

IMPACT OF PLANTING DISTANCE ON YIELD OF CAULIFLOWER UNDER SEMI ARID CONDITION

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ABSTRACT

An experiment was carried out at KVK-Panchmahal (ICAR-CIAH), Godhra Gujarat during 2015-16 and 2016-17 at farmer's fields to find out the impact of planting distance on yield of cauliflower cv. Pusa Katki Hybrid under semi arid conditions of central Gujarat. Among the treatments the highest average plant height (54.76 cm), yield (230.91 q/ha) were recorded in paired row system of planting (T_3) followed by T_2 (45X45 cm) and T_1 (60X60 cm). The mean maximum number of leaves (18.71), weight of leaves (350.34 g) and curd weight (478.78 g) were obtained in T_1 . The highest average curd weight (0.523 kg) was recorded in farmers practices followed by 0.432 by in T_2 and the same was minimum in T_3 (paired row system). The maximum net return (₹ 99093) and B: C ratio (3.24) was recorded in T_3 followed by (₹ 65940) and B: C ratio (2.98) in T_2 and (₹ 50176.50) and B: C ratio (2.85) in T_1 . Study reveals that the planting of cauliflower in paired row system is a better option for taking higher income from a particular land.

Keywords : planting distance, cauliflower, yield, impact

INTRODUCTION

Cauliflower (*Brassica oleracea* var. *botrytis* L.) belongs to family cruciferae. It is one of the most important winter season vegetable. In India, it is grown throughout the country. India is the largest producer of cauliflower with area production and productivity 460000 ha, 8792000 MT and 11.11 MT, respectively (Anonymous, 2019). The cauliflower productivity level of the Panchmahal district is low as comparison to state and national level. The major factors responsible for low productivity in the district are poor awareness about the high yielding varieties, low planting densities, lack of technical knowledge, lack of quality irrigation water, problems of wild animals, plant protection measures, climate change etc. (Vinaya *et al.*, 2017). The demand of medium size curd is higher in market due to urbanization, nuclear family structure, etc. The use of proper planting distance is a most important factor for securing higher yield of desirable heads size of cauliflower. The individual plant and its organs size was increased with wider distance. The curd size of cauliflower was decrease with reducing planting distance (Saini, *et al.*, 2018) in cauliflower and Thamburaj and Singh (2004) in cabbage. The increasing plant population increase yield per unit area (Patil *et al.*, 2007 and Rai *et al.*, 2020) in cauliflower and Atlee *et al.* (2000), in brussels sprouts. Under normal planting distance, the plants have wider spacing to uptake nutrients from the

soil and makes good growth. In case of less planting distance the feeding area for the plant is reduced due to increasing plant population per unit area. This is not helping in improve quality and yield of curd and with the more spacing there is less competition (Singh, *et al.* 2019). Keeping above points in view the on farm trial (OFT) on impact of planting distance on yield of Cauliflower cv. Pusa Katki Hybrid under semi arid conditions of central Gujarat was designed by KVK-Panchmahal during 2015-16 and 2016-17 at five farmer's field to increase the productivity of cauliflower.

OBJECTIVE

To know the impact of planting distance on yield of cauliflower under semi arid condition

METHODOLOGY

The present investigation was carried out at five farmer's fields of the Panchmahals district of Gujarat under on farm trial (OFT) during 2015-16 and 2016-17. The experiment were laid out with three treatments *viz.* T_1 control >60X60cm, T_2 Recommended distance 60X45 cm and T_3 Paired row system between two row 60X60 cm and plant to plant (30x30 cm) at various villages *viz.* bukhi, aeral, rakli, vejalpur, popatpura and derol. The number of plants accommodated in different treatments were T_1 (27777), T_2 (37037) and T_3 (74074). The certified seed was procured

from National Seed Corporation and raised healthy seedlings at ICAR-KVK, Panchmahal and distributed to selected farmers. Before implementation of on farm trial, a training programme was conducted and trained all the selected farmers about the various aspects of cauliflower cultivation. The demonstrations were laid under keen supervision of KVK experts and visited frequently from preparation of land, seed treatment, application of manure and fertilizers, seed rate, sowing of seed, weed management, harvesting, grading and sale of produce with help of various extension tools.

Plant height

Table 1 : Effect of planting distance on plant height of cauliflower cv. Pusa Katki hybrid

Treatment	25 days			50 days			At harvest		
	2015-16	2016-17	Mean	2015-16	2016-17	Mean	2015-16	2016-17	Mean
T ₁	14.38	15.16	14.77	24.52	23.86	24.19	35.13	36.18	35.655
T ₂	15.83	14.36	15.095	28.91	28.24	28.575	41.26	42.13	41.695
T ₃	18.97	17.88	18.425	34.13	35.18	34.655	54.38	55.14	54.76
SEm+	0.151	0.166	0.111	0.388	0.363	0.172	0.421	0.451	0.230
CV	2.023	2.360	1.264	2.976	2.826	0.947	2.157	2.274	0.167
CD-5%	0.493	0.544	0.364	1.267	1.185	0.561	1.371	1.473	0.750

Perusal of data presented in table-1 shows that the planting spacing (60 X 60, 60 X 45 cm and paired row system between two row 60 X 60 cm and plant to plant (30 X 30 cm) was significantly influenced the plant height at all stages (after 25, 50 and at harvest). The mean maximum plant height was recorded in T₃ (18.42 cm, 34.65 cm and 54.76 cm) at different growth stages (25, 50 DAS and at harvest) followed by T₂ (15.09 cm, 28.57 cm and 41.69 cm) and minimum in T₁ (14.77 cm, 24.19 cm and 36.65 cm). More or less similar

Number of leaves

Table 2 : Effect of planting distance on number of leaves of cauliflower cv. Pusa Katki hybrid

Treatment	25 days			50 days			At harvest		
	2015-16	2016-17	Mean	2015-16	2016-17	Mean	2015-16	2016-17	Mean
T ₁	11.73	12.08	11.91	15.96	16.22	16.12	18.97	18.45	18.71
T ₂	11.72	11.58	11.65	15.48	15.56	15.54	18.44	18.51	18.47
T ₃	8.93	8.78	8.85	13.93	13.78	13.78	15.63	16.03	15.83
SEm+	0.222	0.336	0.191	0.180	0.228	0.148	0.255	0.220	0.131
CV	2.682	6.861	3.952	2.671	3.368	2.194	3.230	2.796	1.660
CD-5%	0.727	0.097	0.623	0.589	0.746	0.485	0.833	0.720	0.428

The number of leaves per plant was significantly affected by the various planting spacing at 25, 50 DAS and at harvest (table-2). The increasing trend for number of leaves per plant was found in all treatments and maximum at harvest. The average maximum number of leaves (11.91, 16.12 and 18.71) was recorded in T₁ (60 X 60 cm) in all stages (25, 50

The data on plant height, number of leaves, curd weight, curd diameter, yield/ha, cost of cultivation and B:C ratio were recorded time to time. The data was analyzed by using standard method (Snedecor and Cochran, 1989).

RESULTS AND DISCUSSION

The results obtained from the study on “Impact of planting distance on yield of cauliflower cv. Pusa Katki Hybrid under semi arid conditions of central Gujarat” are given in following sub heads.

trend was also noted in both the years of study. It was observed that closer planting recorded more plant height than wider spacing at various sampling stages. This is may be due to increasing plant density with shallow root system limits the availability of space for lateral growth. The results of the study are agreement with Saini, *et al.* (2018) they reported minimum plant height at 50 X 50 cm and maximum at 50 X 30 cm. The similar findings are also reported by Kannan, *et al.* (2016) in cauliflower, Manasa (2017) in red cabbage.

DAS and at harvest) followed by T₂ (11.58, 15.54 and 18.47) and minimum in T₃ (8.85, 13.78 and 15.83), respectively. The number of leaves in T₁ (60 X 60 cm) and T₂ (60 X 45 cm) are statistically atpar. It was observed from the present study the number of leaves was higher in plants planted at wider distance than closer. This is may be due to planting at wider

distance the plant have more area to uptake nutrients from the soil. The results of the study are in agreement with the findings as reported by Singh (2005) observed a significant improvement in the number of leaves per plant with increased

intra row spacing from 30 cm (14.48) to 45 cm (15.71) in cauliflower cv. Pusa Snowball K-1. The similar findings are also reported by Hill (2000) in Chinese cabbage, Sarker, *et al.* (2002) in cabbage.

Weight of leaves

Table 3 : Effect of planting distance on weight of leaves of cauliflower cv. Pusa Katki hybrid

Treatment	25 days			50 days			At harvest		
	2015-16	2016-17	Mean	2015-16	2016-17	Mean	2015-16	2016-17	Mean
T ₁	118.32	118.13	118.52	327.28	328.38	327.83	348.32	352.35	350.34
T ₂	117.13	118.35	117.74	314.36	313.26	313.81	336.65	334.68	335.66
T ₃	103.22	102.32	102.77	273.17	272.67	272.92	236.34	235.64	235.99
SEm+	0.442	0.407	0.254	0.780	0.697	0.864	0.676	1.146	0.568
CV	0.875	0.806	0.503	0.572	0.511	0.634	0.492	0.833	0.413
CD-5%	1.441	1.322	0.829	2.562	2.771	2.818	2.207	3.732	1.851

Perusal of data presented in table-3 reveals that the planting spacing was significantly influenced the leaves weight at all stages (after 25, 50 and at harvest). The mean maximum leaves weight was recorded in T₁ (118.52 g, 327.83 g and 350.34 g) at different growth stages (25, 50 DAS and at harvest) followed by T₂ (117.74 g, 313.81 g and 335.66 g) and minimum in T₃ (102.77 g, 272.92 g and 235.99 g).

More or less similar trend was also noted in both the years of study. It is may be due to the wider planting have more space to uptake nutrients and increasing growth of plant. Singh, *et al.* (2019) reported that the weight of leaves increase with planting distance. The similar findings are also reported by Patil, *et al.* (1995), Tripathi and Sharma (1991), Sharma and Chaudhary (1996) in cauliflower.

Curd weight and diameter

Table 4 : Effect of planting distance on curd weight, curd diameter and yield (q/ha)

Treatment	Curd weight (g)			Curd diameter (cm)			Yield (q/ha)			No. of plants per ha
	2015-16	2016-17	Mean	2015-16	2016-17	Mean	2015-16	2016-17	Mean	
T ₁	432.32	525.24	478.78	21.83	21.91	21.87	119.44	129.20	124.32	27777
T ₂	425.15	436.28	430.71	21.76	21.88	21.82	157.40	162.40	159.90	37037
T ₃	296.17	305.22	300.69	17.24	17.27	18.26	229.63	232.20	230.91	74074
SEm+	0.934	0.568	0.415	0.439	0.426	0.0813	0.907	1.207	1.145	
CV	0.543	0.301	0.230	3.863	4.682	0.945	1.202	1.581	1.491	
CD-5%	3.047	1.855	1.354	1.431	1.391	0.284	2.961	3.937	3.735	

The curd weight and diameter was significantly affected by the different plant spacing. The wider planted plants produce large size curd than closer planting (table-4). The highest average curd weight (478.78 g) was recorded in T₁ followed by T₂ (430.71 g) and minimum (300.69 g) in T₃ (paired row system). The range of curd diameter was recorded in 18.26-21.87 cm, whereas the maximum in T₁ and minimum in T₃. The similar trend in curd weight and diameter were also recorded in both year of study. The results of the study are line of Saini *et al.* (2018) reported 8.10 cm curd diameter at planting distance (50 X 50 cm), 7.50 cm at 50 X 40 cm and minimum (7.07 cm) at 50 X 30 cm distance. The similar results are also reported by Patil, *et al.* (1995), Tripathi and Sharma (1991), Sharma and Chaudhary (1996) in cauliflower; Kumar *et al.* (2007) in broccoli.

Yield

The data presented table-4 reveals that the maximum yield (230.91 q/ha) was recorded in when the seedling planted in paired row system (T₃) followed by T₂ (159.90 q/ha) and minimum in T₁ (124.32 q/ha). The total production was significantly increased with the increasing plant population, whereas the individual curd size reduced. This may be due to the available area for particular plant to uptake nutrients was reduced so that the plant growth and curd size reduced. The results of the present study are line of Choudhary, (2013), reported that the planting geometry of 60 × 30 cm in late season cauliflower (28.76 t /ha) resulted in higher cauliflower yield and profitability over other respective planting geometries. The similar findings are also

reported by Saini, *et al.* (2018), Srivastava and Singh (1994), Sharma and Chaudhary (1996) in cauliflower; Singhal, *et al.* (2009); Kumar *et al.* (2007) in broccoli.

ECONOMICS

Table 5 : Effect of planting densities on Economics of cauliflower cv. Pusa Katki hybrid

Treatment	Cost of cultivation (₹/ ha)			Gross return (₹/ ha)			Net return (₹ ha)			Benefit : cost ratio		
	2015-16	2016-17	Mean	2015-16	2016-17	Mean	2015-16	2016-17	Mean	2015-16	2016-17	Mean
T ₁	26000	28000	27000	71665	82688	77176	45665	54688	50176	2.76	2.95	2.85
T ₂	32000	34500	33250	94444	103936	99190	62444	69436	65940	2.95	3.01	2.98
T ₃	43000	45200	44100	137778	148608	143193	94778	103408	99093	3.20	3.29	3.24
SEm+	805.19	321.19	357.18	1541.70	663.67	265.80	285.62	592.73	486.81	0.022	0.039	0.027
CV	5.346	2.006	2.296	3.403	1.328	0.557	0.944	1.747	1.517	1.722	2.838	0.996
CD-5%	1625.87	1047.47	1164.85	5027.78	2164.34	866.82	931.41	1933.01	1587.56	0.074	0.127	0.088

The data presented in table-5 reveals that the cost of cultivation in different treatments varied from ₹ 27,000 to 44,100 per ha, the maximum was recorded in the treatment T₃ (₹ 44,100) followed by T₂ (₹ 33250) and minimum (₹ 27000) in T₁. The higher cost of cultivation in T₃ is due to need more seedlings, manure, fertilizers, manpower, etc. The maximum gross returns (₹1, 43193.00/ha), net returns (₹ 99,093.00/ha) and highest B: C ratio (3.24) were recorded in the treatment T₃ (paired row system) followed by T₂ (₹ 99190.00, ₹ 65940.00 and 2.98) and the same was minimum in T₁ (₹ 77176.50, ₹ 50176.50 and 2.85) respectively. The maximum gross returns may be due to increased total curd yield. The present study reveals that the planting of cauliflower in paired row system is a better option for taking higher income from a particular land. The similar findings are also reported by previous researches Sataneek, *et al.* (2003) in cucumber, Kumar, *et al.* (2014) in okra.

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