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SHORT COMMUNICATION

Effect of different spacing and nitrogen levels on growth, yield, quality and monetary returns of cauliflower (*Brassica oleracea* var. *botrytis* L.*)* under North Gujarat condition.

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Cauliflower (*Brassica oleraceavar. botrytis* L.) is one of the most popular vegetable crops among the cole crops. Cauliflower was introduced in India from London by Dr. Jenson in 1822 and in such a short period of its introduction, In India, cauliflower is cultivated in an area about 347 lakh ha with an annual production of about 6569 thousand MT (Anon., 2010). Advance technology for cauliflowers cultivation is use of hybrid varieties and drip irrigation. In the plains, cauliflowers are available from September to May. In Gujarat, it is cultivated in 19,815 ha with a production of 3,56,747 MT (Anon., 2009-10) and productivity of 18 MT ha^{-1}. There is great potential for increasing the productivity per unit area by use of optimum plant spacing and cultural practices in cauliflower. Spacing and plant population per unit area plays an important role for growth and development of the crop. Higher plant population can be achieved by reducing the distance between rows and plants. The yield of cauliflower is directly influenced with proper manuring and fertilization. Therefore, in recent thus much emphasis has been given for the use of major nutrients (N, P, and K). Nitrogen is an essential nutrient required by the plant for its growth, development and reproduction. An adequate supply of nitrogen is associated with vigorous vegetative growth. Nitrogen is a constituent of protein, nucleic acid and chlorophyll etc. It is helpful in large size compact curd development. Hence, the present study was undertaken to find out the Hence, the present study was undertaken to find out the "effect of different spacings and nitrogen levels on growth and yield cauliflower (*Brassica oleracea* var. *botrytis L.)* under North Gujarat conditions" *rabi* 2010-11.

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An experiment was conducted at Horticulture Instructional Farm, C. P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar during *rabi* 2010-11. The experiments consist of four planting spacing (S_1-30 cm X 20 cm, S_2-30 cm X 30 cm, S_3-45 cm X 30 cm and S_4-45 cm X 45 cm) having in main plots and four levels of nitrogen (N_1-100 kg ha^{-1}, N_2-150 kg ha^{-1}, N_3-200 kg ha^{-1} and N_4-250 kg ha^{-1}) under sub plot treatments and replicated thrice in split plot design. The soil of experimental field was sandy loam in texture, low in organic carbon and available nitrogen, medium in available phosphorus and rich in potassium. The cauliflower variety "Early Kunwari" was sowing in nursery bed with seed rate of 500 g ha^{-1} and five week age old seedling with six leaf stage was used for transplanting in main field.

Effect of spacing

The results showed that the significant variation was observed in all growth characters, yield and economics (Table 1 & 2) *viz.*, Plant height at 30 DAT and at harvest, number of leaves per plant 30 DAT and at harvest, curd yield, protein and ascorbic acid content, net returns and B: C ratio. Significantly maximum plant height (22.62 cm and 33.65 cm at 30 DAT and at harvest, respectively), number of leaves per plant (12.27 and 27.87 at 30 DAT and harvest, respectively), diameter of curd (14.57 cm), B: C ratio (3.74) were observed in treatment S_3 (45 cm X 30 cm), while average weight of curd (831.40 g) and protein content (2.69%) was observed in treatment S_4 (45 cm X 45 cm). However, higher curd yield (297.41 q ha^{-1}) and net returns (Rs. 161588) was obtained under treatment S_1 (30 x 20 cm). In wider spacing better availability of nutrient, sunlight, moisture and space to plants consequently improve plant vigor and growth. These findings are in agreement. Less number of plants led

better utilization of moisture, space and sunlight, which might be led to better accelerated photosynthates, vegetative and productive growth. Ultimately diameter and yield of curd was increase. These findings are in agreement with the result of Mannan *et al*.

Effect of nitrogen levels

The results (Table 1 & 2) showed that the significant variation was observed in all growth characters *viz.*, Plant height at 30 DAT and at harvest, number of leaves per plant at 30 DAT and at harvest. Significantly highest plant height (22.47 cm and 33.36 cm at 30 DAT and at harvest, respectively), number of leaves per plant (12.05 and 25.87 at 30 DATP and harvest, respectively), diameter of curd (14.83 cm), average weight of curd (628.06 gm), curd yield (269.60 q ha^{-1}), net returns (Rs. 180006 ha^{-1}) and B: C ratio (6.05) were observed higher in treatment N_3 (200 kg N ha^{-1}). This might have increased nitrogen supply which helped in the expansion of leaf area and increased

Table 1. Effect of different spacing and varying levels of nitrogen on growth and yield attributes of cauliflower

Treatments	Plant height (cm)		Number of leaves $plant^{-1}$		Diameter of curd (cm)	Average weight of curd (g)
	At 30 DAT	At harvest	At 30 DAT	At harvest		
S_1: 30 X 20 cm	20.35	29.20	10.67	22.05	11.30	357.48
S_2: 30 X 30 cm	21.06	30.71	11.33	23.40	13.59	505.51
S_3: 45 X 30 cm	22.62	33.65	12.27	27.87	14.57	616.76
S_4: 45 X 45 cm	22.04	31.87	12.04	26.07	13.59	831.40
S.Em±	0.40	0.84	0.24	0.81	0.47	22.20
C.D. (*P*=0.05)	1.51	2.89	0.84	2.81	1.62	76.58
N_1: 100 kg ha^{-1}	20.33	29.38	11.07	23.75	11.56	518.58
N_2: 150 kg ha^{-1}	21.13	30.97	11.45	24.30	13.00	545.11
N_3: 200kg ha^{-1}	22.47	33.36	12.05	25.87	14.83	628.06
N_4: 250kg ha^{-1}	22.22	31.72	11.73	25.47	13.57	619.40
S.Em±	0.43	0.67	0.20	0.53	0.34	10.95
C.D. (*P*=0.05)	1.26	1.94	0.59	1.55	0.99	31.88

Note: DAT = Day after transplanting

Table 2. Effect of different spacing and varying levels of nitrogen on growth and yield attributes of cauliflower.

Treatments	Curd yield (q ha^{-1})	Quality		Net return (Rs. ha^{-1})	BCR
		Protein (%)	Ascorbic acid (mg/100g)		
S_1: 30 X 20 cm	297.41	2.49	57.85	161588	3.12
S_2: 30 X 30 cm	279.17	2.55	59.63	160885	3.58
S_3: 45 X 30 cm	248.42	2.60	59.64	145544	3.74
S_4: 45 X 45 cm	195.33	2.69	59.40	109245	3.32
S.Em±	9.51	0.09	1.95	---	---
C.D. (*P*=0.05)	32.82	NS	NS	---	---
N_1: 100 kg ha^{-1}	235.19	2.32	55.23	152978	5.35
N_2: 150 kg ha^{-1}	252.44	2.53	59.00	166528	5.70
N_3: 200kg ha^{-1}	269.60	2.63	59.10	180006	6.05
N_4: 250kg ha^{-1}	263.11	2.83	63.19	174564	5.86
S.Em±	5.21	0.06	1.28	----	---
C.D. (*P*=0.05)	15.16	0.18	3.73	----	----

Note: DAT = Day after transplanting and BCR: Benefit cost ratio

chlorophyll content which accelerated the photosynthetic rate and in turn increased the supply of carbohydrates to the plant. These results are in close agreement with the findings of Singh (2004). The better availability of nitrogen might have also favoured to metabolic and auxin activities in the plants and ultimately resulted in increased size, weight and yield of curd. While, protein content (2.83%) and ascorbic acid content (63.19 mg/100 g) was recorded higher with the application of 250 kg N ha^{-1}. This might be due to fact that the protein content is essentially the manifestation of N concentration in curd. Hence, increased N concentration under equal rate of nitrogen application might have increased the protein content of curd. These findings are in accordance with the results of *Ducsay et al. (2004),* Mal *et al.* (2005).

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