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Response of Drill Sown Chilli (*Capsicum annuum* L.) to Different Spacings and Fertilizer Levels Under Rainfed Condition

V S Kubsad, M M Nekar and U K Hulihalli
Fodder Research Unit, MARS, University of Agricultural Sciences, Dharwad 580 005, Karnataka

ABSTRACT

A field experiment was carried out during *kharif* 2005-06 and 2006-07 at Agricultural Research Station, Annigeri, University of Agricultural Sciences, Dharwad to study the response of drill-sown chilli (cv. Annigeri Deluxe) to spacings (60 cm x 30 cm, 75 cm x 15 cm , 75 cm x 30 cm, 90 cm x 15 cm and 90 cm x 30 cm) and fertilizer levels (75-32.5-32.5, 100-50-50 and 125-62.5-62.5 kg ha^{-1}) in vertisols under rainfed conditions. The pooled results revealed that the crop sown at 75 cm X 15 cm spacing recorded significantly higher dry chilli yield (1444 kg ha^{-1}) which was 7.6, 4.5, 16.1 and 8.4% higher over 60 cm x 30 cm, 75 cm x 30 cm , 90 cm x 15 cm and 90 cm x 30 cm spacings, respectively. Application of 125-62.5-62.5 kg NPK ha^{-1} recorded significantly higher dry chilli yield (1473 kg ha^{-1}) which was 17.6 and 9.9 % higher over 75-32.5-32.5 and 100-50-50 kg NPK ha^{-1}, respectively.

Key words : Benefit Cost Ratio, Drill Sown Chilli, Fertilizer Levels, Net Returns, Spacings

Chilli (*Capsicum annuum* L.) is cultivated by transplanting method in irrigated and assured rainfall areas. While in dry zone areas the transplanting of chilli is not successful due to uncertainty of rains. Therefore, the farmers of the region are practicing dry sowing of chilli in vertisol by using seed-cum-fertilizer drill during May. Thus it helps for the better germination and establishment of the chilli crop. The maximum yield potential of any crop can be achieved by adopting the optimum agronomic practices *viz*., spacing, fertilizer application, thinning etc. Jain and Chauhan (1988) reported that plant density is the most important non-monitory input which could be manipulated to attain the higher productivity of the plant. In Northern Dry Zone of Karnataka, the dry sowing of chilli is widely practiced by adopting traditional cultivation practices. Therefore, present investigation was undertaken to find out the optimum levels of spacing and fertilizer levels for drill sown chilli to enhance the productivity under rainfed conditions.

MATERIAL AND METHODS

A field experiment was conducted at Agricultural Research Station, Annigeri during *kharif* seasons of 2005-06 and 2006-07 on vertisols under rainfed condition. The soil of the experiment site had pH of 8.1, medium in available nitrogen (249 kg ha^{-1}), low in available phosphorus (17.2 kg ha^{-1}) and high in available potassium (531 kg ha^{-1}). There were fifteen treatments tested in a split plot design with three replications. The main plots were five spacings (60 cm X 30 cm, 75 cm X 15 cm, 75 cm X 30 cm, 90 cm X 15 cm and 90 cm X 30 cm) and sub plots had three fertilizer levels of NPK (75-32.5-32.5, 100-50-50 and 125-62.5-62.5 kg NPK ha^{-1}). The gross and net plot sizes were 5.0 m x 4.5 m and 4.0 m x 3.0 m, respectively. The seeds of chilli crop cv. Annigeri Deluxe (Byadagi Dabbi) were treated with imidac loprid against seed borne pathogens and drill sown on 22nd May 2005 and 28th May 2006 in dry soil by mixing with sand. The fertilizer was applied, 15 days after germination as per the treatments (half dose of nitrogen along with full dose of phosphorus and potassium). Remaining half dose of nitrogen was applied at 45 days after germination as top dressing when rains were received. Thinning of seedlings was done leaving one seedling/spot at 30 days after sowing. The total rainfall received during cropping period (May to December) was 474.8 mm and 580.4 mm during 2005 and 2006 respectively. Five plants were randomly selected in each plot for recording the yield attributes at harvest. The dry chilli yield recorded in net plot was expressed in kg/ha. The economics were calculated based on prevailing market prices of inputs and outputs. As the trend of results was similar during both the years, the pooled results were analysed and discussed.

RESULTS AND DISCUSSION

The pooled results on growth and yield components, dry chilli yield and economics are presented in Table 1 and 2.

Table1. Dry chilli yield, yield attributes and economics of drill-sown chilli as influenced by different spacing and fertilizer levels.

(Pooled over two years)

Treatments	Plant height [cm]	Primary branches plant^{-1}	Pods Plant^{-1}	Dry chilli yield [kg ha^{-1}]	Cost of cultivation [Rs ha^{-1}]	Gross returns [Rs ha^{-1}]	Net returns [Rs ha^{-1}]	B : C ratio
Spacing [cm]								
60 X 30cm	67.9	6.5	11.5	1334	15189	59134	43945	3.76
75 X 15cm	63.1	7.2	16.4	1444	14339	63558	49219	4.28
75 X 30cm	60.6	7.5	14.4	1379	15659	60846	45187	3.74
90 X 15cm	59.1	9.3	10.2	1212	14590	53299	38709	3.55
90 X 30cm	55.3	9.7	11.4	1322	24423	66663	42240	3.51
SEm±	1.5	0.9	1.6	62	-	1471	1742	0.16
CD at 5%	4.4	2.2	4.6	184	-	4324	5221	0.46
Fertilizer Levels [NPK kg ha^{-1}]								
75-32.5-32.5	58.5	7.1	11.5	1214	14684	53773	39089	3.52
100-50-50	61.5	8.2	12.9	1327	15139	63455	48316	4.19
125-62.5-62.5	63.6	8.9	14.1	1473	15636	64871	49235	4.15
SEm±	0.8	0.6	0.5	46	-	1552	1409	0.08
CD at 5%	2.4	1.7	1.4	136	-	4648	4222	0.22

Effect of spacing

Pooled data indicated that closer spacing of 60 x 30 cm recorded significantly higher plant height(67.9 cm) compared to wider spacings (Table 1). This can be attributed to maximum inter- and intra-plant competition for the growth parameters. A wider spacing of 90 x 30 cm recorded significantly maximum primary branches plant^{-1} (9.7) compared to closer spacings of 60 cm x 30 cm (6.5), 75 x 15 cm (7.2) and was on par with 75 cm x 30 cm and 90 cm x 15 cm spacings. More number of primary branches plant^{-1} was mainly due to maximum availability of inter- and intra-space along with growth factors to individual plant. Significantly maximum pods plant^{-1} (16.4) were observed with 75 cm x 15 cm spacing compared to others which is a major yield component except 75 cm x 30 cm (14.4) with which it was on par. Thus reflected in maximum dry chilli yield (1444 kg ha^{-1}) which was 76, 4.5, 16.1 and 8.4% higher over 60 cm x 30 cm, 75 cm x 30 cm, 90 cm x 15 cm and 90 cm x 30 cm, respectively. The maximum dry chilli yield was mainly attributed to maximum number of pods plant^{-1} which is a major yield contributing parameter (Table 1). The present results are in conformity with the findings of Channabasavanna (2002) and Bharathi and Surya kumari (2008). The maximum gross returns (Rs 63,558 ha^{-1}), net returns (Rs 49,219 ha^{-1}) and B:C ratio (4.28) were realized with same spacing (75 cmx 15 cm) compared to others. Ramakrishna and Palled (2005) also reported the similar results in chilli.

Effect of fertilizer levels

The pooled results indicated that a linear increase in growth and yield components, dry chilli yield and economics with increase in fertilizer levels (Table 1). Application of highest fertilizer dose of 125-62.5-62.5 kg NPK ha^{-1} recorded significantly higher plant height (63.6 cm), primary branches plant^{-1} (8.9) and pods plant^{-1} (14.4) compared to lowest fertilizer dose of 75-32.5-32.5 kg NPK ha^{-1} and was on par with medium fertilizer dose of 100-50-50 kg NPK ha^{-1}. The dry chilli yield was significantly higher (1473 kg ha^{-1}) with the highest fertilizer dose of 125-62.5-62.5 kg NPK ha^{-1} which was 17.6 and 9.9% higher over lower and medium fertilizer levels, respectively. The maximum dry chilli yield was mainly related to maximum plant height plant^{-1} and pods plant^{-1}. The maximum gross returns (Rs 64,871) and net returns (Rs 49,235 ha^{-1}) were realized with the highest fertilizer dose (125-62.5-62.5 kg NPK ha^{-1}) which was significantly higher over lowest fertilizer level and was on par with medium fertilizer level. While the highest B:C ratio was realized with medium fertilizer level (4.19) compared to highest fertilizer level (4.15) which was due to lower cost of production. Ramakrishna and Palled (2005) reported the highest dry chilli yield and economics at highest fertilizer levels.

Table2. Interaction effects of spacing and fertilizer levels on yield and economics of drill-sown chilli (Pooled over two years).

Spacings (cm)	Fertilizer levels (kg NPK ha^{-1})		
	75-32.5-32.5	100-50-50	125-62.5-62.5
	Dry chilli yield (kg ha^{-1})		
60 X 30cm	1193	1415	1395
75 X 15cm	1326	1414	1594
75 X 30cm	1180	1406	1543
90 X 15cm	1090	1157	1389
90 X 30cm	1278	1244	1445
SEm±		84	
CD at 5%		256	
	Cost of cultivation (Rs ha^{-1})		
60 X 30cm	14592	15089	15586
75 X 15cm	13842	14339	14836
75 X 30cm	15302	15589	16086
90 X 15cm	14092	14589	15087
90 X 30cm	15592	16089	16586
SEm±		-	
CD at 5%		-	
	Gross returns (Rs ha^{-1})		
60 X 30cm	52884	62832	61387
75 X 15cm	58461	62066	70148
75 X 30cm	52527	62054	67957
90 X 15cm	48245	50727	60925
90 X 30cm	56752	54596	63641
SEm±		2764	
CD at 5%		8282	
	Net returns (Rs ha^{-1})		
60 X 30cm	38292	47743	45801
75 X 15cm	44619	47727	55312
75 X 30cm	37225	46465	51871
90 X 15cm	34153	36138	45838
90 X 30cm	41160	38507	47055
SEm±		2853	
CD at 5%		8568	
	B : C Ratio		
60 X 30cm	3.46	4.01	3.81
75 X 15cm	4.07	4.19	4.58
75 X 30cm	3.31	3.84	4.08
90 X 15cm	3.29	3.41	3.95
90 X 30cm	3.50	3.30	3.75
SEm±		0.13	
CD at 5%		0.41	

Interaction effects

The crop sown at 75 x 15 cm supplied with highest fertilizer dose of 125-62.5-62.5 kg NPK ha^{-1} (S_2F_3) recorded significantly higher dry chilli yield (1594 kg ha^{-1}) compared to other treatments except 60 cm x 30 cm spacing with fertilizer dose of 125-62.5-62.5 kg NPK ha^{-1} (1395 kg ha^{-1}), 75 cm x 15 cm spacing with fertilizer dose of 100-50-50 kg NPK ha^{-1} (1414 kg ha^{-1}), 75 cm x 30 cm spacing with fertilizer dose of 100-50-50 kg NPK ha^{-1} (1406 kg ha^{-1}), 90 cm x 15 cm spacing with fertilizer dose of 125-62.5-62.5 kg NPK ha^{-1} (1389 kg ha^{-1}) and 90 cm x 30 cm spacing with fertilizer dose of 125-62.5-62.5 kg NPK ha^{-1} (1445 kg ha^{-1}) which were on par (Table 2). Lower yield of 1090 kg ha^{-1} was recorded at wider spacing of 90 x 15 cm with the lowest fertilizer dose of 75-32.5-32.5 kg NPK ha^{-1}. The results on economics revealed that adopting a spacing of 75 x 15 cm with a fertilizer dose of 125-62.5-62.5 kg NPK ha^{-1} realized the highest gross returns (Rs 70,148 ha^{-1}), net returns (Rs 55,312 ha^{-1}) and B : C ratio (4.58). while the lowest gross returns (Rs 48,245 ha^{-1}), net returns (Rs 34,153 ha^{-1}) and B:C ratio (3.29) were accrued at 90 cm x 15 cm spacing supplied with 75-32.5-32.5 kg NPK ha^{-1}. The results are in accordance with Ramakrishna and Palled (2005) and Patil (1998) in chilli.

Thus, it may be concluded that drill sowing of chilli at 75 cm x 15 cm spacing with a fertilizer dose of 125-62.5-62.5 kg NPK ha^{-1} was found optimum for getting maximum dry chilli yield and economics under rainfed conditions.

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