

## FIELD EXPERIMENTATION IN ARECANUT - PART I

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### INTRODUCTION

Arecanut (*Areca catechu* Linn), a perennial plant is so different from annuals and certain of the perennials that it needs special statistical considerations. The fact that it lives longer and is thus more susceptible to mishaps needs greater caution to be bestowed in making plans about it. Due to the fairly large size of the tree and by virtue of its individuality the influence of genetic variations is likely to be more pronounced than positional variation. Agronomic investigations of arecanut may broadly be classified into two (a) nursery experiments and (b) main field experiments. Study of the different criteria for seednut selection and various sowing experiments so as to get higher percentage of quality seedlings come

under the former category of investigation whereas the different cultural and manurial experiments undertaken in bearing gardens to improve the yield of palms come under the latter.

It is highly desirable that the plant material used for any field experimentation should be of homogenous nature. Arecanut being a highly cross-fertilised crop the possibility of the seednuts gathered from open pollinated nuts (uncontrolled methods of pollination) breeding true to their mother palms is rather remote. Certain parental combinations can possibly produce seedlings with better vigour than certain others. Such varied behaviour of parental combinations brings in an error due to genetic variation in the agronomic experiments

## LITERATURE

when the nuts used for such experiments are gathered from open pollinated bunches. The effect of this factor of variability can be reduced by including a large number of plants in a plot. This will necessitate the use of large sized plots which again brings in another source of error, i. e., variability of soil. Besides, there are large number of ecotypes occurring in each tract and indiscriminate use of seednuts these ecotypes for experimental purposes may bring in another influencing factor due to the varied size and shape of nuts. It is also not known whether the age of the mother palm and the different bunches on the tree from which seednuts could be gathered have any influence on the seednut performance. Due to the limited number of nuts available in a single bunch of one palm, sufficient number of nuts required for one complete experiment will invariably be not available from the same and thus necessitates the use of nuts gathered from different palms of possibly varied genetic constitution. Besides, the areca seedlings require shade in the hot months. Provision of a uniform shade is necessary to avoid variations due to uneven shade. Annuals like sesbania were found to shed leaves after flowering and pod-setting. It is, therefore, seen that plot experiments and field trials in arecanut are affected by many uncontrollable factors that absolute accuracy cannot be expected.

In view of the fact that only much less of statistical layouts have so far been applied to various agronomic experiments arecanut certain precautions that may be exercised in planning and laying out the experiments with particular reference to plot size based on the observations made at the Central Arecanut Research Station, so as to reduce these errors are discussed in this paper.

Gadd (1922) working on the experimental errors of field trial with *Havea* (rubber) found that 16 tree plots gave low probable error expressed as percentage of mean and that the increase in size of the plot above 16 gave in comparison only a small reduction of probable error. The same author while reviewing the uniformity of probable errors states that there is large diversity with reference to probable error as given by different workers showing thereby that the value will probably vary with parentage of trees, their age and the conditions under which they are grown. A large number of small plots is generally to be preferred to a few large ones. A good average size for general utility purpose is 1/40 of an acre (Paterson 1939). Pearce (1953) while cataloguing the uniformity trials conducted by different workers with reference to various perennial crops states that the choice of the plot size would depend entirely on circumstances. He also states that in any experiment the source of each plant should be known and if it is not practicable to use plants from only one source either each block should be made up in this way or a pseudovariate used to eliminate possible differences. Recent work at East Malling suggests that the proportion of total variation arising out of non-positional sources is greatest in the case of young trees that have not long been subject to the effect of their planting position. Conagin and Fraga (1955) working on coffee with two plot sizes of 9 and 4 plants found that smaller plots were efficient in eliminating differences in soil fertility. Hutchinson and Panse (1935) have stressed the necessity of having non-experimental margins round the experimental plot.

## EXPERIMENTAL

(a) **Layout of nursery experiments.** At the Central Arecanut Research Station, Vittal, all the nursery experiments are laid out in two stages consisting of (i) the primary nursery and (ii) the secondary nursery so as to be in conformity with the local practice of sprouting the seednuts and transplanting the same. Seednuts of individual treatments are sown in pits of 1' to 1½' square and about 4" to 6" depth depending upon the number of nuts to be sown. The soil of these pits is loosened to a depth of one foot and filled with sand to a depth of 3" to 4". Thirty or more nuts are arranged over these sand beds with their calyx end pointing upwards, just covered with sand and watered daily unless otherwise stated. Beds of 6' x 11' are formed and 24 sprouts of uniform growth selected at random are transplanted at a spacing of 1' x 1', in

three rows of eight plants each with a border row all round. The pits as well as the beds are laid out on the same approved statistical design.

(b) **Plot size for nursery experiments.** In order to determine the optimum number of plants required for nursery experiments, morphological features (height, number of leaves, diameter at collar, length of leaf, number of roots and length of root) of one hundred seedlings raised from nuts of single bunch of a mother palm with a border now all round were measured. The mean, standard deviation and the standard deviation of mean were then calculated taking different number of plants from 4 to 40 as units. The data is presented in Table-I. The number of plants per plot with its corresponding standard deviation of the mean plotted in a graph (Figures 1 and 2),

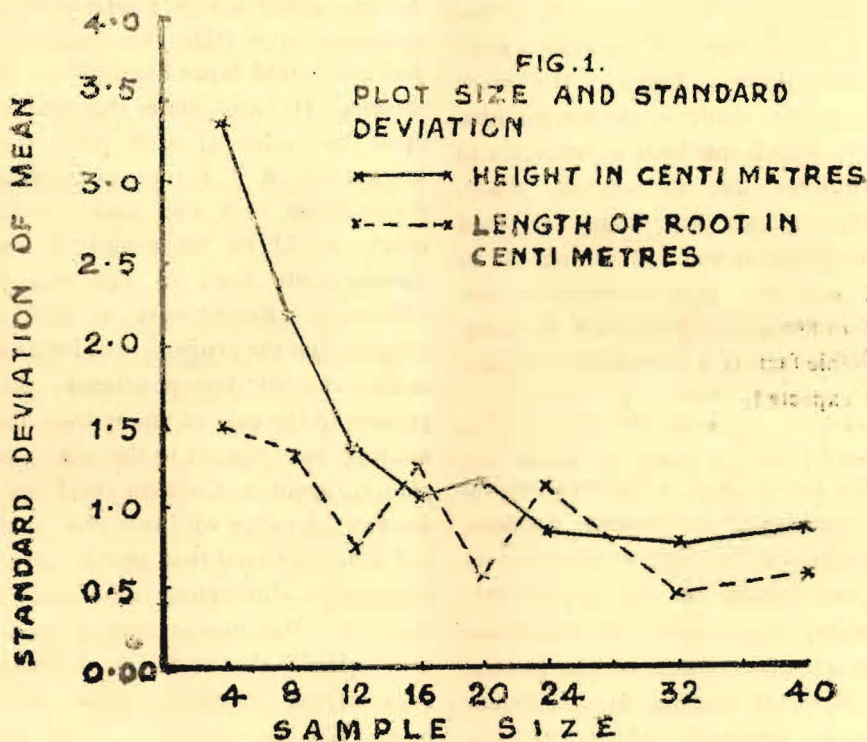
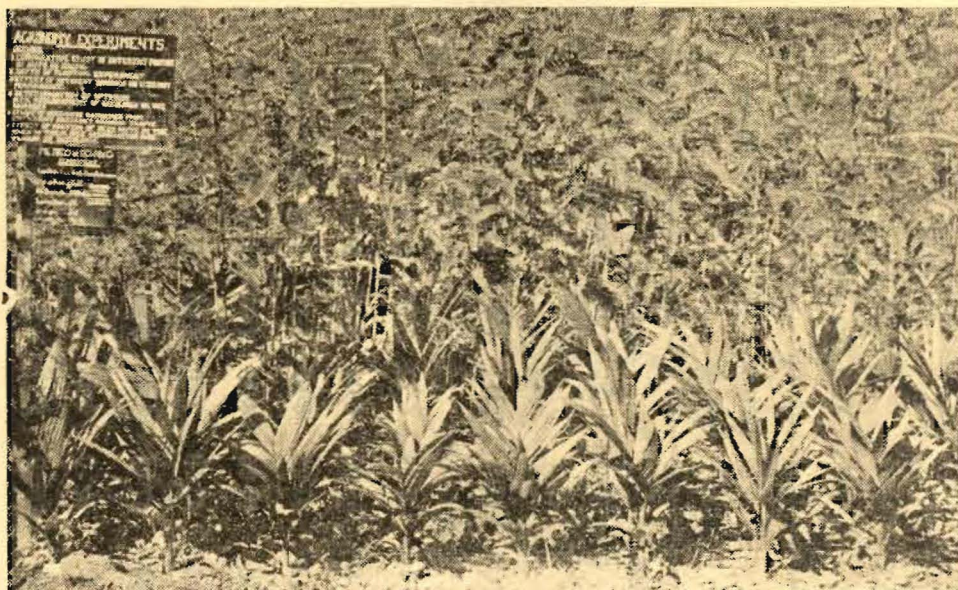
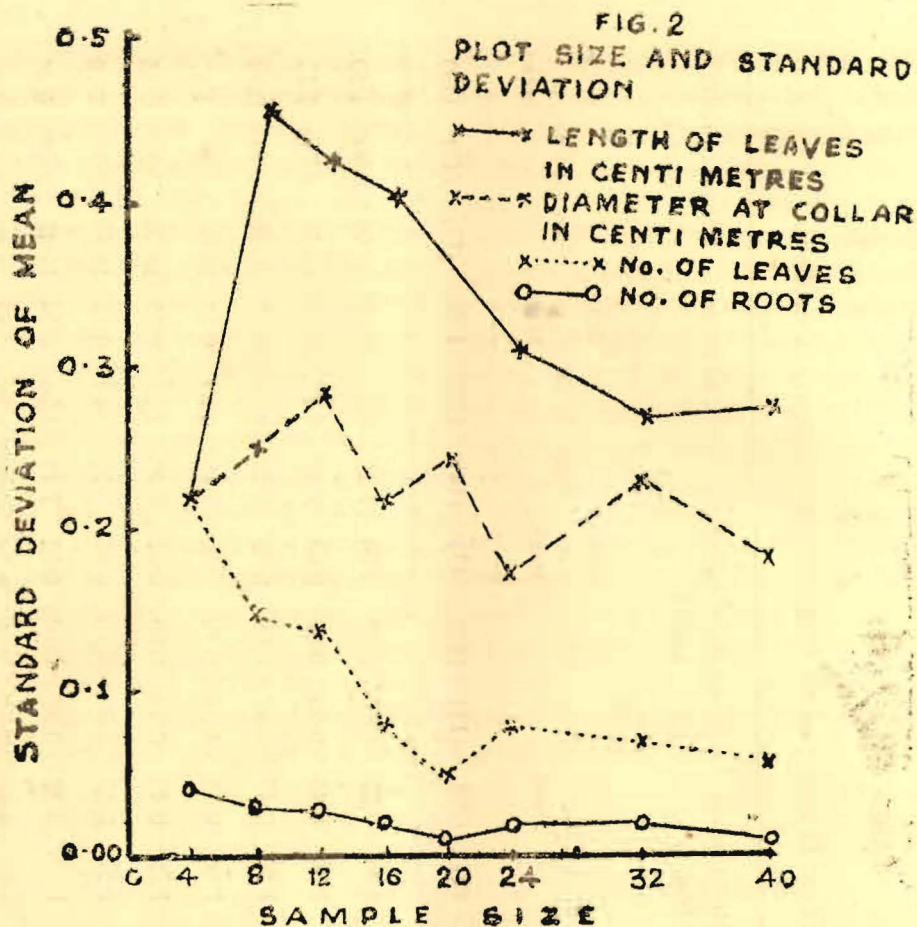


TABLE — I

Plot size and standard deviation of mean etc. in respect of six morphological characters of seedlings.

Sam- ple size	Height (c.m.)		No. of leaves.			Length of leaves (c.m )			Diameter at collar (c.m )			No. of roots		Length of roots (c.m )				
	Mean	St.Dn.	St.Dn. of Mean	Mean	St. devi- ation	St.Dn of Mean	Mean	St Dn.	St.Dn. of Mean	Mean	St.Dn.	of Mean	Mean	St Dn	St.Dn. of Mean	Mean	St Dn.	St.Dn. of Mean
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
4	45.25	6.72	3.36	3.25	0.43	0.22	21.25	0.44	0.22	1.00	0.07	0.04	7.25	0.44	0.22	20.00	3.00	1.50
8	45.00	6.04	2.14	3.25	0.43	0.15	20.75	1.30	0.46	0.96	0.09	0.03	7.50	0.71	0.25	19.50	3.74	1.32
12	47.25	4.67	1.35	3.33	0.47	0.14	21.92	1.50	0.43	0.97	0.09	0.03	7.25	0.01	0.29	20.90	2.70	0.78
16	44.06	4.33	1.08	3.12	0.33	0.08	21.44	1.66	0.41	1.02	0.10	0.02	7.19	0.89	0.22	20.81	5.09	1.27
20	45.10	5.20	1.16	3.05	0.22	0.05	21.25	1.79	0.40	0.97	0.06	0.01	7.40	1.11	0.25	19.10	2.38	0.53
24	47.46	3.95	0.84	3.21	0.41	0.08	21.96	1.57	0.32	0.96	0.10	0.02	7.21	0.87	0.18	19.87	5.37	1.10
32	46.50	4.42	0.78	3.19	0.39	0.07	21.41	1.77	0.28	0.97	0.10	0.02	7.19	1.36	0.24	19.47	2.48	0.44
40	46.10	5.57	0.88	3.05	0.38	0.06	21.50	1.53	0.29	0.97	0.09	0.01	7.92	1.29	0.20	20.62	3.45	0.55



(c) **Provisions of uniform shade of the seedlings.** Since banana was found to provide uneven shade to the seedlings, seeds of *Sesbania speciosa*, a tall growing leguminous green manure plant were sown in the month of October along the south and western borders of the experimental beds. The gaps were filled up to get a uniform stand. The plants were pruned at uniform height of six feet just before the time of flowering and thereafter at 15 to 20 days interval to keep up the height (Figure 3). Care was taken to remove the stray flowers that developed so as to prevent pod setting.

Experiments to find out the desirability of using nuts produced under controlled method of pollination for various agronomical experiments, to study the border effect to find out the influence of age of trees, order of bunches etc., and to determine the optimum number of trees required for main field experimentation are underway

## DISCUSSION

The method of sprouting the nuts and transplanting the sprouts has the specific advantage in that the failures due to lack of germination of nuts can be avoided and thus a uniform number of seedlings per plot can be had in the secondary nursery where the seedlings are to be studied for their morphological characters. It is necessary that care should be taken to exclude from the experiment trees that are mis-shapen or damaged by pests or are too small to give the shape of tree desired or are in some other way going to be formed only with difficulty. When all unsuitable plants have been excluded, the final choice should be made at random and also allocated to the field positions at random (Pearce 1953). Since border effects, such as, seepage of

manures, effect of wider spacing etc. would lead to an inflation of error variance, it is highly necessary that border rows are provided for each treatment

From the Table-I, it is seen that the standard deviation of the mean tend to become more or less constant for 24 or more seedlings. From the figures 1 and 2, it is seen that at 24 seedlings plot the curve has begun to flatten out and beyond this point is begins to approximate the horizontal. It is, therefore, clear that there is a reduction in the standard deviation of mean as progress is made from 4 to 24 tree plots and that by increasing the size of plot above 24 the reduction of standard deviation in comparison with the number of extra plants required is small. It is also interesting to note that curves with reference to height, number of leaves and diameter at collar, the characters on which seedlings are commonly compared show a more steady fall than the rest.

In selecting planting material for field experiments clonal material will be ideal or at other times imbred seedlings are the best possible. Arecanut being a seed propagated crop the question of clonal propagation is out of question. Breeding a pure line will also take 40 to 45 years in view of the fact that each generation takes five to six years to come to bearing. It may not be worthwhile to delay the experiments for such a long time and as such ways and means of utilising the available open pollinated nuts to the best of advantage have to be thought of. From the various ecotypes occurring in each tract after determining their percentages the ecotype of most common occurrence may be used to avoid the error due to the variation in size of nut. In as much as it has been observed that young trees are more

subject to variation arising out of non-positional sources, palms of middle age or more will be better for the collection of experimental nuts. Until such time the superiority or otherwise of nuts from one bunch of the palm over the nuts of the other bunch of the same palm is established, nuts of uniform bunches from all the trees may have to be collected. Using nuts from a single bunch for the entire experiment, if sufficient number of nuts are available will be the best in view of the uniformity of the material or at least nuts from different bunches for different replications will be the next best. When the number of treatments are sufficiently large as to make it difficult to get the minimum nuts required for a treatment, the same may be reduced but increasing the number of replications. Preventing the pod setting of *Sesbania* by removing the flower buds and pruning was found to prolong the vegetative phase of the plant.

#### SUMMARY

- 1 The different factors that are likely to bring in error in the various agronomic experiments on arecanut have been discussed.
- 2 A method for laying out experiments in the nursery has been outlined.
- 3 Twentyfour seedling plot was found to be the optimum plot size for nursery experiment.
- 4 While selecting nuts for the experiments care may be taken to select nuts of the

most commonly occurring ecotype from middle aged or older palms and from the same order of bunch so as to reduce the error variance.

- 5 Pruning the *sesbania* and nipping the flower buds were found to increase the vegetative phase of the plant and thus provide sufficient shade.

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