ANNUAL PROGRESS REPORT OF THE
Central Arecanut Research Station, Vittal
MYSORE STATE, FOR THE PERIOD
FROM 1—4—1958 to 31—3—1959.

SECTION A. GENERAL

1. Date of commencement of the Research work under report. ... The Research work at the Station was started from 2—4—1956.

2. Date on which the present period of the scheme will expire ... The Scheme is scheduled to terminate on 31—3—1966.

3. Total amount sanctioned:

1. Recurring:	5,47,726/-
2. Non-recurring:	1,19,250/-
Total.	6,66,976/-

3. Receipts realised:

A. Since the inception of the scheme upto 31-3-58	5,941	13
B. During the year under report (1958—59)	4,986	19
Total	10,927	32

4. Total amount spent from this Committee's share of expenditure as on the last day of the year under report.

	non recurring		recuring.	
A. Since the inception of the scheme upto 31—3—58	64,366	39	86,517	74
B. For the year under report (1958—59)	17,533	37	78,493	02
Total.	81,899	76	165,010	76

5. Staff Employed: Dr. G. I. Patel, Arecanut Specialist continued to be in charge of the Research Station till 16-2-1959 when he left the services of the Committee. Shri Ghouse Mohiyuddin Agronimist, continued to be in charge of the Station during the rest of the period. Shri E. I. Antony, Fieldman, was relieved with effect from 8-1-1959 afternoon, on his transfer to the Regional Arecanut Research Station, Palode, Shri V. C. Radhakrishnan joined duty as Fieldman in this vacancy from 15-1-1959, forenoon. He was relieved on 31-3-1959 afternoon, consequent on his transfer to Regional Arecanut Research Station, Peechi. Shri K. Kunhirama Panikker reported for duty as Fieldman on 30-3-59 forenoon. A Statement of staff as on 31-3-59 is enclosed as Appendix-I.

6. Object of the Scheme: The objects of the Research Station are:

1. To solve the local problems confronting Arecanut Industry.
2. To co-ordinate the research work conducted at the various Regional Research Stations, and
3. To conduct fundamental research.

SECTION B-TECHNICAL PROGRAME.

1. The approved technical Programme for the entire period is given below:—

Technical Programme for the Central Arecanut Research Station, Vittal, as Amended by the Special Technical Sub-Committee

I. *Breeding and Genetics of Areca.*

(1) Collection and maintance of indigenous and exotic species and types of Areca.

(2) Detailed survey of arecanut gardens to assess genetic variation and select superior types.

(3) Floral biology of areca—flowering behaviours (rate, time and duration of flowering.)

II. *Anatomical Studies.*

Structure and development of fruit in areca (to be taken up at the Central Coconut Research Station, Kasargod.)

III. *Physiological Studies.*

(1) Studies on fruit setting and shedding (to be taken up at the Central Coconut Research Station, Kasargod.)

(2) Salt resistance experiments with areca seedlings (to be taken up at Central Coconut Research Station, Kasargod.)

(3) Physiological studies on germination of arecanuts (to be taken up at Central Coconut Research station, Kayamgulam.)

(4) Investigations on different species of areca under rainfed and irrigated conditions (at Central Arecanut Research Station, Vittal, and all Regional Research Stations.)

(5) Pot culture experiment with N. P. K. only (at Central Coconut Research Station, Kayamgulam.)

IV. *Agronomy of Arecanut*

A-STANDARDIZATION OF NURSEY PRACTICES.

(1) *Criteria for seednut selection:-*

(a) Effect of position of seednuts in the bunch on their size germination and vigour of seedlings.

(b) Influence of age of trees on their seednut performance.

(c) To determine the frequency of seednuts having different floating habits, factors, influencing such habits and their relative merits.

(d) Studies on the performance of nuts gathered at different stages of maturity for seed purpose.

(e) Comparative merits of seednuts from different bunches of the same tree.

(2) *Sowing experiments*

(a) Comparative study of different position of seednuts in sowing.

(b) Determination of optimum depth of sowing.

(c) Effect of different spacings on seednut performance.

(d) Standardization of media for sprouting seednuts.

(e) Effect of shade Vs. open on the seednut germination and growth of seedlings with particular reference to sun scorch and pest (mites) attack.

(f) Determination of the efficiency of sowing unsprouted Vs. sprouted seeds.

(g) Influence of post harvest treatments and period of sowing on seednut performance.

(h) Relative merits of single, double and treble transplantation of seedlings in the nursery.

(3) Storage trials on seednuts and viability studies.

(4) Standardization of the method of packing seedlings.

(5) Study of seednuts from different arecanut growing tracts for their viability, earliness in germination and vigour of seedlings.

(To be taken at the Central Arecanut Research Station, Vittal and Regional Research Stations.)

B-CULTURAL EXPERIMENTS.

(1) Determination of optimum spacing (to be done at Central Arecanut Research Station, Vittal.)

(2) Effect of depth of transplanting seedlings-cum-intervals or irrigation on growth and yield.

(3) Effects of different methods of intercultivation on the productivity on the palms.

(4) Study of intercrops in arecanut gardens.

(5) Comparative studies of different green manure-cum-cover crops for areca gardens.

To be taken up at Central Arecanut Research Station, Vittal, and Regional Research Stations.

C-MANURIAL EXPERIMENTS.

(1) Determination of optimum N. P. K. requirements of:

(a) Seedlings in the nursery-for producing vigorous seedlings.

(b) Permanently transplanted seedlings in the garden for producing vigorous, early bearing and productive palms.

(2) Effect of time of application—cum—methods of manuring.

(3) Comparative effects of different doses of lime application over a basal dose of manure to bearing palms (to be taken up at Central Arecanut Research Station, Vittal.)

V *Chemical Studies*

(1)	Detailed survey of soils of different arecanut growing tracts, collection of samples for chemical and mechanical analysis.	To be taken up at Central Cocouut Research Station, Kasargod.
(2)	Analysis of plant parts and soils for determination of uptake of N. P. K. by palms and exhaustion of soils.	
(3)	Chemical analysis of irrigation water.	

VI. *Investigation on Diseases and Pests.*

(1) Survey of diseases for location of areas of high incidence of diseases and pests (to be carried out under the direction of Dr. K. P. V. Menon).

(2) Trial with proprietory fungicides and insecticides, to find effective control measures for all diseases and pests.

VII: *Crop Weather Study.*

(1) To record meteroligical data on rainfall, maximum and minimum temperature, humidity, soil temperature and moisture, sunshine and wind velocity.

(2) Influence of seasonal and geographical factors on the time and nature of flowering and fruiting.

2. Detailed programme of work for the year is as follows.

DETAILED PROGRAMME OF WORK FOR THE YEAR 1958-59

Item No. in the Techanical Programme	Name of the experiment	Year of commencement	Year of conclusion	Remarks
1	2	3	4	5
1.	**Breeding and Genetics of areca**			
1.	Collection and maintence of indigenous and exotic species and types of areca	1958–59	To be continued for several years.	
2.	Detailed survey of areca-nut gardens to assess genetic variation and select superior types.	1958–59	do.	The experiment is being conducted in growers' gardens.
3.	Floral biology of areca-flowering behairouss(rate, time and duration of flowering).	1958–69	1960–61	
IV. A	**A–Standardization of Nursery.**			
	PRACTICES.			
I.	**I. Criteria for seednut Selection.**			
	(a) Effect of position of seed-nuts in the bunch on their size, germination and vigour of seedlings.	1958–59	1960–61	—

1	2	3	4	5
2	**2. Sowing experiments.**			
	(a) Comparative study of different position of seednuts in sowing	1958-59	1960-61	——
	(b) Determination of optimum depth of sowing	1958-59	do.	——
	(c) Determination of the efficiency of sowing unsprouted Vs. sprouted seeds.	1958-59	do.	——
3.	Storage trial of seednuts and viability studies	1958-59	do	——
5.	Study of seednuts from different arecanut growing tracts for their viability earliness in germination and vigour of seedlings	1958-59	do.	——
V. B.	**B.Cultural Experiments**			
	(1) Determination of optimum spacing	1958-59	To be continued for several years	
VI.	**Investigation of pests and diseases.**			
	(2) Trial with proprietory-fungicides and insecticides, to find effective control measures for all disease and pests	1958-59	To be continued for several years	

SECTION C – RESULTS.

1. **Seasonal Conditions** :– The year under report had more or less normal weather conditions without much of extremes. There was a total rainfall of 3508.3 m·m recorded on 120 rainy days as given below :–

	Month		No. of rainy days.	Rainfall in m. m.
1.	April,	1958	7	(Not measured)
2.	May,	1958	12	283·8
3.	June,	1958	16	1010·4
4.	July,	1958	30	1187·3
5.	August,	1958	28	559·0
6.	September,	1958	12	193·8
7.	October,	1958	8	108·6
8.	November,	1958	7	165·4
9.	December,	1958	—	— — —
10.	January,	1959	—	— —
11.	February,	1959	—	— —
12.	March,	1959	—	— —
		TOTAL	120	3508.3m·m·

2. **Development of the farm**

(*a*) *Areca Garden: Block II (area 5.50 acres)* :

The garden which was planted in the previous year with a view to take up progeny studies and conduct certain cultural experiments and which has completed just 3 years (from seed) was manured with 20 lb. each of green leaf and cattle manure, woodash 2 lb., burnt earth 2 lb· and ¾ lb· fish compost per palm during the year· The garden was also top-dressed with urea at 50 lb· Nitrogen per acre applied in two doses. Forking and weeding the garden was done when-ever found necessary. Just at the commencement of rainy season in June, the garden was provided with good drainage channels at the rate of one for every two rows of palms· The garden was irrigated well

during the hot months. A green manure crop of Sesbania and Kolinji was also raised and incorporated in the garden. The yeild of green manure was estimated at 10,890 lb. per acre.

The bases round all the palms were drenched with 0·1% Ceresan in the months of June–July against rotting. Mites were controled by spraying with wettable sulphur from time to time Bordeaux Mixture 1·0% strength was also sprayed on the foliage of young palms during rainy season against leaf spot by fungal infection. The young palms are normal in condition.

(*b*) *Areca Nurseries* :

During the year there were nurseris of 3 age groups.

(I) Nursery 1956-58 :– This was the second nursery raised at the Station. From this nursery 25,329 seedlings were sold to ryots and 2,302 utilised for planting at the station. The cost of production of seedlings and other relevant details are given below.

Cost of raising 1½ year old areca seedlings

1.	No. of seednuts sown	....	40,703
2.	No. of nuts germinated	....	37,283
3.	No. of good seedlings available for disposal at the end of 1½ years	....	27,631
4.	Percentage of quality seedlings over nuts sown	....	67%

Economics		Rs	nP.
1.	Cost of seednuts	1,609	19
2.	**Cultivation expenses**		
	a) Sowing seednuts	71	00
	b) Preparation of nursery	184	89
	c) Planting sprouts	114	35
	d) Irrigation	776	48
	e) Weeding, mulching etc.	340	00
	f) Spraying and plant protection	224	83
	g) Manuring	394	28
	h) Shading	508	96
	Total .... Rs	4,223	98

			Rs.	nP.
3.	Receipts by sale of seedlings	...	3,146	49
4.	Miscellaneous receipts	...	269	76
5.	Cost of raising 1½ year old seedlings	....	0	15
6.	Area Covered	...	2.03 acres.	

(ii) **Areca Nursery : 1957-59** :– This was the 3rd Nursery of the station.

Seednuts numbering 46,890 procured from premarked trees in private gardens and sown during the late part of the previous year germinated well, the germinated nuts being 42543 Nos.(90·6%) Of the germinated seednuts, 36,840 selected sprouts were utilised for planting in the main nursery. The main nurseries were applied with a basic dose of farm yard manure at 5 tons per acre and were provided with tne shade crop of banana. Immediately after planting in June–July, the nursery beds were mulched with green leaf at 15,000 lb per acre. In the month of July the young seedlings were sprayed with 1 0% bordeaux mixture against leaf–spot caused by fungal infection. In September, the nurseries were top-dressed with urea at 50 lb. per acre and again after four months (i. e., in January) they were applied with Cal. Ammo. Nitrate at 50 lb. per acre. Burnt earth was also applied at 5,000 lb. per acre. Spraying the foilage with wetable sulphur during the hot months was repeated whenever mite infestation was noticed. During the hot months, the shade for the young seedlings was further augmented by raising the green manure crops of *Sesbania* and *crotalaria striata* and the latter was found to be more effective as a shade crop. Copious irrigation was given to the nurseries from middle of November, 1958, to end of May, 1959.

(iii) **Areca Nursery : 1958–60** :– This is the fourth nursery of the Station.

As usual seednuts (90,511) procured from pre–marked trees were sown in pits (1′×1′×6″) filled with sand and watered daily, Germination counts were recorded periodically.

(c) *Miscellaneous crops :*

(i) **Green manure crops** :- Green manure crops of *Sesbania* speciosa and Kolinji (**Tephosia purpurea**) were raised as pure crops in Block I, V and IV-A of the farm covering a total extent of 6.50 acres.

Sesbania speciosa was also raised as a shade-cum-green manure crop in the margins of nursery beds in the main garden (Block II) and in the spacing experimental garden (Block III and IV-A) covering a total of 11 50 acres.

(ii) **Green leaf manure** :- Gliricidia cuttings numbering 5,127 were planted round the boundaries and vacant spaces of the farm with a view to augment the resources of green leaf supply of the Station.

(iii) **Cocanut Trees** :- All the coconut trees standing at the station were manured each with 50 lb. of green leaf, 2 lb. super phoshate and 10 lb. wood ash The yield of the trees were steadily increasing from year to year as shown below and during the year 6924 ripe coconuts were harvested.

S. No.	Year	Yeild of ripe nuts for the year
1.	1955-56	1727 Nos.
2.	1956-57	3545 Nos.
3.	1957-58	4806 Nos.
4.	1958-59	6924 Nos.

Eroded bases of coconut trees were rebuilt to a length of 280′ and width 12′.

(iv) **Coconut nursery** :- A small nursery with 214 seed nuts was raised during the year in order to plant the seedlings at the station.

(V) **Coconut seedlings planted** :- With a view to serve as a permanent shade cum-wind break, 140 coconut seedlings raised at the station were planted on the Western boundary of the farm.

(Vi) **Fruit plants**:- The following miscellaneous fruit plants were planted around the four sides of the main garden.

1.	Graft mangos	....	41 Nos.
2	Guava layers	....	6 Nos.
3.	Sapota grafts	....	6 Nos.
4.	Ctstard apple seedlings	...	3 Nos.
5	Bread fruit plants	....	3 Nos.
6.	Pummelo plants	...	3 Nos.
7.	Malta lemon layer	....	6 Nos.

(d) Permanent Improvements:

1. **Anti-erosion measure** :- With a view to protect the land facing the river from eroding, one row of pandanus was planted.

2. **Prevention of flood entry to garden** :- To prevent the over flow of river water to garden an earthen embankment 100′×6′×4′ was built on the western corner of the garden.

3. **Digging new drainage channels** :- To take off rain water from the farm, drainage channels running to 1370 ft. length were dug round Block-V and Block-IV B.

4. **Installing new engine pumpset** :- One more diesel engine pumpset—5 H. P. was procured and installed temporarily in the farm.

5. **Levelling and ploughing**:- 5.75 acres of slopy land was terraced and levelled with the help of Bull-grader. Nine acres of the newly levelled fields were ploughed with disc plough.

6. **Extension of farm area** :- During the year 26.26 acres of A. W. lands were got alienated to the farm. Thus increasing

its total extent to 65·86 acres. Fresh proposals were submitted for extending the farm area by another 69·35 acres, A sketch map of the extent of lands now occupied by the C.A.R. S. may be found at appendix II.

7. **Construction of farm shed** :- The work of construction of farm shed (20′×12′) with Mangalore tiled roof was completed during the year.

8. **Rivetment of river side** :- Estimates were prepared and sanctions were obtained for rivetting the river side of the farm. The work could not be taken up since contractors did not come forward.

9. **Fencing of river side with barbed wire** :- Estimates were prepared and sanctions were obtained for fencing the river side of the farm with barbed wire. The same has been procured.

3. AGRONOMY

1: Experiment to co-relate the weight of seednut with their germination and vigour of seedlings :

This experiment which was laid out in 1956–57 on a randomised replicated design with three treatments consisting of seednuts weighing (i) 31 to 35 gms, (ii) 36 to 40 gms, and (iii) 41 to 46 gms. and eight replications, in order to find out whether the weight of seednut has got any influence on germination and vigour of seedlings was continued. The morphological data (height, number of leaves and girth) of the seedlings were recorded and the data along with the germination counts were statistically analysed. The results are given below : -

(a) Germination :-

TABLE—I.

Treatment (weight of seed)	Average percentage of germination	No. of days taken to start germination	No of days taken to complete germination
1. 31 to 35 Gms.	86·94	50.62	85· 0
2. 36 to 40 Gms.	94·73	48.00	80·75
3. 41 to 45 Gms.	97·88	48·00	81.75

TABLE—II

ANALYSIS OF VARIANCE

Source of variation	Sum of squares	Degrees of freedom	Mean square	F.
Blocks	430·50	7	61·50	1.58
Treatements	507·19	2	253.59	6·50 *
Error	546.57	14	39·04	—
Total	1484·26	23	—	—

* significant at 5% level.

Critical difference = 6·7

Conclusion — 3 2 1

From the above, it is seen that the percentage of germination increases with seed weight and that the germination of seed with weight 36 to 40 gms. and 41 to 45 gms. are not significantly different where as the difference in the percentage of germination in the group 31–35 gms. and those in other two groups is significant. It is also seen that nuts with lesser weight has taken more number of days both for starting and completing germination.

(b) Morphological data of seedlings :

(I) Girth.

TABLE—III

Weight of seed.	Average girth of plant
1. 31 to 35 gms.	9 52 cms.
2. 36 to 40 gms.	9.86 cms.
3 41 to 45 gms.	10.50 cms.

TABLE—IV

ANALYSIS OF VARIANCE

Source of variation	Sum of squares	Degree of freedom	Mean square	F.
Blocks	22.41	7	3.20	9.14*
Treatments	3.93	2	1.96	5.60*
Error	4.86	14	0.35	—
Total	31·20	23	——	——

* Significant at 1% level.

Critical difference = $\frac{0.62}{3\sqrt{2}\ 1}$

Conclusion —

It is seen that plants raised from nuts of the heaviest weight group have recorded maximum girth and the treatement pifference of this group with the rest is statistically significant.

(ii) Height and number of leaves :

TABLE—V.

Weight of seed	Average height of plant	Average No. of leaves/plant
31 to 35 gms.	94·41 cms.	5·0
36 to 40 gms.	99·53 cms.	5·14
41 to 45 gms.	105.66 cms.	5·23

TABLE—VI

ANALYSIS OF VARIANCE

Source of variation	Height				No. of leaves			
	Sum of squares	D. F.	Mean Square	F.	Sum of square	D. F.	Mean squares	F.
Blocks	3102.30	7	443.19	4·79*	0.51	7	0·07	1·75
Treatments	507·58	2	253.79	2·74	0·16	2	0·08	2·00
Error	1298·33	14	92·52	—	0·48	14	0.03	—
Total	4905·21	23	—	—	1·15	23	—	—

* Significant at 5% level.

From the above, it is seen that the treatments are not significantly different with reference to the effects on height and number of leaves. However, it is seen that the trend is in favour of heavier seed weights.

The experiment has been repeated during the year on similar lines for coufirmation and the germination of the nuts is in progress.

(2) Effect of position of seednuts in the bunch on their size, germination and vigour of seedlings.

This experiment which was laid out during the previous year on a split plot design in order to find out the influence of the position of seednuts in the bunch on their size and germination was continued. The treatments consisted of three main plots (top, middle and bottom portions of the bunch) and four sub-plots (1st, 2nd, 3rd and 4th rachis). The seed weight were satistically analysed and the results are given below :-

TABLE—I

AVERAGE WEIGHT OF NUTS

Position	Mean weight	Rachis No.	Mean weight
Top	36·36	1	35·80
Middle	36·85	2	35·76
Bottom	34·04	3	35·20
		4	36·24

TABLE—II

ANALYSIS OF VARIANCE

Source of variation	D.F.	Sum of squares	Mean S. S.	Variance ratio
Replication	3	4937·47	1645·82	5·873*
Main treatment	2	773·12	386·56	1.379
Error (a) ...	6	1681·31	280·22	—
Sub-treatment ...	3	351·20	117·07	0·923
Inter action	6	526·24	87·71	0·696
Error (b) ...	27	3424·29	126·83	—
Total	47	11693·63	—	—

* Significant at 5% level

It is seen that there is no significant difference between the effects of position of seed-nuts, whether they are taken from top, middle or bottom or from different rachis i. e., main treatment effects and sub-treatment effects are not significantly different.

The germination of the nuts were recorded and the mean figures are given below. The data is to be statistically analysed.

TABLE—III.

AVERAGE PERCENTAGE OF GERMINATION.

Position	Mean % of germination	No. of days taken to start germination	No. of days taken complete germination	Rachis	Mean % of germintaion	No. of days taken to start germination	No. of days take to complete germination
Top	79.95	47.5	67.5	1	84.83	50.8	68.3
Middle	83.83	45.0	71.0	2	80.78	45.3	69.3
Bottom	89.71	46.0	57.5	3	84.04	45.3	63.3
				4	88.36	46.5	59.6

The experiment has been combined along with two other factors (age and order of bunches) and laid out for the second time.

3. Studies on the performance of nuts gathered at different stages of maturity for seed purpose :

A randomised replicated trial with six treatments and six replications was laid out with seednuts of 8, 8½, 9, 9½, 10 and 10½ months maturity in order to study the performance of these nuts from the point of view of seed quality. Thirty seednuts have been sown under each treatment. The germination is in progress.

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

An experiment on a 3^3 factorial confounded design in nine plot blocks with two replications was laid out for studying the effect of age of mother palms (young, middle and old), order of bunches (first, second and third) and the position of nuts in the bunch (top, middle and bottom) on seednut performance. Thirty nuts were sown under each treatment. The germination of the nuts is in progress.

5. Comparative study of different position of seednuts in sowing :

Observations on the seednuts sown under this experiment laid out during the previous year on a randomised replicated design with four treatments and eight replications in order to find out the ideal position of sowing seednuts in the nursery was continued. After the completion of the germination of the nuts, the sprouts, were transplanted in the main nursery for further study. The germination data was statistically analysed and the results are given below :

TABLE—I

AVERAGE PERCENTAGE OF GERMINATION

Position of sowing	% of germination	Critical difference	No.of days taken to start germination	No. of days taken to complete germination
1. Vertical	94·0	7·18	46·5	98·62
2 Horizontal	93·0	—	54·0	117·0
3. Slanting	86·5	—	52·2	90·3
4. Topsytusry	78·0	—	63·5	113·8

TABLE—II

ANALYSIS OF VARIANCE

Source of variation	D. F.	Sum of squares	Mean S. S.	Variance ratio
Blocks	7	1355·5	193·64	4·056*
Treatments	3	1305·5	435·16	9.115*
Error	21	1002·5	47·74	——
Total	31	3663·5	——	——

* Significant at 5% level.

Conclusion : 1 2 3 4.

From the above, it is seen that sowing nuts vertically is significantly better than sowing horizontally or topysturvy. Vertically sown seednuts appear to slant germination early. However, completion of the same does not seem to get influenced.

The experiment has been repeated on similar lines for confirmation

6. Determination of optimum depth of sowing seednuts :

This experiment laid out during the previous year on a 5 × 5 Latin square design in order to find out the optimum depth at which seednuts have to be sown for sprouting was continued. Germination counts of the nuts were recorded and the data statistically analysed. The results are given below:

TABLE—I

PERCENTAGE OF GERMINATION.

Treatment (sowing depth)	Mean % of Germination	No. of days taken to start Germination	No. of days taken to complete germination.
1—0"	93·6	45·8	91·4
2—1"	86·4	56·8	97·4
3—2"	68·8	69·4	102·4
4—3"	63·2	75·0	105·0
5—4"	49·6	82·0	102·6

TABLE—II.

ANALYIS OF VARIANCE

Source of variation	Sum of squares	Degrees of freedom	Mean S. S.	F.
Rows	4048·64	4	1012·16	4·08*
Columns	1091.84	4	272·96	1·10
Treatments	6314·24	4	1578·56	6·37**
Error	2974·72	12	247·89	—
Total	14429·44	24	—	—

* Significant at 5% level.
** Significant at 1% level.

Critical difference = $\frac{21{\cdot}7}{\sqrt{1\ 2\ 3\ 4\ 5}}$

Conclusion —

It is seen that the treatment differences are statistically significant. Sowing the nuts and just covering (0″ depath)has recorded the maximum germination of 93·6% and is significantly better than sowing at two inches or below depths. It is also seen that as the depth of sowing increases the number of days taken to start and complete germination also get increased. The experiment has been repeated for confirmation

7. Effect of different spacings on seednut performance :

An experiment on a 5×5 Latin square design was laid out with five different spacings (6″ × 6″, 9″ × 9″, 12″ × 12″, 15″ × 15″ and 18″ × 18″)on the seedlings in the nursery in order to find out the influence of these spacings on the growth of the seedlings. Twenty seedlings were planted under each treatment with a guard row all round. Observations are in progress

8. Determination of the efficiency of sowing unsprouted Vs. sprouted seeds :

The observation trial laid out during the previous year in order to find out the efficiency of directly sowing the seednuts in the nursery and transplanting the sprouts raised in the primary nursery to the main nursery was continued. The morphological observations of the seedlings will be recorded and the experiment repeated on a regular statistical design

9. Storage trial of seednuts and viability studies:

Observations in this experiment which was laid out during the previous year on a $4 \times 8 \times 2$ split plot design in order to find out a suitable method of storing seednuts without loss of viability was continued. Germination coconuts were recorded at regular intervals and the final data statistically analysed. The results are given below :-

TABLE—I

MAIN PLOT TREATMENTS

	Intervals of sowing	Percentage of germination	Critical difference
1.	One week after	85·9	2·4
2.	Two weeks after	82·9	
3.	Three weeks after	79·1	
4.	Four weeks after	69·0	

TABLE—II.

SUB PLOT TREATMENTS.

Treatments.	% of germination	Critical difference
1. Control–keeping open under shade	56·6	6·07
2. Packing seednuts in double gunny	89·9	
3. Packing seednuts in Alkathene bags inside double gunny bags	82·9	
4. Dipping seednuts in 1% bordeaux mixture and packing in double guuny	93·2	
5. Dipping seednuts in 0·1% mercuric chloride and packing in doule gunny bags	90·6	
6. Dipping seednuts in folidol (2 c. c. per gallon of water) and packing in double gunny bags.	91·5	
7. Drying seednuts in sun for 16 hours and packing in double gunny bags.	37·6	
8. Packing seednuts with dry saw dust in double gunny bags	91·4	

TABLE—III

ANALYIS OF VARIANCE.

Source of variation	D. F.	Sum of squares	Mean S. S.	Variance ratio
Replication	1	16 00	16·00	0·09
Intervals of sowing	3	2593·69	864 56	49·40*
Error (a)	3	52 50	17·50	——
Sub-treatment	7	23944·19	3420 50	97·58*
Inter action	21	6661·06	317·19	9·05*
Error (b)	28	981 50	35·05	——
Total	63	34248·94	—	——

* Significant at 5% level.

Conclusion : Main treatment— 1 2 3 4

Sub-treatment — 4 6 8 5 2 3 1 7.

From the above, it is seen that the treatment differences are significant both for main and sub-treatments as well as for the interaction. 'Storing the seednuts over one week after their harvest significantly reduces the viability. Seednuts treated with chemicals and saw dust have recorded significantly higher percentage of germination than the rest.

The sprouuts from all the treatments excepting that of 1 and 7 (wherein due to low germination, sufficient number of sprounts were not available) were transplanted for further study of the possible influence of these treatments on the growth of seedlings.

Since treatments 3, 1 and 7 recorded very low germination, these treatments were deleted. It had also been observed that even in the case of nuts treated with fungicides and packed in double gunny, nuts treated with fungicides and packed double gunuy, nuts coming in contact with gunny bags showed fungal growth on them. It was, therefore, thought worth

while to treat the gunny bags also with a fungicide. With the above points in view, the experiment was modified to include the following treatments and laid for the second time on split plot design with four replications instead of two.

Treatments :-

1. Control—(packing seednuts in double gunnies)

2. Packing undtreated seednuts in double gunnies treated with 1% bordeaux mixture.

3. Packing nuts treated with 1% bordeaux mixture in double gunnies treated with 1% bordeaux mixture.

4. Packing nuts treated with 0 1% mercuric chloride in double gunnies treated with 1% bordeaux mixture.

5. Packing nuts treated with Folidol (2 c. c. per gallon of water) in double gunnies treated with 1% bordeaux mixture.

6. Packing nuts treated with 1% Boardeaux mixture Folidol 2 c. c. per gallon of mixture in double gunnies treated with 1% bordeaux mixture.

7. Packing nuts with dry saw dust in double gunnies treated with 1% bordeaux mixture.

Fifty nuts have been sown under each treatment and the germination is in progress Besides, in order to test the relative merits of the above treatments under field conditions, 1500seed arecanuts in each were treated with the different chemicals etc. and despatched to the Arecanut Nursery Assistant at Baruva for further study.

10. Study of seednuts from different arecanut growing tract for their viability, earliness in germination and vigour of seedlings :

In order to study the relative performance of nuts gathered from different tracts, the above experiment which was laid out

during the previous year with seednuts collected from nine different tracts was continued. The mean germination of seednuts of the different tracts is given below :

Tract	% of germination	Time taken to start germination	Time taken to complete germination
1. S. Kanara	97.2	50 0	103
2. Trichur	95 2	50.0	95
3. Palghat	93·6	60.0	110
4. Kozhikode	93.2	49 5	108
5. Cannanore	94·4	54.0	112
6. Shimoga	96.8	47·0	81
7. Wyanad	27.5	46·0	92
8. Coimbatore	92.8	42.0	91
9. N. Kanara	43.2	42.0	79

Further observations on the sprouts transplanted in the main unrsery was not continued since it was decided to classify the eco-types of each tract and than select the most common one to represent the tract, Accordingly, in collaboration with the Botany Section a detailed survey of the important arecanut growing tracts of Kerala, Mysore and Bombay States was undertaken. The Revenue Districts where arecanut is cultivated on a fairly large scale was treated as the main unit and these in turn divided into tracts with special reference to cultivation practices and altitude. One Hundred trees in each tract were marked out at random in a representative garden and the nuts of equal maturity collected from these trees were measured for length and breadth and the eco-types fixed based on a suitable range. The eco-types having the maximum

percentage of occurrence was then selected. The nuts from 15 tracts have been sown on an 8 × 8 double lattice design along with other ecotypes. Germination of the nuts is in progress.

11. Determination of optimum NPK aequirement of seedlings in the nursery :

An experiment was laid out on a 3^3confounded factorial design with three levels of nitrogen (0 lb., 75 lb., and 150 lb. per acre) three levels of phosphoric acid (6 lb., 25 lb. and 50 lb. per acre) and three levels of potash (6 lb.,75 lb. and 150 lb. per acre) with a view to findout the optimum NPK requirement of the seedlings. Nitrogen was applied in the form of ground nut cake and area in equal proportions. phosphoric acid as super phosphate and potash as burnt earth and muriate of potash in equal proportions. The manures were applied in two equal split doses, i. e., three months and six months after planting. The eqperiment is in rpogress

An experiment to find out the response of seedligs of varied vigour to different levels of maunring is being proposed in order to study the masking effect on selection of seedlings, if any, due to manuring.

12. Determination of optimum spacing :

An experiment was designed on a randomised replicated lay out with six treatments (6′ × 6′, 6′ × 9′, 6′ × 12′, 9′ × 9′, 9′ × 12′, and 12′ × 12′) and six replications in order to find out the optimum spacing that is to be adopted while planting the areca seedlings in the mainfield. A uuiform plot size of 72′ × 36′ (5·96 cents) was used for each treatment. A total number of 1902 pits of 3′ cube required for the experiment were dug and the seedlings transplanted at a uniform depth of the feet in November, 1958, after noting their morphological features such as height, diamter at collar, number of fuuctioning leaves, length of second leaf from bottom and the maximum spread of leaves. Seedlings from two mother palms were used for the replication of the experiment, guard rows being planted with

seedlings of one mother palm and experimental rows with seedlings of the second. Each plant was mulched with green leaf at 15 lb. after planting and later manured in February, 1959 with 15 lb. cattle manuare and ¼ super phosphate and in March with ½ lb. ground nut cake and two ounces of muriate of potash. In order to get uniform shade to the plants, a crop of Sesbania has been raised.

13. Comparative studies of different green manuare crops for arecanut gardens :

With view to find out a suitable green manure crop for arecanut gardens, the following twenty four different species of green manures were got from the Indian Agricultural Research Institute, New Delhi, the Agricultural Research Station, Mandya and private sources.

1. Crotalaria fulria.
2. Crotalaria genecensis
3. Crotalaria Juncea.
4. Crotalaria anagyroides.
5. Crotllaria usermoensis.
6. Crotalaria grahamiane.
7. Indogofera spp.
8. Indogofera hirsuta.
9. Indogofera sumatrana.
10. Desmodium purpareum.
11. Desmanthis virgatus.
12. Phaseolus lathyroides.
13. Sesbania aculeata.
14. Melilotus alba.
15. Tephrosia purpurea.
16. Tephrosia noctiflora.
17. Tephrosia candida.
18. Theprosia vogelli.
19. Leucana glauca.
20. Aeschynomene americana.
21. Cassia Lora
22. Cassia leschenaultiana.
23. Centrosema pubescens.
24. Calapogonium 'muconoides'

There were sown along the boarders of the nursury beds for preliminary observations and multiplication. Germination of the seeds of many of the species was found to be poor. *Tephrosia, candida Crotalaria, usermoensis* and *C. anagyroides* .

were found to come up well and also provide shade to the seedlings,

14. Uniformity Trial-Collection of yield data of palms :

A total of 570 palms of uniform age cultivated under uniform conditions were marked out in a private garden. The complete morphological features of these palms were recorded and the nuts when ripe are being harvested, counted and weighted separately. The yield data so gathered will be analysed to find out the optimum number of trees for experimental purposes.

15. Shading experimental nurseries :

Since banana which is the usual shade crop grown in the arecanut nursery is likely to bring in variation due to unevenness of shade, seed of sesbania were sown throughout the entire lengths and widths of beds on the south and western sides. The plants when they started flowering were prunned at a uniform height of 6′. This was found to give uniform shade to the seedlings.

4. BOTANY.

1. Collection and maintenance of indigenuos and exotic species and types of areca :

Out of five seedlings of exotic varieties of areca received from the Office of the Indian Central Arecanut Committee and planted at Central Arecanut Research Station, during 1956-57 four, namely, Indonesia-2 Nos,· Andaman-1 No., and Nicobar —1 No have survived. The plants are healthy. None of them have put forth inflorescences. Measurements such as height number of leaves, number of nodes and girth are being maintained.

Morphological featurers are being studied in the case of indigenous types which were collected and transplanted during last year. It is proposed to maintain a few plants out of these

types in view of the systematic investigation taken up on the types (vide item I (2) in the approved Technical Programme)

Relevant details pertaining to exotic species and types of areca including unclassified ones collected and maintained at Central Arecanut Research Station during the period under report are furnished below :

EXOTIC SPECIES AND TYPES OF ARECA (RECEIVED UPTO 31—3—59)

S.No.	Foreign Countries	Name and address of the sources from where exotic types and species were collected	No. of varieties including unclassified introduces upto 31-3-59
1	Suva (Fiji)	Director of Agriculture, Suva, Fiji	1
2	Mauritius	Director of Agriculture Govt. of Mauritius	1
3	Peking (China)	Commissioner for Government of India in China, Peking	1
4	New Guinea	Department of Forests, Territory of Papua and New Guinea, Port Moresby	1
5	Ceylon	Botanist and Senior Agricultural Research Officer, Division of Botany, Department of Agriculture Peradenia, Ceylon	2
6	Indonesia	Lambaga Hortus Batanicus, Purat Kebuu Roya Indonesia) Bogar-Java, Indonesia	6
7	Indo-China (Saigon)	Saigon Agricultural, Department Saigon.	3
8	East Aden (Saudi Arebia)	Department of Agriculture, SAIUN, Wadi Hadhramant, Aden	1
9	Malaya	Director of Botanic Gardens, Cluny Road, Singapore-10	1
		Total Consignment	17

PERCENTAGE OF GERMINATION IN DIFFERENT OF EXOTIC SPECIES & TYPES OF ARECA RECEIVED UP TO 31—3—1959.

S.No.	Foreign Countries	Nos. received	Nos. Sown	Nos. germinated	% of germination	No of days taken to start germination	No. of days taken to complete germination	Measurements		Remarks
								length	Breadth	
								cms.	cms.	
1	Suva (Fiji)	50	46	5	10.8	61	71	4·6	2.6	Areca Catechu Linn
2	Mauritius ...	60	56	47	83.9	57	98	3·4	1·2	Areca Trinndra Roxb.
3	Peking (China) ...	29	25	8	32·0	43	57	5·3	3·7	Areca Catechu Linn
4	New Guinea .. .	45	41	N.G.	—	—	—	5.1	3·2	——
5	Ceylon(Peradenia)....	50	46	41	89.1	42	99	5·9	4.1	Areca Catechu Ramban
6	Indonesia	17	15	10	66.6	43	81	3·5	1.2	Areca triandra Roxb long var
7	do.	110	100	75	75.0	39	95	2.5	1·2	Areca triandra Roxb
8	do.	32	28	N.G.	—	—	—	2.9	1.3	Areca Macrocalyx zypp
9	do.	22	19	5	26·3	43	65	5·3	1·3	——
10	do.	3	2	N. G.	—	—	—	6.2	3.5	——
11	do.	16	14	13	92.9	36	58	5·3	3.7	Areca Catechu Var Alba Bl.
12	Saigon	50	47	46	97·9	48	103	2.8	4·0	(Red variety) Cau Hon day.
13	Saigon	50	47	24	51.0	33	78	5.6	4.5	(White variety) Cau Hon day.
14	Saigon	43	40	36	90·0	44	78	5.2	4.0	(White variety) Cau Vu B.
15	Ceylon(Peradenia)···	32	29	28	96.5	59	93	5·9	4.2	Rate Puwak
16	Aden	29	26	N.G.	—	—	—	4.9	4.2	——
17	Singapore	12	10	10	100·0	8	30	5·0	3·3	——

Def :— N. G. = Not Germinated.

It is intended to take up the future procurement through Bnreau of plant Eutroduction, Indian Council of Agricultural Research as recommended by the Agricultural Research Sub-Committee.

2. Floral Biology of Areca.

(a) The flowering behavious (rate, time and duration of flowering) of both male and female flowers of areca was studied in a private garden. It was observed that majority of the male flowers opend between 6 a. m. and 10 a. m. with a persisting stoong aroma. Anthesis was also found to start at 6 a. m. The opened male flowers started shedding from 10 a.m, The female flowers were found to start opening at 2a. m. and continued up to 10 a. m. with a mild pleasant smell.

The male flowers began to open first and continued flowering from tip to the base of the rachis. Practically when all the male flowers have completed blooming and shedding the female flowers began to open from bottom to tip. The plam however is essentially crosspollinated due to this nature of flowering but in a few cases where there is overlapping in the opening of the flowers in the two successive bunches of the same palm self pollination is possible.

The above studies were continued during this year also and the conclusions arrived at agree with the observations made during the privious year.

Observations on the duration of male phase and female phase of areca are being pursued as done in the past years. The palms of three age group, namely young, middle and old were marked out for the study in the private gardens.

(a) Receptivity of stigma in areca :

In the experiment undertaken to study the receptivity of stigma, female flowers from one bunch of four different palms of three age groups (young, middle and old) opened on the same

day were bagged and polinated daily at the rate of one rachis per day up to the tenth day after openning so as to cover the entire bunch. It was observed that percentage of fruit set was different in each rachis. Female flowers in rachis 1 to 6 have given higher percentage of fruit set when compared with rachis 7 to 9 and practically nil in the case of 10th rachis. It was also observed that in old palms there was no setting from the 7th rachis and onwards, as against the fruitset upto 9th rachis in the case of middle aged and young palms. It was further observed that middle aged palms have given maximum percentage of fruitset followed by young and old palms. The experiment was taken up in a private garden.

c. Floral initiation

The crowns of thirty five palms were collected for the above study, from private gardens. The observations of leaf scar and bunch scar (presence of scars and the distance between scars) remained on the stem during the past years were made with a view to ascertain the bearing habit of the palms. The morophological features—size, shape weight and volume of the fruits of the oldest standing bunch were recorded. The crowns were dissected and the observations such as, leaf number, inflorescence number presence of aborted and non-aborted spathes length and breadth of spathes, age of inflorescence, internodel distance and girth of internodes were made. The young spathes have been preserved for examining for female and male flowers production in the spathes of varying developments. The studies on flower bud initiation will also be undertaken. The growing points have been fixed to study the shoot apex, leaf and floral initiations.

3. Breeding and Genetics of Areca :

Survey of arecanut gardens to assess genetic variation and select superior type.

A wide range variation exists in the size, shape and colour of nuts, fruitset, size and shape of the kernal etc. in different arecanut growing tracts of various states in India.

The extent of genetic variation existing with reference to the morphological characters of the nuts (length and breadth) were determined, distinct ecotypes were classified and collected, with a view to utilise the desirable ecotypes for cytological anatomical and other studies besides to utilise them in hybridization programme and also to assess the comparative merits of different areconut products made out of their fruits from the point of view of quality and yield. The occurence of the most common type in each tract was also assessed to study the relative merits of seednuts from different arecanut growing tracts for their viability, earliness in germination vigour of seedlings etc.

The states of Mysore, *K*erala and Bombay were classified into different tracts depending upon the area under arecanut cultivation. The Revenue Districts were treated as main units which in turn were divided with special reference to geographical climatic and cultivation practices. Gardens in these tracts were surveyed and a garden of average maintenance with at least 500 trees was fixed up for the study. One hundred palms selected at random were marked out in the garden. Five nuts of equal maturity from each of the marked out trees were collected and their length and breadth recorded. Thereafter the the suitable range of length and breadth for the particular tract was fixed and the ecotypes classified. Mother palms for each ecotype were marked for the collection of seednuts for sowing them at the Central Arecanut Research Station for further study. The following tracts were surveyed and ecotypes noted against each collected.

TABLE

The following types were collected :

State	District	(Region) Tract	No. of types	Size Length cms.	Size Breadth cms.
1. Kerala	Trivandrum	Palode	3	4·12–6·0	2 6–3·5
2. Kerala	Quilon	Edamon	4	4·12–6·0	2·5–3·4
3. Kerala	Trichur	Pengamukku	4	4·5—6·4	3·0–3 9
4. Kerala	Palghat	Kumaranellur	4	4·5. –6·4	3 0–3·9
5. Kerala	Cannanore	Kurumattur	2	5·0—6 9	3 0–3·4
6. Kerala	Kozhikode	Kottakal	4	4·5—6·4	3·0–3 9
7. Kerala	Kozhikode	Waynad	3	4·5—6 4	2·3–3·2
8. Kerala	Kozhikode	Manjeri	4	4·6—6·5	2·8–3·8
9. Mysore	South Kanara	Mani	8	4·1—6·0	3·1–4·0
10. Mysore	Chikkamagalur	Sringeri	4	3·9—6 0	2·4–3·1
11. Mysore	Shimoga	Kallahalla (Thirthahalli)	7	4·0—5·3	2 0–3.4
12. Mysore	Shimoga	Kaladi(Sagar)	3	2.8—4 5	2·0–4·0
13. Mysore	Karwar	Sirsi	5	3·2—4·7	2 9–3·9
14. Bombay	Ratnagiri	Dapoli	4	4·1—6·4	2·6–3·9
15. Bombay	Kolaba	Deveagar (Shrivardhan)	5	4 1—5·8	2·9–4·9
		Total	64		

This experiment which has been taken up in collaboration with the agronomy section was laid out on an 8 × 8 double lattice design with two replications. Fifty seednuts of each

type were sown under each replication. Germination counts are being made. One hundred nuts from each type were sundried for 'Chali' for finding out comparative merits. Certain details such as, the name of the tract quality of Chali sold, price offered against the prevailing market rate, etc. have been gathered from the South Kanara Marketing Society, Mangalore, as a preliminary measure to find out whether it will be possible to locate a suitable locality for taking up the study.

It is intended to undertake similar survey of arecanut gardens in Assam and West Bengal.

4. Influence of self, cross and open pollination of selected palms on fruitset, germination of seednuts vigour of seedlings and their subsequent performance :

In this experiment which was taken up in a private garden near vittal one hundred and ninety four sprouts obtained from two hundred and thirteen fully tree ripe nuts produced under four different treatments in the same bunch, such as, (i) open pollination, (ii) cross pollination with a palm of a distant garden, (iii) cross pollination with a palm of the same garden and (iv) self pollination, were transplanted in the nursery beds in randomized replicated trial in two series as followed while sowing. The result with respect to their germination is given below :

	Treatments		% of germination
1.	Open pollination	....	91.6
2.	Cross with a palm of distant garden	....	87.5
3.	Cross with a palm of the same garden	....	87.9
4.	Self pollination	....	92.6

The above data shows that self pollinated and open pollinated nuts have given greater percentage of germination than crossed pollinated ones. Prior to planting the sprouts, relevant morphological characters were noted.

During the year under report eight hundred and twenty six hybridized fully tree ripe nuts from seventeen different bunches and each bunch with above four treatments, (namely open pollination, cross pollination with a palm of a distant garden, cross pollination with a palm of the same garden and self pollination) were collected. They were sown after recording weight, length, breadth and volume of the entire fruit. One fruit from each treatment has been preserved for studying the morpholgy of kernel and embryo. It was observed that self pollination gave 23% fruitset, cross with a palm of a distant garden gave 14% fruitset, cross with a palm of the same garden gave 23% fruitset, and open pollination gave 32% fruitset.

Hybridization work on the same selected palms is being continued.

5. Study of variations genetic constitution of the female parent :

One hundred and thirty one cross nuts and seventy open pollinated nuts gathered from the two mother palms were sown and the comparative germination is given below :

Palm No.	Treatment	Nos. sown	Nos. Germinated	% of germination
1.	Open pollinated	45	44	97·7
	Cross pollinated	120	72	60·0
2.	Open pollinated	25	24	96·0
	Cross pollinated	11	9	81·8

Open pollinated have given greater percentage of germination than cross pollinated ones.

One hundred and forty nine sprouts in all obtained there from were transplanted in the main nursery beds after recording the morphological features.

6. Production of elite seeds in areca :

A detailed plan showing the staff. financial and working aspects on the production of elite seeds in areca was prepared. The relevant literature in this connection was collected.

7. Hybridization of the cultivated and the wild areca :

$$\left.\begin{array}{l}\text{Wild areca "Ramadike"} \\ \underline{\text{Actinorytes calapparia ?}} \\ \text{(Female)}\end{array}\right\} \times \left\{\begin{array}{l}\text{Cultivated areca} \\ \underline{\text{Areca catechu Linn}} \\ \text{(Male)}\end{array}\right.$$

The crossing was effected in a private garden. Eleven sprouts were obtained out of seventynine crossed nuts sown for germination. The sprouts have been planted in the nursery after recording the morphological features.

8. Effect of husking Half husking and unhusking on germination of seednuts, vigour of seedlings and subsequent performance :

Randomized replicated trial with the above three treatments was laid out. Sixteen hybrid nuts (240 Nuts in all) were sown under each treatment

S.No.	Treatments	Nos. Sown	Mean days taken for statrting germination	Nos. germinated	% of germination
1.	Husked (kernel)	80	33.4	73	91.25
2.	Half husked	80	38.2	69	86.25
3.	Unhusked	80	45.8	68	85.00

Kernal has given better percentage of germination than half husked and unhusked.

Ten seedlings from each of the above treatments, viz. Kernel, half husked and unhusked were transplanted in the main nursery with boarder rows of bulk seedlings in the same randomized replicated design. Morphological features of the seedlings have been studied.

9. Progeny studies :

The height, girth number of leaves and the length of the oldest standing leaf of the individual seedlings were noted for four hundred and sixty seedlings raised at the station from seednuts gathered from the known mother palms for determining the performance of the progenies

The seedlings were sold out to a private party who has transplanted the seedlings in a newly laid out private garden at Vokkethur (Vittal)

Observations are being regularly made.

✓ 10. To investigate the causes of shedding of buttons and tendernuts in arecanut and methods of control :

Shedding of female flowers and tendernuts of areca in various stages of development up to maturity has been noticed. As this source has been of considerable loss to the arecanut growers, a special study has been taken up.

A randomized replicated experiment with seven treatments inclusive of one control has been laid out in a private garden. Only middle aged palms were marked out for the experiment. Third bunch with unopend female flowers were fixed up, in all palms for all treatments. Every treatment has fivetrees in each replications and there were four replications in each treatment.

Prior to the treatment, each time the sheddings in each case have been collected, counted and measurements taken A cloth has been tied underneath the selected bunch so as to collect all the sheddings. The chemicals such as growth promoting hormones and also a standard insecticide/fungicide mixture

have been applied to the bunch in the form of sprays and repeated once in every fortnight. The field experiment has been supplimented with relevant laboratory investigations and further studies. The percentage of shedding of buttons and tendernuts in different stages of development have been determined.

The following are the treatments :

S.No.	Treatment		Concentration.
1.	2, 4—D	...	20 p. p. m.
2.	I A. A.	....	20 p. p. m.
3.	2, 4 — D+I. A. A.	...	20 p.p.m. each
4.	Standard insecticide/fungicide mixture (shell copper and Endrex)		
5.	Chogaru	....	4·0%
6.	Urea	...	0·5%
7.	Control	...	

The experiment has been taken in collaboration with Pathology section in a private garden.

5. PATHOLOGY.

A. Survey of diseases for locating areas of High incidence of diseases and pests :

It was reported by Shri G. V. Bhat, a grower from Adyanadka that spraying mud solution against Keleroga was as effective as bordeaux mixture spraying in the control of the disease. On examination, the nuts of the mud treated palms showed Koleroga infection. Further study is in progress.

A few gardens round about Manjeri (Kerala) were visited. It was seen that the gardens were purely rainfed and cultural

practices were not regular. The gardens suffered for water during sumer. About 5% of the palms showed 'Band' symptoms The growers were advised about suitable manurial formulae and were asked to treat the plants showing 'Band' symptoms with ½ lb. of copper sulphate and ½ lb. of lime mixture. Further they were advised to standardise their cultural practices and irrigate the gardens during summer months.

The garden of Shri Baliappa Gowda at Devachalla was visited. The root system of some of the bearing palms was rotten and in certain cases drying up. A borer was seen to be attacking the stem and collar regions of the palms causing there by the death of a few palms. The grower was advised to remove badly affected and dead plants outside the garden and burn and to treat the empty pits and palms with Dieldrex or Gammaxane

A newly laid out garden in Enmakaje Village, which was badly infested with mite was visited and spraying Wettable sulphur (1 lb. per 10 gallons) reeommended.

B. Trial with proprietory fungicides and insecticides to find effective control for all diseases and pests :

I. Trial with proprietory miticides against mite :

Preliminary trials with miticides laid out last year in the farm nursery showed that Folidel 2 c. c. per gallon and Systox 2 c. c per gallon were better than the rest. In a similar trial on red mits laid out in a standing private garden, it was noticed that Folidol 2 c c per gallon, Systox 2 c. c. per gallon and Ekatin 4·5 c. c. per gallon were promising. A small block beetle was found to be very closely associated with mites and was found to feed upon them.

An experiment on a 10 × 4 randomized replicated design was laid out on the farm to try out nine proprietory miticides in the farm nursery, each treatment being replicated four times The following chemicals were tried.

S. No.	Chemicals	Dose per gallon.
1.	Systox 50 ...	2·5 c. c.
2.	Folidol E-605	2·0 c. c.
3.	Ekatin ...	4·5 c. c.
4.	Metasystox	4·5 c. c.
5.	Wettable sulphur (B.P.M.)	1½ oz.
6.	Karathane W. D. ...	4½ gms.
7.	Ultra sulphur	7·6 gms.
8.	Basudin	5·7 c. c.
9.	Armite	4½ gms.
10.	Control ...	—

Pre-treatment counts of mite populations were recorded from random leaf samples for all the treatments. The chemicals were applied in a fine mist form. After 15–20 days post-treatment counts were recorded again as before and the chemicals were then applied Final counts recorded after 15-20 days following the second spray indicated that Ekatin, Systox, Ultrasulpher and Metasystox gave satisfactory check against rebuilding of colonies of mite.

2. Trial against white grub (Root pest :

Yellowing of crowns and reduction in yield were reported from many places round about and an examination revealed the presence of a variety of white grubs which damaged the root system. These are larvae of the black, dark beetle which also lives in the soil. The body is soft and curved.

An Observation trial against these with proprietory chemicals, was laid out in a representative garden at Paivalike. One hundered five affected palms were marked out and 15 palms were allotted for each treatment with one untreated set as

control. Recommended doses of the following chemicals were trie in dust and solution form ·

A·	Folidol Dust	B.	Folidol E-605 liquid
	Aldrex 5% dust		Aldrex solution·
	Intox '8' dust		Copper sulphate.

The bases of the selected palms were dug out to expose the roots. The chemicals were then applied close to the roots. The soil was then thrown back· After treatment observations revealed that drenching with Folidol solution gave better results· Crowns of palms under the treatment showed definite improvement in colour and these palms put forth a healthy growth of fresh roots· Eighteen to 20 grubs and eggs were available from an untreated control palms at a depth of about a foot.

However, it was observed that the pest had moved two-wards untreated zones from the treated ones in the same plot. This indicated that a broad cast application of the pesticide may heve a better effect than treating individual palms and a fresh experiment has been laid out accordingly·

Eggs, grubs and a few adult stages of the pest were collected for further study·

3. Experiments in the control of shedding of buttons and tender nuts in arecanut :

Preliminary trials in the causes and control of the shedding were takan up in collaboration with botanical studies (Reference : Botany) at Rajah's garden, Vittal· A laboratory examination of the fallen nuts revealed that the majority of the developed nuts showed insect bites which served as passage for the fungi to enter. A randomized replicated trial has been again laid out. (Vide Botany)·

Preliminary trials with S· V· copper sovaspray indicated that a 2% solution induced shedding of nuts in arecanut palms·

4. Laboratory Work :

Fungi were isolated from collars of young seedlings showing rotting. A few isolates were obtained from leaf spot lesions. The laboratory studies also included examination of various diseased specimens submitted from time to time by growers for diagnosis and advice.

5. Plant protection work on the farm :

Eight Hundred Seventifive plants in the main garden on the farm were sprayed with 1% bordeaux mixture as a protection against fungal infections in the spindle. Soil around the base of all the plants in the garden and gaps caused by the removal of dead plants were thoroughly drenched with 0·1% solution of Ceresan wet against collar rot and subsequent infections. An after treatment count indicated considerable relief.

Seedlings and plants in the main and spacing gardens were rpeatedly sprayed with wettable sulphur solution against mite. 0·1% Cercsam drench was applied as a prophylactic measure in the bulk, experimental and exotic variety nurseries and also to young sprouts. Areca triandra seedlings were sprayed with a combination spray of Shell copper and Endrex.

6. Publication of research paper :

One paper 'The important diseases and pests of Arecanut and their control' was written up and got published.

The detailed programme of work for the year 1959—60 is enclosed as appendix iii.

SECTION D—DEVOLPMENT OF INITIATIVE AND LEADERSHIP AMONG THE JUNIOR RESEARCH WORKERS.

Shri K. Shama Bhat, B. Sc. (Agri), Farm Assistant, was in charge of the developmental activities of the research station. He has got ability to engage, control and supervise farm labour

and exhibit keen interest in the improvement of the farm. He possesses keen aptitude for reserch work also.

Shri K. V. Ahamed Bavappa, B. Sc. (Agri), Agronmy Assistant, was in charge of all the agronomical studies of the crop. In spite of the existing poor staff of the section, he has implemented the agronomical experiments as per the technical programme. He possesses a thorough knowledge of laying out experiments in the field and also to compile, and interpret results. He has got enthusiasm and zeal to shoulder heavy repsonsibilities.

Shri K. Narasimha Murthy, B. Sc., (Agri). Botanica Assistant, was in charge of the botany section. He has implemented the items of the Technical programme even though proper facilities are not available for taking up Hybridization work etc. Yet he has initiated such studies and has been able to arrive at some conclusions. He exhibits ability and much interest in his work.

Shri K. S. Nagaraja Rao, M Sc., was in charge of the Pathology Section. He has undertaken survey work to investigate the various pests and diseases of and to suggest suitable remedial measures. He has initiated, isolation and inoculation studies in the laboratory. He has laid out field trials to find out effective control measures against some of the f important diseases and pests on areca. He possesses incentive or work.

SECTION E—REMARKS OF THE SCIENTIFIC COMMITTEES AND ACTION TAKEN THEREON.

(a) Remarks of the Scientific Committee of the Indian Central Arecanut Committee on the previous years annual reoprt.

Shri C. M John suggested that the Station could keep a Distribution Register for following the performance of the seedlings sold from the station. The raising of four different varieties of bananas, in his opinion, might induce variations in the growth of the arecanut crop itself He was also of the

view that some of the agronomical experiments could be combined.

Dr.Pal said that the techinical programme for the station had been finalised by a sub-committee and he felt that the progress report should be given project wise. He suggested that the research part should be strictly technical and all information necessary for a proper assessment of the progress of work should be given. In the report under consideration, in some places the necessary information for instance, detalis of the exotic, types which had been procured were not given. The report could also advantageously include a summary of the main results written in a popular way.

The President stated that among the many species of arecanut palms that were to be secured from foreign countries, only a few varieties had been procured.

The agricultural Research Sub-Committee was of opinion that in future the procurement of plant material from foreign countries should be done through the Bureau of Plant Introduction, Indian Council of Agricultural Research. The Sub-Committee further recommended that the statistical staff at the Headquarters of the Committee should be utilised for the Statistical work at the C. A. R. S.

(b) Action Taken :

A Register showing distribution of seedlings has been maintained. Four different varieties of banana raised in arecanut garden have been removed and only one variety is bing maintained. However, different varieties of banana are being grown to find out their suitability in comparation with the local varieties in the arecauut nursery. Various agronomical experiments have been combined whereever possible. The progress report has been given project wise. Details of exotic types which have been introduced are appended in Page No. 21. A summary of the main results has been included. Further collection of exotic varieties is being made, through the Bureau of Plant Introduction, Indian Council of Agricultural Research,

New Delhi The services of the Statistical staff of the Committee are being utilised for the analysis of the experimental data.

SECTION F—SUMAMARY

The arecanut garden raised over an area of 5·50 acres for progeny studies and conducting certain cultural experiments was properly manured and irrigated. Quality seedlings numbering 25,329 were distributed to the public and 2,302 planted at the Research Station. Selected sprouts numberiug 36,840 have been transplanted in the main nursery and 90,511 selected seednuts sown for raising quality seedlings. Different green manure crops and green manure leaf crops were raised in order to augment the resources of green leaf supply of the station. The coconut trees were manured and 6,924 nuts harvested from them. One hundred and forty coconut seedlings were also planted. One 5 H. P. diesel engine and pumpest was installed at the station. An area of 5·75 acres of slopy land was terraced and levelled. A. W. lands to an extent of 26.26 acres were alienated to the farm. A farm shed was constructed.

The various investigations undertaken on the criteria for seednut selection and other factors that influence the production of quality seedlings revealed that (a) heavier seednuts give higher percentage of germination and produce better quality seedlings, (b) position of nuts in the bunch does not affect their size, (c) vertically or horizontally sown nnts give significantly higher germination than sowing in slanting position or topsyturvy, (d) sowing the nuts and just covering or covering with one inch soil is significantly better than deeper sowings, (e) storing the seednuts over one week after their harvest definitely reduces their viability and (f) treating seednuts with chemicals maintains the germination in storage.

Experiments on study of the performance of nuts gathered at different stages of maturity, study of the effect of age of trees, order of bunches and position of seednut in the bunch of seednut performance, study of different

spacings on seednut performance, study of nuts from different arecanut growing tracts, study on manurial requirement of seedlings and studies on the suitablity of different green manures for the arecanut gardens have been initiated.

Seveteen exotic types and specis of areca have so far been collected and maintained. Action has been taken to collect the outstanding species and types from the foreign countries. Studies on floral biology of areca undertaken showed that majority of the male flowers opened between 6 a. m. and 10 a m. with a persisting strong aroma and that anthesis starts at 6 a. m. The opened male flowers started shedding from 10 a.m. The female flowers started opening at 2 a. m and continued up to 10 a. m. Studies on the receptvity of stigma and floral initiation have been started. After a survey of the important arecanut growing tracts of Kerala, Mysore and Bombay States, distinct ecotypes based upon the morphological charactors of the nuts were fixed. Sixtyfour such ecotypes were collected and sown. In the studies on the influence. of self cross and open pollination of selected palms on fruit-set, germination of seednuts etc. open pollination was found to give the highest fruitset of 30%. Selfpollinated nuts gave maximum germination of 92.6%. A cross between cultivated and a wild areca was affected. Progeny studies and investigation on the causes of shedding of buttons and tendernuts have been initiated.

A garden treated with mud solution against Koleroga at Adyandka was visited. It was found that the mud treatment was ineffective. Samples of mud collected from here are being studied for fungicidal qualities, if any. Gardens at Manjeri, Devachalla and Enmakaje were visited where Band Borer and mite were the major complaints noticed. Trials against mites were continued this year also. An experiment laid out indicated that Ekatin, Systox, Ultrasulphur and Metasystox were effective. Trials with white grub are being continued. An experiment laid out indicated that Ekatin, Systox, Ultrasulphur and Metasystox were effective. Trials with white grub are being continued. An experiment onthe control of shedding of buttons and tendernuts in collaboration with the botanical studies has been laid out. Pathogens from collars and leaves of

seedlings were isolted in the laboratory. Garden plants were treated with Bordeaux mixture and ceresan against fungal diseases. They were treated with Wetable sulhur against mite. Seedlings were treated with Ceresan and Shell copper against fungal attack. They were treated with Wettable sulphur and Endrex against pests.

Mother palms numbering 1,006 were marked out in addition to 3.419 marked out previously. Three lakhs of seed-nuts were collected from these mother palms for the Central Arecanut Research Station nursery as well as for the outside nurseries. Two scientific papers were written up and published. A total of 56 Research and Extension workers whose name appear in appendix IV of the Kerala and Mysore States and of the Indian Central Arecanut Committee were trained in various aspects of arecanut cultivation.

The station attracted a good number of visitors during the year and names appearing in appendix IV are the important peromalities. All of them were taken round and the work in progress explained to them.

Place : VITTAL
Date : 30-7-'59.

(Sd·) Agronomist,
For ARECANUT SPECIALIST.

APPENDIX I.

STAFF OF THE CENTRAL ARECANUT RESEARCH STATION VITTAL AS ON 31ST MARCH '59.

	Name and qualifications	Designation.	Scale of Pay.
1.	Shri. Ghouse Mohiyddin, B. Sc, (Ag.)	Agronomist Arecanut Specialist incharge	Rs. 275–800

Research Staff.

1.	Shri. Shama Bhat, B. Sc., (Ag)	Farm asstt,	Rs. 160-10-300
2.	Shri. K V. Ahamad Bavappa, B. Sc. (Ag)	Agronomy Asstt.	do.
3	Shri. Narasimha Murthy, B. Sc. (Ag)	Botany Asstt.	do.
4.	Shri. K.S. Nagaraja Rao, M.Sc.	Pathology Asstt.	do.
5.	Shri. B. Prabhakar Rao.	Fieldman.	Rs. 60–150
6.	Shri. K. K. Krishnan Nambiar.	do.	do.
7.	Shri. P. T. Sreedharan Nair.	do.	do.
8.	Shri. V C Radhakrishnan.	do.	do.
9.	Shri. K. Kunhirama Panikker.	do.	do.

Ministerial Staff.

1.	Shri. K. Raghava Rao.	Headclerk-cum-Acctt.	Rs. 80–220
2.	Shri B. Abdul Aziz.	Clerk Typist	Rs. 60–130
3.	Kumari H. Shreemanthini Bai.	Junior clerk.	Rs. 60–130

APPENDIX III.

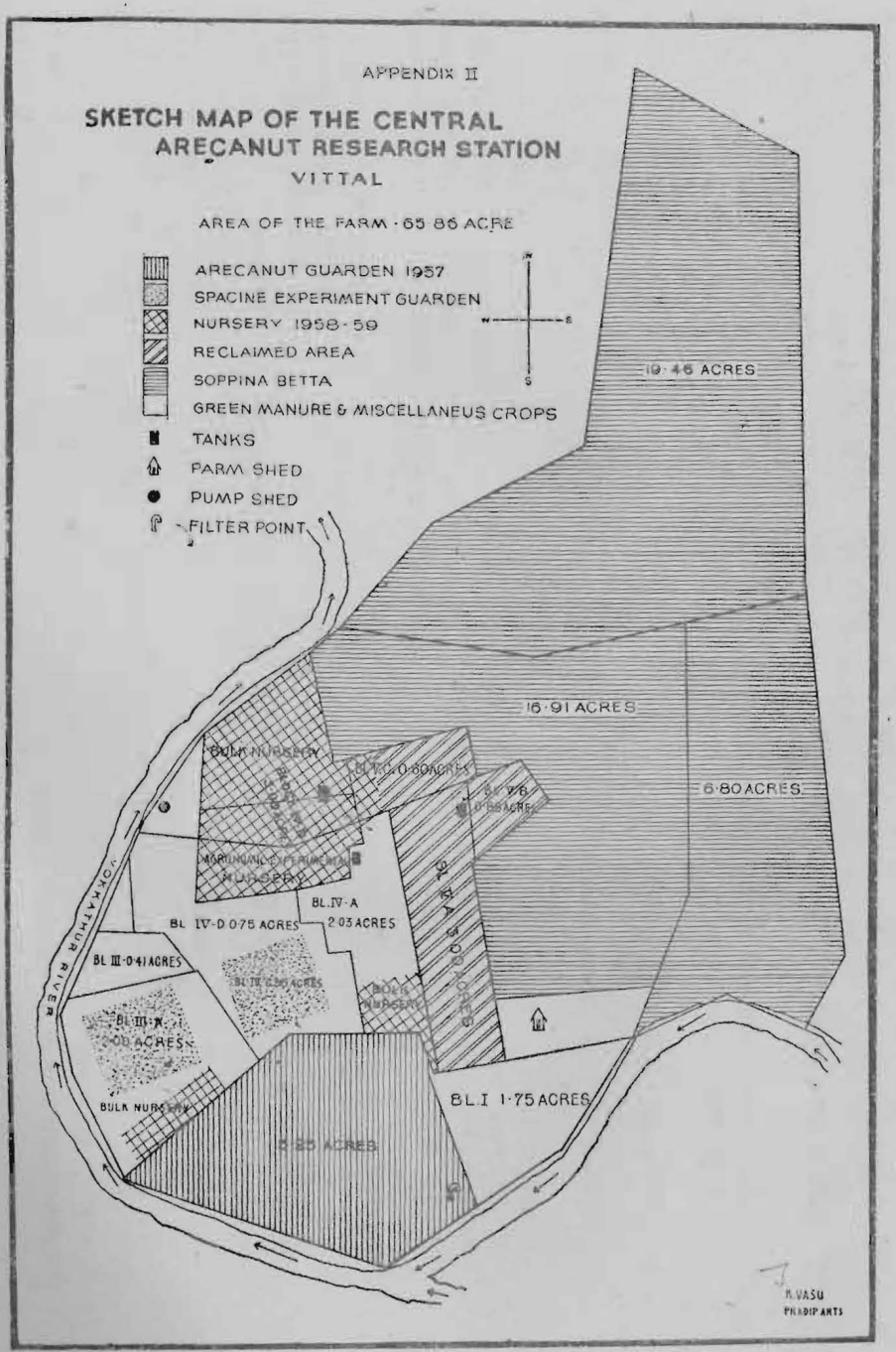
DETAILED PROGRAMME OF WORK FOR THE YEAR 1959-60.

Item No. in the Technical Programme	Name of the experiments	Year of commencement	Year of conclusion	Remarks
1	2	3	4	5
	BREEDING AND GENETICS OF ARECA.			
I (1)	Collection and maintenance of indigenous and exotic species and types of areca.	1958-59	To be continued for several years.	
(2)	Detalied survey of arecanut gardens to assees genetic variation and select superior types	1958-59	do.	
(3)	Floral biology on areca-flowering behaviour (Rate, time and duration of flowering).	1958-59	1960-61	The experiment is being conducted in growers gardens
II	**ANATOMICAL STUDIES.**			
	Structure and develpment of fruit in areca	1959-60	——	The experiment will be taken up together with other items on cyto-genetics.
III	**PHYSIOLOGICAL STUDIES.**			
(4)	Investigations on different species of areca under rainfed and irrigated conditions	—	——	The work will be taken up soon after the different species of areca are collected.

APPENDIX II

SKETCH MAP OF THE CENTRAL ARECANUT RESEARCH STATION VITTAL

AREA OF THE FARM - 65 86 ACRE



1	2	3	4	5
IV A	**A.-STANDARDIZATION OF NURSERY PRACTICES.**			
	1. Criteria for seednut selection			
IV A. (1)	(a) Effect of position of seednuts in the bunch on their size, germination and vigour of seedlings	1958-59	1960-61	
	(b) Influence of age of trees on their seednut performance	1959-60	1961-62	Observations on mother palms selected for the experiment have already been started in 1958-59.
	(c) To determine the frequency of seednuts having different floating habits factors influencing such habits and their relative merits.	1959-60	1961-62	Will be taken up subject to the appointment of the envisaged additional staff for the section.
	(d) Studies on the performance nuts gathered at different stages of maturity for seed purposes	1959-60	1961-62	Observations on mother palms already started during 1958-59.
	(e) Comparative merits of seednuts from different bunches of the same tree.	1959-60	1961-62	do.
	2. Sowing experiments			
IV A. (2)	(a) Comparative study of different position of seednuts in sowing.	1958-59	1960-61	

1	2	3	4	5
	(b) Determination of optimum depth of sowing.	1959-60	1961-62	
	(c) Effect of different spacing on seedling performance.	1959-60	1961-62	Will be taken up subject the appointment of the envisaged additional staff
	(d) Standardisation of mediafor sprouting seednuts.	1959-60	1961-62	Will be taken up subject to the appointment of the envisaged additional staff
	(e) Effeet of shade Vs. open on the seednut germination and growth of seedlings with particular reference to sun scorch and pests (mites) attack.	1959-60	1961-62	do.
	(f) Determination of the efficiency of sowing unsprouted Vs. sprouted seeds	1958-59	1960-61	——
	(g) Influence of post harvest treatments and period of sowing on seednut performance	1959-60	1961-62	Will be taken up subject to the appointment of the envisaged additional staff
	(h) Relative merits of single, double and treble transplation of seedlings in the nursery.	1959-60	1961-62	do.
IV A.	(3) Storage trial of seednuts and viability studies	1958-59	1960-61	——

1		2	3	4	5
IV A.	(4)	Standardisation of the method of packing seedlings	1958–59	1961–62	Will be taken up subject to the appointment of the envisaged additional staff.
IV A.	(5)	Study of seednuts from different arecanut growing tracts for their viability, earliness in germination and vigour of seedlings	1959–60	1961–62	——
		B. CULTURAL EXPERIMENTS			
IV B.	(1)	Determination of optimum spacing	1958–59	To be continued for several years	
	(2)	Effect of depth of transplanting seedlings cum intervals or irrigation on growth and yield.	1959–60	do	Will be taken up subject to the avialbility of land and appointment of additional staff.
	(3)	Effect of different methods of intercultivation on the productivity of palms	1959–60	do.	do.
	(4)	Study of intercrops in arecanut gardens	1959–60	do.	Will be taken up subject to the appointment of additional staff

1	2	3	4	5
	(5) Comparative studies of different green manuare-cum-cover crops for areca gardens	1959-60	To be continued for several years	Will be taken up subject to the appointment of additional staff
	C-MANURIAL EXPERIMENTS.			
IV C.	(1) Determination of optimum NPK requirements of :			
	(a) Seedlings in the nursery for prdoucing vigorous seedlings	1959-60	1961-62	Will be taken up subject to the appointment of the additional staff.
	(b) Permanetly transplanted seedlings in the garden for producing vigorous, early bearing and productive palms	1959-60	For a number of years.	Subject to availablity of land and appointment of additional staff
	(2) Effect of time of appilicatiou-cum-method of manuring	1959-60	do.	Subject to availability of bearing garden and appointment of additional staff.
	(3) Response of seedlings of varied vigour to different levels of manuring	1959-60	1961-62	
	(4) Influence of manuring the seedlings at different levels on their establishment in the main field	1959-60	1961-62	

1	2	3	4	5
	(5) Comparative effect of different doses of lime application over a basal dose of manuare to bearing palms	1959-60	For a number of years	Subject to the availability of bearing garden and appointment of additional staff.
VI (ii)	2. TRIAL WITH PROPRIETORY FUNGICIDES AND INSECTICIDES TO FIND EFFECTIVE CONTROL MEASURERS FOR ALL DISEASES AND PESTS.			
	(1) Environmental factors influencing the incidence of mites (pests on leaves) and the methods of control	1959-60	1961-62	To be taken up on young seedlings at Central Arecanut Research Station and on grown up palms in grower's gardens.
	(2) Trial on effective soil insecticide in the control of grubs (pests on roots)	1959-60	1961-62	To be taken up in the bearing gardens in the growers' fields
	(3) To find cheap and effective fungicides for Koleroga or (Mahali)	1959-60	1963-64	Subject to making available the bearing garden.
	(4) To investigate causes and methods of control for button shedding and tendernut fall.	1959-60	1961-62	To be taken up in the bearing gardens in the grower's fileds,

1	2	3	4	5
VII	**CROP WEATHER STUDY.**			
	(a) To record meteorological data on rainfall, maximum and minimum temperature, humidity, soil temperature and moisture, sunshine and wind velocity.	1959-60	To be continued till the station exists	
	(b) Influence of seasonal and geographical factors on the time and nature of flowering and fruiting.	1959-60	——	

APPENDIX IV.

The following are the list of important visitors and trainees deputed by different States and Institutions for training during the year 1958-59.

1. Shri M. N. Chouta, Advocate & Ex-member of the Indian Central Arecanut Committee, Mangalore.
2. Shri T. P. Abraham, Statistician (Agri.), Indian Council of Agricultural Research, New Delhi.
3. Shri B. S. Varadarajan, Secretary, Indian Central Arecanut Committee, Kozhikode.
4. Shri Maloor Subba Rao, Advocate, Bangalore.
5. Shri K. Venkappayya, Urimajlu
6. Dr. K. Manjunnath Rai, Vittal.
7. Shri V. Srinivasa Shetty, M. L. A. Mysore State, Coondapoor.
8. Shri K. R. Shetty, Assistant Commissioner, Puttur.

TRAINING.

	Name of sponsoring authority: 1	Designation of the trainess 2	No. of trainees 3	Period of training 4
1.	Indian Central Arecanut committee:	Field Assistant.	3	15 days
2.	do	Research Officers, R.A.R.S., Tumkur, Mohitnagar, Peechi, Kahikuchi.	4	3 days
	Mysore State	Superintendent I/C. A.R.S., Thirthahalli.	1	3 days

1	2	3	4
Mysore State	Village level workers.	13	15 days
Kerala State	Instructors of Baisc Agrl. Schools	5	3 days
Mysore State	Village level workers.	21	15 days
Assam State	Statistcian	1	3 days
Kerala State	Arecanut Development Assistants.	2	10 days
Mysore State	Staff of the Basic Agri. Schools	6	2 days