IDENTIFICATION OF PREPOTENT MOTHERPALMS IN COCONUT (*Cocos nucifera* L.) - VARIETY, KOMADAN

BY

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DECLARATION

I hereby declare that this thesis entitled "Identification of prepotent motherpalms in coconut (*Cocos nucifera* L.) variety, KOMADAN"is a *bonafide* record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any University or Society.

College of Agriculture,
Vellayani, 18-9-1982.

SHYLARAJ, K.S.

CERTIFICATE

Certified that this thesis, entitled "Identification of prepotent motherpalms in coconut (Cocos nucifera L.) variety, KOMADAN " is a record of research work done independently by Kumari. SHYLARAJ, K.S. under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

College of Agriculture,
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INTRODUCTION

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Present day breeding of crop plants, as a rule, does lay extra emphasis on the identification of and treading along fresh avenues for the purpose of realising specifically needed effects. For this, collection of relevant information on the felt fundamental aspects, sensible to the situation, followed by the application of an appropriate methodology based on critically sound and logical consideration of a multitude of factors, including those that could be localised precisely to be innate to the living system concerned, as well as those arising from a not-too-stable environmental set up, acting either independently or in unison, turns out as extremely inevitable. Further, the understanding of the genuine need, and the resorting to of diverse approaches, more suited and helpful for attaining effectively the distinctly defined objective for different categories of crop plants, whether perennials or seasonals/annuals, demand significantly vital foci of special attention.

The breeder, whose chief concern is, to set in a significant improvement in terms of the genetic performance potential of the crop concerned, could diagnose readily the defects and deficiencies, that constitute bulk of the factors, that are responsible for the expression of seriously uneconomical conditions of disadvantage, that call for an imminent action for rectification. Many of the factors, that cause such disadvantage, could be cast off, through a judicious choice of the most appropriate method of breeding, that is generally less complex in the case of field crops, compared to those grouped under perennials, owing mainly to the peculiar array of the different phases of life and their individual duration. This is perhaps, the most important reason why, the breeder is tempted necessarily, to resort to formulation of relevantly suited, and seperate programmes of breeding in dfferent crops, particularly, those that are essentially perennials.

It is justified, that in the breeding of perennials, as a generalised rule, stress should be given to practising selection, in favour of individuals on the basis of their possessing proven superiority and desirability over others, followed by their being exposed to subsequent means of asexual propagation, as far as conditions permit feasibility, with a view to evolve rapidly and readily a stereotype community conforming to the required standards of desirability.

Among the prevailing diversity of perennial crops that are being cultivated in Kerala, the coconutpalm (Cocos nucifera L.) is, undoubtedly, the most important from the economic point of view. It belongs to the family Palmae, under the order Palmales. The genus is reported to be a monospecific one (Thampan, 1981). The crop has a world wide distribution confining its adaptation, preferentially, to the coastal zones of the tropics. Its adaptation requirement is so rigid that it does not thrive well at higher altitudes even in the tropics. The palms perform remarkably well under conditions where there is plenty of rainfall (Menon and Pandalai, 1958).

A salient feature noticed, is that compared to the large majority of other crops, there is a considerable reduction in varietal and form diversity in coconut. The prominent varieties are the Talls and the Dwarfs. Further, these two categories exhibit certain amount of perceptible diversity with regards to the mean fruit size and the distribution of coloured pigment, noticeable particularly in parts that constitute the crown. Identifiably distinct communities, too, have become established independently in certain ecogeographically different pockets in the coconut growing tracts (Menon and Pandalai, 1958; Thampan, 1981). The criteria for formulating a satisfactory descriptor for identification of these sub-communities were drawn from the features mentioned above.

The most extensively cultivated form of the western coast of the Peninsular India is the West Coast Tall. This is the predominant cultivated form in Kerala. Further, this form exhibits differentiation into identifiable subgroups as has been cited hencebefore. Such a community, known locally as the KOMADAN, was used in this study. This type was particularly chosen, because it is found to possess attributes of economically superior worth compared to the more familiar West Coast Tall. The origin of this exclusive community is traced back to a cultivator's garden at Thottapuzhasseri, situated on the northern banks of the river Pamba. The designation KOMADAN represents KOMATTU, the name of the family of the cultivator, from whom seednuts were procured initially, quarter of a century back, to establish a garden in the premises of the Agricultural College at Vellayani. The palms raised from these seednuts are found to maintain satisfactorily and steadily, their superior nutyield potential.

Trees of the species are reported to be predominantly cross pollinated, and hence a higher incidence of heterozygosity for a greater majority of genes is expected to exist naturally. Further, being a crop that is exclusively seed propagated, the presence of a widely varying spectrum of variability, in terms of several characters, too could be anticipated in the seedling progeny population. This is undoubtedly the reason why otherwise accomplished motherpalms yield in varying proportions relatively superior as well as inferior progenies.

As a means for inducing an overall improvement in this crop, several recommendations have been made so far, and it is seen, that most of these recommendations are based on observations made on trees belonging to the West Coast Tall category. The recommendation proposes exercising of a Triphasic Selection Schedule to be carried out at the levels of individual motherpalms, seednuts and seedling progeny. The norms to be leaned upon, in this context, have been enumerated.

As has been referred to earlier, the type KOMADAN possesses characters that make it distinctly different from the typical West Coast Tall. Here again, as a means for inducing an overall improvement, the Triphasic Selection Schedule is believed to yield significantly good results. This sophisticated selection schedule adds emphasis on selection of motherpalms on the basis of phenotypic appraisal of certain expressed characters.

Being a crop that is heterozygous to a considerable extent, the fact, that coconutpalms looking alike need not breed in the same manner, cannot be overlooked. In addition, it is likely that, in spite of multilevel selection being practised rigorously, the progeny too need not be always identically ideal. Therefore, in order to ensure a satisfactory recovery of a nearly uniform stand of ideal progeny population, it is felt, that selection of motherpalms should be based, in addition to the attributes laid out so far as important, on information pertaining to the progeny performance also. The availability of this information is facilitated through the conduct of the PREPOTENCY TEST (Liyanage, 1967; Satyabalan et al., 1975).

The concept of PREPOTENCY was proposed originally by Harland(1957). The term refers to a condition expressed by individuals possessing genetic superiority to transmit desirable characters to the progeny in economically advantageous proportion. Though, the presence of this phenomenon could be located among all sexually reproducing living systems, its relevance is more sensible in the context of breeding of perennial crops, especially those, that do not lend themselves suited for successful asexual propagation, an example of which is the coconutpalm. In the study, a scientifically based effort has been made to identify prepotent palms from among those belonging to the type KOMADAN.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Reports on aspects relevant to the context of the experiment, though scanty, when compared to those for other crops, are being reviewed.

Further, reports seem to suggest that the advantage of scientifically based selection practised on motherpalms, seednuts and seedlings in the nursery, is of vital importance in effecting overall improvement in coconut.

Motherpalm Selection

Jack(1930), as one of the pioneers in the area of coconut research, suggested that it is not at all practically impossible to bring about improvement in coconut culture through the application of a scientifically based motherpalm selection procedure. According to his estimates, significant increase in nutyield to the order of 25 to 35 per cent can be attained through careful choice of the more suited motherpalms alone.

Smith(1933), on the basis of his findings, put forward a standard recommendation for the selection of economically more desirable motherpalms. The recommendation emphatically bears a basis on the per tree annual yield of nuts and the wetmeat content in the nuts. Further, importance is given to the size of individual nuts as well. According to the recommendation, palms bearing an annual yield of not less than 100 medium sized nuts with a mean pernut wetmeat content of 500 gms at least, alone need be chosen for the purpose of collecting seednuts.

Pieris(1934) recognised a few visually discernible attributes that are believed to be significantly associated with established superior nutyield potential in coconutpalm. Observations, he gathered during an investigation, formed the basis of characterising such palms. They should have relatively stouter and straight stem preferably with close spaced leaf scars. The stalk of the frond too should be sturdy - neither too long, nor too short; and the leaves must be borne in such a manner that the *in toto* orientation should facilitate effective expression of the best functional ability. Preference should be given to trees that have a potentiality to produce an increased number of bunches that are attached to the palm by means of sturdy stalks that do not generally permit buckling to occur. A significantly higher number of female flowers per bunch, to be precise 100 or more, should be given positive weightage alongwith the other attributes listed above.

Patel(1938) proposed that the length of the stem and the number of leaves present in the crown should be considered as important criteria for motherpalm selection, since they are believed to influence characters that make the palm more ideal for seednut collection.

Umali(1940) reported occurrence of considerable reduction in the percentage germination among lighter nuts - those weighing 680 gms and less, than the heavier ones. According to the author there is definite advantage in selecting trees that bear comparatively more number of heavier nuts per bunch.

Liyanage(1953) substantiated that palm improvement in coconut could be effected to the tune of an additional percentage of around 50, by adhering strictly to scientific methods of choosing motherpalms. Further, he pointed out the prospects of increasing the efficiency percentage upto 90 and above, through permitted open pollination among selected palms grown in isolation.

Liyanage(1962) found considerable variation between palms, irrespective of the type to which they belong in terms of a multitude of characters, both vegetative and productive. He also found that the values for genetic variance for these characters exhibited a trend that supported positively the above observation. The heritability value (h^2) for these characters too revealed a significantly distinct wide range. The value for the more important components of nutyield - number of bunches produced per year, number of nuts per bunch and the weight of husked nut were 0.47, 0.52 and 0.95 respectively. For number of female flowers per bunch and the setting percentage, the values for the estimate were 0.52 and 0.81 respectively. A suggestion was proposed to confine practising of selection exclusively and preferably in favour of characters having a higher estimated value for heritability for the effective realization of the required benefit. Another feature of practical importance noticed during the study was that the values for the genetic correlation between yields of nut and copra, and the time taken for bearing initiation and the yield of copra, were remarkably high, though differed in sign. For the former it was +0.79 and for the latter -0.81. Based on the information gathered and the estimates computed, he was the first to introduce a multiple criteria approach for selecting motherpalms in coconut. The index was formulated as follows:

$$I = X_1 - 14.70X_2 - 4.47X_3 \quad \text{where}$$

X_1 = Number of nuts/palm/ year

X_2 = Weight/husked nut

X_3 = Time taken for bearing initiation (months)

In his openion, that many more indices could be formulated using varying combinations of characters that prove themselves to be of greater importance, and from among these indices the most effective and conveniently implementable one can be identified readily on the basis of comparison and favourable advance in this regard could be obtained without any serious concern.

Pankajakshan et al. (1963), on the basis of a study conducted for a continuous period of four years, recommended selection of palms characterized by a higher value for the mean of the quantified yield factor with a low and steady value for standard deviation, as requirementally more suited, since the average annual yield and the consistency of performance of the palm were equally important and relevant under the context concerned. Further, they pointed out that a percentage increase in efficiency to 79 could be achieved in the selection of motherpalms by restricting selection to the best 10% palms in a standing population. This attained benefit in terms of percentage could be enhanced to even 100%, if the proportion of palms selected to a still lower percentage of around 5.

Liyanage(1964) carried out mass selection on a sample of 104 individuals in favour of nutweight and selected the best 10% and consequently genetic gain to the extent of 12.8% was attained. The total number of leaves produced during the first 40 months and yield of nuts at the 13th to 14th year, exhibited significant positive correlations. Hence, the leaf production expressed numerically during the early growth period of the palm is believed to serve advantageously in assessing the future yield.

Liyanage(1967), further revealed the effectiveness of mass selection based on the observations made on the progenies of 104 unselected seed parents. The phenotypically best 5% of the parental population yielded progeny that gave an additional 14 per cent yield, compared to the value for the overall progeny population mean.

Zuniga et al.(1969) selected potentially high yielders in three coconut plantations. They put forward recommendations in favour of a three year yield study, sufficient to predict the yield potential of parent palms, provided only 5-10% of the best trees were selected.

Apacible and Mendoza(1968), in a study conducted on 6 and 15 palms belonging respectively to the Dwarf and Tall varieties of coconut made out several characters that could be used as valid criteria for the choice of superior motherpalms, seednuts and seedlings. In the scheme proposed, emphasis is given in favour of steady average bearing nature among palms belonging to a group yielding not less than 100 nuts per year, comparatively heavier medium sized spherical or near spherical seednuts, and relatively taller, year old seedlings with noticeably greater girth at the collar and presence of more number of split leaves.

Abeywardena(1970) suggested measures to improve the calibration of coconut experiments. A scrutiny of the pre-experimental yield of the palm was recommended as an inevitable measure. Using the information as a calibrating variate, the experimental error can be reduced by 30 to 50%. Further, a survey of the pre-experimental yield pertaining to two years could enhance the degree of accuracy to more perfeection than what was the case with a single year's data.

Manthriratna(1970a) proposed that substantial increase in yield can be made obtainable by selection of seed parents in favour of heavier husked nuts, followed by a further rigid selection of seedlings in the nursery.

De Silva and George(1970) suggested a three stage selection programme for coconut improvement involving (1) selection of motherpalms on the basis of expressed superior performance and phenotypically healthier disposition, (2) selection of seednuts for the desired combination of maturity and size, and (3) selection for vigorous seedlings.

Thampan (1971) outlined the criteria for motherpalm selection as follows:

1. Select palms possessing desirable phenotypic characteristics such as stout straight trunks with closely spaced leaf scars, 30-40 average sized fronds well oriented on the crown and a large number of inflorescences with short stalks distributed evenly round the crown.

2. Restrict selection to the best 10 per cent of the palms in each field for characteristics such as higher nut production (80 to 100 nuts), higher weight of husked nuts (650 to 700 gm), a higher percentage of flower set and a large number of spikelets with only one or two female flowers on each.

3. Identify motherpalms of high breeding value with capacity to maintain consistently high progeny values on the basis of early growth features of the progenies. A short sprouting period and a higher rate of leaf production are reliable indications of early flowering and high yield.

4. Select even young palms which show superior yield performances during the second and third years of bearing provided they possess other desirable traits.

Nampoothiri et al.(1975) suggested that the time taken for flowering initiation, production of spathes and female flowers as worthwhile characters for adult palm selection. A proper distribution of female flowers in the inflorescence is emphasised to be desirable, since only one or two female flowers per spike, lead to successful setting of fruits.

Balingassa and Carpio(1977) stressed the need to take up production and quality of nuts into consideration during motherpalm selection. Preference is given accordingly to palms that produce a greater number of nuts with increased meat content.

Peter and Jayaraman(1977) supported the views of Balingassa and Carpio mentioned above.

Shantappa and Viswanathan(1977) pointed out that it is possible to raise seedlings from nuts gathered from motherpalms that were qualified earlier as superior, irrespective of the time when they are harvested during the year.

Kannan and ~~Narayanan~~ Nambiar(1979) studied the influence of motherpalm and seedling selection on the performance of progenies and emphasised the unsuitability of palms yielding less than 20 nuts per year for seednut collection.

Seednut Selection

Mendiola(1926) emphasised that immediate improvement of coconutpalm could be attained through selection of seednuts.

Smith(1933) stressed the need for seed selection as well as study of nursery results in view of the fact that certain palms persistently yield nuts of low germination and poor growth characteristics.

Umali(1940) reported considerable reduction in germination exhibited by nuts weighing 680 gms and less. He recommended selecting comparatively heavier seednuts for the purpose of resolving increased advantage.

Marar and Jayarajan(1960) recommended that for collection of seednuts, instead of lowering the bunches by means of ropes, the practice done for routine harvest can be followed without any disadvantage. However, they feel that the special practice may be adopted under conditions when the trees are considerably tall and the ground is hard.

Marar and Shambu(1961) found that the expected vigour of seedlings could be assessed in advance from the expressed orientation of seednuts allowed to float on water. It was observed that the sprouts from vertically floating nuts were decidedly more vigorous than those from obliquely or horizontally floating nuts. Also it was suggested that this simple method can be used to spot out and discard motherpalms that are likely to give rise to poor progenies in the nursery without actually undertaking detailed nursery studies.

Manthriratna(1970b) emphasised the importance of seednut selection in generalised coconut improvement.

De Silva and George(1970) suggested triphasic selection schedule for improvement of the coconut. Accordingly, the motherpalm, seednuts and the seedlings in the nursery, are to be exposed separately to selection.

Thomas(1978) studied the influence of seed size and the method of sowing on the germination and growth of seedlings in the nursery, and found that the size influences earliness as well as increased percentage of germination, though not to the level of significance. Horizontal sowing of seednuts, preferably those that weigh 1000-1300 gms each, is found to yield better results.

Seedling Selection

Jack and Sands (1929) found that earlier germination of seednuts in coconut, was associated with early bearing and consequent enhancement of production in terms of nutyield. Hence the importance of early germination should be given the consideration it deserves while formulating the criteria for selection of seedlings.

Umali (1940) observed that early germination and comparatively better nursery performance of seedlings were evident when seednuts were collected from trees with a higher setting percentage of 35 or more, coupled with a higher number of female flower bearing rachillae (50.5 or more).

Liyanage (1953) suggested that careful standardised selection of seedlings is all the more effective in ensuring better later performance of seedlings. He found that selection at this stage alone could effect an increase in nutyield to a percentage of about 10. In Srilanka, a comparative study of the yield data of selected and unselected seedlings over a period of 19 years have shown that an additional 12% increase in yield can be attained for the selected genotype.

Charles(1959) stated that in nursery selection of seedlings, the better ones were characterised by their expressed increase in vigour and progressively steady rate of development. Such seedlings have greater thickness at the neck region and possessed deep green colouration of the foliage. He expressed that positive vigour can be judged at the four-leaf-stage of the seedling in the nursery, from the measured girth at the base, size, spread and colour of leaves, rapidity of growth and overall sturdiness.

Marar(1960) recommended the establishment of elite seed gardens for producing quality coconut seedlings on a large scale. The practicable prescribed method was to raise a nursery from open pollinated nuts collected from desirably identified motherpalms and to make a rigorous selection among the seedlings on the basis of already established criteria such as earliness in germination, increased number of leaves, possession of good girth at the collar and expressed superior vigour in growth.

Pankajakshan and George Minnie(1961) carried out an investigation with one-year old seedlings of the variety West Coast Tall to understand the relative importance and the interdependence of the three characters - girth, height and number of leaves and found that seedling vigour can be judged on the basis of these characters. Interdependency of these characters was tested by calculating the appropriate values for the coefficient of partial and multiple correlations. Results showed that among the three characters considered, height and number of leaves were practically independent of each other. Further, girth at collar was positively and significantly correlated to these characters. About 60% of the variation in girth is controlled by the combined influence of height and number of leaves.

Ninan(1964) emphasised the need for seedling selection based on growth rate and vigour for coconut improvement.

Fremond and Brunin(1966) found that rapid early growth of seedlings was associated with earliness in flowering.

Apacible and Mendoza (1968) maintain a view in favourable support of seedling selection on the basis of vigour for improvement in coconut.

Satyabalan et al.(1968) studied hybrid seedlings and found that the characters that can be used to assess seedling vigour were the number of days taken for germination, girth at the collar of seedling, height of the seedling and the number of leaves produced in an year.

Manthriratna(1970) proposed that substantial increase in yield can be obtained by a selection of seed parents on the weight of husked nuts followed by a rigid selection of better seedlings in the nursery.

De Silva and George(1970) suggested a three stage selection programme for coconut improvement as already cited, in which the advantageous implications of seedling selection is projected.

Srinivasa and Ramu(1971) observed that in coconut seedlings developed from nuts that germinated within a period of 4 months had more leaves than those germinated later. The splitting of leaves into leaflets also was noticed to occur earlier in these seedlings. Such seedlings should be selected for planting so as to resolve a superior late stage performance.

Nampoothiri et al.(1974) conducted a study on variation in germination pattern in a number of coconut cultivars.

They observed a wide range of variation in the number of days taken for germination from the date of harvest of the seednut. Further, they found that nuts harvested earlier and kept under longer storage took only less time for sprouting because during storage the conditions were almost exactly similar to that in the nursery. Hence, when the number of days taken for germination is to be counted as a criterion for seedling selection, it should be initiated from the date of harvest.

Nampoothiri et al.(1975) studied phenotypic and genotypic correlations of certain characters with yield in coconut and found that girth at the collar was the only seedling character which showed significant phenotypic correlation. This study therefore formed the basis of the recommendation that seedling selection should be practised in favour of number of leaves and girth of collar.

Kannan and Nambiar(1979) studied the influence of motherpalm and seedling selection, on the performance of progenies and observed that for ensuring better establishment, early flowering and higher yield, poorer seedlings should be identified and rejected even if they have a scientifically identified superior motherpalm source.

Wudiart(1979) identified the criteria for selection of seedlings in earlier germination and differentiation of the sprout and recommended that individuals characterised by abnormality of any sort should be rejected summarily.

Prepotency in Coconut

Dwyer(1938) proposed a view in favour of 'plant-to-row' method of selection for general improvement of the coconut-palm. He suggested that seednuts sown in nurseries with progenies of individual palms in separate rows are to be compared in terms of growth and vigour of seedlings to facilitate elimination of inferior rows. If needed, selected vigorous seedlings from the retained superior rows can be planted so as to enable the conduct of further pedigree studies.

Harland(1957) stated that every high yielding motherpalm need not produce high yielding progenies. Further, the individuals with potentiality to yield better progeny could be identified on the basis of a study of the performance of the progeny population. He felt that from a study of sufficiently large number of progenies from open pollinated mothers it could be possible to arrange them in the order of better progeny yield and identify mothers, that in spite of having been indescriminately pollinated by unknown males. In case the progeny too grew up to exhibit superior performance like the mother, it could be deducted that they have inherited the gene/genes that is/are present apparently in the dominent form, from the mother. He used the expression PREPOTENT to describe such palms.

Ninan and Pankajakshan(1961) studied the seedling characters among the open pollinated progenies and hybrids of some high yielders of coconut, variety West Coast Tall and concluded that on the basis of an analysis of the seedling performance, it is possible to identify and isolate high yielding motherpalms that facilitate the recovery of a relatively advantageous proportion of superior progenies. Furthermore, they found that the success of motherpalm selection lies in the identification of prepotent palms and their being continuously used in propagation and breeding work.

Liyanage(1967) conducted trials in coconut and suggested that seedling progeny analysis is effective in identifying prepotent palms.

Parham(1968) emphasised the selection of outstanding palms and their being used as the male parents in crosses for effecting improvement of coconut through hybridisation.

Liyanage(1972) opinioned that prepotency could be due to the function of superior general combing ability, though the absolute genetic basis of it is not understood clearly.

Satyabalan et al.(1975) conducted a study of seedling characters and yield attributes of 43 open pollinated progenies of 8 high yielding West Coast Tall palms and indicated the scope of identifying prepotent palms based on progeny performance in the nursery for breeding as well as propagation at the commercial scale.

Arecanut

Bavappa and Abraham(1961) noticed the different types of variations in Arecanut and estimated their individual magnitude. Three categories on the basis of nutweight - light, medium and heavy were identified. Heavier nuts were found to cause significantly higher percentage value for germination and produced seedlings with noticeably superior vigour. The percentage of quality seedlings recovered from heavier seeds was also found to be high.

Bavappa et al.(1964) formulated Batlett's index of germination in arecanut having practical value for assessing germination pattern of seednuts. These indices have been positively and significantly correlated with vigour of sprouts and the seedlings.

Bavappa and Ramachander(1967[a]) studied the inter-relationship among seedling characters and yield in arecapalm. They found that superior year old seedlings carried 4 leaves at least. They would have been attained a collar girth of about 20 cm or more, one year after the transplanting. Towards the close of the second year there would be differentiation of 4 or more distinct nodes. The results of a later detailed study of the yield factor seems to suggest that seedling selection resorted to, according to the proposal cited above, can help in effecting elimination of uneconomically low yielders from a population. Further, they found that approximately 50% of seedlings according to this scale represent economically inferior performance.

Bavappa and Ramachander(1967[b]) found that phenotypically identical arecapalms did not possess identical potentiality with regards to transmitting the genetic ability to produce more to the progeny. The distribution of those palms possessing the desired degree of transmittability as referred to above, did vary considerably in proportion and were found to be scattered randomly in a plantation.

Further, regularity in bearing did not indicate maintenance of any relevant dependency on prepotency. The heritability value for yield was found to be comparatively low. Positive correlations with yield, phenotypic and genotypic, were found to be present between the number of leaves present at the planting time, girth of collar one year after the transplanting and the number of nodes distinct another one year later.

Ramachander and Bavappa(1972) formulated a selection index in this species from the number of leaves and height of plant measured at the time of transplanting. Further, it was found that by effecting selection on the basis of this index resulted in enhancing a relative improvement of 332%.

Formulation of Indices for Selection

Smith(1936) was the first to expose the scope of relying upon computed values of indices for effecting efficiently selection in plant communities. The author described the mode of application of the theory of discriminent function in plant selection.

MATERIALS AND METHODS

MATERIALS AND METHODS

The experiment was conducted during February 1981-June 1982, as a Post Graduate Research Project under the Kerala Agricultural University at the Instructional Farm, Vellayani.

MATERIAL

Forty coconut palms of apparently the same age group, belonging to an exclusively identified type locally called KOMADAN, and their seedling progenies with traceable lineage together constituted the base material for the investigation.

The particulars of the trees chosen for the study are as follows:

Identification Number of palms.	Farm identification Number	*Mean nutyield per palm per year
1	2	3
1	2569	36
2	2571	78
3	2617	70
4	2619	51
5	2623	78

1	2	3
6	2625	65
7	2627	63
8	2641	67
9	2643	74
10	2565	100
11	2567	87
12	2570	113
13	2572	116
14	2573	98
15	2618	115
16	2621	95
17	2622	92
18	2628	113
19	2630	113
20	2632	118
21	2637	105
22	2638	86
23	2639	104
24	2640	105
25	2644	95
26	2645	104
27	2646	110
28	2648	104
29	2649	91
30	2650	109

1	2	3
31	2651	95
32	2564	203
33	2568	142
34	2620	128
35	2629	125
36	2631	138
37	2633	122
38	2634	132
39	2642	154
40	2647	167

* Based on the previous five years' harvest record.

METHODS

After assigning the appropriate identification numbers, the palms were grouped into three categories as shown below.

1. Sparse yielders (S) - Palms yielding less than 80 nuts per year.
2. Average yielders (A) - Palms yielding 80-120 nuts per year.
3. Prolific yielders (P) - Palms yielding more than 120 nuts per year.

Accordingly, 9/40 palms belonged to category S, 22/40 to category A, and 9/40 to category P.

Seednuts were collected from individual trees during February-April 1981. Identification number was given to each nut before they were stored till sowing. They were sown in June 1981 in the nursery with a spacing of 30 cm^2. Storage and nursery management care were practised on norms prescribed in the Package of Practices of the Kerala Agricultural University (1980).

Particulars of data collected

Data were collected from February 1981 to June 1982, in respect of the motherpalm, seednut and seedling characters.

I. MOtherpalm Characters

The following characters were studied and recorded on individual tree basis during the course of the Calender year 1981.

1. Girth of the stem (M_1)

Girth of the stem at one metre height from the base was measured and expressed in centimetres.

2. Number of fronds (M_2)

Fully split fronds alone were counted.

3. Number of bunches (M_3)

The number of bunches in different stages of development (Bunches in which the spathe has split open distinctly) were counted.

4. Mean number of female flowers per inflorescence (M_4)

It was estimated using the formula

$$X = \frac{a}{b}$$

Where

X = mean number of female flowers per inflorescence

a = total number of female flowers produced during the year.

b = total number of inflorescence produced during the year.

5. Average percentage of fruitset (M_5)

It was estimated by using the formula

$$X = \frac{a}{b} x\ 100$$

Where

X = Average percentage of fruitset

a = Total number of fruits produced during the year.

b = Total number of female flowers produced during the year.

6. Total yield of nuts during the year (M_6)

The total number of mature nuts harvested during the period under study was recorded. In this experiment nuts were harvested 9 times in the year.

7. Difference between the number of nuts obtained during the peak and lean pluckings (M_7)

Yield data for each harvest were recorded and the difference between the maximum and minimum numerical values worked out.

Altogether 7 motherpalm characters (M_1......M_7) were studied, of which three (M_1...M_3) were based on a single observation made during the year under investigation, and the remaining four (M_4....M_7) were based on nine observations made at the time of the 9 harvests.

II Seednut Characters

Immediately after harvest, the following data were recorded in respect of individual nuts.

1. Fresh weight (S_1)

Each nut was weighed on the day of harvest and the value was recorded in Kilograms.

2. Volume of the nut (S_2)

Volume of each nut was estimated on water displacement basis on the day of harvest and the value was expressed in litres.

III Seedling Characters

The recorded data in respect of seedling attributes are outlined below:

1. Number of days for sprouting (S_3)

The number of days for the appearance of visible sign of sprouting from the date of harvest of the seednut was counted.

2. Height of one year old sprout (S_4)

This variable was expressed in centimeters. In addition, monthwar increase in this value was also recorded.

3. Collar girth of one year old sprout (S_5)

The value was entered in centimeters. Here again monthwar increase in magnitude was studied.

4. Number of days for leaf splitting initiation (S_6)

The number of days for the first symptom of leaf splitting from the date on which the seednut was detached from the motherpalm represented the value.

5. Number of split leaves in one year old sprouts (S_7)

The number of split leaves in one year old seedling was counted.

Statistical Analysis of the Data

Adequate data were collected, the details of which are given below.

Source of data, number of individuals from which data were collected and the number of observations made during the year under study

Sl. No.	Variable	No.of observations during the year.	No.of individuals from which data was collected.	No. of observations pertaining to each variables.	Source of data
1	2	3	4	5	6
1	M_1	1	40	40	Motherpalm
2	M_2	1	40	40	"

1	2	3	4	5	6
3	M_3	1	40	40	Motherpalm
4	M_4	9	40	360	"
5	M_5	9	40	360	"
6	M_6	9	40	360	"
7	M_7	9	40	360	"
8	S_1	1	400	400	Seednut
9	S_2	1	400	400	"
10	S_3	1	400	400	Seedling
11	S_4	12	371	4452	"
12	S_5	12	371	4452	"
13	S_6	1	371	371	"
14	S_7	1	371	371	"

Total number of observations recorded 12406

The ungrouped data was grouped before the basic statistical estimates like the Range, Mean, Variance and Coefficient of Variation were worked out characterwise. Further, these estimates were computed under yield categorywise and also on pooled basis.

Subsequent utilisation of data was undertaken according to the procedure, the features of which are detailed below.

This phase of analysis initiated with an assessment of the comparative superiority of the individual one year old seedling progeny in respect of the expressed increase in vigour, for the estimation of which a multiple criteria approach was adopted. Consequently, the absolute value for the Expressed Seedling Vigour Index (ESVI) was computed. For this, 4 out of the 7 'S' variables (S_1, S_4, S_5 and S_7) were utilized. From the logical point of view, a more reliable and accurate value for the index could be obtained as and when the number of variables in the proposed multiple criteria model is increased. However, for the sake of practical convenience, it was felt, that the inclusion of a relatively fewer number of presumably more important variables are preferable to that incorporating a larger number of variables irrespective of their possessing significantly greater importance and merit.

In this context, S_2 refers to the volume of nut and this was eliminated from the index formulation, since this character was believed to be influenced by a number of other variables, dependent or independent, the contribution of each to the variable under consideration appeared to be quite unknown, variable and far from consistent.

Another variable that was not purposefully included in the index formulation was the number of days taken for sprouting (S_3) which was observed on individual seednut basis. Observations made in this regard appeared to reveal that seednuts varied considerably in this aspect irrespective of the pedigree. Further, it appeared that some sprouts that became distinct at a later stage exhibited a phenomenal rapid growth rate that in a shortwhile they developed into seedlings that possessed apparent increase in vigour and *vice versa.* This observation being of an inconsistent and eventually not so reliable nature, it was decided to rate it as one of the variables of lesser importance and was not included in the formulation of the indices.

During the experiment, data were collected in respect of the number of days taken by each seedling to start splitting of leaves (S_6). There are instances in which even one year after sowing the seednuts in the nursery, some of the seedlings did not even manifest this character. Further, since all the seednuts did not produce seedlings and since some of the seedlings did not express this character, it was decided to eliminate it from the index formulation venture, fearing that a condition otherwise can lead to not-so-dependent results may set in.

For the computation of the absolute value for the ESVI (Expressed Seedling Vigour Index) the procedure adopted by Smith(1936), was employed. The four variables recognised to be used in estimating the value of the ESVI were assigned with differential weightages corresponding to their rating of relative importance, as resolved from the application of Matrix Inversion Technique. This approach facilitated assigning the different variables with a more scientifically based and dependable values for the weightage which took into consideration the appropriate phenotypic as well as the genotypic values.

Eventually the values for the ESVI were computed for each and every seedling that survived through an year in the nursery. For this the following equation was used.

$$ESVI = W_1S_1 + W_4S_4 + W_5S_5 + W_7S_7$$

where W_1, W_4, W_5 and W_7 represented the weightages assigned to variables S_1, S_4, S_5 and S_7 respectively.

Thus the ESVI values for the 371 seedlings derived from 40 motherpalms belonging to three different yield categories were obtained.

Identification of vigorous and less vigorous seedling progenies

The mean of the 371 values for the ESVI as detailed above was taken as the critical borderline value for identifying the two categories of seedling progenies. Those that recorded a value higher than the critical value (mean index value) were considered to possess significantly superior vigour.

The pedigree of these identified vigorous seedlings was traced back to the respective motherpalms. These motherpalms possessed the potentiality to produce vigorous seedlings as well as seedlings with less vigour.

In the next phase a systematic and scientifically explainable approach was taken to identify the "Prepotent" motherpalms from the lot. The procedure adopted was as follows:

The mean ESVI of each identified motherpalm, as detailed above, was worked out. A subsequent level of screening of motherpalms was made at this stage, when individuals having a mean value for ESVI greater than the value used as the critical limit for identifying the superior progeny from the inferior ones were recognised separately as Prepotent Mother Palms.

As an additional probe of study in the related context the association of the 'M' characters in these finely identified Prepotent motherpalms was tested against the mean value for ESVI (MESVI)

Given below is the scheme used in this connection. Seven associations were tested.

1. (MESVI. M_1)
2. (MESVI. M_2)
3. (MESVI. M_3)
4. (MESVI. M_4)
5. (MESVI. M_5)
6. (MSEVI. M_6), and
7. (MESVI. M_7)

Note: Since significant relationship was noticed only in respect of a single paired combination among the 7 referred to above, further attempt to formulate a Motherpalm Selection Index through a similar multiple criteria model was not pursued.

RESULTS

RESULTS

The salient features made out in the light of the observations recorded during the course of the experiment, presented in the form of tables and graphs are furnished.

Table 1. - Range (R), Mean (M), Variance (V) and Coefficient of Variation (CV) of the seven mother palm attributes in coconut type KOMADAN

Category	Attributes	R	M	V	CV
1	2	3	4	5	6
	M_1	62- 85	71.00	61.69	11.03
	M_2	18- 36	28.00	35.00	21.13
S	M_3	10- 18	16.00	109.44	35.80
	M_4	17- 47	29.00	50.36	39.67
	M_5	29- 47	31.40	74.61	23.28
	M_6	65-115	88.00	459.36	24.33
	M_7	12- 31	17.89	50.36	37.67

(contd...)

Table 1. (contd.)

1	2	3	4	5	6
	M_1	65- 85	72.00	287.87	23.44
	M_2	24- 40	32.00	31.24	17.47
	M_3	11- 22	17.00	7.36	15.83
A	M_4	20- 85	32.00	196.89	44.04
	M_5	17- 59	36.45	147.99	32.45
	M_6	57-187	125.00	1152.34	27.34
	M_7	11- 50	25.55	119.40	42.78
	M_1	65- 86	75.00	52.28	9.70
	M_2	28- 40	34.00	17.44	12.20
	M_3	10- 26	18.00	25.00	27.78
P	M_4	24- 41	28.00	12.19	12.57
	M_5	35- 60	61.44	80.94	18.66
	M_6	122-229	167.00	2136.00	27.67
	M_7	14- 41	27.00	90.52	35.83

(contd..)

Table 1. (contd.)

1	2	3	4	5	6
	M_1	62- 86	75.00	41.63	8.60
	M_2	18- 40	32.00	32.25	17.75
	M_3	10- 26	17.00	10.79	19.24
Pooled	M_4	17- 85	30.00	134.08	38.15
	M_5	17- 60	39.50	100.35	25.37
	M_6	55-229	126.00	1873.05	34.36
	M_7	11- 50	23.00	106.41	43.96

Table 2. --Range (R), Mean(M), Variance (V) and Coefficient of Variation (CV) of the two seednut attributes in coconut type KOMADAN.

Category	Attri-butes	R	M	V	CV
1	2	3	4	5	6
S	S_1	0.73-1.89	1.27	0.05	17.38
	S_2	1.40-3.80	2.33	0.30	23.57
A	S_1	0.90-3.26	1.47	0.12	23.86
	S_2	1.46-6.40	2.83	0.79	31.46

(contd..)

Table 2. (contd.)

1	2	3	4	5	6
P	S_1	0.94-2.04	1.42	0.07	18.30
	S_2	1.59-4.23	2.47	0.23	19.46
Pooled	S_1	0.73-3.26	1.41	0.10	22.25
	S_2	1.40-6.40	2.64	0.60	29.37

Table 3. -- Range (R), Mean(M), Variance (V) and Coefficient of Variation (CV) of the five seedling attributes in coconut type KOMADAN

Category	Attri-butes	R	M	V	CV
1	2	3	4	5	6
S	S_3	109-266	172.48	1241.09	20.42
	S_4	61- 88	130.74	828.69	22.02
	S_5	8- 17	12.40	4.88	17.82
	S_6*	..	..	..	..
	S_7	0- 5	1.10	1.54	113.13

(contd..)

Table 3. (contd.)

1	2	3	4	5	6
	S_3	81-264	163.21	987.09	19.25
	S_4	41-229	124.99	959.04	24.78
A	S_5	7- 21	13.11	6.41	19.31
	S_6*	..	..	..	..
	S_7	0- 5	1.05	1.23	105.62
	S_3	114-232	167.06	1034.65	19.25
	S_4	76-227	151.05	991.62	20.85
	S_5	7- 19	13.22	6.40	19.14
P	S_6*	..	..	..	..
	S_7	0- 4	1.27	1.28	89.19
	S_3	81-266	165.72	1069.38	19.73
	S_4	41-229	137.32	1039.56	23.48
	S_5	7- 21	12.92	5.77	18.60
Pooled	S_6*	..	..	..	..
	S_7	0- 5	1.11	1.32	103.51

* The values for S_6 (the number of days taken by individual seedlings from the time of detaching the seednut from the motherpalm to the time when the first splitting of leaf was noticed) are not entered in the table since all the seedlings did not exhibit this character, and hence accurate estimates, as that given for the other variables, could not be worked out.

Table 4. -- Computed weightage values for the different seedling attributes which were included in the formulation of the Expressed Seeling Vigour Index (ESVI)

Sl.No.	Attribute	Weightage
1	S_1	-3.1240
2	S_4	+0.1419
3	S_5	+0.9501
4	S_6	+9.2607

Table 5. -- Computed values for the Expressed Seedling Vigour Index (ESVI), and the individual rating of 371 seedling progenies of 40 palms of coconut type KOMADAN

* RATING 'V' represents vigorous seedling(Seedlings with values for ESVI greater than the critical mean ESVI value of 37.13

Sl.No. of seed- lings	Identi- fication No. of palm	Cate- gory	Identi- fication No. of seedling	Value for ESVI	Rating
1	2	3	4	5	6
1	2569	Sparse	1- 1	16.34	..
2	"	"	1- 2	17.46	..
3	"	"	1- 3	11.45	..
4	"	"	1- 4	21.06	..
5	"	"	1- 5	24.16	..
6	"	"	2- 7	21.95	..
7	"	"	2- 8	25.69	..
8	"	"	2- 9	29.34	..
9	"	"	2-10	61.52	V

contd..

Table 5. (contd.)

1	2	3	4	5	6
10	2571	S	1- 1	21.99	..
11	"	"	1- 2	26.12	..
12	"	"	2- 3	16.15	..
13	"	"	2- 4	34.97	..
14	"	"	2- 5	17.79	..
15	"	"	2- 6	47.65	V
16	"	"	2- 7	39.46	V
17	"	"	2- 8	23.06	..
18	"	"	2- 9	25.22	..
19	2617	S	1- 1	12.91	..
20	"	"	1- 2	43.57	V
21	"	"	1- 3	33.53	..
22	"	"	1- 4	20.78	..
23	"	"	1- 5	34.01	..
24	"	"	2- 6	74.32	V
25	"	"	2- 7	64.10	V
26	"	"	2- 8	57.28	V
27	"	"	2-10	77.09	V
28	2619	S	1- 1	20.15	..
29	"	"	1- 2	20.34	..
30	"	"	1- 3	26.80	..
31	"	"	1- 5	41.42	V
32	"	"	2- 6	42.09	V
33	"	"	2- 8	23.72	..
34	"	"	2- 9	65.11	V
35	"	"	2-10	32.37	..

contd...

Table 5. (contd.)

1	2	3	4	5	6
36	2623	S	1- 1	45.50	V
37	"	"	1- 2	51.42	V
38	"	"	1- 3	53.42	V
39	"	"	1- 4	75.95	V
40	"	"	1- 5	62.91	V
41	"	"	2- 6	48.84	V
42	"	"	2- 7	49.97	V
43	"	"	2- 8	24.39	..
44	"	"	2- 9	21.11	..
45	2625	S	1- 1	28.61	..
46	"	"	1- 2	46.96	V
47	"	"	1- 3	52.09	V
48	"	"	1- 4	47.64	V
49	"	"	1- 5	24.41	..
50	"	"	2- 6	29.07	..
51	"	"	2- 7	61.58	V
52	"	"	2- 8	35.78	..
53	"	"	2- 9	58.41	V
54	"	"	2-10	33.16	..
55	2627	S	1- 1	15.91	..
56	"	"	1- 2	35.76	..
57	"	"	1- 3	44.40	V
58	"	"	2- 6	50.25	V
59	"	"	2- 7	47.47	V
60	"	"	2- 8	47.88	V
61	"	"	2- 9	28.23	..
62	"	"	2-10	26.68	..

contd...

Table 5. (contd.)

1	2	3	4	5	6
63	2641	S	1- 1	31.52	..
64	"	"	1- 2	29.47	..
65	"	"	1- 3	34.06	..
66	"	"	1- 4	24.50	..
67	"	"	1- 5	28.42	..
68	"	"	2- 6	40.54	V.
69	"	"	2- 7	27.07	..
70	"	"	2- 8	43.67	V
71	"	"	2- 9	31.52	..
72	"	"	2-10	26.29	..
73	2643	S	1- 1	36.42	..
74	"	"	1- 2	49.03	V
75	"	"	1- 3	58.45	V
76	"	"	1- 4	45.99	V
77	"	"	1- 5	18.60	..
78	"	"	2- 6	22.83	..
79	"	"	2- 7	14.47	..
80	"	"	2- 8	27.91	..
81	"	"	2- 9	48.73	V
82	2565	Average	1- 1	38.28	V
83	"	"	1- 2	23.99	..
84	"	"	1- 3	23.55	..
85	"	"	1- 4	41.70	V.
86	"	"	1- 5	46.14	V
87	"	"	2- 6	48.71	V
88	"	"	2- 7	66.68	V
89	"	"	2- 8	45.41	V
90	"	"	2- 9	90.03	V
91	"	"	2-10	71.02	V

contd...

Table 5.(contd.)

1	2	3	4	5	6
92	2567	A	1- 1	45.01	V
93	"	"	1- 2	20.74	..
94	"	"	1- 3	36.78	..
95	"	"	1- 4	36.91	..
96	"	"	1- 5	53.44	V
97	"	"	2- 6	29.12	..
98	"	"	2- 7	75.33	V
99	"	"	2- 8	54.02	V
100	"	"	2- 9	60.66	V
101	"	"	2-10	43.75	V
102	2570	A	1- 1	21.89	..
103	"	"	1- 2	50.21	V
104	"	"	1- 3	35.53	..
105	"	"	1- 4	49.91	V
106	"	"	1- 5	51.67	V
107	"	"	2- 6	37.33	V
108	"	"	2- 7	57.50	V
109	"	"	2- 8	48.95	V
110	"	"	2- 9	46.58	V
111	"	"	2-10	66.80	V
112	2572	A	1- 2	13.10	..
113	"	"	1- 3	13.80	..
114	"	"	1- 5	23.78	..
115	"	"	2- 6	57.18	V
116	"	"	2- 7	26.90	..
117	"	"	2- 8	34.96	..
118	"	"	2-10	43.79	V

contd...

Table 5.(contd.)

1	2	3	4	5	6
119	2573	A	1- 1	20.25	..
120	"	"	1- 2	18.61	..
121	"	"	1- 3	9.96	..
122	"	"	1- 4	22.35	..
123	"	"	1- 5	22.34	..
124	"	"	2- 6	25.90	..
125	"	"	2- 7	17.29	..
126	"	"	2- 8	51.19	V
127	"	"	2- 9	67.43	V
128	"	"	2-10	9.07	..
129	2618	A	1- 1	36.34	..
130	"	"	1- 2	35.38	..
131	"	"	1- 3	60.44	V
132	"	"	1- 4	70.26	V
133	"	"	1- 5	19.85	..
134	"	"	2- 6	49.92	V
135	"	"	2- 7	63.10	V
136	"	"	2- 8	58.68	V
137	"	"	2- 9	60.14	V
138	"	"	2-10	78.35	V
139	2621	A	1- 1	25.57	..
140	"	"	1- 2	21.36	..
141	"	"	1- 3	29.42	..
142	"	"	1- 4	18.60	..
143	"	"	1- 5	25.62	..
144	"	"	2- 7	61.70	V
145	"	"	2- 8	21.15	..
146	"	"	2- 9	32.59	..
147	"	"	2-10	28.27	..

contd...

Table 5. (contd.)

1	2	3	4	5	6
148	2622	A	1- 1	24.03	..
149	"	"	1- 2	24.77	..
150	"	"	1- 3	33.62	..
151	"	"	1- 4	26.50	..
152	"	"	1- 5	39.48	V.
153	"	"	2- 6	35.15	..
154	"	"	2- 7	35.68	..
155	"	"	2- 8	45.20	V
156	"	"	2- 9	26.01	..
157	"	"	2-10	45.33	V
158	2628	A	1- 1	47.75	V
159	"	"	1- 2	51.51	V
160	"	"	1- 3	17.14	..
161	"	"	1- 4	23.87	..
162	"	"	1- 5	33.99	..
163	"	"	2- 6	46.78	V
164	"	"	2- 7	24.41	..
165	"	"	2- 9	41.43	V
166	"	"	2-10	43.45	V
167	2630	A	1- 1	42.78	V
168	"	"	1- 2	52.56	V
169	"	"	1- 3	27.91	..
170	"	"	1- 4	55.21	V
171	"	"	2- 5	41.27	V
172	"	"	2- 6	35.07	..
173	"	"	2- 7	37.85	V
174	"	"	2- 8	26.23	..

contd...

Table 5. (contd.)

1	2	3	4	5	6
175	2632	A	1- 2	15.22	..
176	"	"	1- 3	32.25	..
177	"	"	1- 4	18.21	..
178	"	"	1- 5	15.11	..
179	"	"	2- 6	4.83	..
180	"	"	2- 9	11.90	..
181	"	"	2-10	40.25	V
182	2637	A	1- 1	14.68	..
183	"	"	1- 2	20.61	..
184	"	"	1- 3	19.60	..
185	"	"	1- 4	28.34	..
186	"	"	1- 5	34.76	..
187	"	"	2- 6	34.39	..
188	"	"	2- 7	45.49	V
189	"	"	2- 8	37.43	V
190	"	"	2- 9	65.56	V
191	"	"	2-10	49.28	V
192	2638	A	1- 1	21.38	..
193	"	"	1- 2	25.42	..
194	"	"	1- 3	20.20	..
195	"	"	1- 4	48.21	V
196	"	"	1- 5	47.92	V
197	"	"	2- 6	43.54	V
198	"	"	2- 7	60.39	V
199	"	"	2- 8	38.55	V
200	"	"	2- 9	33.94	..
201	"	"	2-10	48.25	V

contd....

Table 5. (contd.)

1	2	3	4	5	6
202	2639	A	1- 2	22.28	..
203	"	"	1- 3	21.33	..
204	"	"	1- 4	43.30	V
205	"	"	1- 5	34.27	..
206	"	"	2- 6	17.97	..
207	"	"	2- 7	20.66	..
208	"	"	2- 8	24.26	..
209	"	"	2- 9	20.61	..
210	"	"	2-10	48.41	V
211	2640	A	1- 1	55.18	V
212	"	"	1- 2	33.16	..
213	"	"	1- 3	34.59	..
214	"	"	1- 4	25.70	..
215	"	"	1- 5	42.37	V
216	"	"	2- 6	42.88	V
217	"	"	2- 7	29.93	..
218	"	"	2- 8	25.41	..
219	"	"	2- 9	28.34	..
220	"	"	2-10	36.01	..
221	2644	A	1- 1	20.24	..
222	"	"	1- 4	21.45	..
223	"	"	2- 6	46.75	V
224	"	"	2- 7	13.12	..
225	"	"	2- 8	34.43	..
226	"	"	2- 9	39.30	V
227	"	"	2-10	40.15	V

contd...

Table 5. (contd.)

1	2	3	4	5	6
228	2645	A	1- 1	46.47	V
229	"	"	1- 2	23.57	..
230	"	"	1- 3	36.48	..
231	"	"	1- 4	36.90	..
232	"	"	1- 5	49.18	V
233	"	"	2- 6	38.10	V
234	"	"	2- 7	36.71	..
235	"	"	2- 8	32.51	..
236	"	"	2- 9	48.08	V
237	"	"	2-10	37.30	V
238	2646	A	1- 1	46.47	V
239	"	"	1- 2	23.57	..
240	"	"	1- 3	36.48	..
241	"	"	1- 4	36.90	..
242	"	"	1- 5	49.18	V
243	"	"	2- 6	38.10	V
244	"	"	2- 7	36.71	..
245	"	"	2- 8	32.51	..
246	"	"	2- 9	48.08	V
247	"	"	2-10	37.30	V
248	2648	A	1- 1	20.14	..
249	"	"	1- 3	34.14	..
250	"	"	1- 4	49.66	V
251	"	"	1- 5	43.94	V
252	"	"	2- 6	52.02	V
253	"	"	2- 7	37.15	V
254	"	"	2- 8	21.65	..
255	"	"	2- 9	53.82	V
256	"	"	2-10	53.33	V

contd...

Table 5. (contd.)

1	2	3	4	5	6
257	2649	A	1- 1	24.84	..
258	"	"	1- 2	32.06	..
259	"	"	1- 3	20.57	..
260	"	"	1- 4	22.22	..
261	"	"	1- 5	22.47	..
262	"	"	2- 6	22.75	..
263	"	"	2- 7	27.10	..
264	"	"	2- 8	22.33	..
265	"	"	2- 9	37.38	V
266	"	"	2-10	48.32	V
267	2650	A	1- 2	26.23	..
268	"	"	1- 3	24.63	..
269	"	"	1- 4	31.02	..
270	"	"	1- 5	31.15	..
271	"	"	2- 6	54.94	V
272	"	"	2- 7	52.67	V
273	"	"	2- 8	19.51	..
274	"	"	2- 9	33.20	..
275	"	"	2-10	52.90	V
276	2651	A	1- 1	30.03	..
277	"	"	1- 2	38.71	V
278	"	"	1- 3	38.86	V
279	"	"	1- 4	42.39	V
280	"	"	1- 5	28.75	..
281	"	"	2- 6	27.67	..
282	"	"	2- 7	25.12	..
283	"	"	2- 8	43.85	V
284	"	"	2- 9	49.12	V
285	"	"	2-10	29.74	..

contd...

Table 5. (contd.)

1	2	3	4	5	6
286	2564	Prolific	1- 1	39.64	V
287	"	"	1- 2	24.01	..
288	"	"	1- 3	22.62	..
289	"	"	1- 4	14.09	..
290	"	"	1- 5	52.72	V
291	"	"	2- 6	18.82	..
292	"	"	2- 7	35.04	..
293	"	"	2- 8	54.38	V
294	"	"	2- 9	33.90	..
295	"	"	2-10	55.48	V
296	2568	P	1- 1	19.86	..
297	"	"	1- 2	21.85	..
298	"	"	1- 3	26.29	..
299	"	"	1- 4	37.51	V
300	"	"	1- 5	36.74	..
301	"	"	2- 6	64.89	V
302	"	"	2- 7	23.34	..
303	"	"	2- 8	26.06	..
304	"	"	2- 9	46.03	V
305	"	"	2-10	37.46	V
306	2620	P	1- 1	19.88	..
307	"	"	1- 2	23.54	..
308	"	"	1- 3	51.53	V
309	"	"	1- 4	42.76	V
310	"	"	1- 5	40.59	V
311	"	"	2- 6	65.88	V
312	"	"	2- 7	80.07	V
313	"	"	2- 9	50.94	V
314	"	"	2-10	32.82	..

contd...

Table 5. (contd.)

1	2	3	4	5	6
315	2629	P	1- 1	42.76	V
316	"	"	1- 2	26.95	..
317	"	"	1- 3	25.40	..
318	"	"	1- 4	65.28	V
319	"	"	1- 5	22.29	..
320	"	"	2- 6	58.26	V
321	"	"	2- 7	38.68	V
322	"	"	2- 8	35.69	..
323	"	"	2- 9	32.58	..
324	"	"	2-10	15.59	..
325	2631	P	1- 1	32.63	..
326	"	"	1- 2	63.54	V
327	"	"	1- 3	41.82	V
328	"	"	1- 4	40.11	V
329	"	"	1- 5	43.26	V
330	"	"	2- 6	56.89	V
331	"	"	2- 8	55.25	V
332	"	"	2- 9	45.13	V
333	"	"	2-10	50.61	V
334	2633	P	1- 1	18.89	..
335	"	"	1- 2	52.61	V
336	"	"	1- 3	23.12	..
337	"	"	1- 4	47.33	V
338	"	"	2- 6	51.64	V
339	"	"	2- 7	31.03	..
340	"	"	2- 8	75.46	V
341	"	"	2- 9	45.93	V
342	"	"	2-10	50.96	V

contd...

Table 5. (contd.)

1	2	3	4	5	6
343	2634	P	1- 1	20.06	..
344	"	"	1- 2	23.12	..
345	"	"	1- 3	34.25	..
346	"	"	1- 4	38.70	V
347	"	"	2- 6	38.62	V
348	"	"	2- 7	64.87	V
349	"	"	2- 8	58.95	V
350	"	"	2- 9	65.83	V
351	"	"	2-10	79.64	V
352	2642	P	1- 1	34.48	..
353	"	"	1- 2	38.79	V
354	"	"	1- 3	48.98	V
355	"	"	1- 4	50.74	V
356	"	"	1- 5	54.41	V
357	"	"	2- 6	37.18	V
358	"	"	2- 7	51.44	V
359	"	"	2- 8	61.70	V
360	"	"	2- 9	38.57	V
361	"	"	2-10	30.92	..
362	2647	P	1- 1	18.51	..
363	"	"	1- 2	39.38	V
364	"	"	1- 3	55.96	V
365	"	"	1- 4	25.82	..
366	"	"	1- 5	25.33	..
367	"	"	2- 6	59.32	V
368	"	"	2- 7	56.95	V
369	"	"	2- 8	25.72	..
370	"	"	2- 9	31.27	..
371	"	"	2-10	51.95	V

Table 6. -- Prepotent Motherpalms identified on the basis of Pedigree Progeny Analysis conducted on 40 palms of coconut type KOMADAN, and the treewise recovery of vigorous seedlings

Sl. No.	Motherpalm identification number	Mean value for ESVI	Rating of prepotent palms.	No.of nuts sown	No.of viable seedlings at 1 year	Vigorous seedlings recovered
1	2	3	4	5	6	7
1	2569	25.44	..	10	9	1
2	2571	28.05	..	10	9	2
3	2617	46.40	P	10	9	5
4	2619	34.00	..	10	8	3
5	2623	48.17	P	10	9	7
6	2625	41.77	P	10	10	5
7	2627	37.07	..	10	8	4
8	2641	29.08	..	10	10	2
9	2643	25.70	..	10	9	4
10	2565	45.38	P	10	10	8
11	2567	45.64	P	10	10	6
12	2570	46.64	P	10	10	8
13	2572	30.50	..	10	7	2
14	2573	26.44	..	10	10	2
15	2618	53.27	P	10	10	7
16	2621	29.36	..	10	9	1
17	2622	33.58	..	10	10	3
18	2628	36.70	..	10	9	5
19	2630	36.58	..	10	8	5
20	2632	18.99	..	10	7	1

contd....

Table 6. (contd.)

1	2	3	4	5	6	7
21	2637	35.01	.	10	10	4
22	2638	38.78	P	10	10	6
23	2639	28.13	.	10	9	2
24	2640	35.36	.	10	10	3
25	2644	30.78	.	10	7	3
26	2645	38.53	P	10	10	5
27	2646	38.53	P	10	10	5
28	2648	40.68	P	10	9	6
29	2649	28.00	.	10	10	2
30	2650	36.25	.	10	9	3
31	2651	35.42	.	10	10	5
32	2564	35.07	.	10	10	4
33	2568	34.00	.	10	10	4
34	2620	45.33	P	10	9	6
35	2629	31.89	.	10	10	4
36	2631	47.69	P	10	9	8
37	2633	45.71	P	10	9	6
38	2634	48.72	P	10	9	6
39	2642	44.72	P	10	10	8
40	2647	39.02	P	10	10	5

'P' represent Prepotent Motherpalms (Motherpalms with mean value for ESVI greater than the mean index value of 37.13)

Table 7. -- Association of Palmwise Mean of the values for Expressed Seedling Vigour Index (MESVI) and the seven motherpalm attributes in coconutpalm type KOMADAN

Sl. No.	Paired comibination tested	Correlation Coefficient (r)	t value
1	2	3	4
1	(MESVI. M_1)	+0.254	1.084
2	(MESVI. M_2)	+0.159	0.663
3	(MESVI. M_3)	+0.368	1.631
4	(MESVI. M_4)	-0.402	1.811
5	(MESVI. M_5)	+0.535	3.093 *
6	(MESVI. M_6)	+0.049	0.833
7	(MESVI. M_7)	+0.051	0.211

(t_{16} at 5% level of significance = 2.12)

* Significance

Routine periodical measurements were recorded with regards to the overall height, and girth of collar of individual seedlings during their 12 months stand in the nursery. The mean of these measurements were estimated categorywise and on the generalised scale. The information thus made available is presented hereunder in the form of graphs plotted on a suitable scale.

FIG. 1 GRAPH SHOWING THE PROGRESSIVE INCREASE IN HEIGHT DURING THE FIRST 12 MONTH PERIOD IN THE NURSERY OF SEEDLINGS FROM THE 3 NUT YIELD CATEGORIES.

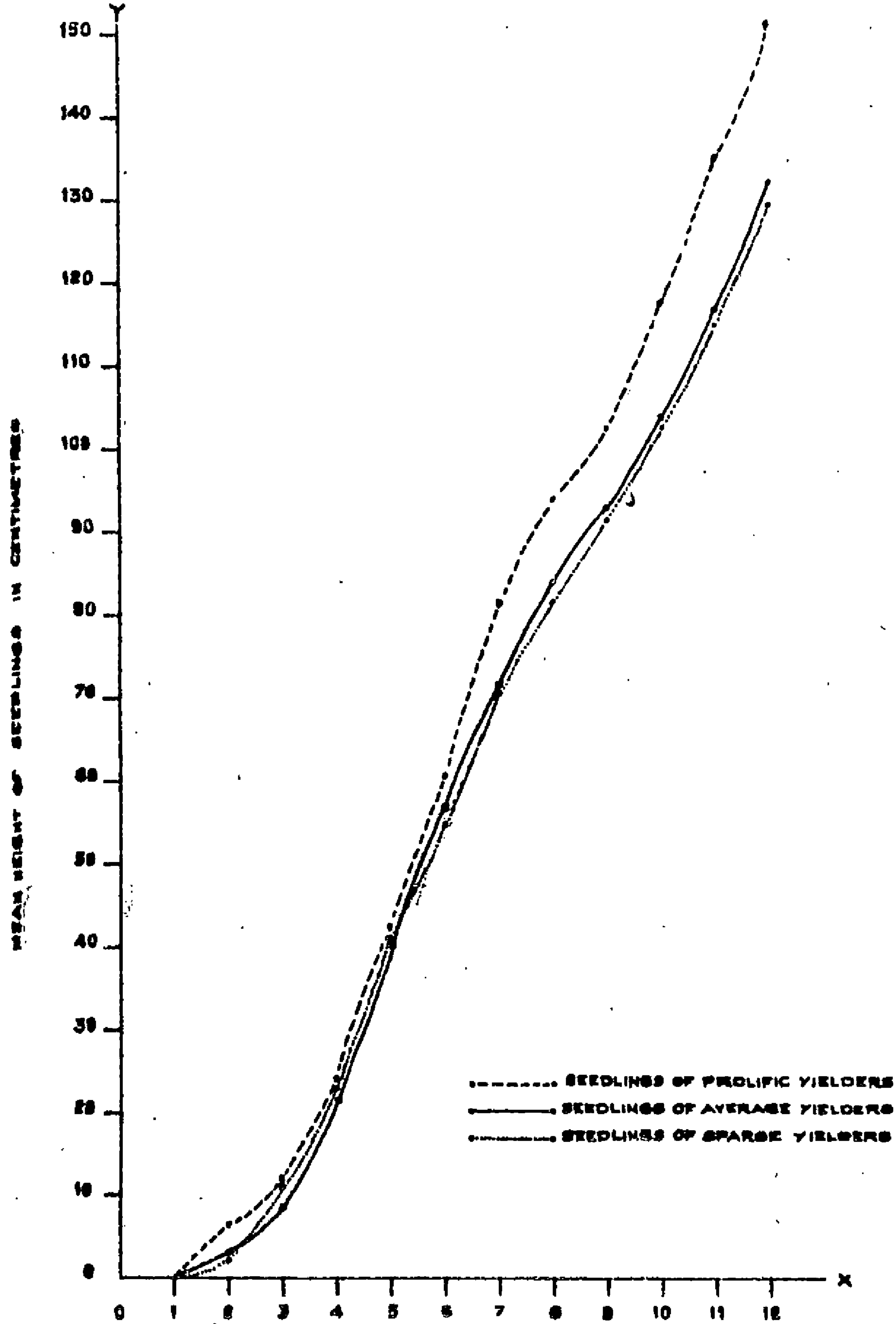


FIG. 2. GRAPH SHOWING THE PROGRESSIVE INCREASE IN COLLAR GIRTH DURING THE FIRST 12 MONTH PERIOD IN THE NURSERY OF SEEDLINGS FROM THE 3 NUT YIELD CATEGORIES.

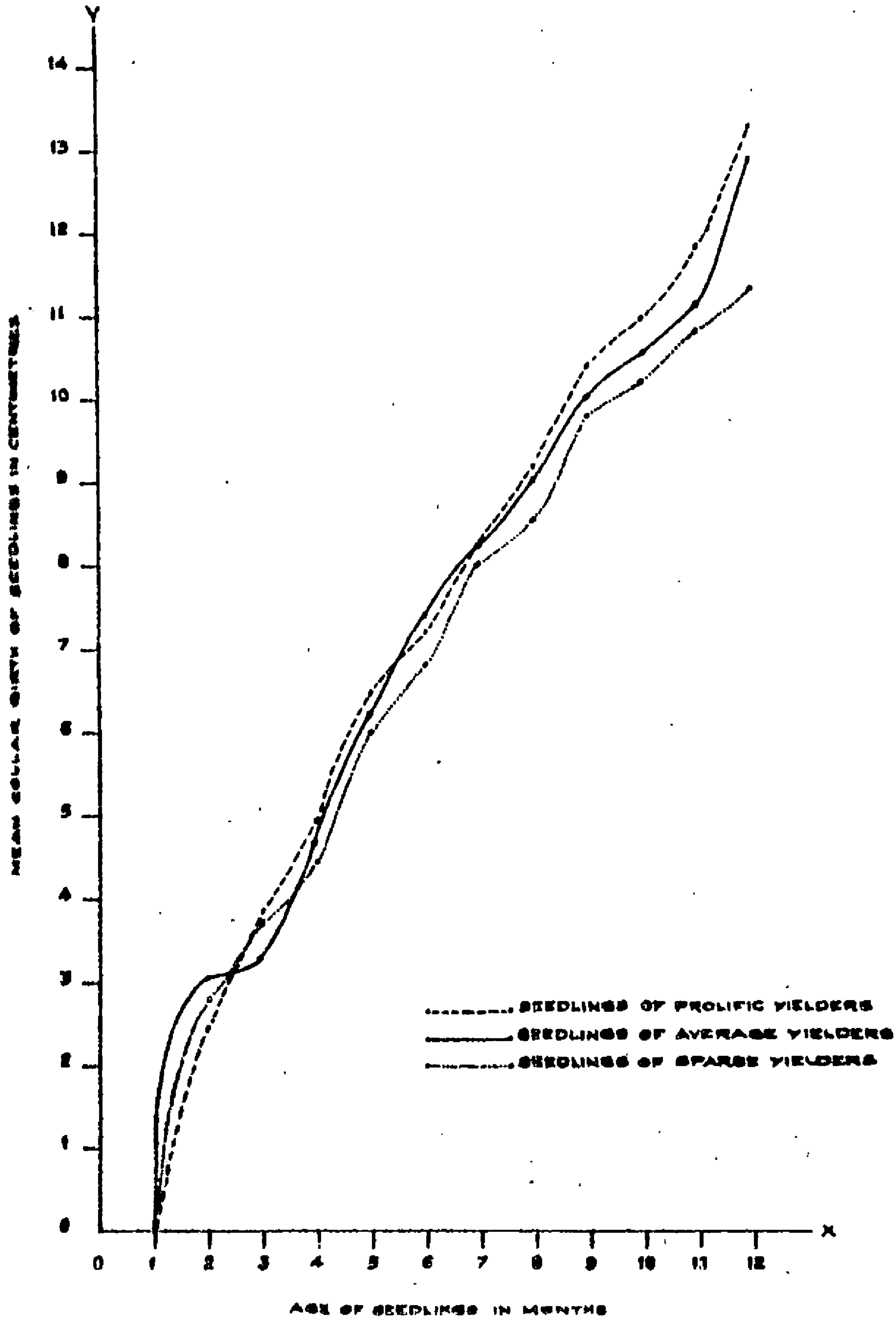


FIG. 3 GRAPH SHOWING THE PROGRESSIVE INCREASE IN HEIGHT DURING THE FIRST 12 MONTH PERIOD IN THE NURSERY OF SEEDLINGS DERIVED FROM THE IDENTIFIED PREPOTENT PALMS AND FROM THE POOLED CATEGORY.

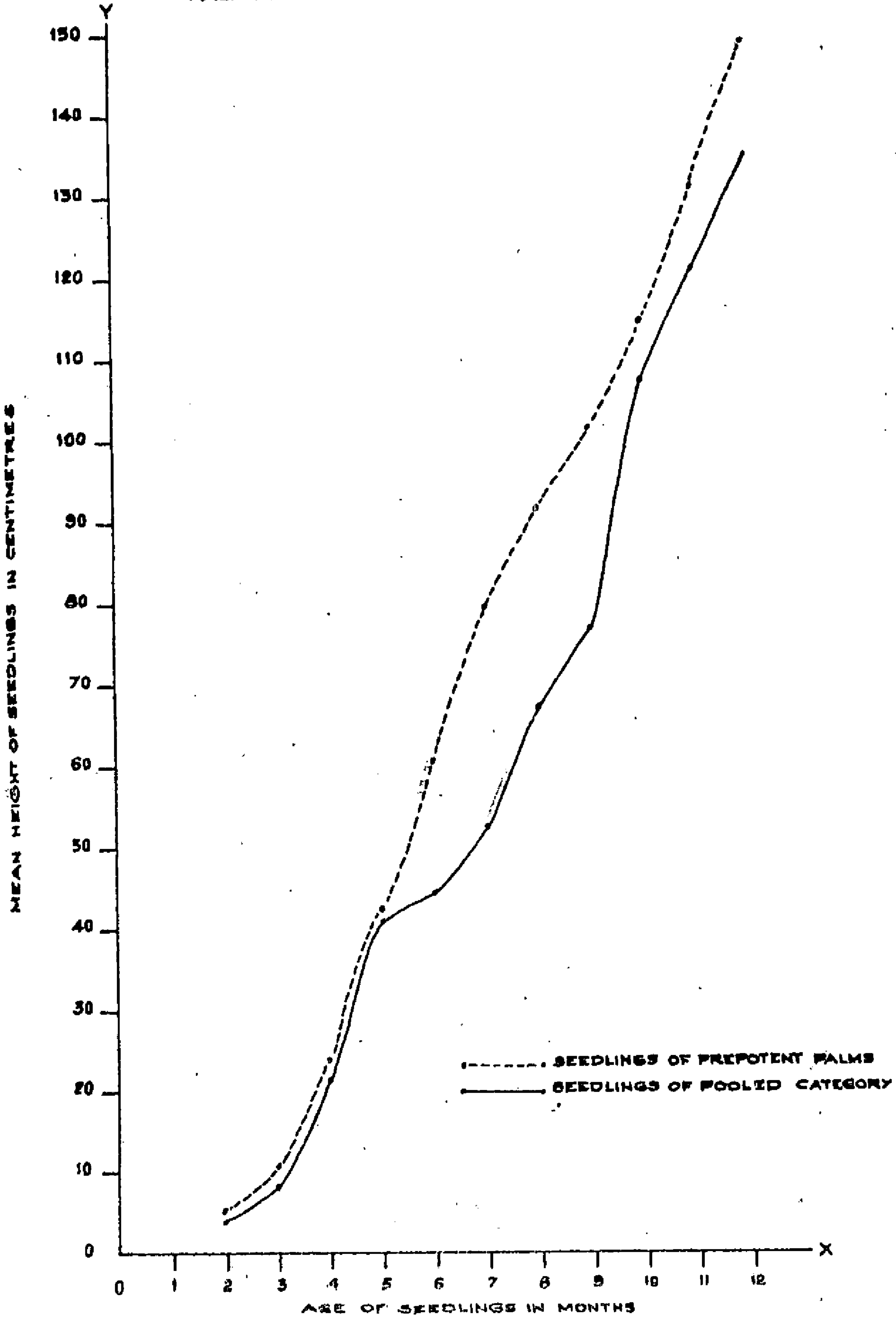
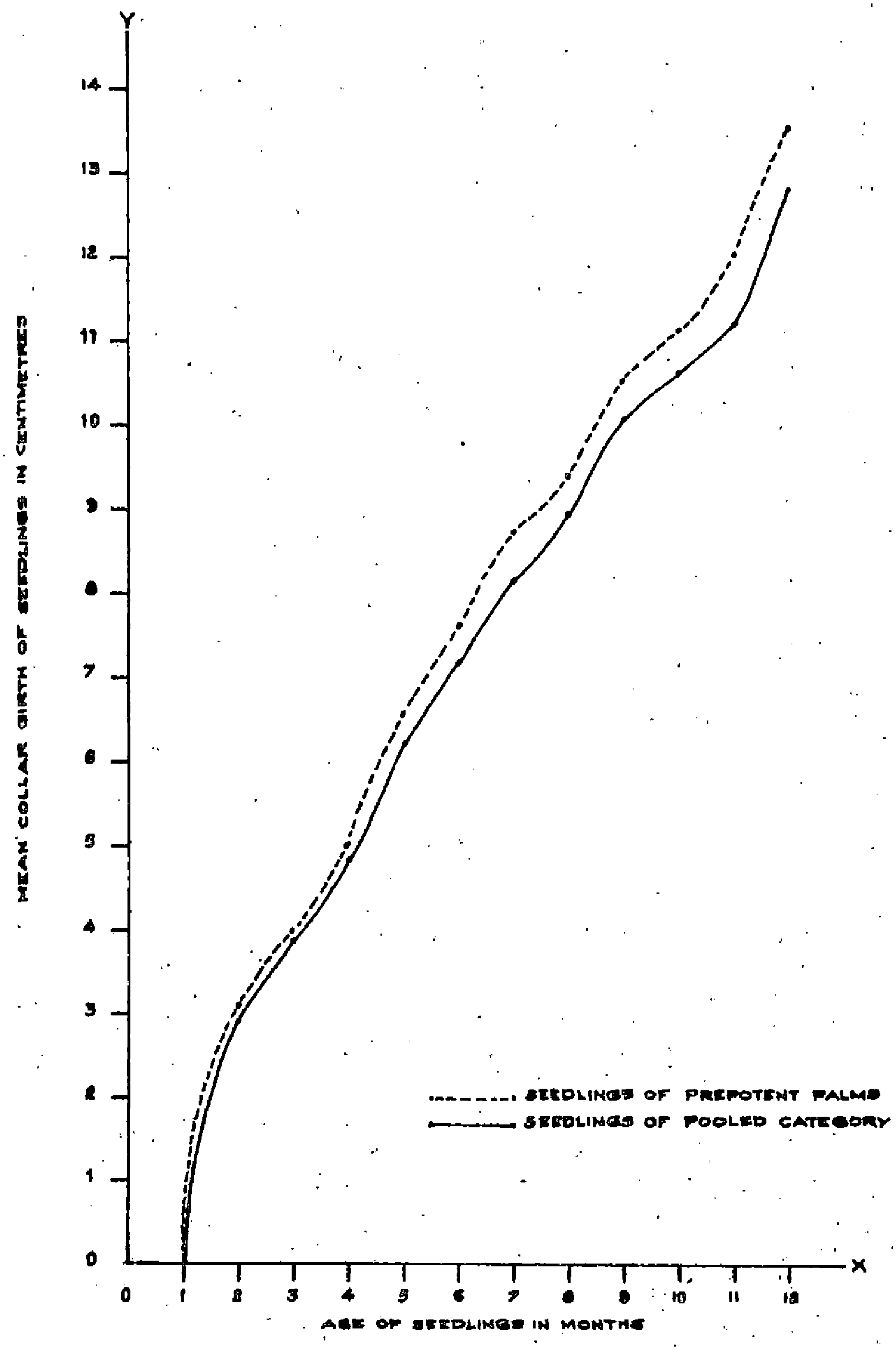


FIG. 4. GRAPH SHOWING THE PROGRESSIVE INCREASE IN COLLAR GIRTH DURING THE FIRST 12 MONTH PERIOD IN THE NURSERY OF SEEDLINGS DERIVED FROM THE IDENTIFIED PREPOTENT MOTHER PALMS AND FROM THE POOLED CATEGORY.



DISCUSSION

DISCUSSION

The informations, made available through the conduct of the experiment, proved themselves to be of use in the identification of PREPOTENT palms in coconut, type KOMADAN. The implications relevant to the context are being discussed.

Motherpalm Attributes

The 40 coconutpalms of the type as mentioned above, from which data in respect of the motherpalm attributes were collected, belonged to 3 distinct nutyield categories-9 to the sparse, 22 to the average and 9 to the prolific yielding classes. The variables studied in this connection are listed below:

i) M_1 - girth of stem,

ii) M_2 - number of leaves,

iii) M_3 - number of bunches,

iv) M_4 - average number of female flowers per inflorescence,

v) M_5 - average setting percentage,

vi) M_6 - annual nutyield, and

vii) M_7 - numerical qualification of the regularity in the number of nuts obtained during the 9 harvests of the 12 month period.

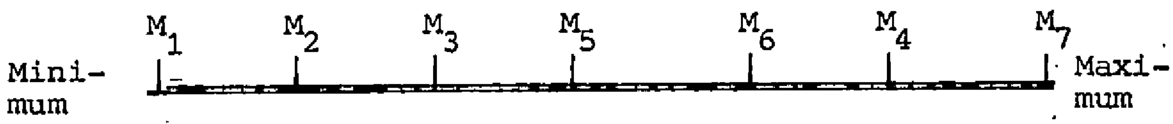
Reference is made to table -1. The values for the coefficient of variation for the motherpalm attributes are rearranged on the nutyield category and the pooled bases for the purpose of convenience to enable making of a comparative appraisal.

Values for the coefficient of variation

Motherpalm attributes	Nutyield categories			
	S	A	P	Pooled
M_1	11.03	23.44	9.70	8.60
M_2	21.13	17.47	12.20	17.75
M_3	35.80	15.83	27.78	19.24
M_4	39.67	44.04	12.57	38.15
M_5	23.28	32.45	18.66	25.37
M_6	24.33	27.34	27.67	34.36
M_7	37.67	42.78	35.83	43.96

From the figures, it is evident that all the variables exhibited signs of variability, the magnitude of which varied not only from each other, but also between the nutyield categories.

Given below is a graphical representation of the scale of variability exhibited by the above 7 variables based on the numerical values entered under the column representing the pooled lot.



From the scale, it is apparent that of the 7 variables, M_7 exhibits the maximum variability. An exactly similar trend is exhibited by the trees belonging to the P category. In the remaining two categories (S and A), an almost similar trend is discernible. This variable denoted numerically the regularity with which nuts are harvested through the nine plucking of the year.

The observations seem to suggest that in type KOMADAN, palms, irrespective of the nutyield category to which they belong, are quite inconsistent in yielding an almost identical number of nuts through the temporally protracted harvests. However, the harvests made to collect seednuts neither came within the peak nor the lean session, but remained elsewhere, when only an average number of nuts were obtained. Further, it is not quite impossible, that as and when the number of nuts on per bunch/harvest basis increased, as in the case in the peak periods, of harvest, the chances of the weight and coincidentially the size of individual nuts getting dwindled are more. Similar is the case under conditions vice-versa. Consequently, it is only probable that a seednut that weighs less carries relatively less of stored food material that is available to the growing embryo/young seedling in the nursery, a condition that can in turn lead to a diminution in the expression of attributes that characterize the overall phenominon of vigour. Similarly, with an increase in size of nut that maintain a direct correspondence with the weight, the number of nuts per bunch is likely to be small and consequently the per tree recovery of seedlings in terms of number is also likely to be less. But the requirement of the practical breeder in coconut is to identify particular motherpalms that possess an inherent potentiality to yield more number of vigorous seedlings on single tree basis (PREPOTENT palms) then only the efforts spended will turn out as meaningful.

The next character, that is entered under the pooled category in the list, that exhibited a relatively higher order of variation, is M_4 (the mean number of female flowers per inflorescence). In this case, the value for the mean recorded under the P group is low, and since the number of trees under the category is much less (9) it is felt that launching a confirmatory commitment in this regard need not be exactly wise.

The categorywise value for the mean and Coefficient of Variation are given below:

Category	Mean	CV
S	29	39.67
A	32	44.04
P	28	12.57
Pooled	30	38.15

It appears that the female flower production potential is maximum in the Class A, followed by S, and the least under P. The values for the CV at the same time show higher degree against groups S and A. Probably, this particular low rating is the vital factor, that the category its represents, namely P, bears an increased number of nuts.

In the light of the above evidence motherpalm selection in favour of regular production of an average number of female flowers, distributed properly in the inflorescence with one or two female flowers per spike, is found to be beneficial. The same view was supported by several workers. (Thampan, 1971; and Nampoothiri, et al., 1975) But selection in favour of more number of female flowers, preferably 100 or more was reported to be beneficial by Pieris (1934).

The categorywise value for the mean and CV for the next order variable, M_6 (the annual nutyield) are furnished below:

Category	Mean	CV
S	88	24.33
A	125	27.34
P	167	27.67
Pooled	126	34.36

The extent of variation is almost the same for the 3 categories. However, the values for the mean are different. But a collective influence is suspected to have been imposed upon this character, by M_4 and M_5 and pertinent implication relevant to the context is being proposed.

Fruits (nuts in coconut palm) develop from fertilized female flowers and the number of fruits produced (M_6) depend on the female flower production potential of the palm (M_4) and the setting percentage (M_5). The role of M_4 in giving expression to M_6 is discussed earlier. Regarding M_5, which can be identified as the moderately variable attribute among the 7 studied, the values for the mean and CV are furnished hereunder to substantiate the version that appears to be the most sensible.

Category	Mean	CV
S	31.40	23.28
A	36.45	32.45
P	61.44	18.66
Pooled	39.50	25.37

Mean value for the fruit setting percentage is the maximum under category P and the minimum under category S, with A category occupying a position in between. Further, the least variable situation is recorded against P category. This can be safely and conclusively considered as the very reason why palms under category P yield more number of nuts on per tree basis.

The result is in favour of selection of motherpalms for higher nut production (around 100) characterized by production of an average number of female flowers coupled with a comparatively high setting percentage. The same view was reported by earlier workers (Smith, 1933; Thampan, 1971; Nampoothiri et al., 1975)

A trend similar to that proposed for M_5 is seen in respect of M_3 (number of bunches) also. The number of fronds (M_2) compared to the variable referred to above already indicates a positive tendency towards maintaining stability like M_1 (girth of stem). In this context the favourable view in respect of motherpalm selection; observed from the study, is presence of 30-35 suitably oriented fronds and an increased number of bunches (around 15). The feature was recognised to be of importance by certain earlier workers (Pieris, 1934; Thampan, 1975).

The seven variables mentioned as above, are indeed under genetic control to some extent, at the same time they are under the influence of the different factors of the external environment to varying extent. May be M_1 is the only variable that is least affected by the latter mentioned factors.

To sum up the observations discussed above, a fact turns out to be clear, that though coconutpalms are recognised to maintain appreciable stability and type identify in palm attributes, also to varying extent ~~to~~ exhibit variability at the levels of individual palms, and nutyield categories, the existence of which can be resolved through adopting a reasonably sophisticated biometrical approach.

Nut Characters

The two variables studied in respect of seednut are S_1 (weight) and S_2 (Volume). From the table-2, it appears that like the motherpalms characters, these characters also exhibited variability, the magnitude of which being more for the volume than the weight. The fruit in coconut which is more popularly referred to as the nut, has a structure consisting of materials which are different in nature, that the reason for expression of relatively more variability in the volume is not difficult to digest.

Selection in favour of medium sized seednuts was reported to be beneficial by several workers. (Smith, 1933; Umali, 1940; Thomas, 1978) But a closer scrutiny of table -4, reveals that the computed weightage value for the variable S_1 (weight of nut) bears a negative sign, which could be interpreted as to indicate that nuts weighing less are equally likely to produce vigorous seedlings and vice versa. This is apparently a trend that does not offer any justifiable compromise. Under the context, it should not be overlooked that proposing a satisfactory justification to this possibility could be possible only after the results of a suitably arranged experiment are examined.

Further, a deeper probe into the aspect appears to unveil additional sensible possibilities in the above context. It is felt to be equally likely that seedlings from heavier nuts suffer drastically the shock of transplantation, when those from the lighter nuts exhibit a trend that is diametrically opposite. Probably the seedlings of the latter category, in their haste to attain themselves the stage of independent existence, would have become equipped themselves with the functionally more accomplished root system much in advance, which need not be exactly the case of those belonging to the former category. Under the circumstance it will not be quite out of place, if one commits onself in putting forth a suggestion in favour of choosing seednuts with weight dispersed around the value for the mean in this regard, for realising in terms of a potentially acceptable compromise a significantly encouraging and effective response to the felt need.

Seedling Attributes

The values for the CV for the 4 seedling characters - S_3, S_4, S_5 and S_7 seem to expose noteworthy features of practical importance.

CV for seedling attributes

Seedling Attributes	S	A	P	Pooled
S_3	20.42	19.25	19.25	19.73
S_4	22.02	24.78	20.85	23.48
S_5	17.82	19.31	19.14	18.60
S_7	113.13	105.62	89.19	103.51

Aspects on S_6 are not discussed, since the variable (number of days for initiation of leaf splitting) did not express itself in all the seedlings, irrespective of the nutyield category of the motherpalms from which the corresponding seednuts were chosen and was not put to further scrutiny fearing that a reliable conclusion will not become available as in the case of the remaining other 4 characters included in this study. This has been already pointed out on an earlier occasion also.

Germinability of seednuts was considered as one of the important observations in connection with the collection of data pertaining to seedling characterization. Observations in this regard were confined to the first six months that followed the sowing of seednuts, when sprouts appeared as early as the ninetyfirst day counted from the date of seednut harvest, in the same instance, the process appeared to have got delayed considerably in others.

The review of the reports on the earliness in/ delayed germination of coconut seednuts exposed instances when authors proposed that earliness in germination is significantly and directly associated with superiority in their later performance. (Jack and Sands, 1929; Satyabalan et al., 1968).

The results obtained regarding this aspect in the study is furnished in the table given below:

Category	No.of palms belonging to each category.	No. of prepotent palms identified.	Percentage of prepotent palms identified	Mean No. of days for germination
S	9	3	33.33	205
A	22	8	36.36	212
P	9	6	66.67	216

From the table, it is evident that the maximum percentage of prepotent palms was identified from the P category. But the mean number of days taken for germination counted from the date of harvest was found to be maximum for this category, and minimum for the S category from which the percentage of prepotent palms identified is the lowest (33.33%)

However, in this study, the results obtained seem to reveal a trend that is apparently opposite to the one as mentioned above, for a relatively larger proportion of individuals, and this is the very reason why no strong support is being extended to the view of the authors referred to above.

Further, this character is found to exhibit variability of relatively low magnitude that did not manifest significant difference among individuals of the different nutyield categories. Variables S_4 (height) and S_5 (collar girth) maintain relatively less of variation between the different nutyield categories. But S_7 (number of split leaves at one year) behaves in a different manner and the values for CV is found to be very high. Moreover, the values pertaining to the different groups exhibit greater difference than that for the other two characters.

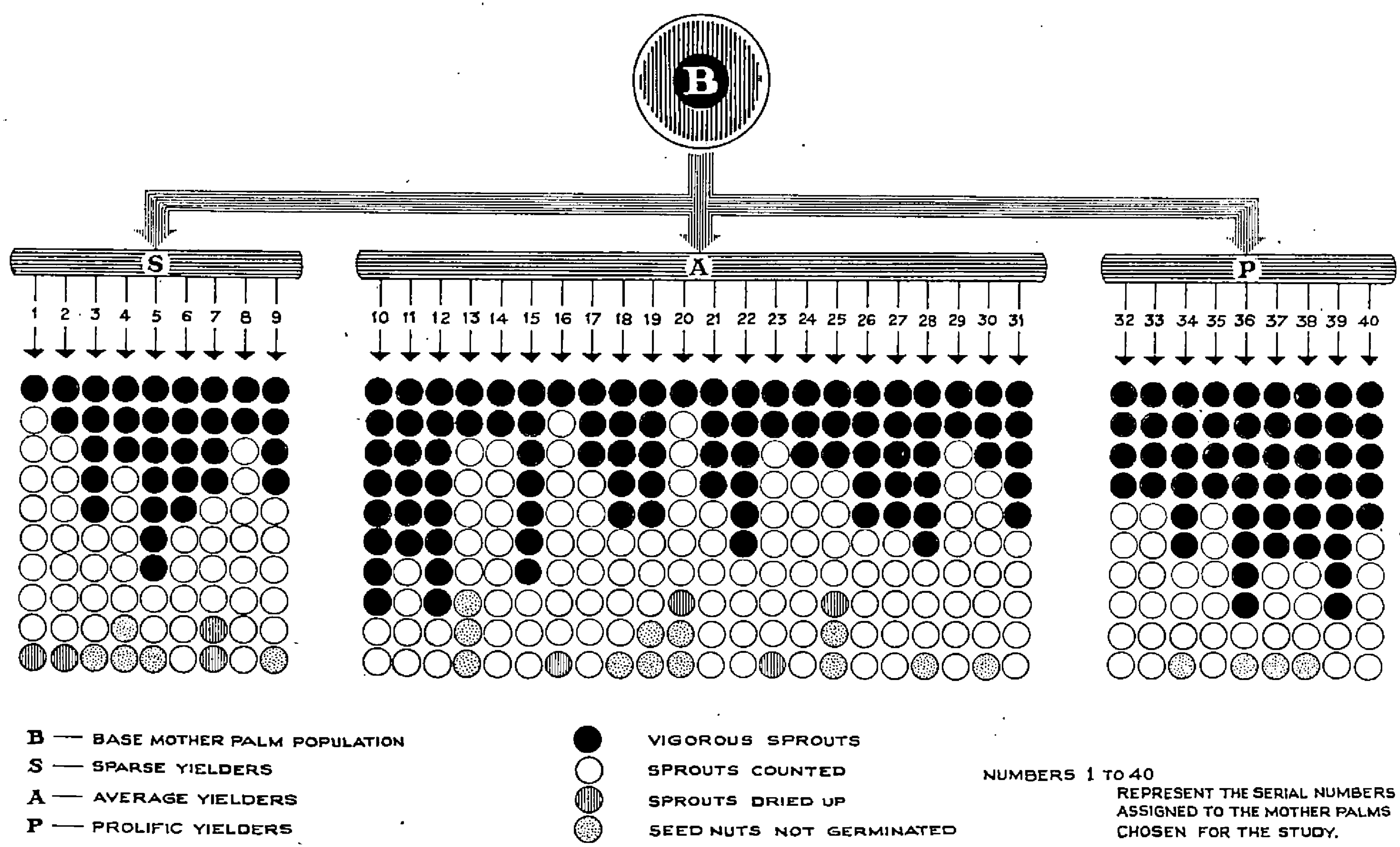
Further, on a closer scrutiny of the table-4 it appears that the corresponding weightage values computed for these 3 variables for the formulation of ESVI, possess positive sign and S_7 was the variable that accounted for the maximum value followed by S_5. Hence the importance of this seedling variable S_7 in effecting scoring in favour of vigorous seedlings is being substantiated. Apaciable and Mendoza, 1968, also stressed that the prevalence of increased number of split leaves in the seedling was a positive indication of better future performance. The observations made during the study also seem to indicate that in the case of vigorous seedling selection, it is desirably preferable to select comparatively taller ones possessing greater collar girth, with more number of split leaves. Advantage in seedling selection made in favour of higher measurements for collar girth and seedling height was also stressed by several earlier workers (Marar, 1960; Pankajakshan and George Minnie 1961; Apacible and Mendoza 1968; Satyabalan, et al. 1968; Nampoothiri et al., 1975)

From the graphical representations (Fig.1 and 2) it is clear that the pattern of progressive increase in height and collar girth of seedlings bear a distinct parallelism among the 3 nutyield categories. Further, seedlings from the palms belonging to the sparse category exhibited, towards the close of the 12 month period in the nursery, a lower mean value for these two variables, whereas for the P category, the mean value is comparatively higher.

However, in Fig. 3 and 4, one finds the expression of an interesting phenomenon. Here comparison is made between the monthly mean values for height and collar girth of seedlings derived exclusively from the prepotent palms identified during the course of the study, and the figures computed from all the 40 palms forming the bulk. From the comparison, it appears that seedlings obtained from the identified prepotent palms have a higher mean value for these two attributes than that for those derived from trees in pooled basis.

From the above findings, it is distinct that seedlings, irrespective of their status as more vigorous or less, developed exclusively from prepotent motherpalms in general, are taller with a greater girth measurement of the collar. This again support that the identification of prepotent palms is of significantly greater importance when seednuts are being selected for the purposes of extensive propagation, through controlled or open pollination.

DIAGRAMATIC REPRESENTATION OF THE RESULTS OF PEDIGREE PROGENY ANALYSIS CONDUCTED TO IDENTIFY THE PREPOTENT MOTHER PALMS IN COCONUT-TYPE, KOMADAN.



Identification criteria for prepotent motherpalms.

Reference is made to the diagramatic representation of the results of the pedigree progeny analysis conducted in this connection.

As has been mentioned earlier, 400 seednuts have been sown initially in the nursery from which 371 seedlings become available for evaluation in terms of vigour during the 12 month period of study. These seedlings facilitated accurate tracing back of the corresponding motherpalm from which the seednuts were collected.

Four seedling characters were studied (S_3, S_4, S_5 and S_7) and a multiple criteria approach was adopted for the purpose of identifying the vigorous from the less vigorous seedlings. An expression - ESVI (Expressed Seedling Vigour Index) was computed seedling-wise, and a critical limit value for making the descrimination of the seedlings as already mentioned above was identified in the general mean index (37.13).

As has been pointed out earlier, in the multiple criteria approach adopted for the purpose of computing the value for ESVI, differential weightages were assigned to variables, S_1, S_4, S_5 and S_7. In index formulation, the least complex procedure is the one in which identical weightages are given to different variables. There are several other models of weight assignment proposed. Yet another method is to assign arbitrary differential weightages corresponding to the logically recognised ranking of importance in terms of the different variables. In the approach adopted in the experiment, instead of going in for assigning an arbitrary value for the weightage, the Descriminent Function Analysis Method proposed by Smith (1936) was chosen, so as to give the weights a more absolute value bearing a scientifically explainable relationship to the concerned corresponding genotypic and phenotypic values.

The values for the indices ranged from 4.83 to 90.03 and of the 371 seedling progenies only 176 recorded an ESVI value higher than that of the critical limit value. These 176 seedlings were identified as the vigorous ones.

The table furnished below is worthy in gathering information that is important in this context.

Particulars of vigorous seedlings recovered from classified and unclassified palms.

	S	A	P	Unclassified
1. No. of nuts sown	90	220	90	400
2. No.of seedlings sprouted	85	208	86	379
3. No.of seedlings remained viable till one year	81	204	86	371
4. No.of identified vigorous seedlings	33	92	51	176
5. Percentage sprouting	94.44	94.54	95.56	94.25
6. Percentage recovery	90.00	92.72	95.56	92.75
7. Percentage within class vigorous sprouts	40.74	45.10	59.30	47.40
8. Percentage overall (pooled) vigorous sprouts	18.75	52.27	28.64	47.44

In coconutpalm, type KOMADAN, the overall percentage germination of seednuts appears to be quite high (94.25%). Similar is the case with percentage recovery of seedlings (92.75%). When motherpalms were categorized on nutyield basis, the average yielders gave a figure for percentage recovery of seedlings, almost same as the one mentioned above (92.72). However, the percentage value for sparse yielders in this regard is as low as 90.00 whereas that for prolific yielders is as high as 95.56.

A further analysis of the percentage recovery of vigorous seedlings in the case of categorised palms reveals, that the highest value is recorded against the prolific yielders and the lowest against the sparse yielders.

These observations seem to unveil the fact that the identification of individual prolific bearers is of advantage in the selection of prepotent motherpalm in this community because of the following 3 reasons:

a) Per tree yield of seednuts is more because of the possession of an inherently higher nutyield potential.

b) Per tree availability of seedlings is more because of the very high value for percentage germination and percentage recovery, and

c) Per tree recovery of vigorous seedlings is maximum because proportion of vigorous seedlings among the total seedlings obtained is predominantly high.

In the study of 40 motherpalms, only 9 came under the P category ie. approximately less than 1/4 of the total population. Average yielders too have proved themselves to be desirable motherpalms, since the nutyield, percentage germination and relative proportion of vigorous seedlings recovered are fairly good. Out of the 40 palms, 22 were included under this category ie. approximately a percentage value above 50. Taking into consideration, grouping of the average and prolific yielders together, one can expect an availability of approximately 75-80% potentially good motherpalms in an average population of the type, KOMADAN.

In the light of the above, the following workable recommendation is being proposed so as to select motherpalms in coconut belonging to the type mentioned. Palms under categories A and P together possess the potentiality to produce a mean nutyield of 146, percentage germination of 94.84 and percentage recovery of vigorous seedlings of 49.31. Yield of nuts (M_6), the most important variable in connection with the categorisation of palms exhibit only moderate variability. This observation aids further to confirm the apparent favourable odd in raising the desired benefit of identifying prepotent palms through the selection of individuals from among the average and prolific nutyielding categories.

It is seen from the chart that

i) All the palms, irrespective of the nutyield category to which they belong, produced vigorous progeny identified on the basis of the value computed for the Expressed Seedling Vigour Index.

ii) When some of the palms produced a greater number of vigorous progeny, others did behave otherwise.

iii) Prepotent palms were identified among those which expressed the potentiality to yield relatively more number of vigorous progeny and such palms represented all the three nutyield categories.

Altogether 17 palms (42.5%), out of the 40 palms, were identified as the prepotent, in which 14 palms (35%) belonged to A and P category. The above observations further confirm the fact that it is comparatively easy to identify prepotent palms by selecting phenotypically ideal palms from among the average and prolific nutyielding categories of an ordinary KOMADAN population and subjecting them to early seedling progeny analysis. This view was supported by several earlier workers (Harland, 1957, Liyanage, 1967; Satyabalan et al., 1975). Further, among the seedling progeny of identified prepotent palms, exclusive selection of vigorous seedlings and the outright rejection of inferior ones, should also be done. This view is in support to the one recommended by Kannan and Nambiar, 1979.

However, one has to bear in mind that, the seedlings vigorous or not, should be transplanted, and their subsequent performance watched continuously so as to confirm whether the vigorous seedlings develop into adults with significantly superior merit or not or vice versa. This aspect has not been studied during the course of the experiment because it was not incorporated in the original approved programme.

In conclusion, it is being proposed that,

1. In coconut type KOMADAN, for enhancing overall stand and performance improvement, a systematic schedule of triphasic selection has definite advantage.

2. Motherpalms are to be preferentially chosen from among those yielding regularly on an average 100 nuts per tree per year with not too significant difference in the nuts yielded through the different sessions of harvest in an year.

3. Further, motherpalms are to be identified from among those that cultivate a general healthy disposition with adequately strong and thick culm with uniformly and closely spaced leaf scars, bearing a globose crown with around 35 fronds alligned in such a manner as to ward off mutual shading and to accommodate bunches with reasonably good number of medium sized rounded or nearly round nuts borne by means of adequately stout stalks. Here the emphasis is on the standards of motherpalm selection.

In seednut selection, it is preferable to choose medium weighing nuts with an almost spherical shape.

Seedlings from the nursery need exercising more rigorous ordeals associated with selection. Superior ones can be identified among those that are relatively taller with a satisfactory measure for the girth of collar, bearing more number of split leaves at the age of one year from the date of sowing.

The information gathered during the study, therefore, seems to project the vital importance of specifically identifying PREPOTENT palms through progeny analysis at seedling stage, from among the palms proved to be ideal on the basis of overall phenotypic appraisal; followed by selection for vigorous seedlings from the nursery, in inducing significant improvement in the crop, including the type KOMADAN.

SUMMARY

SUMMARY

1. The object of the experiment was to identify, through a systematically arranged pedigree progeny analysis, prepotent palms from among trees that form a lot in the coconutpalm (Cocos nucifera L.) belonging to the type, KOMADAN and to propose reliable norms relevant in this connection.

The term PREPOTENCY refers to a condition expressed by individuals possessing genetic superiority to transmit desirable characters to the progeny, in economically advantageous proportion.

2. The data, made use of for drawing conclusions, were collected during the period February 1981 - June 1982.

3. Forty palms of apparently the same age group of 25 years constituted the base material for the investigation. Of these, 9 belonged to the Sparse (S), 22 to the Average (A), and the remaining 9 to the Prolific (P) yielding categories. For the categorisation, a scrutiny of the past nutyield performance data were depended upon. When Sparse yielders represented individuals yielding

80 nuts per year and less, Prolific yielders scored a number including and above 120 invariably. The Average yielders held a position in between.

4. Ten seednuts per tree were collected and sown during June, 1981 in the nursery after storage according to the recommendations given in the Package of Practices of the Kerala Agricultural University, 1980.

5. Three different sets of data were collected. They represented motherpalms, seednuts and seedling progeny.

a) <u>Motherpalm Attributes</u> - Seven variables were studied in this regard.

i) M_1 - girth of stem,

ii) M_2 - number of leaves,

iii) M_3 - number of bunches,

iv) M_4 - average number of female flowers per inflorescence,

v) M_5 - average setting percentage,

vi) M_6 - annual nutyield, and

vii) M_7 - numerical qualification of the regularity in the number of nuts obtained during the 9 harvests of the 12 month period.

b) Seednut Attributes - The following observations were made.

i) S_1 - Fresh weight, and

ii) S_2 - Volume.

c) Seedling Attributes - Observations recorded are being enumerated.

i) S_3 - Number of days for germination from the date of harvest of the seednut,

ii) S_4 - Height of one year old seedling,

iii) S_5 - Collar girth of one year old seedling,

iv) S_6 - Number of days for initiation of leaf splitting from the date of harvest of the seednut, and

v) S_7 - Number of split leaves at one year old seedling.

6. The experiment was arranged in such a manner as to facilitate ready identification of each and every seedling progeny in the nursery to its corresponding maternal parent.

7. A multiple criteria approach was sought to formulate individual values for the Expressed Seedling Vigour Index (ESVI). For this, differential weightage values were

assigned to the variables after the procedure described by Smith (1936). Four variables--individual weight of seednuts (S_1), and measurements of height (S_4) and girth of collar (S_5) and the number of split leaves (S_7) in one year of old seedlings, were used for estimating the actual value for the indices. A significant mark in the linear scale that accounted for all the estimated index values, was identified in the general mean index, that, in turn, facilitated distinction of the more vigorous from the less vigorous among the seedling progeny.

Further, the experiment revealed, in general, the potentiality and scope of relying upon multiple criteria models, for a multitude of purposes in breeding, particularly in selection.

8. It was found that, irrespective of the nutyield category to which they belonged, all the trees produced vigorous as well as less vigorous seedlings, but in varying proportions.

9. Based on a criterion, that gave encouraging recognition exclusively to palms that expressed a significant enhancement in the recovery proportion of vigorous seedlings, the prepotent palms were identified.

10. Further, an attempt was made to find out which among the motherpalm attributes showed significant dependency on the mean value for the ESVI corresponding to the particular palms. The results of the study seem to suggest that the existence of a significant association did express only for a single variable - the average setting percentage (M_5). Since additional variables possessing similar importance were not resolved during the course of study, a further attempt to formulate the Expressed Motherpalm Selection Index (EMSI) was not pursued.

11. The pattern of growth expressed by seedlings in the nursery revealed an almost direct and progressively increasing trend for height as well as girth at the collar, among the individuals, irrespective of the nutyield category to which their motherpalms belonged. Further, it was noticed that the seedlings developed from prepotent palms manifested an almost similar pattern, but the degree of improvement progression was noticeably high.

12. Thus, in the light of the findings made out during the study, for inducing an overall enhancement in the performance factor in the coconutpalm type KOMADAN, the following recommendations are being proposed.

Emphasis should be given in favour of following a Systematic Triphasic Selection Schedule. In the initial phase, select prepotent motherpalms on the basis of the expressed early progeny performance in terms of generalised vigour, from among a lot consisting of apparently healthy trees yielding not less than 100 nuts per year. Preference should be given to trees in which the number of nuts harvested during the different sessions of the year does not differ considerably. Further, the trees should have uniformly thick and sturdy culms with reasonably close spaced leaf scars. The crown should be preferably globose in shape with around 35 fronds that sport an alignment suited particularly for avoiding mutual shading and for facilitating convenient accommodation of bunches of desirable specifications. It is felt desirable to have fairly large number of medium sized, rounded or near rounded nuts in the bunches. In the second phase of selection, discard all malformed and defective ones before sowing them in the nursery. In the last phase of selection, that is confined exclusively to the seedlings in the nursery, adoption of a more rigorous screening procedure is recommended. Tall seedlings with a good collar girth measurement that bear relatively larger number of split leaves are to be selected preferentially.

In conclusion, it is felt, that resorting to procedures, as detailed under the recommendations given above, can help substantially, in setting in an overall general improvement in coconut culture.

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IDENTIFICATION OF PREPOTENT MOTHERPALMS IN COCONUT (*Cocos nucifera* L.) - VARIETY, KOMADAN

BY

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ABSTRACT OF THE THESIS
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ABSTRACT

A systematically arranged experiment on Pedigree Progeny Analysis was conducted during 1981-82 in the premises of the College of Agriculture, Vellayani, with 40 randomnly chosen trees of the coconutpalm, type KOMADAN. The advantages of following a Triphasic Selection Schedule carried out at the levels of the motherpalm population, seednuts and the one year old seedling progeny in the nursery, and the special worth of identifying, on the basis of the information made available through the conduct of the early seedling progeny analysis, the prepotent palms, are substantiated. Accordingly, a recommendation in favour of confining for benefit, extensive seednut collection, exclusively to such palms as mentioned above, identified from among those in a chosen lot, characterized by phenotypically distinguishable overall healthy outlook, followed by exposure to a procedure of more intensively rigorous selection in the nursery, of superior seedlings is proposed.