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OPTIMUM SIZE AND SHAPE OF PLOTS AND BLOCKS FOR EXPERIMENTS ON PEARL MILLET

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The optimum size and shape of plots have generally been established by conducting uniform variety trials on different crops. Ray *et al.* (1973) provided a method of obtaining an optimum size and shape of plots for perennial crops from fertilizer trials to save time and resources. In view of its economy the method was applied to an annual crop of pearl millet.

The treatments consisted of five pearl millet cultivars (BJ 104, PHB 12, BD 111, CM 46 and CAZRI local) in main plots and five nitrogen levels (0, 30, 60, 90 and 120 kg /ha) in sub plots. The treatments were replicated four times in a split plot design. The gross plot adopted was 5m x 4 m and net plot size was 4m x 3m. The crop was sown in rows 50 cm apart with a plant spacing of 12.5 cm, making a plant population of 16 plants/m^2. The standard errors of main plot and sub plot means worked out were 49.99 and 42.68 kg/ha, respectively. The mean experimental yield of grain was 1100 kg/ha. The crop was harvested square metre-wise. The yield data were adjusted first for the plant population and then for the treatment effects. The adjustment factor (t_{ij}) was calculated as per equation (1) :

$$t_{ij} = \frac{T_{ij}}{r} - m \quad .. \quad .. \quad ..(1)$$

Where, T_{ij} is the total yield of the $_i$th variety and $_j$th nitrogen level from the 'r' replications and 'm' generated mean.

Then $\left(\frac{t_{ij}}{12}\right)$ was subtracted from the square metre yields of $(i, j)^{th}$ plot since each plot was of 12 sqm. The adjusted data were than analysed as uniformity data to obtain optimum size and shape of plot and block. The efficiency of blocks (B_e) was estimated as per equation (2) :

$$B_e = \frac{V_l}{V_x} \quad .. \quad .. \quad .. (2)$$

Where V_x is coefficient of variation of block size x and V_l is the coefficient of variation without blocking.

The yields of various plot and block sizes and shapes were obtained by combining yields of square metre plots in different combinations.

Table 2. Efficiency of blocks of different sizes and shapes

Block size (m^2)	No. of plots/block	Plot shape (m)	Block shape (m)	C.V. (%)	Block efficiency
60	4	3x5	12x5	9.88	1.77
		5x3	20x3	10.28	1.46
75	5	3x5	15x5	10.97	1.59
		5x3	25x3	10.18	1.48
80	4	4x5	16x5	5.41	2.57
		5x4	20x4	8.35	1.49
90	6	3x5	18x5	9.59	1.82
		5x3	30x3	12.65	1.19
96	4	4x6	16x6	9.50	1.72
		6x4	24x4	13.50	0.96
100	5	4x5	20x5	3.48	3.99
		5x4	25x4	7.55	1.65
120	6	4x5	24x5	8.86	1.57
		5x4	30x4	7 55	1.65
	5	4x6	20x6	8.69	1.88
		6x4	30x4	12.15	1.10
	4	5x6	20x6	9 95	1.25
		6x5	24x5	9.39	1.47
150	5	5x6	25x6	10 36	1.20
		6x5	30x5	6.79	2.03

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Size and shape of plots : The coefficient of variation decreased with the increase in length and breadth of the plot (Table 1). The plots with greater length, in general, had lesser coefficient of variation compared to those of same size but with shorter lengths which indicated that the shape of plot influenced the precision of the experiment. The plot size of 5m x 4m had the least coefficient of variation and thus can be regarded as optimum size and shape.

Table 1. Coefficient of variation (%) with different shapes and sizes of plots

Length (m)	Breadth (m) 2	3	4	5	6
2	26.12	23.33	20.66	20.62	20.06
3	22.94	19.33	18.01	17.48	15.77
4	19.14	15.66	13.00	13.90	16.37
5	16.43	15.02	12.47	17.14	12.53
6	15.60	15.44	13.36	13.79	12.74

The data were fitted for the soil fertility after Smith (1938) as presented by equation (3) :

$$V_x = 33.48\ x^{-0.3388} \cdots (3)$$

Where, V_x is variance of mean per plot of X units.

The value 0.3388 in eq.3 indicated a low correlation among contiguous plots.

Block size and shape : The blocks of oblong shape were found to be less efficient (Table 2). The plots in a block arranged with their lengths were more efficient. Among the block sizes tested, the blocks with 5 plots were found to be more efficient compared with other sizes. For the optimum plot size (5m x 4m), the block of 5 plots had an efficiency of 1.65.

The relationship between the coefficient of variation (V) and block size (X) is expressed by the equation (4) :

$$V = 2.598\ x^{1.1284} \cdots (4)$$