or less constant both in different bunches of the same tree and from year to year.

The factors that might influence the floating habits of the nuts are, the weight of the entire nut (including husk) and the weight of the kernel. With a view to find out to what extent these influence the habits, the study was extended to this aspect also. Representative samples of nuts drawn from lots possessing the different habits were taken and the above mentioned data were collected. These are presented below:

Tree No.	Floating habit	Mean weight of nut (gm.)		Mean weight of kernel (gm.)	
		First harvest	Second harvest	First harvest	Second harvest
17	Vertical	45.0	45.0	14.8	13.4
	Slanting	43.6	41.0	13.4	11.6
	Horizontal	36.4	35.0	12.0	10.4

The data reveal that nuts with vertically floating habits are the heaviest in the bunches, both in regard to the weight of the entire nut and the kernel. Those with horizontaly floating habits appear to be the lightest among the nuts.

These observations are of considerable interest and practical utility in that it has been found from another set of trials that higher germination and greater vigour of resulting seedlings are associated with greater seed weight. Therefore selection of seednuts for weight can be done by studying their floating habits, which method is easier and quicker than weighing each nut individually. Further and more detailed studies on the above aspect are under way.

d) Studies on the performance of nuts gathered at different stages of maturity for seed purposes:

This experiment was taken up to study the extent of germination of nuts gathered at different stages of maturity and the performance of the resulting seedlings in order to arrive at the optimum period for collection of seednuts.

The experiment was first laid out in 1958-'59 with the following six treatments.

Sowing
1) Eight-months-old seednuts.
2) Eight-and-a-half-months-old seednuts.
3) Nine-months-old seednuts.
4) Nine-and-a-half-months-old seednuts.
5) Ten-months-old seednuts.
6) Ten-and-a-half-months-old seednuts.

The age of nuts i. e. maturity, was computed from the time of opening of female flowers. The germination data showed that germination of eight-months-old seednuts was significantly inferior. As sufficient number of seedlings from treatments (1) and (2) were not available, the treatments could not be carried to the secondary nursery. Thus in the secondary nursery only treatments (3) to (6) were studied. After one year's growth in the secondary nursery the morphological data of the seedlings were collected and analysed. The analysis showed that the treatments did not have significantly varying effects on any of the characters studied. During 1960-'61 the experiment was taken up with only the following four levels of maturity of nuts.

1) Nine-months-old.
2) Nine-and-a-half months-old.
3) Ten-months-old.
4) Ten-and-a-half-months-old.

The nuts were sown in January and February 1961 after they had attained the stages of maturity indicated and the germination data were collected and analysed. The results are given in Table VIII (a)

It will be seen from the Table that the treatments do not have significantly varying effect on the germination percentage.

The sprouts obtained from the above sowings were transplanted in the secondary nursery and the morphological data were similarly collected and analysed. The results of analysis are given in Table VIII (b).

It can be seen that the treatments differ significantly with reference to all the morphological features (i. e., height, girth and number of leaves) studied. Seedlings obtained from ten-months old-seednuts (Treatment No. 3) were found to be superior to all the others. Treatment No. 1 namely, seedlings from nine-months-old-seednuts was inferior to the rest in respect of all the characters.

In 1961–'62 the experiment was repeated on similar lines and the nuts for the purposes were sown from December 1961 to February 1962. The germination data were statistically analysed. It was found that there was no significant difference between the treatments as in the previous year. The results of analysis are given in Table VIII (c).

Maturity studies - Field trial:

Seed arecanuts are usually collected from the second and the third bunches of mother-palms for sowing. Normally they are collected when they are fully tree-ripe. There is a time log of anything from 15 to 30 days between the ripening of the nuts in these two bunches. In the experiment "Studies on the performance of nuts gathered at different stages of maturity for seed purposes" no appreciable difference in the germination percentage was observed between nuts of 9½ months to 10½ months maturity. It was therefore felt that, while collecting seednuts for sowing, the third bunch may be harvested at the same time as the second, thereby avoiding a second visit to the garden for collection of seed material from the same tree. In order to confirm if this can be done, one set of trials was initiated in 1960–1961 with the above two treatments replicated 20 times in a randomised block design. Fifty nuts were sown in each treatment. The germination data revealed no significant difference between the treatments. In regard to the morphological data, seedlings obtained from fully tree-ripe nuts were found to have produced significantly larger number of leaves.

The experiment was repeated in 1962–'63 on the same lines as before. The seednuts had completed germination and the data are under examination.

With a view to find out if there is any considerable difference as regards the quality and output of "Chali" or cured produce obtained from the fruits thus harvested, representative samples of nuts were drawn from the two bunches, and the weight data were collected. The data are given below. For the sake of comparison the data collected in the same set of trials in 1960–'61 are also given.

Year	Percentage of dry weight to fresh weight of fruit from		Percentage of dry weight of kernel to fresh weight of fruit from	
	Second bunch	Third bunch	Second bunch	Third bunch
1960–'61	39.60	39.40	25.40	25.90
1962–'63	35.66	35.03	22.01	21·41

It can be seen from the above data that there was little difference in both the years between the two treatments as regards the output of 'Chali'.

As regards quality, however, both the set of trials have shown that the 'Chali' obtained from the lots collected from the third bunch was considerably inferior to that obtained from the fully tree ripe bunch. The sample collected from the 1962-'63 trials was sent to the South Kanara Agricultural Co-operative Marketing Society Ltd., Mangalore for evaluation. The Society has reported that the product obtained from the lower fully ripe bunch fetched 81 per cent more price than the product obtained from the fruits collected from the upper bunch.

Further studies on this aspect are under way.

2. Sowing Experiments:

a, b) Study of different positions-cum-depths of sowing seednuts:

This experiment is intended to find out the ideal position for sowing seednuts, as well as the optimum depth at which the seednuts have to be sown in order to obtain a high percentage and early germination. The experiment, which was first laid out in 1959–'60 was repeated on a 12 x 4 randomised block design during the year under report with the following treatments.

Positions:
1) Vertical
2) Slanting
3) Horizontal

Depths:
1) 0"
2) 1"
3) 2"
4) 3"

The results of the previous two years revealed that sowing seednuts vertically or in slanting positions at 0", 1" and 2" gave higher percentage of germination than the other treatments.

The germination data relating to the 1961–'62 experiment were analysed statistically. The results are presented in Table IX.

It can be seen that the main effect of depth alone is significant. Sowing seednuts at depths of 3" and 2" has given significantly lower germination than sowing at 0" and 1" depths, the latter two being on a par. The main effect of position of nuts, even though not significant, shows a trend in favour of slanting position.

These results are broadly in conformity with those obtained in the previous two years. The experiment has been concluded with the 1961–'62 set.

e, f) *Effect of different spacing-cum-efficacy of sowing unsprouted and sprouted seeds on seedling performance:*

This experiment is intended to find out the effect of sowing the seed arecanuts directly in the secondary nursery as against transplanting the sprouts after germination on seedling-growth, and the optimum spacing to be given in the nursery when these methods are adopted. The experiment was initiated in 1959–'60 and laid out on a 8 x 4 randomised block design with the following treatments.

Nature of the seed arecanut:

(1) Unsprouted. (2) Sprouted.
(In both cases the sowing was done on the same day).

Spacings given:

1) 9" x 9"
2) 12" x 12"
3) 15" x 15"
4) 18" x 18".

As regards the morphological data, the results of 1959–'60 trials showed that in general seedlings obtained from pre-germinated seeds made better growth than the seedlings obtained from sowing made directly. The data on the morphological characters of seedlings obtained from 1960–'61 sowing were analysed. The results are presented in Table X (a).

It can be seen that the treatment differences are significant in respect of height of the seedlings only. Seedlings raised by transplanting sprouts as well as planting at spacings of 18" x 18" and 15" x 15" are better than the other treatments.

The experiment was repeated during 1961–'62. The germination data recorded were analysed and the results are presented in Table X (b).

It can be seen that the treatments do not have any significant effect on germination. This result is in conformity with the previous year's findings. The sprouts were transplanted in the secondary nursery during 1962 season and the morphological data were recorded for analysis. The trial will be concluded with this set.

e) *Effect of shade vs. no shade on scednut germination and growth of seedlings with particular reference to sun-scorch and pest (mite) attack:*

This experiment was taken up to find out the optimum intensity of shade that is to be provided for the seedlings in the nursery to obtain healthy growth, and was first laid out in 1959–'60 with the following treatments replicated eight times, and was repeated in the succeeding two years.

1. No shade (complete exposure to sun).
2. Partial shade.
3. Complete shade.

The germination data of seednuts sown during the first two years of trial did not reveal any significant difference between the treatments. The sprouts obiained from the first year trial were transplanted in the secondary nursery, and the morphological data of seedlings analysed. Only in the case of number of leaves the treatments were found to differ significantly, partial and complete shade producing seedlings with significantly more number of leaves than no shade.

The sprouts obtained from the second year trial were transplanted in the secondary nursery, and after one year the morphological data were collected and analysed. The results of analysis are given in Table XI (a)

It can be seen that in respect of height and girth the three treatments differ significantly from one another, partial shade being the best followed by complete shade and then no shade. As regards number of leaves 'no shade' is significantly inferior to the other two treatments.

During 1962–'63 the experiment was repeated. The germination data gathered were analysed. The results of analysis are given in Table (XIb)

It can be seen that, as in the previous years, there was no significant difference in regard to germination.

In addition to studying the germination percentage and morphological data, data on the number of casualties in the different treatments in the primary nursery were collected in two of the years, and in the secondary nursery during 1962-'63. The data collected in the primary nursery are given below. These are being analysed statistically but the data indicate that the "no shade" treatment had definite adverse effect on growth of seedlings in the primary nursery.

Year	Treatment:	Percentage of mortality No shade	Partial shade	Complete shade
1961		48.75	0.75	1.25
1962		13.11	2.35	0.30

Similar data gathered in the secondary nursery during the year also indicated that the treatment "no shade" had adverse effect on seedlings. The percentage of mortality in the "no shade" treatment was 18.75, as against 2.1 in the case of partial and complete shade treatments.

During the current year the experiment was modified as "Effect of different intensities of shade in the seed bed and in the secondary nursery on the growth performance" with the same three treatments as above in the primary nursery, followed by the following nine treatments to be given in the secondary nursery.

Treatment in primary nursery	secondary nursery
1) to 3) No shade	No shade
	Partial shade
	Complete shade
4) to 6) Partial shade	Same as above
7) to 9) Complete shade	Same as above

The nuts sown in the primary nursery have completed the germination and will be transferred to the secondary nursery in due time.

d) *Standardisation of media and methods for sprouting seednuts*:

This experiment was first laid out during 1959-'60 on a 5x6 randomised block design in order to find out a suitable medium or method for sprouting seed arecanuts. The treatments including some of the local practices.

Consisted of:

1) Sowing the seeds in soil medium.
2) Sowing the seeds in sand medium.
3) Arranging the seeds in country baskets with a layer of straw as cover.
4) Tying the seeds in straw bundles.
5) Heaping the seeds under shade.

For each treatment 100 seed arecanuts were utilized. Partial shade was provided for the sprouts and they were watered daily. The germination data recorded were analysed and are given in Table XII.

It may be seen from the Table that there is significant difference between the treatments as regards germination percentage. Nuts sown in soil and sand medium have given significantly higher germination than the other treatments. This result is in conformity with that obtained in the previous two years.

g) *Influence of pre-sowing treatments and period of sowing on seednut performance*:

It is a common practice in this locality to treat the seednuts differently prior to sowing, with the belief that such treatments will improve germination and result in more vigorous seedlings. The trial was first initiated in 1959-'60 with a view to determine the merits of these different practices. The following were the twelve treatments, replicated six times in a randomised block design.

1. Harvesting and immediate sowing.
2. Treating in cowdung slurry and immediate sowing.
3. Treating in cowdung slurry and air drying for three days and sowing.
4. Treating in cowdung slurry and air drying for six days and sowing.
5. Treating in cowdung slurry and air drying for nine days and sowing.
6. Sun drying for two days and sowing.
7. Sun drying for four days and sowing.
8. Sun drying for six days and sowing.
9. Air drying for three days and sowing.
10. Air drying for six days and sowing.
11. Air drying for nine days and sowing.
12. Soaking in water for three days and sowing.

During the first year of trial, the treatments were found to have significant influence on germination. Sun-drying nuts for different number of days and sowing, as well as air drying for the longer periods after treating with cowdug slurry, gave significantly lower germination than harvesting and immediate sowing. But during the second year the germination data did not show any significant difference between the treatments.

The morphological data of the seedlings collected after one year in the secondary nursery in the first year experiment showed that the treatments did not have significantly varying effect on any of the morphological characters studied.

The morphological data of the seedlings collected in the second year trial have been statistically analysed and results are given in Table XIII(a).

From the Table it may be seen that the treatments do not have significantly varying effect on any of the morphological characters.

The experiment was repeated during 1961–'62. The germination data on analysis revealed that the treatments did not effect germination significantly. The results are given in Table XIII (b). The sprouts were transplanted in the secondary nursery and the morphological data of the seedlings after one year in the secondary nursery have been collected and are under examination.

h) Determination of optimum age of transplanting seedlings cum-sowing in situ vs. transplanting of single, double and treble transplanted seedlings in the nursery:

The object of the experiment is to determine the relative performance of plants obtained from the nuts sown *in situ*, of seedlings planted in the mainfield at different ages, and the seedlings of the above ages which had been transplanted once, twice or thrice in the nursery prior to field planting. The following treatments have been adopted and the experiment has been laid out as an observational trial.

	1)	Directly sowing seednuts in the mainfield.
Field planting	2)	One-year-old seedlings.
,,	3)	Two-year-old seedlings.
,,	4)	Three-year-old seedlings.
,,	5)	Four-year-old seedlings.
,	6)	Two-year-old seedlings which had been transplanted once in the nursery.

„ 7) Three-year-old seelings which had been transplanted twice in the nursery.

„ 8) Four-year-old seedlings which had been transplanted thrice in the nursery.

The nuts for treatment (1) had been sown in the field in 1961. Their germination was satisfactory and the plants are in excellent condition. The plants relating to treatment (2) were field-planted in 1962 and those relating to (3) and (6) will be planted in July 1963. Those relating to (7) and (8) were transplanted in the secondary nursery as proposed during the period under report.

The morphological characters of the seedlings were recorded during 1962 and the means are furnished below:

Treatment details	Average girth (cm.)	Average height (cm.)	Average No. of leaves
Treatment 1)	4.49	137.06	5.60
Treatment 2)	4.02	111.67	6.00
Treatments 3), 4) and 5	5.43	136.17	5.47
Treatments 6), 7) and 8	2.79	82.38	4.30

From the above data it can be seen that seedlings resulting from nuts sown directly in the mainfield, seedlings transplanted when one-year-old as well those retained in the primary nursery without further transplanting have made relatively better growth so far.

Transplanting seedlings in the secondary nursery is seen to cause stunting of growth of the seedlings as indicated by lesser height, girth and number of leaves produced.

4. Standardisation of method of packing seedlings:

This experiment was laid out first during 1961.'62 with a view to determine the best method of packing arecanut seedlings for long distance transport and the maximum period for which seedlings so packed can be retained without planting, without their capacity to establish being impaired. The experiment was taken up on a 4 x 3 x 4 split plot design with the following treatments.

Main treatments: Planting intervals--(four)--No. of days

1) Five
2) Ten

3) Fifteen
and 4) Twenty

Sub-treatments: Material for packing (three).
1) dry grass (Muli)
2) areca leaf-sheath
and 3) alkathene film

In all the cases the seedlings were lifted from the nursery with a 6 inches ball of earth and were packed in the three types of materials mentioned above. Ten seedlings were used per treatment. The results of analysis of the first year data showed that the main treatments, sub-treatments as well as the interactions had significantly varying effect on the establishment of the seedlings. Seedlings planted five days after lifting gave significantly higher pecentage of establishment than the other treatments. As regards packing material, alkathene film gave signifIcantly higher number of plants established.

The experiment was repeated during the current year adopting the same treatments and lay out as in the previous year. While packing the seedlings with different packing materials, it was observed that packing with alkathene film consumed considerably lesser time than packing with 'muli' and areca-leaf-sheath. Observations recorded at the time of planting also showed that wilting and yellowing of the seedlings were less in the case of the seedlings packed with alkathene.

The aggregate of 480 plants under the different treatments were planted out in the mainfield under uniform conditions in November 1962.

The data on establishment of the seedlings were being gathered. The mortality counts of seedlings recorded under different treatments during the period showed that there was no mortality among the seedlings when planted five and ten days after lifting under any of the treatments, but when planted 15 and 20 days after lifting, there was mortality to the extent of 5% and 10 to 12½% respectively. This observation is in conformity with last year's findings.

Further observations are being continued.

Other studies

a) Determination of the optimum intervals of irrigation for germinating seed arecanuts:

This observational trial is intended to determine the optimum intervals to be given between irrigations to obtain maximum germination and optimum growth of seedlings in the primary nursery. The trial was initiated in 1960-'61 and was repeated during the succeeding two seasons in a slightly modified form with the following treatments:

Watering the seed beds once.

1) daily,
2) in two days,
3) in three days,
4) in four days, and
5) in five days.

The trial was laid out on a 5x6 randomised block design and thirty seed arecanuts were sown under each treatment. The quantity of water given for each treatment bed was seven litres at the sheduled intervals. The germination data were recorded periodically. The data pertaining to the year 1961-'62 were statistically analysed. The results are presented in Table XIV (a)

It can be seen from the Table that the treatments have significantly varying effect on germination. Increasing the intervals between the irrigations beyond three days has reduced the germination significantly. These results are in conformity with the results of the previous year. The experiment has been repeated during the year.

The morphological data of the seedlings obtained from the different sets of treatments were recorded at the time of transplanting the same to the secondary nursery. The data were analysed statistically and are presented in Table XIV (b)

It can be seen from the data that the treatments have significantly varying effect on height and girth. Seedlings raised from nuts watered once daily or once in two days have made better height growth than those in the other treatments. Watering once in five days has produced seedlings of significantly lesser girth.

b) Direct sowing seednuts in alkathene bags vs. transplanting in secondary nursery:

This observational trial was initiated in 1960-'61 to determine the relative merits of sowing seed arecanuts in alkathene bags, bamboo baskets

and in the nurseries as per the usual practice in relation to growth of seedlings, ease of transport and earliness and degree of establishment of plants in the mainfield. The data collected in the first two years of trial indicated that bamboo baskets do not last for more than six months and therefore do not make satisfactory containers for the plants. The seedlings raised in alkathene bags showed significantly greater girth and height growth than those raised in the nursery beds.

In order to find out the relative performance of seedlings raised in alkathene bags and in the nursery beds, fifty seedlings from each treatment were planted out in the mainfield in July 1962. Observations made in June 1963 showed that all the plants in either of the treatments had established themselves.

The morphological data of the seedlings were collected during the month and these are under examination.

c) Study of different shade crops, other than banana, for the arecanut nursery:

This experiment was laid out during July 1962 in order to find out the suitability of the following crops as shade for the arecanut seedlings in the secondary nursery.

1. *Crotalaria anagyroides*
2. *Coccinia indica*
3. *Cyamopsis psoraloides* (cluster beans)
4. *Tripsacum laxum* (Gautemala grass)
5. No shade crop (control)

A 5 x 5 Latin square design was adopted for the experiment. There were 20 experimental seedlings with a gaurd row all-round for each treatment. The morphological characters of the sprouts were recorded at the time of transplanting in June. All the shade crops were planted in September following. Manuring and other cultural operations were given according to the requirement of each crop.

The vines of Coccinia spread rapidly over the *pandals* and formed a dense green canopy over the seedlings. The other three shade crops also grew up well and provided the seedlings with varying intensities of shade.

The morphological data of the seedlings under the different treatments have been collected and are under examination. However, a visual

examination of the seedlings indicated that those raised under Coccinia are more healthy and vigorous than those raised under the other crops. Those raised under *C. anagyroides* were stunted in growth and the foliage was pale green in colour.

The vines of Coccinia came into bearing in December 1962, about three to four months after planting, and upto the end of May 1963 had given an yield of 266 kg. of fresh fruits valued at Rs. 42/-. The vines were still bearing crops. The cluster bean crop gave an yield of 3.5 kg. valued at Rs. 0-56 nP. upto the end of May 1963, and completed its life.

VI. B. Cultural Experiments:

a) 1) Determination of optimum spacing in the mainfield:

The experiment is intended to determine the spacing to be given to the arecanut palms in the mainfield to obtain optimum yield, and was planted in November 1958. A randomised replicated design has been adopted with six replications. The following are the six spacing under study.

1) 6' x 6'
2) 6' x 9'
3) 6' x 12'
4) 9' x 9'
5) 9' x 12'
6) 12' x 12'

In the experimental plots a number of plants were found to be affected by sun-scorch. The number of plants thus affected was found to be different in different treatments, and therefore counts of the number of plants thus affected were made in order to see the effect of spacing on the extent of sun-scorching. The percentage of sun-scorch affected palms under different treatments of all the six replications is given below:

Spacings		Percentage of sun-scorch affected palms
1) 6' x 6'	...	7.1
2) 9' x 6'	...	12.6
3) 12' x 6'	...	46.1
4) 9' x 9'	...	50.7
5) 12' x 9'	...	71.3
6) 12' x 12'	..	85.7

(For this study all the trees –both experimental and border – in each treatment have been taken into account.)

From the above, it will be seen that as the spacing between plants increases there is a progressive increase in the number of plants affected by sun-scorch.

The data on morphological characters, viz., girth at the permanent mark, girth at the last exposed node, number of nodes above the permanent mark, height of the last node above the permanent mark, and number of leaves on the crown were recorded and are under statistical study. The mean data are however presented in Table XV.

From the Table, it can be seen that the treatment differences in respect of the girth at permanent mark and number of leaves in the plant are not marked. However, girth at the last node is less in the case of close spacings of 6' x 6' and 6' x 9' as compared to others. Again, plants in 6' x 6' treatment have produced largest number of nodes and made greatest amount of height-growth.

During the year a number of palms in the experimental plots started flowering. Data on production of spadices were recorded in each treatment.

2) Effect of depth of transplanting seedlings-cum-intervals of Irrigation on growth and yield:

The land on which the trials were proposed to be laid out did not come into possession and therefore planting could not be taken up.

(3) Effect of different methods of intercultivation on the productivity of palms:

The land on which the trials were proposed to be laid out did not come into possession and therefore planting could not be taken up.

(4) Study of intercrops and associate crops in arecanut gardens:

This experiment is intended to find out whether growing of certain intercrops in the arecanut gardens has any adverse effect on the performance of the palms. The crops proposed for trial are banana, pineapple, ginger, pepper and betelvine.

It is programmed to lay out the experiment in a garden proposed to be raised for the purpose. However, spacimen plots of the above intercrops as well as such crops as elephant-yam and arrow-root were planted for

studying their performance under the shade of arecanut palms preliminary to laying out the trials.

(5) **Relative performance of different green manure and cover crops in arecanut gardens:**

This experiment is intended to find out the effect of growing some of the common green manure and cover crops in arecanut garden on palm performance, and it is programmed to lay out the trials in a garden proposed to be raised for the purpose. However, specimen plots of the following crops have been opened to find out their performance under the shade of the arecanut palms as a preliminary to laying out the trials.

1. *Pueraria javanica*
2. *Calapogonium muconoides.*
3. *Centrosema pubescens*
4. *Tephrosia candida*
5. *Crotalaria anagyroides*
6. *Crotalaria striata*
7. *Sesbania speciosa*
8. *Crotalaria walkeri*
9. *Indigofera endecaphylla*
10. *Mimosa invisa var inermis*
11. *Stylosanthes gracilis*

Observations carried out in the plots sown in June 1962 with different green manure crops have confirmed the earlier observation that *Pueraria javanica* and *Calapogonium muconoides* are highly suitable for cultivation in arecanut gardens and give a closo cover to the soil.

Observations collected in the collection plots have also shown that *Stylosanthus gracilis* and *Mimosa invisa* var *inermis* also grow satisfactorily under local conditions.

6) **Investigation on different types of *Areca* under rainfed and irrigated conditions:**

This trial is intended to find out if any of the types that are known to grow under low moisture conditions in the different arecanut growing tracts of the country can be grown as purely rainfed crops or with limited irrigation.

For this purpose a few of such types had been collected earlier from the different Regional Stations of the country. However, it has now been decided to combine the study of drought resistant types with the cultivar survey proposed to be taken up shortly.

Therefore the different types collected earlier have been planted out in the indigenous type collection plot for a study of the performance.

7) Effect of growing banana in arecanut gardens for different durations:

A plot of about one hectare on the northern side of the farm was terraced and kept ready for planting during 1963-'64 an experiment to determine the effect of growing banana for different durations as intercrop with arecanut.

8) Relative performance in the mainfield of plants of different ages at the time of planting and of single, double and treble transplants of the above ages:

9) Drainage experiments in arecanut garden:

As the land on which these two trials were proposed to be laid out had not yet come into possession, the trials could not be laid out.

10) Mixed garden of arecanut and coconut:

An area of 0.2 ha. required for the experiment was got ready and the coconut seedlings will be planted in 1963-'64.

Other Studies:

a) Assessment of the benefits accrued by adopting the improved agronomic and plant protection practices advocated by the Central Arecanut Research Station:

It was reported in the last report that in order to make an assessment of the beneficial effect of adopting the cultural manurial and plant protection practices as advocated by the Station for arecanut gardens in relation to the practices which the local growers are now adopting, an observation trial had been initiated during the year in a garden planted in 1957.

During the year the plots required for the two sets of treatments were demarcated and the trees numbered.

The treatments are proposed to be given in early 1963-'64.

b) Effect of different spacings and method of lay out on the incidence of sun-scorch on arecanut palms:

Stem breaking is a very serious problem in most of the arecanut growing tracts, and particulary so in south Kanara and North Kerala regions. This is caused by the cumulative effect of scorching by the sun's rays, the southern and south-western sides of the palms.

There is a belief among the growers that aligning the trees in the north-south direction reduces such damage due to the protection that each successive tree in the row gives to the next tree. This experiment was initiated to find out to what extent this belief is true, and was laid out in November 1960. The plants were spaced at 8' x 8', 9' x 9' and 12 feet quincunx, and one set of such trees was aligned in north-south direction and another set at an inclination of 20° to north-south direction. The lines were run with the help of a magnetic compass

The plants have so for not attained the height required to give protection to the neighbouring palms.

c) *The study of the influence of seednut maturity on palm performance.— Observational trial*:

With a view to find out the performance in the main-field of palm derived from nuts collected at different stages of maturity, such as nine, nine-and-a-half, ten, ten-and-a-half months, an observational mainfield trial was laid out during the year. Fifteen seedlings were planted under each treatment. The morphological data of the seedlings were collected at the time of planting.

The planting material for the above trial was obtained from the stock raised for the corresponding nursery trial which has been discussed earlier, and thus this observational trial is a follow up of the nursery trial.

d) *Study of the effect of age of trees, order of bunches and Positian of seednut in the bunch on seednut performance*: — *Mainfield observational trial*:

With a view to determine the performance in the mainfield of stock derived from seeds collected from palms of different ages (young—10 to 15 years, middle-aged 30 to 35 years, and old palms—above 50 years), 36 seedlings derived from two palms (at 18 seedlings per palm) for each of the above three age groups were planted out during the year in the mainfield, at a spacing of 9' x 9' as an observational trial. The 18 seedlings of each age group are made up of six seedlings derived from seednuts collected from each of the three bunches produced by the palm during the main harvest period. These six again are made up of two seedlings each raised

from the nuts located in the bottom, middle and top of each of the three bunches. There are thus 108 seedlings planted for the trial.

The stock for the planting again was obtained from the corresponding nursery trial which has been discussed earlier in the report, and thus this trial is also a follow up of the nursery trial.

VI. C. Manurial experiments:

1. Response of seedlings of varied time of germination to different levels of manuring:

The object of this experiment is to study the growth response of seedlings obtained from the seednuts which germinated at the different periods from sowing, to three different levels of manuring, and was initiated in 1960-'61. The experiment was laid out on a 9 x 4 randomised block design with the following treatments.

Period of germination:

1) Early (germinated within 50 days of sowing),
2) Late (germinated within 50 to 58 days of sowing) and
3) Very late (germinated after 58 days of sowing).

Manurial doses:

	N	P_2O_5	K_2O	
1) No manuring	0	0	0	Pounds per acre
2) Moderate manuring	75	25	75	
3) Heavy Manuring	150	50	150	

The results of the first year trial showed that manuring significantly increased the growth of the seedlings over no manuring. There was no significant difference between moderate and heavy manuring. Seedlings obtained from the seednuts which germinated at different periods from sowing also did not show any significant difference in response to the treatment.

The morphological data of the seedlings of 1961-'62 experiment were collected and the data analysed. The results are presented in table XVI.

It can be seen that the main effect of manuring is found to have significantly varying effect on all the morphological features. The vigour of the seedlings increases with manuring. But there was no significant difference between moderate and heavy manuring. The main effect of time of germination of nuts is not found to be significant. These results

are in conformity with the previous year's result. The analysis of the morphological data of sprouts (pre-treatment data) showed that there was significant difference as regards morphological characters of the sprouts obtained from early, late and very late germinated nuts, earlier germinated seednuts giving more vigourous sprouts. This initial difference in vigour of the sprouts in the primary nursery due to earliness in germination is however found to get evened up during their growth in the secondary nursery.

The experiment was repeated during the current year. The morphological data of the seedlings were recorded and are under examination.

2) Determination of optimum requirements of N P K in the mainfield:

This mainfield experiment is intended to determine the optimum manurial requirements of arecanut palms for producing vigorous, early bearing and heavy-yielding palms. The experiment was laid out in 1961 on a 34 confounded factorial design as a single replicate in nine plot blocks with 20 seedlings per treatment.

The following are the treatments:

Nutrients or manure:	**Levels:**			
Nitrogen	0,	50 &	100	pounds per 500 palms.
P_2O_5	0,	40 &	80	
K_2O	0,	75 &	150	
Green leaf	0,	7500 &	15000	

The morphological characters viz., girth at collar-region and number of functioning leaves of the plants in the experimental plots were recorded at the time of planting. Soil samples were collected just before the first application of manure at three depths, namely, 0-6", 6"-18" and 18" 36" and at nine points in each treatment plots, one composite sample of these for each depth being then taken. These are awaiting analysis.

Application of the scheduled doses of manures was completed in November, 1962.

3) Simple Manurial Trials on arecanut in ryots' gardens:

Twelve Simple Manurial Trial units had been laid out in 1960-'61 in private gardens in and around the Central Station. During the year under report, scheduled doses of manures were applied for the experimental palms under all the twelve units.

The morphological data of the palms were recorded in December 1962 and yield data were collected during the harvesting season from November 1962 to March 1963.

The relevant data for 1962-'63 have been sent to the Agricultural Officer, Indian Central Arecanut Committee, Kozhikode for analysis.

4) Effect of applying N P K in organic and inorganic forms on palm performance:

There is a common belief among growers that application of inorganic manures continously exhausts the palms and shortens their economic life. There is also a belief that if a garden which has been receiving fertilizers is changed over to organic manures, the tree refuses to respond. This experiment was programmed to determine how far the above notions are correct.

A five-year-old standing garden acquired during 1960 '61 was earmarked for taking up this experiment.

The lay out of the experiment is being finalised in consultation with the Statistician, Institute of Agricultural Research Statistics, New Delhi and it is expected that it will be possible to initiate the trials in September 1963.

5) Relative merits of different nitrogenous fertilizers:

The land on which the trials were proposed to be laid out did not come into possession and therefore planting could not be taken up.

VI. D. Miscellaneous:

1) Uniformity trials-- Collection of yield data of palms:

This study was initiated in 1958-'59 in a private arecanut garden to determine the optimum number of trees required for experimental plots and the shape of such plots. For this purpose, five hundred and seventy palms of identical age and of more or less uniform growth were selected. The palms were being given uniform manurial and cultural treatments from the begining.

Data on morphological characters and yield of these palms were collected regularly from 1958-'59 and also during the year under report. For yield, the number and weight of ripe arecanuts were recorded bunch-wise. For the purpose of calculating ratio of fresh and dried produce fruits from 75 trees selected at random were dried, and the weight of dry-whole nuts and their respective kernels (Chali) were recorded bunch wise.

The yield data for the years 1958-'59 and 1959-'60 were analysed statistically and the results indicated that the order of co-efficient of variation was lesser in the year 1959-'60 as compared to the previous year, and as such the number of trees required for the estimation of the treatment differences with a precision at 5% level was lesser for both four and eight plot blocks.

It was also observed from the results of 1959-'60 that the reduction in the co-efficient of variation was not marked when the plot size was increased from 12 to 24 trees.

The yield data collected during 1960-'61 were analysed statistically and the results are presented in Table XVII.

It can be seen that the order of co-efficient of variation is lesser this year than in the two previous years, and this has resulted in reduction in the number of trees required for estimation of the treatment differences with a precision of 5% for both four and eight plot blocks.

3) Project to find out weight ratios of raw and processed arecanuts and cost of processing per pound of processed nuts:

This project is intended to find out the weight ratio between raw or fresh arecanuts and the final produce, and the data was to be utilized for the correct estimation of the production of processed arecanut in this tract. The project was initiated during 1960-'61 in two representative centres where 'Chali' or 'Biligotu' is prepared, viz., Iritty in Cannanore district of Kerala State and Vittal of Mysore State. In each centre the data were collected in the yards of one progressive cultivator who undertakes curing himself, and one curer who processes the fresh fruits purchased from the growers. The collection of data was repeated in 1961-'62 and also in 1962-'63.

Besides recording the data pertaining to the actual project, detailed particulars regarding the method of processing, the type of produce, quality and quantity of the produce, marketing arrangement and economics of arecanut cultivation were also gathered.

Complete data and the relevant information were sent to the Secretariat for analysis

4) Influence of different strengths of alkali on the retting of arecanut husk:

This study was initiated in 1961-'62 on the suggestion of the Senior Scientific Officer, Arecanut Technology Unit, and is intended to find out

if the husk of arecanut can be softened by treating it with alkalies and thereby rendered easy for packing. Treatment with 1.0%, 2.5% and 5.0% lime solution for 20 and 40 days were tried and it was found that the husk kept soaked for latter two concentrations for 40 days had softened to the maximum extent.

The trial was repeated during the year with the same concentrations but the three periods of soaking were employed *viz.*, 15, 25 and 40 days. A six kg. sample of dried husk was utilized for each treatment.

On examination of treated samples it was found that the samples soaked in 2.5% and 5.0% solutions for 25 and 40 days had softened most and could be pressed easily into bales. The other samples did not get softened sufficently to lend themselves to packing as above.

PESTS AND DISEASES:

VII. 2) Trial with proprietary fungicides and insecticides to find out effective control measures for all diseases and pests:

1) Control of mites: (White mite—Paratetranychus indicus; Red mite—Raoiella indica) ou arecanut with different miticides including systemics:

Trials on the control of mites were initiated in 1959 60 and it had been proposed to continue these trials for confirmation of results already obtained as well as to find out the efficacy of a few new preparations, and for this purpose the required plots had been planted out, but as the incidence of the pest was very low during the year, the trials could not be taken up.

In one part of the nursery, however, a severe infestation was observed over a small area and some observational trials were conducted here with the following miticides in the concentrations shown against each.

1.	Chlorocide—Malathion liquid	... 1 kg. in 640 litres
2.	Sultaf (wettable sulphur)	... 1 kg. in 150 litres
3.	Akar—338	.. 1 cc. per litre
4.	Trithion	... 6.7 cc per 10 litres
5.	pp 175 Sayfos	... 3. gm. per 100 litres
6.	Control	... No spraying.

The spray application was done only once in the peak season of infection. The population count of the pest was taken before spraying and again 20 days after spraying. The data obtained are given below.

S. No.	Treatment.	Pre-treatment count of mites per sq. cm.	Post treatment count of mites per sq. cm.
1.	Chlorocide-Malathion liquid	14.83	—
2.	Akar-338	21-17	—
3.	Trithion	17.11	6.44
4.	pp 175—Sayfos	18.12	8.50
5.	Sultaf	20.00	15.00
6.	Control (unsprayed)	20.00	25.00

From the Table, it can be seen that there was no reinfestation of mites on the plants sprayed with choloride-Malathion liquid and Akar-338 but that colonies appeared on those sprayed with Sultaf, pp 175-Sayfos and Trithion- The control plants continued to harbour large colonies.

These trials therefore have brought out that Chlorocide – Malathion liquid and Akar-338 are ovicides as no further colonies appeared on the plants, while the others are toxic to the pest at the adult stage only and not at the egg stage, and discontinuance of spraying therefore resulted in emergence of fresh colonies of the pest.

2) Trials with different soil insecticides in the control of white grubs *(Lepidiota* sp.**) on arecanut:**

Trials with application of Intox-'8' liquid and Heptachlor were taken up in two gardens near Vittal during the year. The data collected are under examination.

3) Trials to find out cheap and effective fungicides against 'Koleroga' or 'Mahali' with and without adhesives:

'Koleroga' or 'Mahali' caused by the fungus *Phytophathora arecae* is one of the major diseases of the arecanut palm and accounts for enormous losses of crops in most arecanut growing tracts. Trials on the control of this disease were continued during the year under report.

A field trial with four trees per treatment was laid out on a 8 x 4 randomised block design with the following treatments.

S. No.	Treatments	Dose
1.	Fytolan	1 kg. in 200 litres of water.
2.	Coppesan	
3.	Blitox	

4.	Fytolan	1 kg. in 100 litres of water.
5.	Coppesan	
6.	Blitox	
7.	Bordeaux mixture	One per cent.
8.	Control	No spray.

The three preparations mentioned in 1 to 6 above are copper oxychlorides and contain 50% active copper. The copper content in the suspension made of 1 kg. in 200 litres is 25%, and this is equal to the copper content in Bordeaux mixture, the standard fungicide. In these trials, the higher concentration, namely, 1 kg. in 100 litres of water was included in order to find out whether higher concentrations will improve their efficacy in controlling the disease as it is the common experience that in places of heavy rainfall these are not as effective as Bordeaux mixture when employed on equal copper basis. However, there was no incidence of 'Mahali' in the experimental plots during the year, and therefore the efficacy of the fungicides could not be evaluated.

It was however found in these trials that the fruits which had received treatments with the oxychloride showed copper spray injury to varying extent, those receiving the higher concentrations displaying deeper and wider injury than the lower concentrations. The injury took the form of greenish brown sunken spots of varied sizes which turned black later on. The injury had reached the kernels in most cases, thereby detracting its quality also. The injured fruits either turned yellow prematurely or cracked and were then shed. The data of the percentage of fruits thus injured under each of the treatments are given below:

S.No.	Treatment		Percentage of nuts showing copper injury
1.	Fytolan—0.5%	...	0.851
2.	Coppesan—0.5%	...	0.246
3.	Blitox—0.5%	...	0.885
4.	Fytolan—1.0%	...	5.375
5.	Coppesan—1.0%	...	1.947
6.	Blitox—1.0%	...	5.986
7.	Bordeaux mixture—1%	...	0.087

It can be seen from the above data that Bordeaux mixture has done least amount of damage by way of spray injury, and among the oxychlorides, Coppesan has caused the least damage.

The trials are being repeated.

Two samples of injured fruits in each were collected and the dried pericarp was got analysed for copper content at the Central Coconut Research Station, Kayamkulam. The results are presented below:

S.No.	Treatment	Copper (Cu) in ppm	Remarks
1.	Fytolan—1%	297	
2.	Fytolan—1%	302	Expressed on basis of oven-dried materials.
3.	Blitox—1%	569	
4.	Blitox—1%	330	
5.	Coppesan—1%	272	
6.	Coppesan—1%	307	
7.	Spray uninjured fruits	136	

From the obove Table, it will be seen that in general there is higher deposition of copper in the injured nuts as compared to the uninjured ones and that Coppesan which has done least damage in terms of number of fruits affected caused the least amount of copper deposit on the nuts.

In 1961–'62 one set of trials of an exploratory nature had been laid out to determine whether the adhesive property of the oxychlorides, if improved by the addition of adhesives would increase their efficacy. Two oxychlorides, namely, Coppesan and Blitox and Bordeaux mixture were included in the trial and were employed with and without adhesives. The trials however remained inconclusive due to the absence of the disease during the year.

4) Study to find out the causes and methods of control of button shedding and tendernut fall:

As a preliminary to devising control measures for button shedding and tendernut fall, which are major problems in all arecanut gardens, freshly dropped buttons and tendernuts were collected to find out the cause of the shedding. On an average 81% of the buttons were found affected by the fungi *Gleosporium* sp. and *Diplodia* sp. The fungi prevented the opening of the female flowers by making dense growth on the tip of the flowers, and this prevented pollination and brought about shedding.

In addition, it was also observed in a few private gardens that many of the nuts which had shed prematurely had minute cuts or punctures on the tender basal portion. In most cases the punctures had extended upto the surface of the kernel and the kernel was rotting. The puncture had evidently been caused by an insect, From the kernels thus affected, a fungus and a bacterium were isolated. These are under study. The fungus was isolated on 4% arecanut extract agar medium which was prepared at the Station.

Information on the insect affecting the fruits and on the characters of the fungi and bacteria isolated from the nuts is being collected.

Trials carried out earlier at the Station had shown that spraying the inflorescences with a combination spray of copper fungicide and Endrex (125 cc. of Endrex added to 100 litres of Bordeaux mixture) effectively controlled premature. shedding.

Observations carried out in ryots' gardens where the above treatment was given to the bunches confirmed the earlier results on the efficacy of this combination spray.

5) Control of yellow leaf spot of arecanut:

Trials with different chemicals could not be taken up as the incidence of the disease was negligible during the year.

7) Study of collar-rot of seedlings and influence of soil micro-organisms:

The incidence of collar-rot was very low during the year and therefore the studies could not be taken up.

8) Studies on the control of sun-scorching of stem:

The stems painted with California lime wash, Chaubattia paste and plastic emulsion paint in 1961-'62 are under observation for resistance to sun-scorch.

11) Studies on the retention of copper fungicides on sprayed fruits:

Copper fungicides when sprayed on the surface of the fruit gives it protection from fungal infection. In tracts of heavy rainfall, however, the spray deposit is washed off gradually and the fruit becomes increasingly vulnerable to infection.

Information on the period for which the protective cover lasts on the surface of the nuts will enable the grower to decide on the frequency with which the spray is to be done. One method of obtaining this is by

estimating the copper content on the surface of the nut at periodic intervals following spraying. Another method is artificially inoculating the nuts with fungal culture at different intervals after the first spray and determining the stage at which the nuts catch infection due to the absence of the protective cover.

The second method namely, artificial inoculation of the nuts with culture of *Phytophthora arecae* at different intervals after the first spray initiated during the previous year was repeated during the year. Four bunches of almost equal age in four trees were sprayed with one percent Bordeaux mixture in the third week of May 1962 just prior to the onset of monsoon. Fourteen nuts in all from the bunches were collected at intervals of ten days, starting from 17th July 1962, and were immediately inoculated with the fungal culture under uniform conditions in the laboratory. The data on the number of nuts inoculated, and the number of nuts that caught infection were noted. These are given below:

Date of inoculation (1962)	No. of nuts inoculated	No. of nuts infected	Percentage of infection
17th July		4	28.55
25th July		5	35.71
31st July		5	35.71
8th August	14 each occasion	5	35.71
17th August		—	—
24th August		1	7.14
1st September		—	—
7th September		5	35.71
15th September		3	21.42
21st September		—	—
29th September		—	—
6th October		—	—
15th October		2	14.78

No conclusive inference could be drawn from the results. The experiment is being repeated.

12) Susceptibility of arecanut to 'Koleroga' at different stages of maturity:

Exploratory trials to determine the stage upto which the arecanut fruits take infection from *Phytophthora arecae* causing 'Koleroga' were taken

up during the year. Information on this aspect will be useful in deciding upon the time at which the spraying is to be done and the stage at which the spraying may be discontinued.

The experiment initiated in 1960–'61 was repeated during the year. In March–April 1962 a few inflorescences produced during the months were selected and the date of opening of the female flowers was recorded. Starting from 17th July 1962 (the peak period of infection in the field) two nuts were collected from each of the bunches at an average interval of nine days. The collected nuts were innoculated immediately with the fungal culture in the laboratory under uniform conditions. The percentage of nuts that caught infection is given in Table XVIII.

It is evident from the Table that there is a decrease in the susceptibility of the nuts to fungal infection with increasing maturity. This result is in conformity with that obtained in the previous year.

13) Observations on exploratory demonstration plots where package treatments are laid out:

During the previous year one set of "package plan" trials was laid out in four growers' gardens, where the general health condltions of the trees was poor and the yield sub–normal, with a view to find out to what extent these treatments will improve the general condition of the trees and their yield.

Applicatlon of the macro and micro nutrients was done as per schedule adopted in the previous year. The following were the treatments given.

Dosage per palm per year:

Micro–nutrients:

i)	Ferrous sulphate	..	56.70 gm.
ii)	Sodium borate	..	2.268 gm.
iii)	Manganese sulphate	..	68.04 gm.
iv)	Copper sulphate	..	22.68 gm.
v)	Zinc sulphate	..	22.68 gm.
vi)	Sodium molybdate	...	2.268 gm.

Macro–nutrients:

i)	Lime—wherever soils were acidic	...	454 gm.
ii)	Green leaf	...	12 kg.
iii)	Ammonium sulphate	..	142 gm.
iv)	Super phosphate	....	227 gm.
v)	Muriate of potash	..	114 gm.

The controls received the same manurial treatment as is usually given by the grower himself. Both the plots, treated as well as control, received the usual rounds of irrigation and prophylactic sprays against disease. Quarterly observations on the morphological characters such as condition of the crown, number of leaves, condition of leaves, number of bunches and number of inflorescences were recorded. The yield data of the experimental palms were also maintained. The observations will be continued.

14) Studies of organisms (other than Phytophthora arecae) that cause rotting of fruits and impair keeping quality:

In 1961-'62 one set of trials which involved spraying the inflorescences with fungicides at different stages had been initiated in order to find out the exact stage of infection with organisms other than *Phytophthora arecae* that cause rotting of fruits and impair keeping quality in a private garden.

As there was however large-scale shedding of female flowers in the trees under trial the studies could not be pursued.

15) Study of spray injury to the palms.

This study is combined with the item (11) above.

16) Study of the palms showing symptoms similar to 'Band' in the primary and secondary nurseries and their behaviour in the mainfield:

An observational trial plot was laid out in the farm in order to gather more detailed information on seedlings showing 'Band' symptoms. observations were continued in the case of 14 stunted and 14 normal sprouts of the same age transplanted in the mainfield during the previous year. The morphological data of the sprouts were recorded in June 1963 and the mean data are presented below:

Treatment	Mean girth (cm.)	Mean height (cm.)	Mean No. of leaves.
Stunted (showing 'Band' symptoms)	3.2	97.9	4.2
Normal	8.7	237.3	6.2

It can be seen that the stunted seedlings continue to grow at a slow rate, and are considerably behind the normal plants.

In another set of trials stunted sprouts ranging from eight to thirty-two found in the stock raised from six mother-palms were selected and were

planted out in the secondary nursery along with an equal number of normal sprouts obtained from the same parent palms for a study of the performance in the secondary nuysery, and later in the mainfield.

17) Other problems evoked in the course of studies:

a) Seed treatment experiment:

These trials have been undertaken in order to find out if nursery diseases such as yellow leaf spot, wilt etc. recorded in recent years, which are presumed to be seed-born can be controlled by treating the seed with fungicides before sowing. The experiment was first laid out in 1960-'61 with five chemicals. The results. showed that seedlings raised from seednuts treated with Dithane-Z-78, Tillex and Leytosol were healthy and showed less infection of yellow spot and such other fungal diseases in the nursery. The experiment was repeated during the year. Since Dithane-Z-78 was not available at the time, this formulation was substituted by Merculine. The following were the treatments.

S.No.	Treatments	Concentrations
1.	Ceresan (wet) solution	12 gm. in 12 litres of water
2.	Leytosol	8 gm. in 12 litres of water
3.	Cuprous oxide	60 gm. in 12 litres of water
4.	Merculine	15 cc. in 12 litres of water
5.	Tillex liquid	78 cc. in 12 litres of water
6.	Control (without any treatment).	

The seednuts were dipped in the solution for three to five minutes before sowing. The experiment was laid out on a 6 x 4 randomised block design with 50 nuts per treatment. The germination counts were recorded regularly. The average percentage of germination for the different treatments and control ranged from 87.5 to 94.5, control giving the maximum germination of 94.5%.

The seedlings will be transplanted to the secondary nursery for further observation.

b) Foliar spraying with micro-nutrients:

The plants sprayed with the different micro-nutrients in 1961-'62 did not show any appreciable difference in growth from the control at the time of field planting in July 1962.

d) Micron spray trials:

Due to non-availability of a micron sprayer, the trials could not be taken up.

Trials with nickel chloride:

During the year trials with nickel chloride were conducted to determine its efficacy as an eradicant fungicide. This chemical has been found to be very effective as eradicant of *exobasidium vexans*, the fungus causing 'Blister blight' in tea.

Initially, spraying trials were conducted on the crowns and bunches of a few selected palms with concentrations of 100, 150, 200, 300, 500, 1,000 and 2,000 ppm in order to find out the tolerance limit to this chemical.

Observations made a week later showed that concentrations less than 500 ppm did not produce any phytotoxicity, 500 ppm showed slight foliage injury in the form of brown patches here and there and 1000 and 2,000 ppm caused severe injury to the foliage in the form of large number of brownish patches. These concentrations also produced brownish burnt patches on the tender fruits, especially on the tips.

Bits of pure cultures of *Phytophthora arecae* were planted in petri dishes containing P D A. treated with 100, 150, 200, 300 and 500 ppm of nickel chloride. The controls were kept on pure P D A medium. No inhibition of growth of the fungus was noticed in any of the dishes treated with the chemical.

Subsequently, freshly infected fruits, fifteen in number for each treatment were sprayed in the laboratory with the above concentrations of the chemical. Here again no inhibition was noticed, and the fungus developed on the fruit surface as under normal condition. These trials were followed by trials with same concentrations on equal number of fruits as before for each treatment on which the fungus growth had developed into a felty white mass. In this instance again, no inhibition of fungal growth was noticed. Further trials are underway.

Isolation of a new fungus on arecanut:

A fungus was isolated from the leaf spot lesions on arecanut leaves collected at Sakhigopal, Orissa. The isolate was sent to the Central Coconut Research Station, Kayamkulam and was identified as a species of *Trichoderma*, a common secondary invader on tissues infected by other fungi.

Further studies on this fungus are underway.

F. General:

A. Farm Management and Development:

a) *Arecanut gardens*:

i) **Bulk garden (1957)**: This garden was planted in 1957 and covers an area of 2.23 hectares (5.5 acres). Maintenance operations such as protecting the stems from the afternoon sun by means of arecanut leaf or leaf-sheath tied round the stems, weeding and mulching round the bases of palms during summer months, irrigating and manuring were carried out as per schedule. A crop of *Tephrosia purpurea* (Kolinji) was raised in the garden as green manure crop. The breached up embankment on the southern side was re-built to prevent entry of river water into the garden during floods.

The second crop of the garden was harvested during the year and an yield of 2,09,748 fruits was obtained. These, on drying and husking, gave an yield of 2,815.2 kg. of kernel which fetched a price of Rs. 8,770.21 nP.

Out of a total number of 3,207 palms in the garden, 2,528 or 78.9 per cent were in bunches during the year, as against 54.0 per cent during the preceding year. The average number of bunches per bearing tree was 4.2.

ii) Experimental gardens: The experimental gardens consisting of spacing trial, method of lay out, NPK trial etc. were also maintained in good condition by giving timely attention to cultural and manurial operations.

b) *Arecanut Nurseries*:

i) **Arecanut Nursery—1960-1962**: This is the sixth nursery of the Station. The distribution of seedlings was continued during the year, and as on 30 – 6 – 1963, 43,706 seedlings had been sold from the nursery including 8,572 numbers sold in 1962. The percentage of quality seedlings obtained from this nursery to the number of seednuts sown worked out to 65.6. The cost of production of seedlings worked out to Rs. 0—16 nP. each.

ii) **Arecanut Nursery—1961-1963**: A total number of 88,306 sprouts were transplanted in the secondary nursery. The nursery beds were mulched with green leaf at the rate of 18,000 kg. per hectare immediately after transplanting. A second mulching was given in August-September 1962. In addition to the crop of banana raised for providing shade, seeds of *Crotalaria anagyroides* were also sown along the southern and western boundaries of the nursery beds during November and December 1962.

The nurseries were top-dressed with nitrogenous fertilizers twice during the months of October 1962 and February 1963. The nursery beds were irrigated beginning from middle of November 1962 to end of April 1963.

The seedlings in the nursery were sprayed against pests and diseases as and when found necessary. The major pest noticed was the mite.

Distribution of seedlings from this nursery was commenced in April 1963, and 12,558 seedlings were sold to growers.

iii) **Arecanut Nursery—1962-64:** Procurement of seednuts for this nursery from premarked mother-palms was commenced in November 1962. A total of 94,376 seednuts were sown in the primary nursery during the months beginning from November 1962 to end of January 1963. The nuts recorded 94.36 percent germination.

Field was prepared for transplanting the sprouts, and planting was commenced in the second week of June 1963.

iv) **Selection of mother-palms and procurement of seednuts:** All the 1,201 parent palms marked during the earlier years were checked for their performance and other characters and only 993 palms distributed in 27 private gardens were finally retained. During the year 1,11,516 seednuts were procured from these palms, out of which 99,516 were sown in the Station under bulk as well as experimental nurseries, and the rest (12,000) were sent to the Regional Arecanut Research Station, Palode.

(*c*) *Green manure and cover crops and shade trees*:

Cutting of *Gliricidia maculata* numbering 1975 were planted in the vacant lands for production of green leaf. The cuttings and seedlings planted during previous years are coming up well.

Other shade tree plants like *Eucalyptus grandis*,, *Grevillea robusta* were also planted in small numbers.

Guatemala grass slips numbering 270 were planted for multiplication,

(*d*) *Subsidiary crops*

The coconut palms in the farm were manured as per schedule. The seedlings planted on the boundaries of the Station and on the hillocks during the previous years are coming up well. From the 233 bearing coconut trees, 7,743 ripe nuts were harvested during the period under report, the average per tree working out to 33.

The following planting of subsidiary crops was done.

1.	Cashew layers	24 numbers.
2.	Cashew seeds sown *in situ*.	400 pits.
3.	Pineapple	83 suckers.
4.	Banana variety 'Karibale'	150 suckers.

(*e*) *Plant protection work on the Farm*:

There was only stray incidence of mites in the farm and this was controlled by spraying wettable sulphur. There was also mild incidence of Koleroga' and bud-rot in the main garden in spite of prophylactic Bordeaux mixture spray given at proper time.

All the inflorescences in this garden were sprayed with 0.5% Bordeaux mixture against die-back. Crowns of palms showing symptoms of bud-rot were given surgical treatment and were cleaned and drenched with 0.1% Ceresan wet or dressed with Bordeaux paste. Inflorescences were also sprayed with Endrex against the caterpillar pest. Copper sulphate and time mixture was applied to the plants in the main garden which showed symptoms akin to those of 'Band' disease. Bunches in the main garden were also sprayed with 0.06% Folidol against snails. Exposed stems of palms were protected by tying arecanut leaf-sheath against sun-scorch.

The inflorescences in spacing trial garden were sprayed with 0.06% Folidol against snails and 0.125% Endrex against the new caterpillar pest. Folidol and Metasystox (latter at 0.1%) were sprayed in the NPK experimental garden against scales.

f) *Permanent improvements*:

Field Laboratory: Plastering and flooring the building were completed during the year.

Major constructions: The construction of Laboratory-cum-Administrative building, Guest House and quarters under the charge of the Central Public Works Department made satisfactory progress during the period.

The approach road connecting the Station with the Vittal-Puttur highway was formed and macadamised.

Power supply to the Station: The electrical motors with pumpset installed in the Station were commissioned for work on 2?-11-1962.

Clearing and terracing: An area of 1.5 ha. was cleared of jungle growths and terraced for accommodating the experiment on "the effect of planting banana in arecanut gardens on palm performance."

B. Extension work:

i) *Exhibition*: The Station participated in a number of exhibitions organised by the N. E. S. and other State Organisations at Neralakatte, Manjeshwar, Adyanadka, Manchi and Chippar.

ii) *Advisory work*: The Officers and staff of the Station were in intimate touch with the arecanut growers with a view to get to know their problems and to suggest or find solutions for these. They visited a large number of gardens not only in the South Kanara District, but also in the neighbouring districts of North Kanara, Chickmagalur, Shimoga and Coorg of Mysore State and Cannanore and Kozhikode of Kerala State at the request of the growers to give them advice on the laying out of new gardens rejuvenation of old gardens, raising of nurseries, planting, manuring and plant protection practices.

The number of enquiries received from arecanut growers and State Departments as regards improved methods of cultivation of arecanut and on plant protection practices in arecanut were on the increase and these were attended to promptly.

A large number of arecanut growers, officials and non-officials who visited the Station during the year were taken round the farm and the various items of work in progress were explained to them.

iii) *Training*: Shri S. K. Roy, Assistant Horticulturist, Tripura State was given training on different aspects of arecanut cultivation for about a fortnight.

C. Miscellaneous:

i) *Library*: During the period under report 21 books and 115 periodicals were added to the library.

ii) *Laboratory equipment*: Two more microscopes and one anemometer were purchased for the laboratory during the year.

iii) *Publications*: The following scientific papers were written and sent for publication during the year under report.

1. Additions to the list of abnormalities in arecanut.

2. Increasing fruit-set in arecanut by spray method of pollination.

Besides, the Central Arecanut Research Station contributed material for the 'Questions and Answers' and "Technical News Item" sections of the Arecanut Journal. Reports of the progress of work at the Station were published in the quarterly journal "Agricultural Research" issued by the Indian Council of Agricultural Research, New Delhi.

Some of the pamphlets on different aspects of arecanut cultivation published earlier by the Indian Central Arecanut Committee were revised to bring them in line with the latest findings. Three new pamphlets, namely. on 'Anabe' disease, 'Band' disease and 'root grub pest' were written up.

iv) *Arecanut drier*: The Mechanical drier fabricated by tne Senior Scientific Officer, Arecanut Technology Unit, Central Food Technological Research Institute, Mysore was installed at the Station for trial. The drier was found to be quite useful, particularly for drying the off-season crops harvested during the monsoon months. The working of the drier was very much appreciated by the growers.

v) *Tours*: The Arecanut Specialist inspected the site proposed for the Regional Arecanut Research Station at Sakhigopal, Orissa State in July 1962. He also inspected all the five Regional Arecanut Research Stations under the Indian Central Arecanut Committee as well as the grant-in-aid Arecanut Research Station at Thirthahalli. He examined the working of the grant-in-aid schemes for the investigation of 'Hidimundige', New Yellow leaf Disease and 'Anabe' of arecanut at the College of Agriculture at Bangalore. In addition, he inspected the arecanut nurseries at Periakulam, Kallar and Thimmapuram of Madras State and suggested methods for improving the quality and output of stock from the nurseries.

The Agronomist and other members of technical staff also undertook tours for spot-inspection and advisory work.

vi) *Visitors*: Among the important visitors to the Station were, Shri Anandashram swamiji of Chitrapur Mutt, Shri Sankaracharya of Dwarakapeeth, Shri A. Bhima Bhat, Vice-President, Indian Central Arecanut Committee and members of the Finance and Executive Committee of the Indian Central arecanut Committee, Shri O. D. Garg, Secretary, I. C A. C. and Sri S, G. Aiyadurai, Deputy Chief Development Officer, Indian Central Spices and Cashewnut Committee, Ernakulam.

vii) *Administration:* Shri M. Mohan Rao, Arecanut Specialist continued to be in-charge of the Station during the year.

Shri K. Shama Bhat, Farm Superintendent continued to officiate as Agronomist of the Station till 1-6-1963. Shri K. V. Ahamed Bavappa, Agronomist of the Station rejoined duty after the expiry of the study leave on 1-6-1963 afternoon relieving Shri K. Shama Bhat.

Shri K. S. Nagaraja Rao, Pathology Assistant was transferred to Palode as Research Officer and took charge of the Regional Arecanut Research Station in early March 1963.

Shri N. K. Srinivasa Moorthy, Accountant of the Indian Central Arecanut Committee joined duty as Assistant Administrative Officer at the Station on 22-5-1963.

Kumari M. Leela, Technical Assistant of the Indian Central Arecanut Committee on transfer to this Station joined duty as Botany Assistant on 15-4-1963.

Remarks of Scientific Committee on the previous report and action taken thereon.

	Remarks	Action taken:
1.	The effect of sub-surface drainage provided by tile drains, on the performance of arecanut palm and the feasibility of adopting sprinkler irrigation system in arecanut should be examined.	Provision has been made in the Technical Programme of 1963-'64 to lay out an experiment for studying the effect of sub-surface drainage. Feasibility of adopting sprinkler irrigation is being examined.
2.	The names of treatment should be given in the Tables instead of denoting them by notations as had been done in the report.	The names of the treatments have been given in the present report.
3.	The study of epidemology may be taken up so that the spraying operations might be made on	A meteorological observatory is being set up and the data collected will be correlated with disease

scientific basis through forecasting disease incidence.	incidence. Besides, production and release of *Phytophthora* spores in relation to climatic factors are proposed to be studied.
4. Some more growth regulating substances such as IAA, IBA etc. should be tried to increase fruit set.	Hormones such as IAA, IBA etc. will be tried to increase the fruit-set.

Sd/-
(M. MOHAN RAO)
Arecanut Specialist.

G. Central Arecanut Research Station, Vittal. Technical Programme for 1963-'64.

Item No. in the Technical Programme	Name of the experiment	Year of commencement & completion	Work done so far	Work proposed to be done during the year
(1)	(2)	(3)	(4)	(5)
	BOTANY:			
	Crop improvement:			
I.	**Breeding and genetics of** *Areca*.			
1)	Introduction and maintenance of indigenous and exotic species and types of *Areca* for selection and hybridisation.	1958-'59 To be continued	A total of eight indigenous types and 29 exotic species and types have so far been introduced and are under observation.	Further collections will be made. Survey of the Andaman & Nicobar Islands also is contemplated. *Areca langloisiana* a species recently reported from Celebes will also be collected.
2)	Survey of arecanut gardens to select superior types and assessing genetic variation.	do	A preliminary survey was undertaken at 15 centres in the States of Kerala, Mysore and Bombay and 64 types based on the length and breadth of the fruits were selected.	After the sampling teehnique is worked out, detailed survey will be taken up in the important tracts.

(1)	(2)	(3)	(4)	(5)
	3) Floral biology of *Areca*.			
a), b)	Study of the range of variation in flowering from tree to tree including month-wise variation in flowering in the same garden.	1960-'61 To be continued for five years	Study was started on 200 progenies of ten mother palms and the observations made during '62-'63 show that the largest number of trees produced inflorescences ranging from four to nine and that the maximum percentage of spadices were produced between January and April.	The observations will be continued.
c)	The frequency distribution of number of palms flowering per week during all the weeks. The phenomenon of early flowering etc. to be correlated with fruit production.	1961-'62 To be continued for five years	The daily flowering of the palms in the bulk garden of the Station (8 year old) has been recorded: Yield data also have been recorded.	Study of production of new inflorescences in respect of each palm will be continued. The data will be classified and correlations worked out with yield. Classification of data and correlation study will be taken up.
d)	Floral initiation.	1960-'61 To be continued for five years	—	The data on leaf production and fall will be studied so as to find out the interval between sucessive leaf production, and leaf falls. Collection of inflorescences

(1)	(2)	(3)	(4)	(5)
				at different stages of growth will be taken up to study the development of spadix and the effect of age and season on the production of female flowers.
	e) Study of pollen.	1960-'61 To be continued for three years	Germination percentage of pollen grains (South Kanara type) ranged from 10.8 to 43.9, the highest percentage recorded being in May and the least in July. Storage studies with pollen showed that it can be stored up to 21 days without appreciable loss of viability.	The study will be repeated and extended to exotic types and species. Morphology of pollen of different ecotypes and species will be studied.
	4) Hybridization and selection:			
	a) Standardisation of crossing technique.	1958-'59 To be continued for five years	Of the different materials tried for use as pollination bags, trayophane paper was found to be good but for the limitation that large bags made of this gets tern off in heavy winds. Spraying	Other gauges of tryophane will be tried. The spraying method of pollination will be tested.

(1)	(2)	(3)	(4)	(5)
			pollen suspended in sucrose solution (0.5%) was found to be an effective and easy method of pollination.	
b)	Production of inbred lines of distinct types.	1960-'61 To be continued	Two inflorescences in each ef the two palms in the local type and a number of flowers in the four exotic types were selfed.	Selfing will be repeated on two distinct local types and four exotics. Open pollinated nuts will also be collected. The progenies will be compared.
c)	Hybridization between distinct types and selected palms to combine high yield and regular bearing, and study of progenies.	do	Crosses were effected in two sets of four selected palms of the South Kanara type. Reciprocal differences were noted in regard to the set of nuts.	The crosses will be repeated for confirmation. Work on hybridisation between distinct types will be also initiated so as to get desirable combinations in both the sets.
d)	Hybridization between exotic and indigenous types.	1962-'63 To be continued	Crosses made between the four exotic palms and ten palms of the local type showed incompatibility to varying extent.	Crosses will be repeated for confirmation. Seednuts obtained from the previous crosses will be sown for raising seedlings.
5)	Preliminary studies on progeny behaviour of mother palms.	1960-'61 To be continued	Different vegetative and fruit characters in respect of 200 progenies of ten mother palms are being recorded.	The observations will be continued in respect of all the progenies of a few mother palms. Characters, such as size, shape and

(1)	(2)	(3)	(4)	(5)
				colour of nut, number of nuts per bunch, number of bunches per tree etc. will be studied in the mother palms as well as in progenies. Progeny study will be extended to a few outstanding ones of the present progenies selected from each mother palms. Progenies will be studied on an appropriate design.
6)	Effect of selection of seed nuts on germination and future performance.	1963-'64 To be continued	—	Time of starting germination and total germination percentage in respect of four types of seeds (a) collected from bulk harvest, (b) selected from the bulk, (c) unselected from marked out mother palms will be studied.
II.	**Root Studies**			
a) i)	Root studies at different ages and under different soil conditions in adult palms.	1962-'63 To be continued for five years	—	The spread and penetration of roots will be studied on palms raised *in situ* as well as transplanted ones.
ii)	Root studies in seedlings at different ages.	1963-'64 To be continued for three years	—	Spread and penetration of roots will be studied in the seedlings of primary and secondary nurseries.

(1)	(2)	(3)	(4)	(5)
	b) Root studies in plants showing syptoms similar to "Band"	1963-'64 To be continued for five years	—	The development and spread of roots will be studied both in the 'Band' affected plants and in the normal ones.
III.	**Anatomical Studies:**			
	a) Structure and development of fruit in Arecanut growing under high and low altitudes.	1962-'63 To be continued for five years	—	Structure and development of fruit of the local type will be taken up during the year.
	b) Study of the structure of roots in diseased and healthy plants.	1962-'63 To be continued for five years	—	The anatomy of the roots of diseased plants will be studied and compared with that of the normal.
	c) Study of the anatomy of the leaf of the different ocotypes.	1963-'64 To be continued for five years	—	Sampling technique for the collection of leaf will be standardised with the local ecotype.
IV.	**Cytological Studies:**			
	a) Standardisation of cytological techniques.	1963-'64 1965-'66	—	Techniques for preparing PMC smears as well as root tip squashes will be standardised.
	b) Study of meiosis in different ecotypes of arecanut.	1963-'64 1965-'66	—	Study of meiosis in South Kanara ecotype will be taken up.

(1)	(2)	(3)	(4)	(5)
	c) Karyomorphological studies in different types and species of areca.	1963-'64 To be continued	—	Karyomorphology of the two species *A. catechu* and *A. triandra* will be studied.
V.	**Physiological Studies:**			
	1) Studies on fruit setting and shedding.	1959-'60 To be continued for five years	Spraying the inflorescences with pollen held in suspension in 0.5% sucrose solution was found to increase the fruit set. Effect of certain growth regulators was being studied.	Trials on spraying suspended pollen which have been done only for one season will be repeated. New growth regulators will be tried.
	2) **Inducing mutations in arecanut**			
	a) By irradiation of seednuts (Thermal and Pile neutrons, X-rays and Gamma rays).	1960-'61 To be continued	98 seedlings obtained from the seednuts treated with normal neutron have been planted in the main field. Sprouts were also subjected to X-ray irradiation and seven seedlings obtained.	Irradiation of sprouts with X-rays will be repeated. Observations on the seedlings already planted out will be continued.
	(b) By chemicals (Colchicine etc.)	1961-'62 To be continued	73 seedlings obtained from 320 sprouts treated with Colchicine are in the nursery. Ten seedlings showing formative effects were found to have larger	The seedlings will be transplanted to the main-field. Stomatal and all studies will be continued. A fresh batch of sprouts will be subjected to bolchine treatment.

(1)	(2)	(3)	(4)	(5)
			stomata and cells. One more batch of 544sprouts have been treated with different concentrations of Colchicine.	Observations on the last batch will be continued.
c)	By the use of irradiated pollen in pollination.	1963-'64 To be continued	—	Using X-ray irradiation the lethal dose for arecanut pollen will be determined. Later, pollen irradiated with different doses of X-rays will be used in pollination.
3)	Effect of plant regulators on growth.	1961-'62 To be continued for five years	Studies on effect of MH on seedlings and inflorescences were taken up.	The effect of the giberellic acid on development of fruits will be studied.
4)	Role of micro-nutrients in arecanut.	1961-'62 To be continued for five years	Foliar spraying trials done with certain micro-nutrients in 1961—62 had given indications on tolerance limit.	The tolerance limits of both spray application as well as soil application of different micro-nutrients will be studied on five to six year-old bearing palms.

(1)	(2)	(3)	(4)	(5)
	AGRONOMY:			
VI. A.	**Standardization of nursery practices:**			
	1) Criteria for seednut selection:			
a)	Concluded.			
b)	do			
c)	To determine the frequency of occurrence of nuts possessing different floating habits and factors influencing such habits.	1959-'60 1963-'64	Studies made so far have not shown significant difference either as regards germination or as regards quality of seedlings obtained in respect of the three types of nuts.	Sowing trials will be discontinued. Study on the frequency distribution of the nuts of different floating habits as well as factors influencing the same will be repeated.
d)	Concluded.			
	2) Sowing experiments:			
a)	Concluded.			
b)	do			
c)	do			
d)	do			
e)	Effect of different intensities of shade in seed bed and secondary nursery beds on growth performance of seedlings.	1962-63 1964-'65	Seedlings in the primary nursery were given three intensities of shade including control and they have been transplanted	The experiment will be repeated and observations on the previous experiments continued.

(1)	(2)	(3)	(4)	(5)
			to the secondary nursery with 9 treatments i. e. each treatment having been given the same set of 3 intensities of shade.	
f) and g)	Concluded.			
h)	Determination of optimum age of transplanting seedlings-*cum*-sowing *in situ vs.* transplanting of single, double and triple transplanted seedlings.	1958-'59 To be continued	Direct sowing of nuts in the field and transplanting of one-year-old seedlings have been done. Transplanting of seedlings relating to treatments 6, 7 and 8 was also been done in the nursery.	Transplanting of seedlings in treatments 3 and 6 to the mainfield will be done. Seedlings in treatment Nos. 7 and 8 will be transplanted in the nursery.
3)	Concluded.			
4)	Standardization of method of packing seedlings.	1960-'61 1963-'64	During the first year of trial planting seedlings 5 days after their removal gave significantly higher establishment. Packing in alkathene was found to be superior to the rest. The results of the second year trial did not show much difference between the treatments.	The experiment will be repeated for confirmation.

(1)	(2)	(3)	(4)	(5)
VI. B.	**Cultural Experiments**			
a) 1)	Determination of optimum spacing inthe mainfield.	1958-'59 To be continued	Data on the incidence of sunscorching, morphological features of the plants sueh as girth, internodel distance, number of leaves, production of spadices etc. as influenced by different spacing were recorded.	The observations will be continued. The data gathered so far will be subjected to statistical analysis.
2)	Effect of depth of transplanting seedlings-*cum*-intervals of irrigation on growth and yield.	1963-'64 To be continued	—	
3)	Effect of different methods of intercultivations on the productivity of palms.	1963-'64 To be continued	—	Planting of bulk garden for the trial will be taken up.
4)	Study of intercrops in arecanut gardens.	1960-'61 To be continued	Earlier trials laid out in the existing bulk garden of the station did not give a satisfactory establishment of the different crops due to water-logging that occurred on a few occasions.	do
5)	Comparative studies of different green manure and cover crops for arecanut garden.	1960-'61 To be continued	do	do

(1)	(2)	(3)	(4)	(5)
6)	Postponed			
7)	Effect of growing banana in arecanut gardens for different durations.	1962-'63 To be continued	The field has been levelled and kept ready for taking up planting.	The planting of both arecanut and banana will be taken up during the year.
8)	Relative performance in the mainfield of plants of different ages at the time of planting and of single, double and triple transplanting of theabove ages.	1962-'63 To be continued	—	The nursery stage will be taken up during the year.
9)	Drainage experiments in arecanut gardens.	1963-'64 To be continued	—	
10)	Mixed garden of coconut and arecanut	1962-'63 To be continued	—	The coconut seedlings will be planted.
11)	Relative performance of seedlings obtained from different bunches and different positions in the bunch of mother palms of different ages.	1962-'63 To be continued	The seedlings have been transplanted to the main field.	Observations on growth behaviour of the seedlings under different treatments will be made.
12)	Studies on the performance of nuts gathered at different stages of maturity for seed purposes.	1962-'63 To be continued	The seedlings raised from seednuts of different maturity have been planted in the mainfield.	do

(1)	(2)	(3)	(4)	(5)
VI. C.	**Manurial experiments:**			
1)	Concluded			
2)	Determination of optimum N. P. K requirements in the main field	1961-'62 To be continued	The experiment was laid out in 1961-62. The different manures as per shedule are being applied every year and growth measurements of seedlings recorded.	The application of manures and recording of morphological data will be continued.
3)	Simple Manurial Trials on arecanut in ryots' gardens.	1960-'61 1965-'66	The different manures were applied and yield data recorded. Morphological observations on the palms have also been made.	The application of manures and recording of yield and morphological data will be continued.
4)	Effect of applying N P K in organic and inorganic forms on palm performance.	1962-'63 To be continued	—	Application of manures will be done in September 1963 in the standing garden of the Station.
5)	Relative merits of different nitrogenous fertilizers.	1962-'63 To be continued	—	The nursery stock required for planhing the experiment will be raised.
6)	Study of exhaustion of plant nutrients by adult bearing palms.	1963-'64 To be continued	—	Will be taken up in the permanent manurial experimental plot laid out at the Station when the Chemistry Wing of the Station starts functioning. Soil and plant materials will be taken and analysed.

(1)	(2)	(3)	(4)	(5)
VI. D.	**Miscellaneous:**			
1)	Uniformity trials—Collection of yield data of palms.	1958-'59 1967-'68	Yield data as well as other morphological characters of 570 bearing palms are being gathered for determiniug the optimum plot size for arecanut.	The recording of the data will be continued.
3)	Project to find out the weight ratio of the raw and processed arecanuts and cost of processing nuts.	1961-'62 1963-'64	The projects were conducted in two centres to find out the ratio between fresh arecanuts and the final produce.	The collection of data will be dne for one more year.
4)	Concluded.			
2) & 5)	Harvesting trials:			
a)	Season-wise variation in quality of produce.	1963-'64 1965-'66	—	Nuts collected in different months will be cured separately and the quality assessed in the market.
b)	Quality of produce as influenced by degree of maturity.	1963-'64 1965-'66	—	Nuts of different maturity as judged from the change in colour of fruit will be collected and the quality of cured nuts evaluated in the market.
	PESTS & DISEASES:			
VII. 2)	Trial with different fungicides and insecticides to find out effective control measures for all diseases and pests.			

(1)	(2)	(3)	(4)	(5)
1)	Control of mites.	1959-'60 1963-'64	It was observed that spray applications of chlorocide-Malathion liquid and Akar-338 effectively controlled the incidence as well as re-establishment of mites.	The trial with the five miticides will be repeated for confirming the previous findings.
2)	Control of white grub.	1959-'60 1963-'64	Field trials laid out showed that 'Intox 8' liquid based on chlordane and Heptachlor were effective in controlling the pest.	The trial will be repeated for confirming the results.
3)	Trials on the control of 'Koleroga' or 'Mahali' with and without adhesives.	1959-'60 1964-'65	Trials with different copper oxychlorides showed that there was copper injury on the nuts to varying extent. Nuts sprayed with Bordeaux mixture was free from injury. Due to lack of incidence of Mahali the efficacy of the chemicals could not be evaluated.	The trial will be repeated during the year. In addition, Nickel Chloride, an cradicant fungicide will also be tried.
4)	Trials to investigate causes and methods of control of button shedding and tender nut fall.	1959-'60 1964-'65	The shednuts were invariably found to be affected by *Gleosporium sp.* and *Diploidia sp.* Insect	The study will be continued to find out the insect association with the tendernut fall and effective control

(1)	(2)	(3)	(4)	(5)
			damage by way of a puncture was also noticed on some of the fallen nuts and from the kernel of these nuts a fungus and a bacterium have been isolated:	measures for controlling the same as well as the fungi and bacteria.
5)	Control of yellow leaf spot of arecanut.	1959-'60 1964-'65	The fungus Curvalaria sp. was found to be associated with the yellow spot in arecanut seedlings. Preliminary trials on controlling the fungus showed that Ziram, M C O and M C O S were effective.	The trials have to be repeated for confirmation.
6)	Postponed.			
7)	Study of collar-rot of seedlings and influence of soil micro-organisms.	1960-'61 1965-'66	The trial could not be initiated since the post of Pathology Asst. was vacant.	The causative organism for the malady will be found out and effective control measures tried.
8)	Studies in the control of sun scorching of stem.	1960-'61 1663-'64	In order to prevent sunscorching, protection of the exposed arecanut stems was done with preparations such as California lime wash, Chaubattia paste etc.	The efficacy of these preparations in preventing sunscorching is being evaluated.

(1)	(2)	(3)	(4)	(5)
9)	Postponed.			
10)	Concluded.			
11)	Studies on the retention of copper fungicides on sprayed fruits.	1961-'62 1964-'65	Inoculation trials done on sprayed nuts at intervals showed that there is progressive increase in the percentage of nuts catching infection as the period since collection advances.	The trial will be repeated.
12)	Susceptibility of arecanut to 'Koleroga' at different stages of maturity. (development.)	1961-'62 1964-'65	Observations made so far have shown that there is a decrease in the suceptibility of nuts to fungal infection with increasing maturity.	The trial will be repeated for confirmation. Besides, inoculation of nuts of diffeent stages of maturity will be done on the standing trees(under field conditions)
13)	Observations on exploratory domonstration plots where package treatments are laid out.	1961-'62 1964-'65	Micro and macro-nutrients have been applied in one set of 'package plan' trials for two years.	The application of the manures will be continued and observations on the improvement of palms recorded.
14)	Studies of organisms (other than *Phytophthora*) that cause rotting of fruits and impair keeping quality.	1962-'63 1965-'66	Spraying the arecanuts with Blitox at the time of flower opening was found to give a very low rate of infection of fruits.	The trial will be repeated with different fungicides.

(1)	(2)	(3)	(4)	(5)
15)	Combined with item (II).			
16)	Study of palms showing symptoms similar to 'Band' in the primary and secondary nursery and their behaviour in the main field.	1960-'61 1969-'70	Observations made in the nursery showed that the mean height, girth and number of leaves of seedlings showing 'Band' like symptoms are significantly less than those of the normal ones.	Response of these seedlings to the application of different micro and marco-nutrients will be tried. Attempts will also be made to induce symptoms of 'Band' in the field by subjecting the trees to water logging and such other unfavourable conditions.
17)	Other problems evoked in the course of studies.			

H. APPENDIX I

Rainfall And Temperature Data 1962–'63

Month	No. of rainy days 1962 63	Average no of rainy days during the last five years	Rainfall in m.m. 1962–'63	Average rainfall during the last five years	Average temperature °C. 1962–63	
					Max:	Min:
July	31	29.8	1262.7	1435.10	27.18	20.43
August	27	27.2	1201.9	877.26	27.88	21.72
September	21	20.4	507.6	499.34	27.08	21.88
October	24	13.8	489.5	250.18	30.66	23.31
November	4	4.5	19.0	95.98	29.80	21.28
December	4	0.6	65.1	20.66	30.33	20.59
January	...	...	...	...	34.98	18.34
February	....	...	...	...	31.68	18.08
March	1	0.2	5.1	3.40	35.77	22.15
April	7	3.2	53.5	27.60	35.43	22.70
May	10	13.0	161.0	361.52	34.59	22.68
June	27	23.4	693.9	994.86	29.51	21.80
Total	156	136.1	4459.3	4565.90	..	...

APPENDIX II

TABLE I

Viability during different months of 1962-'63

Months 1962-'63	Concentration of Souree Solution				Total	Mean
	Germination percentage					
	0.5	1.0	2 0	5.0		
July	13.5	5.6	11.9	11.9	43.1	10.8
August	36.4	6.0	14.9	13.2	70.5	17.6
September	14.9	12.3	8.4	15.0	50.6	12.7
October	36.6	17.3	15.1	8.3	77.3	19.3
November	18.8	12.1	13.1	10.7	51.7	12.9
December	16.7	12.1	13.6	20.4	62 8	15.7
January	20.6	20.4	11.9	28.7	81 6	20.4
February	33.8	21.0	24.7	26.5	106.0	26.5
March	21.2	31.4	22.2	27.1	101.9	25.5
April	36.2	30.1	38.1	33.9	138.3	34.6
May	52.4	38.7	47.2	37.3	175.6	43.9
June	14.6	27.5	23.2	20.8	86.1	21.5
Total	312.9	234.5	244.3	253.8	1045.5	261.4
Mean	26.07	19.5	20.36	21.15	87.12	21.78

TABLE II

Hybridization between district types and selected palms to combine high yield and regular bearing and study of progeny

Female parent tree number	Male parent tree No.	No. of female flowers pollinated	No. Set	Percentage Set
1	2	3	4	5
471	594	104	24	23.1
	1059	133	46	34.6
	593	115	42	36.5
	self	129	18	13.9
	open	168	40	23.8
593	594	34	6	17.9
	1059	53	20	37.7
	471	53	2	3.8
	self	77	15	19.5
	open	62	31	50.0
594	1059	35	2	5.7
	593	54	8	14.8
	471	35	3	8.6
	self	43	11	25.6
	open	49	22	44.9
1059	594	206	32	15.5
	593	102	19	18.6
	471	85	15	19.9
	self	191	75	39.3
	open	196	69	35.2
1092	1126	52	Nil	Nil
	80	172	6	3.5
	1886	83	1	1.2
	self	168	Nil	Nil
	open	97	14	14.4
1126	80	156	10	6.4
	1092	132	6	4.5
	1886	119	Nil	Nil

	self	185	10	5.4
	open	131	3	2.3
80	1126	120	3	2.5
	1092	108	5	4.6
	1886	66	3	4.5
	self	94	1	1.6
	open	78	25	32.5
1886	1126	78	9	11.5
	80	70	6	8.6
	open	75	21	28.0

TABLE III

Hybridization between exotic and indigenous types.

Female parent tree No.	Percentage set. Male parent.					
	Indonesia 1	Indonesia 2	Nicobar	Andaman	Self	Open
471	27.2	31.9	50.0	18.5	13.9	23.8
594	2.2	10.0	—	nil	25.6	44.9
1059	67.1	55.2	59.3	47.7	39.3	35.2
1092	12.5	13.8	26.6	7.7	nil	14.4
482	9.0	23.3	27.2	13.5	18.6	—
360	6.6	6.8	1.5	20.3	—	—
1097	nil	—	nil	nil	nil	nil
1098	11.1	4.6	9.3	23.4	11.2	21.9
80	21.6	2.6	7.1	11.1	1.6	20.8
1886	21.7	18.7	—	21.3	—	28.0

Indonesia	2 x 360	6.9
do	x 1097	3.2
do	x 482	43.7
do	x 1098	30.4

TABLE IV

Preliminary Studies on Progeny behaviour of mother palms

(Mean data of 20 progenies)

Mother palm No,	Total number of leaves shed	Total number of inflorscences produced	Percentage of Inflorescences to leaves shed	Mean number of Female Flowers produced per palm	Percentage set*
KMJ-2	164	141	85.9	1021.2	22.46
SDK-16	159	116	72.9	891.1	27.05
SDK-14	164	116	70.8	756.2	28.59
SDK-13	145	90	62.1	602.3	22.45
SDK-6	159	95	59.7	748.3	19.59
SDK-4	154	100	64.9	712.6	29.41
KMJ-13	152	95	62.5	692.6	18.68
SRJ-6	155	94	60.7	617.9	28.29
SRJ-9	151	103	68.2	588.2	23.69
SRJ-5	150	94	62.6	643.1	21.31

* Recorded two months after the close of the female phase.

TABLE V

Supplementary Natural Pollination by Spray Method to Improve Fruit-Set

Months	Open pollination pollination by spraying			Open pollination & spraying Sucrose solution			Control open pollinated		
1962-63	Total flowers	No. set	Percentage	Total flowers	No. set	percentage	Total flowers	No. set	Percentage
October	838	159	18.97	805	30	3.73	871	39	4.48
November	4508	1153	25.58	4171	350	8.39	3251	301	9.26
December	3663	1054	28.77	3192	563	17.64	2942	468	15.91
January	1091	123	11.18	749	103	13.75	752	100	13.30
February	2918	1065	36.49	3147	770	24.44	2213	467	21.10
March	—	—	—	—	—	—	—	—	—
April	1741	703	40.38	1871	317	16.94	1846	365	19.77
May	2395	711	29.64	1925	269	13.97	2146	355	16.19
Total	17154	4968	191.01	15860	2402	98.86	14021	2095	100.00
MEAN			27.29			14.12			14.94

TABLE VI (a)

Study of the effect of age of trees, order of bunches and position of seednut in the bunch on seednut performance

Treatments

1. Age of mother palms—A.
   - i) Young palms (10—15 year)—a_0
   - ii) Middle-aged palms(30—35 years)—a_1
   - iii) Old palms (above 50 years—a_2

2. Order of Bunches—B.
   - i) First—b_0
   - ii) Second—b_1
   - iii) Third—b_2

3. Position of seednuts in the bunch—P.
   - i) Top—P_0
   - ii) Middle—P_1
   - iii) Botton—P_2

Morphological data

Analysis of variance

Source of variation	D.F.	Girth S. S.	Girth M. S.	Girth F.	Height S. S.	Height M. S.	Height F.	No. of leaves S. S.	No. of leaves M. S.	No. of leaves F.
Blocks	11	2.4090	0.2190	2.84**	7,842.88	712.09	3.66**	5.9016	0.5365	1.32
Main effect A	2	1.0611	0.5305	6.89**	2,399.26	1199.63	6.17**	1.1434	0.5717	1.41
B	2	0.1751	0.0875	1.14	295.66	47.83	—	0.1292	0.0646	—
P	2	0.0059	0.0029	—	86.52	43.26	—	0.3444	0.1722	—
1st order interaction A B	4	0.0391	0.0098	—	196.53	49.13	—	0.2236	0.0559	—
,, B P	4	0.2108	0.0527	—	311.86	77.96	—	0.7030	0.1757	—
,, A P	4	0.1281	0.0320	—	216.67	54.07	—	0.6341	0.1585	—
2nd order interaction A B										
Replication 1	2	0.0962	0.0481	—	264.31	132.15	—	0.3284	0.1642	—
,, 2	2	0.1061	0.0530	—	350.10	175.05	—	0.1822	0.0911	—
,, 3	2	0.0736	0.0368	—	151.76	75.88	—	0.1936	0.0968	—
,, 4	2	0.0875	0.0437	—	208.04	104.02	—	0.0982	0.0491	—
Error	70	5.3892	0.0770	—	13,619.98	194.57	—	28.4094	0.4058	—
Total	107	9.7817	—	—	25,943.57	—	—	38.2911	—	—

**Significant at 1% level.

TABLE VI (b)

Two way table of treatment means

1) Girth (cm.)

	b_0	b_1	b_2	Mean
a_0	2.05	2.00	2.07	2.04
a_1	2.16	2.03	2.17	2.12
a_2	1.92	1.84	1.88	1.88
Mean	2.04	1.96	2.04	2.01

	p_1	p_2	p_3	Mean
b_0	2.00	2.10	2.02	2.04
b_1	1.98	1.97	1.92	1.96
b_2	2.03	1.98	2.12	2.04
Mean	2.00	2.02	2.02	2.01

	p_0	p_1	p_2	Mean
a_0	2.02	2.01	2.09	2.04
a_1	2.09	2.15	2.12	2.12
a_2	1.90	1.92	1.82	1.88
Mean	2.00	2.02	2.02	2.01

S. E. of meas A, B, P.	0.046
,, AB, BP, AP,	0.080
C. D. to test means of A (P=0.01)	0.130
S. E. per plot	0.278
General mean	2.01
C. V. (%)	13.83

2) Height (cm)

	b_0	b_1	b_2	Mean
a_0	69.11	63.64	66.45	66.40
a_1	74.03	69.54	76.38	73.32
a_2	62.96	61.48	61.12	61.85
Mean	68.70	64.89	67.99	67.19

	p_0	p_1	p_2	Mean
b_0	66.66	71.14	68.29	68.70
b_1	65.50	64.00	65.17	64.89
b_2	66.63	65.59	61.74	67.99
Mean	66.26	66.91	68.40	67.19

	p_0	p_1	p_2	Mean
a_0	64.25	65.36	69.59	66.40
a_1	71.62	73.18	75.15	73.31
a_2	62.91	62.19	60.46	61.85
Mean	66.26	66.91	68.40	67.19

S. E. of means A, B, P.	2.33
., AB. BP, AP	4.03
C.D. to test means of A. (P 0.01)	6.58
S. E. per plot	13.95
General mean	67.19
C. V. (%)	20.76

3) No. of leaves

	b_0	b_1	b_2	Mean
a_0	4.83	4.83	4.83	4.83
a_1	4.81	4.90	5.01	4.90
a_2	4.70	4.58	4.70	4.66
Mean	4.78	4.77	4.84	4.80

	p_0	p_1	p_2	Mean
b_0	4.69	4.87	4.78	4.78
b_1	4.67	4.93	4.70	4.77
b_2	4.98	4.82	4.73	4.84
Mean	4.78	4.87	4.74	4.80

	p_0	p_1	p_2	Mean
a_0	4.69	4.91	4.88	4.83
a_1	4.88	5.01	4.83	4.90
a_2	4.77	4.70	4.51	4.66
Mean	4.78	4.87	4.74	4.80

S. E. of means A, B, P. 0.106
„ „ AB, BP, AP. 0.184
S. E per plot 0.637
General mean 4.80
C. V. (%) 13.27

TABLE VII (a)

To determine the frequeney of occurrence of nuts possessing different floating habits, factors influencing such habits and their relative merits as seednuts.

Germination data (1961–'62)

Treatment means

	Treatment	Germination percentage
1.	Vertically floating nuts	94.35
2.	Horizontally ,, ,,	95.65
3.	Slantingly ,, ,,	95.00

S. E. of mean	2.78
General mean	95.00
S. E. per plot	7.69
C. V. %	8.09

TABLE VII (b)

Morphological data (1961-'62)

Treatments means

	Treatment	Girth (cm)	Height (cm)	No. of leaves
1.	Vertically floating nuts	1.33	40.02	3.44
2.	Horizontally ,, ,,	1.39	39.29	3.61
3.	Slantingly ,, ,,	1.27	35.37	3.22
	S. E. of means	0.06	1.86	0.19
	General mean	1.33	38.23	3.43
	S. E. per plot	0.18	5.26	0.53
	C. V. (%)	13.53	13.76	15.45

TABLE VII (c)

Percentage of nuts under different floating habits

Vertically floating nuts — V
Slantingly — S
Horizontally — H

Tree No.	1			7			8			14			19		
Bunch	V	H	S	V	H	S	V	H	S	V	H	S	V	H	S
I	74.5	—	25.5	31.3	4.5	64.2	44.8	—	55.2	10.3	3.3	56.4	81.4	—	18.6
II	51.7	4.9	43.4	16.0	19.9	64.1	62.5	—	36.5	—	56.7	34.0	30.6	3.0	40.6
III	57.9	3.2	39.0	22.7	5.3	72.0	48.0	11.0	35.3	—	35.0	63.2	67.4	0.7	31.9

TABLE VII (d)

Percentage of nuts under different floating habits in same palms in three years

Vertically floating nuts — V
Slanting ,, — S
Horizontally ,, — H

Tree No.	Serial No. of harvest	1960-61			1961-62			1962-63		
		V	H	S	V	H	S	V	H	S
8	I	24.5	21.9	53.6	50.7	7.2	42.1	44.8	...	55.2
	II	39.8	17.1	43.3	60.6	0.8	30.7	62.5	...	36.5
	III	18.2	22.7	36.4	41.0	1.6	57.4	48.0	11.0	35.3
	Total	82.5	61.7	133.3	152.3	9.6	130.2	155.3	11.0	127.0
	Mean	27.5	20.5	44.4	50.7	3.2	43.4	51.7	3.6	42.3
14	I	0.5	46.3	51.9	3.6	62.7	32.5	10.3	3.3	56.4
	II	...	81.6	17.6	7.3	21.4	68.6		56.7	34.0
	III	...	63.7	33.3	0.95	90.5	8.6	...	35.0	63.2
	Total	0.5	191.6	102.8	11.85	174.6	109.7	10.3	95.0	153.6
	Mean	0.16	63.8	34.2	3.95	58.2	36.5	3.4	31.6	51.2

TABLE VIII (a)

Studies on the performance of nuts gathered at different stages of maturity for seed purposes.

Treatments:

Sowing

1. Nine-month-old Seednuts
2. Nine-and-a-half-month-old Seednuts
3. Ten-month-old Seednuts
4. Ten-and-a-half-month-old Seednuts.

Germination data (1960—61)

Treatment means

Treatment	Germination percentage
1	91.5
2	96.7
3	96.0
4	95.5

S. E. of mean 0.12

TABLE VIII (b)

Morphological data (1960-'61 Sowing)

Treatments means

Treatment	Height (cm)	Girth (cm)	No. of leaves
1. Nine-month-old nuts	51.54	1.58	3.48
2. Nine-and-a-half-month old nuts	56.11	1.75	4.00
3. Ten-month-old nuts	63.80	2.01	4.48
4. Ten-and-a-half-month old nuts	55.26	1.88	3.88
S. E. of means	2.38	0.08	0.15
C. D. (P = 0.05	6.96	0.23	0.52
General mean	56.68	1.81	3.96
S. E. per plot	7.15	0.23	0.45
C. V. (%)	12.61	12.71	11.36

TABLE VIII (c)

Germination data (1961-'62)

Treatment means:

Treatment	Germination percentage
1. Nine-month-old nuts	91.55
2. Nine-and-a-half-month old nuts	95.55
3. Ten-month-old nuts	95.55
4. Ten-and-a-half month old nuts	93.30
S. E. of means	1.40
General mean	94.03
S. E. per plot	4.19
C. V. (%)	4.46

TABLE IX

Study of different positions *cum* depths of sowing seednuts

Treatments:

Positions
1) Vertical
2) Slanting
3) Horizontal

Depths
1) 0"
2) 1"
3) 2"
4) 3"

Germination data (1961—62)

Treatment means:

A. Position of nuts	B. Depth of Sowing				Mean
	0"	1"	2"	3"	
Vertical	97.5	99.2	91.7	80.8	92.3
Slanting	95.8	98.3	92.5	86.7	93.3
Horizontal	97.5	90.0	93.3	88.3	92.3
Mean	96.9	95.8	92.5	85.3	—

S. E. of means A. B. 3.28
General mean 92.6
S. E. of mean A. 1.89
S. E. of mean B. 1.56
C. D. for A. (P 0-05) 5.23
S. E. per plot 8.02
C. V. (%) 8.66

TABLE X (a)

Effect of Different spacing-*cnm*-efficacy of sowing unsprouted and sprouted seeds on seedling performance.

Treatments

Nature of seed arecanuts

(1) Unsprouted
(2) Sprouted

Spacings (1) 9″ x 9″
(2) 12″ x 12″
(3) 15″ x 15″
(4) 18″ x 18″

Morphological data (1960-'61 Sowing)

Treatments

B. Spacing	A. Nuts								
	Unsprouted			Sprouted			Mean		
	Height (em)	Girth (cm)	No. of leaves	Height (em)	Girth (cm)	No· of leaves	Height (cm)	Girth (cm)	No. of leaves
9″ x 9″	27.52	1.27	2.2[illegible]	28.98	1.00	1.90	28.25	1.14	2.08
12″ x 12″	27·25	1.55	2.23	29.97	1.00	2.07	28.16	1.03	2.15
15″ x 15″	27.91	1.07	2.23	32.70	1.08	1.92	30.32	1.07	2.08
18″ x 18″	27.91	1.17	2.23	32.92	1.26	2.02	30.42	1.22	2.13
Mean	27.65	1.14	2.23	30.93	1.09	1.98	29.29	1.11	2.11

	Height	Girth	No. of leaves
S. E. of means A B	0.91	0.08	0.24
,, ,, ,, A	0.45	0.04	0.12
,, ,, ,, B	0.64	0.06	0.17
C. D. for A (P 0.05)	1.34	—	—
C. D. for B (P 0.05)	1.89	—	—
S. E. per plot	1.82	0.17	0.47
General mean	29.29	1.11	2.11
C. V. (%)	6.21	15.32	22.27

TABLE X (b)

Germination data (1961–'62)

Treatment means

B. Spacing	A. Nuts		
	Unsprouted	Sprouted	Mean
9" x 9"	22.75	23.50	23.13
12" x 12"	22.75	23.25	23.00
15" x 15"	22.75	23.00	22.88
18" x 18"	23.50	22.75	23.13
Mean	22.94	23.12	23.03

S. E. of treatment means	A	0.27
,, ,,	B	9.38
,, ,,	A B	0.54
S. E. per plot		1.07
General mean		23.03
C. V. %		4.64

TABLE XI (a)

Effect of shade-*vs*-no shade on seednut germination and growth af seedlings with particular referenee to sun-scorch and pest (mite) Attack.

Morphological data (1961-62)

Treatment means

Treatment	Height (cm)	Girth (cm)	No. of leaves
1. No shade	51.66	1.93	4.88
2. Partial shade	93.03	2.61	5.49
3. Complete shade	83.31	2.13	5.34
S. E. of means	3.33	0.07	0.07
C. D. (P = 0.05)	10.11	0.21	0.21
General mean	76.00	2.22	5.24
S. E. per plot	9.43	0.19	0-20
C. V. (%)	12.41	8.56	3.82

TABLE XI (b)

Germination data (1962-'63)

Treatment means:

Treatment	Germination percentage
1. No shade	97.26
2. Partial shade	98.50
3. Complete shade	99.50

S. E. of means	0.84
General mean	98.42
S. E. per plot	2.37
C. V. (%)	2.41

TABLE XII

Standardisation of media aud methods of sprouting seednuts

Treatments:

1) Sowing seed arecanuts in soil medium.
2) Sowing seed arecanuts in sand medium.
3) Arranging seed arecanuts in country baskets with straw mulch over the seednuts.
4) Tying seed arecanuts in straw bundles.
5) Heaping the seed arecanuts in shade.

Germination data 1961-'62

Treatment means:

Treatment	Germination percentage
1	93.00
2	93·50
3	74.00
4	70:17
5	58.50

S. E. of treatment means	3.23
C. D. (P = 0.05)	9.51
S. E. per plot	7.91
General mean	77.83
C. V. (%)	10.16

TABLE XIII (a)

Influence of pre-sowing treatments and period of sowing on seednut performance

Yreatments:

1) Harvesting and immediate sowing
2) Treating with cowdung slurry and immediate sowing.
3) Treating with cowdung slurry, air drying for three days and sowing,
4) Treating with cowdung, slurry, air drying for six days and sowing.
5) Treating with cowdung slurry, air drying for nine days and sowing.
6) Sun-drying for two days and sowing.
7) Sun-drying for four days and sowing.
8) Sun-drying for six days and sowing.
9) Air-drying for three days and sowing.
10) Air-drying for six days and sowing.
11) Air-drying for nine days and sowing,
12) Soaking in water for three days and sowing.

Morphological data (1960-61 Sowing)

Treatment means:

Treatment No.	Girth (cm)	Height (em)	No. of leaves
1	1.63	46.57	4.03
2	1.57	46.28	3.96
3	1.60	47.08	4.03
4	1.60	47.73	3.83
5	1.58	44.92	4.13
6	1.64	47.74	4.25
7	1.52	41.63	3.81
8	1.74	50.44	4.31
9	1.67	43.88	3.93
10	1.61	47.04	4.00
11	1.55	43.22	3.76
12	1.83	51.30	4.24
S. E of means	0.08	2.54	0.29
General mean	1.63	46.66	4.02
S. E. per plot	0.20	6.21	0.71
C. V. (%)	12.28	13.31	17.66

TABLE XIII (b)

Germination data (1961-'62)

Treatment means

Treatment No.	Germination %
1	86.46
2	96.83
3	95.83
4	96.87
5	93.75
6	92.71
7	92.71
8	95.83
9	97.92
10	94.79
11	96.87
12	93.75
S. E. of means	2.68
General mean	94.53
S. E. per plot	6.56
C. V. %	6.94

TABLE XIV (a)

Determination of the optimum intervals of irrigation for germinating seed/arecanuts

Germination data (1961–62)

Treatment means:

(No of nuts sown per plot 30)

	Treatment	Mean germination
1.	Watering the seed beds once daily	26.67
2.	,, ,, in two days	25.17
3.	,, ,, in three days	26.83
4.	,, ,, in four days	10.50
5.	,, ,, in five days	7·00
	S. E. of means	2.46
	C. D. (p=0.05)	7.26
	S. E. per plot	6.03
	General mean	17.23
	C. V. (%)	35.00

TABLE XIV (b)

Morphological data 1960-62

Treatment means:

Treatment	Height (cm)	Girth (cm)	No. of leaves
1. watering once daily	26.34	0.88	2 00
2. ,, ,, in two days.	26.30	0.87	1.77
3. ,, ,, in three days	23.43	0.76	1.68
4. ,, ,, in four days	17.18	0.72	1.30
5. ,, ,, in five days	13.31	0.48	1.47
S. E. of means	2.29	0.07	0.27
C. D. (P=0.05)	6.76	0.20	—
S. E. per plot	5.61	0.17	0.60
General mean	21.59	0.74	0.64
C. V. (%)	25.98	22.97	40.24

TABLE XV

Determination of optimum spacing in the mainfield.

Mean morphological data of the palms (1962-'63)

Treatments (spacings)	Girth (cm) at permanent mark	Girth (cm) at the last node	No. of nodes in the stem	Height (cm) between the permanent mark and last node	No. of leaves in the palm
1) 6′ x 6′	49.9	41.7	9.8	181.1	9.1
2) 6′ x 9′	48.2	41.5	8.6	144.2	9.1
3) 6′ x 12′	50.3	44.3	8.2	136.1	9.2
4) 9′ x 9′	49.1	42.8	8.1	125.4	9.1
5) 9′ x 12′	49.2	43.7	8.9	144.3	8.8
6) 12′ x 12′	49.8	45.2	8.7	129.7	9.1

TABLE XVI

Response of seedlings of varied time of germination to different levels of manuring

Treatments:

Period of germination

1. Early
2. Late
3. Very late

Manurial doses.

1. No manuring
2. Moderate manuring
3. Heavy manuring

Morphological data (1961-62)

Treatment Means

1. Girth (cm)

A. Time of germination of nuts	B. Manuring No Manuring	Moderate Manuring	Heavy Manuring	Mean
Early sprouted	1.69	2.20	2.33	2.07
Late sprouted	1.81	1.85	1.98	1.88
Very late sprouted	1.59	1.88	2.09	1.86
Mean	1.70	1.98	2.13	1.94

S. E. of mean A, B	0.073
S. E. of mean A B	0.126
C. D. to test different levels of B. (P=0.05)	0.213
General Mean	1.940
S. E. per plot	0.252
C. V. (%)	12.99

2. Height (cm)

A. Time of Germination of nuts	B. Manuring No. Manuring	Moderate Manuring	Heavy Manuring	Mean
Early sprouted	60.37	79.19	80.68	73.41
Late sprouted	58.35	66.18	78.03	67.52
Very late sprouted	50.76	64 07	93.71	69.51
Mean	56 49	69.82	84.14	70.15

S. E. of mean A, B	3.59
S. E. of mean A B	6.22
C. D. to test different leaves of B (P=0.05)	10.51
General mean	70.15
S. E. per plot	12.44
C. V. %	17.73

3. No. of leaves

A. Time of germination of nuts	B. Manuring No. manuring	Moderate manuring	Heavy manuring	Mean
Early sprouted	3.84	4.64	4.87	4.45
Late sprouted	4.35	4.06	4.51	4.31
Very late sprouted	3.85	4.50	4.43	4.26
Mean	4.01	4.40	4.60	4.34

S. E. of means A, B	0.089
S. E. of means A B	0.155
C. D. to test different leaves of B (P=0.05)	0.261
C. D. to test different leaves of A B (P=0.05)	0.453
General mean	4.340
S. E. per plot	0.309
C. V. %	7.11

TABLE XVII

Uniformity triat—Yield data for 1960-'61

Co-efficient of variation and block efficiency for plots and Blocks different shapes

	4 Plot Block			8 Plot Block		
Plot Size Units	Block shape					
1 Tree	4 Units in a column	51.95	1.03			
	4 Units in a row	53.10	0.99	4 Units in 2 columns	50.80	1.08
	2 Units in 2 columns	52.04	1.63	2 Uuits in 4 rows	54.17	0.95
	2 Units in 2 rows	54.70	0.93	4 Units in 2 rows	53 64	0.97
2 Trees in row	4 Units in a row	32.57	1.11	1 Unit in 8 rows	34.51	0.99
	1 Unit in a row	35.98	0.91	2 Units in 4 rows	35.93	0.91
	2 Units in 2 rows	34.96	0.97	4 Units in 2 rows	34.34	1.00
3 Trees in	2 Units in 2 colums	31.11	1.16	2 Units in 4 colums	33.47	1.01
a colums	1 Unit in 4 colums	36.07	0.87	1 Unit in 8 colums	35.21	0.91
4 Trees arranged	1 Unit in 4 rows	23.04	1.01			
as 2 trees in two	2 Units in 2 rows	25.42	0.83			
rows	1 Unit in 4 colums	22.73	1.03	2 Units in 4 rows	23.84	0.94
6 Trees arranged	4 Units in a colum	20.72	1.33			
as 3 trees in 2	2 Units in colums	23.75	1.01			
colums	1 Unit in 4 colums	26.06	0.84	2 Units in 4 colums	24.65	0.94
8 Trees arranged	1 Unit in 4 rows	17.35	0.87			
as 4 trees in 2 rows	2 Units in 2 rows	17.77	0.83	2 Units in 4 rows	16.76	0.93
12 trees arranged	4 Units in 1 colum	9.80	1.49			
as 3 trees in 4 cols.	4 Units in a row	12.36	0.94	4 Units in two colums	12·01	0.97
16 trees arranged						
as 8 trees in 2 cols.	1 Unit & 4 rows	15.19	0.85			
24 trees arranged						
as 4 trees in 6 rows	2 Units 2 rows	7.59	0.86			

TABLE XVIII

Susceptibility of Arecanut to Koleroga at different stages of Maturity

Date of Inoculation	Age of the nut (in days)	Percentage of Infection	Date of Inoculation	Age of the nut (in days)	Percentage of Infection
	P. No 1			P. No 2	
17—7—62	208	100	17—7—62	86	100
25—7—62	216	50	25—7—62	94	100
31—7—62	222	50	31—7—62	100	100
8—8—62	230	50	8—8—62	108	100
17—8—62	239	50	17—8—62	117	50
24—8—62	246	50	24—8—62	124	50
1—9—62	254	50	1—9—62	132	50
7—9—62	260	—	7—9—62	138	50
15—9—62	268	50	15—9—62	146	50
21—9—62	274	—	21—9—62	152	—
29—9—62	282	—	29—9—62	160	—
6-10—62	289	—	6-10—62	167	—
15-10—62	298	—	15-10—62	176	—
	P. No. 3			P. No. 4	
17—7—62	147	100	17—7—62	123	100
25—7—62	155	50	25—7—62	131	50
31—7—62	161	50	31—7—62	137	100
8—8—62	169	50	8—8—62	147	100
17—8—62	178	50	17—8—62	154	100
24—8—62	185	50	24—8—62	161	50
1—9—62	193	50	1—9—62	169	50
7—9—62	199	—	7—9—62	175	—
15—9—62	207	50	15—9—62	183	50
21—9—62	213	—	21—9—62	189	—
29—9—62	221	—	29—9—62	197	—
6-10—62	228	—	6-10—62	204	—
15-10—62	237	—	15-10—62	213	—

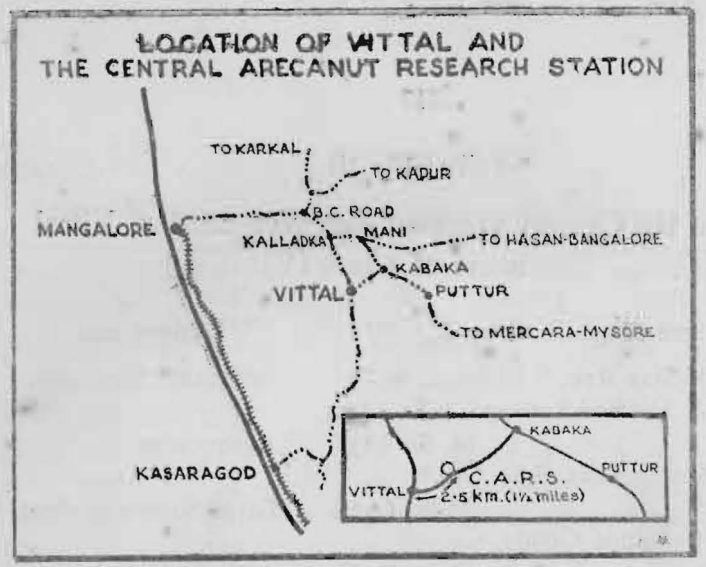
APPENDIX III

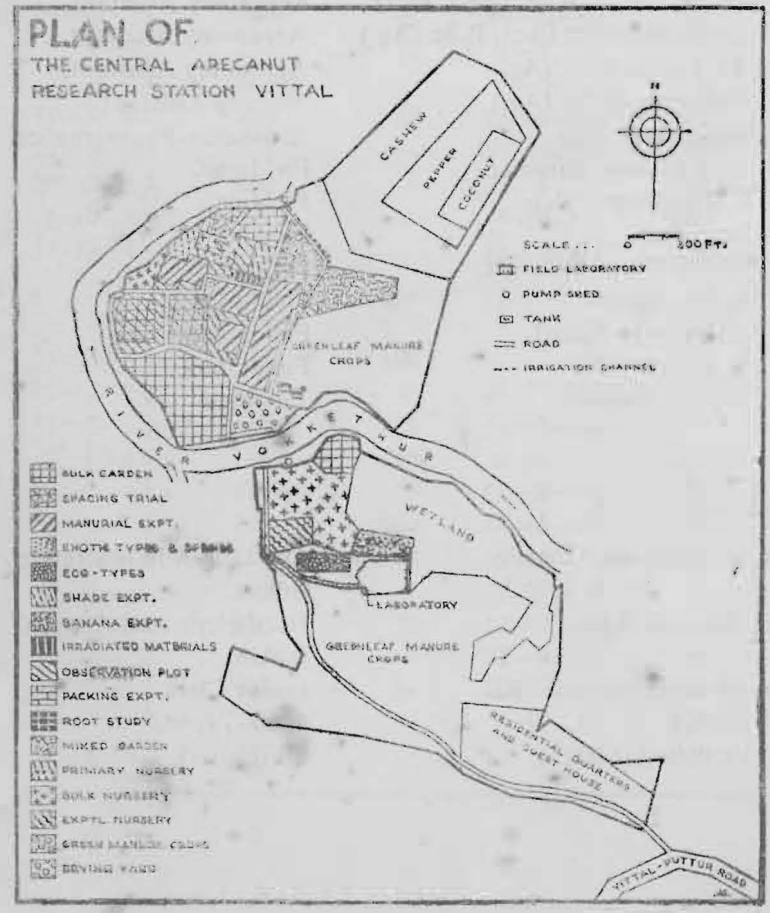
Set up of the Central Arecanut Research Station, Vittal (exclusive of Class IV)

S No.	Name & qualification	Designation
1.	Shri M. Mohan Rao, B.Sc. (Ag.), M.Sc.	Areacanut Specialist.
2.	Shri K. V. Ahamed Bavappa, B.Sc. (Ag.), M. Sc. (Ag.)	Agronomist.
3.	Shri K. Shama Bhat, B.Sc. (Ag.), M.Sc. (Ag.)	Farm Superintendent.
4.	Shri P. Muddappa Gouda, B.Sc. (Ag.), D. H.	Agronomy Assistant.
5.	Shri N. Tirumaleshwara Bhat, B.Sc. (Ag.)	Agronomy Assistant.
6.	Kumari M. Leela, B.Sc. (Ag.)	Agronomy Assistant.
7.	Shri E. Velappan, B.Sc. (Ag.)	Nursery Assistant.
8.	Shri S. Visweswara Raju	Artist-cum-Photographer.
9.	Shri K. K. Krishnan Nambiar	Fieldman.
10.	Shri P. T. Sreedharan Nair	Fieldman.
11.	Shri D. Sankaran	Fieldman.
12.	Shri K. Kunhi Rama Panicker	Fieldman.
13.	Shri E. R. Narayanan	Fieldman.
14.	Shri K. Krishnayya Gopal	Fieldman.
15.	Shri P. V. Joseph	Fieldman.
16.	Shri U. Vijaya Kumar	Fieldman.

Non-technical Staff:

1.	Shri N. K. Srinivasa Moorthy	Assistant Administrative Officer.
2.	Shri K. Raghava Rao	Head-clerk-cum-Accountant.
3.	Kumari H. Shreemanthini Bai	Junior Clerk.
4.	Shri K. Tampi	Clerk-Typist.
5.	Shri S. Venkatesh Murthy	Store-Clerk.


LOCATION OF VITTAL AND
THE CENTRAL ARECANUT RESEARCH STATION
TO KARKAL
TO KADUR
B.C. ROAD
MANGALORE
KALLADKA
MANI
TO HASAN-BANGALORE
KABAKA
VITTAL
PUTTUR
TO MERCARA-MYSORE
KASARAGOD
KABAKA
PUTTUR
C.A.R.S.
VITTAL
2·5 km.(1½ miles)


PLAN OF
THE CENTRAL ARECANUT
RESEARCH STATION VITTAL
CASHEW
PEPPER
COCONUT
N
SCALE ... 0 200 FT.
FIELD LABORATORY
PUMP SHED
TANK
ROAD
IRRIGATION CHANNEL
GREENLEAF MANURE CROPS
RIVER
VOLKETTUR
WETLAND
LABORATORY
GREENLEAF MANURE CROPS
RESIDENTIAL QUARTERS AND GUEST HOUSE
VITTAL-PUTTUR ROAD
BULK GARDEN
SPACING TRIAL
MANURIAL EXPT.
EXOTIC TYPES & SPECIES
ECO-TYPES
SHADE EXPT.
BANANA EXPT.
IRRADIATED MATERIALS
OBSERVATION PLOT
PACKING EXPT.
ROOT STUDY
MIXED GARDEN
PRIMARY NURSERY
BULK NURSERY
EXPTL. NURSERY
GREEN MANURE CROPS
BEARING YARD