

UNIFORMITY TRIAL : SIZE, SHAPE AND DIRECTION OF EXPERIMENTAL PLOTS FOR TURMERIC

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ABSTRACT

The Fairfield Smith equation with standard notations $Y = ax^{-s}$ and its generalisation in the form $Y = ar^{-s_1}c^{-s_2}$ was fitted to the uniformity trial data on turmeric collected from Hirehalli for two different directions with 24 beds of size 1 m \times 12 m each. The directions were north-south and east-west. However, the fertility gradient was in the north-south direction. In both cases the plot sizes consisting of 3 beds of size 1m x 1m along the fertility gradient was found to be optimum.

INTRODUCTION

The importance of optimum size and shape of plots and blocks in agricultural field experimentation is well recognised. Fairfield Smith (1938), worked out an empirical relationship between plot size and the C.V. of yield. Many attempts have been made in evaluating the optimum size and shape of plots for various crops including plantation crops (Agarwal et al., 1968; George et al., 1979, 1983 and 1984).

India ranks first in the world on production of turmeric, producing about 1.2 lakh tonnes from an area of 0.67 lakh ha. Turmeric is generally cultivated in raised beds of varying sizes and shapes. Though the length of the bed varies according to the local practices and conveniences, the breadth is usually maintain-

ed around 1 m. It was a matter of curiosity whether the direction of forming the bed has any influence on the size and shape of plots. In this paper an attempt has been made to evaluate and compare the optimum size and shape of plots under different price situations with beds being formed in two different directions.

MATERIALS AND METHODS

Uniformity trials were laid out at the CPCRI Research Centre, Hirehalli on turmeric during the year 1981-82 with 24 beds of size 1 m \times 12 m in the north-south direction and another in the east-west direction. The ultimate unit was taken as the total of the produce from 1m \times 1 m area of the bed. This resulted in 24 rows of units for both the directions of beds. Plots of varying sizes and shapes were formed, combining the adjacent units column-wise and row-wise and the corresponding C.V. was worked out.

Fairfield Smith's law $Y = ax^{-g}$ was fitted to find the relationship between plot size (X) and C.V. (Y) where g is the heterogeneity coefficient. Generalisation of this law in the form $Y = ar^{-g_1}c^{-g_2}$ was also tried to compare the heterogeneity of rows (r) and columns (c) where g 's denote the heterogeneity coefficients. The plot size and shape giving the required information at a minimum cost was taken as the optimum. The cost of experimentation per treatment to estimate the means at 5 per cent C.V. was worked out for three different price situations K_1 , K_2 and K_3 when the plots are arranged in blocks of 4, 6, 8, and 12 treatments, using the relationship $C_{ki} = C_1r + C_2E$ where C_{ki} is the cost for the i th price situation, C_1 is the cost of maintaining experimental plot, C_2 is the cost of maintaining experimental plants. The arbitrary cost ratios $C_1 : C_2$ for the price situations are 1 : 2; 1 : 3 and 1 : 4 respectively.

RESULTS AND DISCUSSION

The C.V. values determined for various sizes of plots followed closely the relationship $y = ax^{-g}$ (Fairfield Smith's law). The equations and their generalised form along with their R^2 values for both directions are presented in Table 1. The equations were found to be a satisfactory fit in all cases as seen from the R^2

values. The C.V. decreased with the increase in plot size in both directions. When the beds were formed in the north-south direction, column-wise heterogeneity was significantly more than row-wise heterogeneity, indicating that the fertility gradient was in the north-south direction. But in the case of beds formed in east-west direction as seen from Table 1, row-wise heterogeneity was more than column-wise, showing that the fertility gradient was again in the north-south direction. Hence, it is advantageous to form the blocks across the fertility gradient and the plots along it.

Table 1. Fairfield Smith's Law $Y = a X^{-g}$ and its generalisation
 $Y = a r^{-g_1} c^{-g_2}$

Direction	$Y = a X^{-g}$	$Y = a r^{-g_1} c^{-g_2}$
North-south	-0.10	-0.09-0.10
	41.33 × ($R^2 = 0.94$)	40.58 r c ($R^2 = 0.82$)
East-west	-0.08	-0.08-0.07
	59.96 × ($R^2 = 0.96$)	58.50 r c ($R^2 = 0.82$)

Table 2 gives the C.V. percentage, minimum number of replications (r) required and the relative cost of experimentation per treatment under three different price situations K_1 , K_2 and K_3 . Here the plots are arranged in blocks of four and 12 for different sizes and shapes of plots on the observed C.V. for the beds formed in the east-west direction. A close study of the cost of experimentation revealed that relatively a plot size of three units of one column gave the minimum cost in almost all the price situations.

A similar trend was also observed in the case of beds formed in the north-south direction, except that the rows and columns were interchanged (Table 3). The plot size obtained by graphical method also confirmed these results. The optimum size obtained for turmeric is almost the same as the one worked out earlier for ginger (George et al., 1984) another *Zingiberaceae* family, for which the cultivation practices are almost the same. Hence a plot 1 m × 1 m along the fertility gradient was found to be optimum.

Table 2. C.V. per cent, number of replications required and cost of experimentation per treatment for three price situations k1, k2, and k3 in 4 and 12 plot blocks—(Beds formed in east-west direction)

Size and shape of plot	4 plot block				12 plot block					
	CV%	r	k1	k2	k3	CV%	r	k1	k2	k3
1 × 1	32.30	42	504	672	840	42.07	71	2556	3408	4260
1 × 2	29.15	34	408	544	680	48.45	94	3484	4512	5640
1 × 3	36.43	53	636	848	1060	—	—	—	—	—
2 × 1	28.04	32	384	512	640	45.97	85	3010	4080	5100
3 × 1	24.44	24	288	384	480	35.92	52	1872	2496	3120
4 × 1	25.70	27	324	432	540	35.05	55	1980	2640	3300
3 × 2	26.41	28	336	448	560	46.67	88	3168	4224	5280
6 × 1	23.46	22	264	352	440	34.68	49	1764	2354	2940
12 × 1	19.48	16	192	256	320	32.07	42	1512	2016	2520
6 × 2	25.10	26	312	416	520	45.01	81	2916	3888	4860

Table 3. C.V. per cent, number of replications required and cost of experimentation per treatment for three price situations k1, k2 and k3 in 4 and 12 plot blocks—(Beds formed in north-south direction)

Size and shape of plot	4 plot Block					12 plot Block				
	CV%	r	k1	k2	k3	CV%	r	k1	k2	k3
1 × 1	23.68	23	276	368	460	29.31	35	1260	1680	2100
2 × 1	27.11	30	360	480	600	33.21	45	1620	2160	2700
3 × 1	24.83	25	300	400	500	—	—	—	—	—
1 × 2	19.40	15	180	240	300	25.80	27	972	1296	1620
1 × 3	17.03	12	144	192	240	24.48	24	864	1152	1440
1 × 4	16.98	12	144	192	240	23.69	23	828	1104	1380
2 × 3	24.11	24	288	382	480	30.22	37	1332	1776	2220
1 × 6	14.54	9	108	144	180	21.75	19	684	912	1140
1 × 12	12.94	7	84	112	140	19.46	16	576	768	960
2 × 6	12.28	20	240	300	400	28.33	33	1188	1584	1980

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DISCUSSION

Q : Is it not necessary to study the interaction between the cultivars used and plot size?

Ans: The interaction between cultivars and plot size is worth studying. Different plot sizes for different groups of cultivars may have to be adopted, if interaction is found to exist.