

## OPTIMUM PLOT SIZE FOR D×T COCONUT PALMS FROM FERTILIZER TRIAL YIELD DATA\*

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### ABSTRACT

An optimum plot size of 8 seedlings/plot may be adopted for laying out experiments on D×T hybrids. The optimum plot size obtained from the fertilizer experiment at Kayangulam was found to be the same as the plot size obtained from an irrigated uniformity trial data collected on D×T palms from Central State Farm, Aralam.

### INTRODUCTION

Information on the optimum size and shape of plots and blocks is of utmost importance for the successful conduct of field experiments and to draw valid conclusions. It depends on the variability present in the experimental material and with the crop. An idea of magnitude of variability can be obtained from the data of uniformity trial conducted with the crop. Joachim (1935) and Salgado (1937) are the first to publish results of uniformity trial on coconut from Sri Lanka. They reported 18-20 trees per plot as the optimum for field trials. From India no such results are available. To control experimental error in perennials, Pearce (1953) suggested the application of treatments to calibrated trees and Shrikande (1958) suggested along with the above method making use of the pre-experimental data for coconut and work out the co-variance analysis. These methods can be used only when the treatments are imposed on adult

palms and not suited for experiments starting from seedling stage. In the case of annual crops, while it is easy to layout uniformity trials, in the case of perennials, it is difficult to attempt in view of the large area required, long pre-bearing period of the crop and the time taken for the stabilisation of yield. So it will be advantageous if the plot size is worked out from the already available fertilizer trial data. This may help to overcome the delay in obtaining such results exclusively from uniformity trials and will prove economic by saving a lot of land, labour and capital investments.

### MATERIALS AND METHODS

The yield data of the NPK fertilizer trial on D×T coconut conducted at CPCRI (RS) Kayangulam, Alleppey Dist. were used for this study. For comparison, optimum plot size was also worked from the uniformity trial data on D×T palms collected from Central State Farm, Aralam, Cannanore District. At Kayangulam, the yield of 250 palms

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for 1981 and 1982 were collected. The soil type is sandy and the seedlings were planted in 1972. These seedlings were under the fertilizer experiment from the very beginning. At Aralam the yield data available for 160 palms for 1982 and 1983 were collected. These seedlings were planted in 1972 and were growing under irrigated condition with uniform fertilizer and other management practices.

For the fertilizer trial data at Kayangulam, the individual treatment effects were estimated by using the relation  $t_i = \frac{T_i}{r} - m$  where 't<sub>i</sub>' is the 'i<sup>th</sup>' treatment effect, 'T<sub>i</sub>' is the total of mean yield/palm for the i<sup>th</sup> treatment over all replications, 'r' is the number of replications and 'm' is the overall mean yield/palm. The treatment effect estimated by 't<sub>i</sub>' is subtracted from each palm yield effected by 'i<sup>th</sup>' treatment (Ray 1973). In the same way the other treatment effects were also removed to obtain uniformity trial data. The CVs were worked out for plots of different sizes and shapes, using the above data. This was done for the data of individual years as well as for the pooled data at both the locations. Fairfield Smith's equation was also fitted to the data to get an idea of the soil heterogeneity.

#### RESULTS AND DISCUSSION

The average C. V. for different shapes of the same size of plots for the two locations are presented in Tables I and II. Though the variability was generally high at Aralam, the average C. V. decreased with increase in plot size and for the data pooled for two

years also, there was reduction in variance. The per unit decreases in C. V. were minimum when the plot size exceeded 8 palms/plot; at both the locations. Fairfield Smith's equation also gave a good fit for the data. (Smith, 1938) The heterogeneity factor for the pooled data were 0.48 and 0.33 for Kayangulam and Aralam respectively which is a reflection on the higher soil heterogeneity of the Aralam soil. As there is not much variations in C. V. for different shapes, a compact plot of 2 rows of 4 seedlings or 4 rows of 2 seedlings may be convenient for laying out experiments on D×T hybrids. The minimum number of replications required for 5% standard error of treatment mean are given in Table III. The relative efficiency of 'm' plots relative to blocks of 'n' plots is equal to 
$$\frac{(Vr)n}{(Vr)m} = \frac{(n(m-1)(1-n^{-b}))}{m(n-1)(1-m^{-b})}$$
 (Kempthorne 1952) where 'b' is the soil heterogeneity coefficient.

The relative efficiency of different block size of 4, 6, 8 and 20 was 1.24, 1.16, 1.11 and 1 respectively.

This study has shown that fertilizer trial data can be used for working out optimum size and shape of plots, in the absence of real uniformity trial data. In view of the close similarity of results obtained from two locations about 250 km apart, this plot size can be recommended for the entire West Coast of Kerala. The recommendation of 8 palm/plot coming out of this study is much lower compared to the earlier recommendation from Sri Lanka.

Table I. Coefficient of variation for different plot sizes-CPCRI (RS), Kayangulam

Plot size	1981 CV (y)	1982 CV (y)	Av. of 1981 & 1982 CV (y)	Per unit decrease in C. V. for 2 years av. yield
1	35.37	44.4	29.91	
2	24.37	32.98	21.62	19.1
3	18.65	30.20	17.71	4.91
4	17.22	24.27	15.68	1.98
5	16.98	22.69	14.50	1.02
6	13.34	20.69	12.67	0.79
8	11.68	17.49	10.89	0.75
10	11.49	16.44	10.04	0.35
12	9.23	15.78	9.11	0.25
14	10.1	13.19	8.63	0.14
y =	$34.29x^{-0.50}$	$45.79x^{-0.45}$	$30.08x^{-0.48}$	
r <sup>2</sup> =	0.98	0.99	0.99	

Kushwah et al., (1973) have noticed that 75% of the roots are confined to an area of 2 meter radius around the bole of the palm. Patel (1938) has pointed out that only the surface roots at a few feet around the bole are concerned with the absorption of mineral nutrients. In view of these, in ordinary fertilizer trials guard rows may not be necessary. Iyer (1957) has also shown that the mean yields of central trees and border trees do not differ. As the genetic

Table II. Coefficient of variation for different plot sizes-Central State Farm, Aralam

Plot size	1982 CV (y)	1983 CV (y)	Av. of 1982 & 1983 CV (y)	Per unit decrease in C. V. for 2 years av. yield
1	65.74	78.43	68.39	
2	51.52	61.17	54.15	41.31
3	42.49	53.10	46.95	11.43
4	38.99	47.62	42.36	5.06
5	34.91	42.61	38.45	2.9
6	33.37	41.29	37.71	1.4
8	28.81	37.30	33.85	1.08
10	27.45	34.52	31.94	0.62
12	23.24	31.76	29.39	0.74
14	24.07	29.06	28.22	0.43
y =	$66.6x^{-0.39}$	$78.64x^{-0.36}$	$67.82x^{-0.33}$	
r =	0.99	0.98	0.99	

Table III. Number of replications required for 5% standard error of treatment mean

Plot size (x)	4 plot block		6 plot block		8 plot block	
	cv%	r	cv%	r	cv%	r
1	31.40	39	31.19	39	30.99	38
2	21.97	19	22.71	21	22.36	20
3	18.29	13	20.60	17	19.76	16
4	17.37	12	16.80	11	17.19	12
5	15.60	10	16.64	11	16.35	11
6	13.90	8	14.93	9	14.74	9
8	13.77	7	12.19	6	10.78	5
10	11.81	6	11.34	5	10.35	4
12	10.44	4	10.34	4	8.96	3

variation is a potential source of error in coconut, the C. V. has to be kept minimum to detect small treatment differences. So the cost factor has not been considered.

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