Effect of genotypes, fertilizer application & crop geometry on growth, yield and yield attributes in coriander (Coriandrum sativum L.)

ABSTRACT

A field experiment was conducted during rabi 2020-21 & 2021-22 at KVK, Guna. Treatments comprised of three crop geometry viz., 20x10 cm (S_1), 25x10 cm (S_2) and 30x10cm (S_3), two fertilizer levels viz., F_1 45:35:35:20 N:P:K:S ha^{-1}, F_2 60:45:45:30 N:P:K:S ha^{-1} and three genotypes viz., Rcr 41 (V_1), Ajmer Coriander ACr^{-2} (V_2) and Kumbhraj as a check (V_3). The experiment was laid out in Randomized Block Design (RBD) with factorial concept. Result revealed that application of N:P:K:S 60:45:45:30 (F_2) Kg^{-1} ha with a row spacing of 30x10 cm (S_3) row spacing significantly improved plant height, number of branches/plant, while minimum days to 50% flowering was recorded in 20x10cm (S_1), whereas the highest number of umbels/plant, test weight (g), Umbellates $Plant^{-1}$**,** seed yield (kg ha^{-1}), straw yield (kg ha^{-1}), biological yield (kg ha^{-1}), harvest index (%) was recorded in 30x10 cm (S_3) Highest No. of nodes (11.20, 11.08 & 11.28) at harvest in S_3, F_2 and V_2 and primary branches were recorded (8.86, 8.65 & 8.58) in S_3, F_2 and V_2 respectively for growth parameters whereas, maximum No. of umbels and No. of umbellates (39.26, 38.20, 42.39 & 139.91, 134.66, 140.82) was recorded at harvest in S_3, F_2 and V_2 respectively. Maximum Seed yield (13.22, 12.62, 12.80 & 25.77, 24.57, 24.76) was recorded in S_3, F_2 and V_2 respectively (kg ha^{-1}). Ajmer Coriander ACr^{-1} (V_2) recorded an additional net returns of Rs. 89273 and Rs. 82510 over Pant Haritima (V_3) and Rcr 41 (V_1). Highest B:C ratio was obtained with Ajmer Coriander ACr^{-1} (3.36) as compared to Pant Haritima (3.34) and Rcr 41 (2.93) respectively.

Key words: Coriander, genotypes, umbel, B:C ratio, and crop geometry

INTRODUCTION

Coriander (Coriandrum sativum L.) is grown in Mandsaur, Neemuch, Shajapur, Rajgarh, Guna and Vidisha. Row spacing is an important factor for better growth and yield of the plant. Optimum number of plants is required per unit area to utilize efficiently the available production factors such as water, nutrient, light and CO_2. Maximum exploitation of these factors is achieved when the plant population puts forth maximum pressure on all the factors of production Naruka *et. al.* (2012). Nitrogen is a constituent of proteins, enzymes, hormones, vitamins, alkaloids, chlorophyll etc. Adequate supply of N promotes higher photosynthetic activity and vigorous vegetative growth and as a result, the plants turn in to dark green colour. A high N supply favours the conversion of carbohydrate into protein which, in turn promotes the formation of protoplasm. Protoplasm, being highly hydrated, is conducive for the succulent plant growth (Mehta *et. al.* (2013).

Material and methods

A field experiment was conducted during rabi 2019-20 & 2020-21 at KNK Horticulture College, Mandsaur experimental Research Farm, Patan Mandsaur. The experiment was laid out in factorial randomized block design having three replications. There were eight treatment combinations, consisted of three row spacing viz.,20 cm, 22.5cm and 25 cm and two fertilizer levels viz., F_1 - 45:35:35:20 N:P:K:S ha^{-1}, F_2- 60:45:45:30 N:P:K:S ha^{-1}. The seed of three genotypes viz., Rcr 41 (V_1), Ajmer Coriander ACr^{-1} (V_2) and Pant Haritima as a check (V_3) @ 15 kg/ha was used for sowing. Seeds were sown on 8^{th} & 10^{th} October, 2019-20 & 2020-21 in furrows at different row spacing. Manual weeding first at 30 DAS and second at 60 DAS to control the season bound weeds.

RESULTS AND DISCUSSION

(A) Effect of crop geometry (row spacing):

The results clearly revealed that row spacing as well as genotype significantly influenced different growth parameters (Table 1) viz., plant height, number of nodes and primary branches per plant and days taken to 50% flowering. Maximum plant height (cm) at 90 DAS (77.92) was attained at row spacing of 20x10 cm (S_1). Significant increase in plant height from early stage of crop growth under closer row spacing seem to be due to mutual shading due of the dense population. This might have decreased the availability of light to the plants. The reduced light intensity at the base of the plant stem might have accelerated elongation of lower internodes resulting in plant height. Although, plant elongates rapidly due to mutual shading but beyond a certain level, elongation is checked due to reduced availability of photosynthates. These observations are in close conformity with finding of Malav and Yadav (1997) and Kumar *et. al* (2006).

The data depicted that crop raised at row spacing 30x10 cm (S_3) recorded significantly higher number of branches (8.86), number of nodes (11.20) at harvest as compared to row spacing of 20x10 cm (S_1) and 25x10 cm (S_2). Significant improvement in aforesaid parameters due to increase in spacing or in other words reduction in plant population per unit area could be ascribed to availability of more area per plant which implied that individual plant at wider spacing received higher growth inputs (sunlight, water and nutrients) with least competition compared to the plants grown under two closer spacing (Naruka *et. al.* 2012). Thus greater inputs at wider spacing resulted in profuse branching which might have helped in larger canopy development and delayed plant to attain reproductive phase. The larger canopy development associated with profuse branching had increased interception, absorption and utilization of solar energy resulting information of higher photosynthates and finally dry matter per plant. A significant improvement in growth with close spacing was in conformity with the findings of Singh and Buttar (2005) and Kumar *et. al.* (2006). It was observed that at row spacing of 30x10 cm (S_3) various yield attributes i.e. number of umbels per plant, number of umbellate/ plant (139.91) and test weight (8.74 g) highest were recorded in 30x10 cm (S_3) (Table.2). The maximum value for these estimates were obtained at the row spacing 30x10 cm (S_3) significantly improved while i.e. days to 50 per cent flowering (60.62) minimum was recorded in 20x10cm (S_1), whereas maximum number of umbels per plant (39.26) and number of umbellate/ plant (139.91) and test weight (8.74 g) were recorded in 30x10 cm (S_3) (Table.2). Significantly highest seed yield (13.22q/ha) and biological yield (38.98 q/ha) were recorded with row spacing of 30x10 cm (S_3) compared to other spacing (20x10cm (S_1) and 25x10cm (S_2) cm). The profuse branching seem to have led to greater initiation of flowering and adequate supply of metabolites due to the increase in biomass per plant might have helped in retention of flower thereby greater seed formation and seed growth. Similar findings reported by Mehta *et. al.* (2013). These results justify that overcrowding of plants at closer spacing significantly reduced growth and yield attributes of the crop but compensated the yield to a certain level.

Effect of fertilizer applications:

Significantly higher plant height at 90 DAS and at harvest , number of nodes and primary branches per plant and minimum days taken to 50% flowering were recorded as a result of higher levels of fertilization F_2- 60:45:45:30 N:P:K:S ha^{-1} (Table. 1). It is an established fact that higher levels of fertilization is required for the synthesis of protein, chlorophyll and other organic compounds of physiological significance. Thus, increased level of nitrogen in plant by virtue of its increased availability in the soil medium and there after efficient absorption and translocation in various growth by way of active cell division and elongation resulting in greater plant height and number of branches. The nitrogen application might had resulted in larger canopy development and presumably higher chlorophyll content of leaves and essential oil of seeds, as nitrogen actively participate in its formation with profound influence on photosynthetic efficiency of plants, this might had led to higher accumulation of fresh and dry matter. These findings are in close conformity with those of Ghosh (2009), Sharangi et al (2011) and Mehta *et. al.* (2013). In general, the faster growth of plant with nitrogen evidence from increased biomass per plant at successive stages of crop growth showed better availability of metabolites and nutrients.The present trend of increased in seed yield, straw yield and biological yield of coriander with the application of nitrogen was in close conformity with the findings of Naghera *et al* (2000), Tripathi *et al* (2001) and Menaria *et. al.*

(2007).

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CONCLUSIONS

On the basis of two consecutive years research it has been concluded that plant height was highest at 20x10cm (S_1) number of nodes and primary branches/plant significantly increased up to row spacing 30x10 cm (S_3) and nitrogen level of 70 kg/ha. Ajmer Coriander ACr^{-1} (V_2) is far superior not only in growth parameters, but also performed well in terms of yield attributes and ultimately raises the income of the farmers under grid zone of M.P. It may be recommended for Rabi season cultivation to obtain the maximum seed yield (12.80), net return (89273) and high B:C (3.36).

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Table No. 1: Effect of spacing, fertilizer application and genotypes on different growth parameters of coriander

Treatments	P. height (cm) at 90 DAS	P. height (cm) at harvest	No. of Nodes / plant	No. of Pri. branch	DTF (50%)
Crop geometry					
20x10 cm (S_1)	77.92	82.45	8.94	6.98	60.62
25x10 cm (S_2)	66.49	75.01	10.25	7.82	61.67
30x10cm (S_3)	61.03	67.69	11.20	8.86	63.72
S. Em±	1.03	1.12	0.27	0.21	0.48
CD (P=0.05)	2.99	3.26	0.78	0.62	1.41
Fertilizer application					
N:P:K:S 45:35:35:20 (F_1)	63.84	71.21	9.31	7.16	63.77
N:P:K:S 60:45:45:30 (F_2)	73.14	78.94	11.08	8.65	60.29
S. Em±	0.84	0.91	0.22	0.17	0.39
CD (P=0.05)	2.44	2.66	0.63	0.50	1.15
Genotypes					
Rcr 41 (V_1)	63.08	68.74	9.67	7.45	61.45
Ajmer Coriander ACr^{-1} (V_2)	77.82	88.01	10.28	9.58	63.95
Pant Haritima (V_3)	74.77	80.41	8.28	7.59	60.71
S. Em±	1.03	1.12	0.27	0.21	0.48
CD (P=0.05)	2.99	3.26	0.78	0.62	1.41
CV%	6.35	6.32	11.13	11.40	3.31

Table 2: Effect of spacing, fertilizer application and genotypes on yield and yield attributes in coriander

Treatments	No. of Umbels $Plant^{-1}$	No. of Umbellates $Plant^{-1}$	Test Weight (g)	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)
Crop geometry							
20x10 cm (S_1)	35.38	121.31	6.64	10.59	22.80	33.38	31.78
25x10 cm (S_2)	36.67	130.04	7.41	11.92	23.07	34.99	33.91
30x10cm (S_3)	39.26	139.91	8.74	13.22	25.77	38.98	34.11
S. Em±	0.52	1.90	0.24	0.25	0.33	0.63	0.53
CD (P=0.05)	1.52	5.53	0.69	0.72	0.95	1.85	1.56
Fertilizer application							

N:P:K:S 45:35:35:20 (F_1)	35.96	126.71	7.02	11.19	23.02	34.22	32.72
N:P:K:S 60:45:45:30 (F_2)	38.20	134.66	8.30	12.62	24.57	37.19	33.95
S. Em±	0.43	1.55	0.20	0.20	0.27	0.52	0.44
CD (P=0.05)	1.24	4.52	0.58	0.59	0.78	1.51	1.27
Varieties							
Rcr 41 (V_1)	35.61	128.57	6.26	11.54	23.02	34.56	33.40
Ajmer Coriander ACr^{-1} (V_2)	40.39	135.82	8.11	12.80	24.76	37.56	34.07
Pant Haritima (V_3)	32.35	123.14	8.62	11.62	23.78	35.40	32.82
S. Em±	0.52	1.90	0.25	0.25	0.33	0.63	0.53
CD (P=0.05)	1.52	5.53	0.72	0.72	0.95	1.85	1.56
	5.95	6.17	13.15	8.82	5.82	7.51	6.80

Table No. 3: Economics analysis of different treatments in coriander

Treatments	Cost of cultivation (Rs. ha^{-1})	Gross returns (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	Benefit : Cost Ratio
Crop geometry				
20x10 cm (S_1)	35393	131497	96103	3.72
25x10 cm (S_2)	33760	128220	94460	3.80
30x10cm (S_3)	32870	125527	92657	3.82
Fertilizer application				
N:P:K:S 45:35:35:20 (F_1)	35657	116923	81267	3.28
N:P:K:S 60:45:45:30 (F_2)	37233	126120	88887	3.39
Genotypes				
Rcr 41 (V_1)	37887	110907	73020	2.93
Ajmer Coriander ACr^{-1} (V_2)	37887	127160	89273	3.36
Pant Haritima (V_3)	35257	117767	82510	3.34

Note: Seed selling price @ Rs. 8000 q^{-1} prevailing market rate