EFFECT OF POPULATION DENSITY AND SEED-RHIZOME SIZE ON THE YIELD AND PROFIT POTENTIAL OF TURMERIC

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ABSTRACT

Results of a trial to investigate the influence of population density and seed rhizome size on productivity in turmeric (Curcuma domestiea Val.) are reported. The productivity and seed requirement/ha are directly related to population density. The bulking effcacy is inversely related to population density. The profit potential attains a maximum at the population density of 1,11,000/ha. Similarly, profit potential is maximum when whole daughter rhizomes weighing around 25g are used as seed material followed by whole mother rhizomes weighing around 30g, and daughter rhizomes with 3 buds weighing around 20g.

INTRODUCTION

Heavy seed rate which increases the cost of cultivation is a limiting factor in turmeric cultivation. Investigation was, therefore, undertaken to determine the economical seed rhizome size and optimum plant population/ha for economizing on seed rate without affecting the productivity and profit.

MATERIAL AND METHODS

The present trial was laid out at the Department of Horticulture, Rajendra Agricultural University, Dholi, Bihar, in three randomized blocks with 20 treatments, during 1980–82. Details of the treatments are given below:

Treatments: 20–Population density (4) × seed rhizome size(5).

(A) Population density:

Treatment	Plants/ha	Spacing
P_1	3,33,000	20 × 15 cm
P_2	1,66,500	30 × 20 cm

P_3	1,11,000	30×30 cm
P_4	83,250	40×30 cm

(B) Seed–rhizome size:

SR_1 : Mother rhizomes (bulbs) average weight 30g
SR_2 : Whole daughter rhizomes (fingers) average weight 25g
SR_3 : Daughter rhizomes with 3 buds, average weight 15g
SR_4 : Daughter rhizomes with buds, average weight 15g
SR_5 : Daughter rhizome with one bud, average weight 15g

The experiment was carried out in a sandy loam soil with pH of 8.5; and available N, P_2O_5 and K_2O of 0.031%, 22 kg/ha and 225 kg/ha respectively. A local cultivar, *Meenapur*, was sown in the last week of May, in both the years. The fertilizers were applied at the rate of 100 kg N, 60kg P_2O_5 and 60 kg K_2O/ha, in addition to 10 tonnes of farm-yard manure. Other field operations were done as per recommended package of practices for turmeric. Harvesting was done in the last week of January in both the years, after 240 days from sowing. The fresh rhizome yield was recorded. The bulking efficiency of seed-rhizomes was calculated as per the following equation:

$$\text{Bulking efficiency (BE)}\% = \frac{\text{HRY}-\text{SRP}}{\text{SRP}} \times 100$$

Where HRY = Harvested rhizomes yield (kg/ha)
SRP = Weight of seed rhizomes planted (kg/ha)

Results and Discussion

The data on the average yield of fresh rhizomes and average weight of seed rhizomes planted per hectare are presented in Tables 1 and 2 respectively.

The effects of population density and seed rhizome material are independent as the interaction effect is non-significant. The whole daughter seed rhizomes with an average weight of 25 g significantly increased the yield of turmeric (277 q/ha) over rest of the seed rhizome sizes. The lowest mean yield of 143 q/ha was recorded where daughter rhizomes with only one bud were planted. The higher yield with whole daughter rhizomes used as seed

Table 1. Population density × seed-rhizome size on yield of turmeric (mean of 2 years)

Treatment	Yield (q ha^{-1})					Mean
	SR_1	SR_2	SR_3	SR_4	RS_5	
P_1	226	290	195	179	148	207
P_2	224	287	190	170	155	205
P_3	219	276	175	162	146	196
P_4	187	254	167	134	121	173
Mean	214	277	182	161	143	195

Effect	SE (m)	C.D. at (P=0.05)
SR	1.8 q/ha	5 q/ha
P	1.5 q/ha	4 q/ha
SR×P	3.6 q/ha	N.S.

Table 2. Population density × seed rhizome size-requirements of seed-rhizomes (q/ha)

Treatment	Seed rhizomes (q ha^{-1})					Mean
	SR_1	SR_2	SR_3	SR_4	SR_5	
P_1	100	83	67	50	33	67
P_2	50	42	33	25	17	33
P_3	33	28	22	17	11	22
P_4	25	21	17	13	8	17
Mean	52	44	35	26	17	35

may be due to its early germination giving a better start to the crop as compared to mother rhizomes and other treatments.

Large-sized seed rhizomes giving higher yield has also been reported by Hussain and Said (1965), and Randhawa and Mishra (1974). Mohte (1963) recorded higher yield from mother rhizomes as compared to daughter rhizomes. It appears that the weight of seed rhizome is related to yield of turmeric and the minimum weight needed may be 25 g. There is a sharp decline in yield when daughter rhizomes weighing 20g and less are used as seed material. However, it is difficult to say from this investigation whether the weight or the number of buds of daughter rhizomes is important in selecting the seed material.

The higher plant population (3,33,000 plants/ha) increased the mean yield (207 q/ha) significantly over lower plant populations. The yield is linearly related to the density of population. The weights of seed materials treatment-wise are given in Table 2. The bulking efficiency which gives the additional crop harvested over the seed material used and which decides the net returns are given in Table 3. There was a negative relationship between bulking efficiency of rhizomes and population density. Since the cost of seed material is a single major item which decides the profitability, the profit potential is calculated as the difference between gross income and cost of seed rhizome. The data on profit potential are given in Table 4. While fixing the optimum population density and the parameters for selecting seed material, the profit potential and the bulking efficiency are to be considered. The maximum gross income was Rs. 6070/– under the treatment with whole daughter rhizomes sown @ 1,11,000 plants/ha i.e., at the spacing

Table 3. Population density × seed rhizome size–bulking efficiency

Treatment	Bulking efficiency %					Mean
	SR_1	SR_2	SR_3	SR_4	SR_5	
P_1	126	249	193	257	344	234
P_2	349	590	170	581	830	564
P_3	560	895	689	872	1218	847
P_4	650	1120	903	976	1355	1001
Mean	421	714	564	672	937	662

Table 4. Population density × seed rhizome size–profit potential*

Treatment	Profit potential (Rs. ha^{-1})					Mean
	SR_1	SR_2	SR_3	SR_4	SR_5	
P_1	2642	4756	2874	2965	2700	3187
P_2	4103	5930	3744	3503	3370	4130
P_3	4495	6070	3714	3545	3326	4230
P_4	3934	5722	3675	2971	2777	3816
Mean	3794	5620	3502	3246	3043	3841

*Profit potential=Gross income—seed rhizome cost.

Note: Price of seed rhizome and fresn rhizomes at harvest taken at Rs. 30 and 25 per quintal respectively.

of 30 × 30 cm. Though the yield under this treatment was significantly lower than that of whole daughter rhizomes sown at the rate of 3,33,000 and 1,66,500 plants/ha, the profit potential was maximum due to high bulking efficiency and low requirement of seed rhizome/ha as seen in this treatment compared to the other treatments. On the same considerations, the next best treatments are, mother rhizomes weighing 30g and daughter rhizomes weighing 20g as seed materials at a population density of 1,11,000/ha.

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