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The response of cauliflower var. Snowball affected by different day stages level and spacing distances

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Abstract

The effect of spacing distance on the growth and yield of cauliflower (*Brassica oleracea* L.) was studied under the Agro climatic conditions of the Vegetable Research Farm of the Department of Horticulture, Faculty of Agriculture, UdaiPratap Autonomous College, at Varanasi (U.P.) during year (2012-2013). Varanasi is situated between 25° 15' North latitude and 60°03' East longitude. It has subtropical climate. The city is elevated about 129.23 meters above mean sea levels. Three spacing distance between rows ($S_1=30\text{cm}$, $S_2=43\text{cm}$, $S_3=60\text{cm}$) were used in this study. The avoidance of struggle for existence much depends upon placing the plants at proper distance so that they may get sufficient light and air for their proper growth and maintenance. Under this experiment, spacing 30, 45, 60 cm were given to the cauliflower plants to find out the most suitable distance at which they should be placed to grow well and yield the maximum the distance at which the least value of each growth characters was obtained, was taken as standard to compare with the values obtained with regards to the particular growth characters at other distance to find out the significant effect at placing. Thus the fresh weight of plant, fresh weight of leaves, dry weight of leaves and height of plant were found to have been significant effect at spacing 30 and 60 cm of the plant, spacing of 45 and 60 cm were found to have significant effect on fresh weight of plant, fresh and dry weight of leaves. Observation made at 20 days stage it was noted that spacing of 60 cm had significant effect on fresh weight of fresh and dry weight of leaves. At 40 days stage significant effect of 60 cm distance was observed on height of the plant, fresh weight of plant, fresh and dry weight of leaves. At 60 days stage significant effect at 60cm distance it was note that the height of the plant, fresh weight of plant, fresh weight of leaves and dries weight of leaves. At 80 days stage significant effect at 60cm distance was obtained on height of plant, fresh weight of plant, fresh weight of leaves and dry weight of leaves.

Keywords: Spacing, Climatic, Subtropical, Growth, Yield

Introduction

The cauliflower (*Brassica oleracea* var. *botrytis* L.) is an important winter season vegetable crop in India belongs to crucifer family generally termed as cole crops and consumed as raw or cooked. It was introduced into India from England by Dr. Jemson, Incharge of company bagh, Saharanpur, U.P in 1822 (Swarup & Chattarjee, 1972) the period of East- India Company. Cauliflower (*Brassica oleracea* L.) is grown for its white tender, head or curd formed by the shortened flower parts. Cauliflower thrives best in a cool moist climate. It does not withstand very low temperature or too much heat as well cabbage. Cauliflower heads will not develop well in hot weather, for this reason it is grown mostly the fall and winter. The optimum temperature where the cauliflower withstands is 10° to 15 °C. In regions where freezes does not occur, planting may be done at any time of the year if water is available for growing the crop. In regions where hard freezes occur well-hardened plants may be set out as early in the spring as the ground can be prepared or as soon as the danger of hard freezes is over. The increase in yield per acre is due to many factors but primarily due to better production practices resulting from specialization by growers. The average yield produced in Northern areas is far below than the yields produced in other parts of the country. This low yield may be due to the improper agronomic practices or use of improper mineral fertilizer to the crop.

The current research was conducted to evaluate the impact of sowing date on the growth and yield of cauliflower. It is therefore, imperative to examine the spacing distance in cauliflower in light of best spacing distance technology. The present study was undertaken to evaluate the effect of different spacing distance on the growth and yield characteristics of cauliflower. Looking at the importance of this crop and future prospects of this cultivar, present investigation was carried out during the year 2012-2013 in agro – climatic condition of Varanasi district. It is hoped that results of these investigations might prove some importance towards successful cultivation of cauliflower.

Material and Method

The present study was conducted at the Vegetable Research Farm of the Department of Horticulture, Faculty of Agriculture, UdaiPratap Autonomous College, Varanasi (U.P.). The experiment of present investigation, the treatment (all possible combination 3 x 3 = 9) of nitrogen and spacing with variety Snowball was led out three different spacing viz., 30, 45 and 60 cm denotes as S₁, S₂ and S₃ respectively with three different stages 40, 60 and 80 days denotes as N₁, N₂ and N₃ respectively. During the field preparation soil sample up to 25cm depth were obtained for chemical analysis. These samples were analyzed for soil texture, lime contents, organic matter, N, P, K and pH in the laboratory of the soil section. During the preparation of nursery beds well-rotted FYM was added. The beds were made 10cm raised from the soil surface to provide good drainage for the removal of surplus irrigation. The seeds were sown in 10 cm apart and were covered with fine and well-rotted FYM. Beds were immediately misted with the help of sprinkler and all the bed was covered with wheat straw. After three days germination of seeds started and completed after six days. Irrigation was given with the interval of three days with the help of sprinkler. When the seedlings attained the height of 3 cm, thinning was done to get healthy and strong seedlings. After thirty-six days, transplantations of the seedlings started with the interval of 15 days at evening time from the nursery beds to the field. Healthy seedlings of uniform size were selected for the transplantations seedlings that did not survive after transplanting were quickly replaced. The observations were recorded to study the different characters of plants grown in different treatments in each replication. The following characters were studied.

Height of plant (cm)

The height of plants from bottom of levels of ground to the tips of leaves was measured at an interval of 20 days with the help of meter scale. The height of all the three plants which were tagged in each sub-plots was measured and the average height of the treatment and replication was calculated.

Fresh weight of the plant (g)

Three plants from each plot were selected and average weight of the plants was recorded, the intervals between observations were same as above.

Number of leaves

The leaves of selected sample account the total leaves and recorded the number.

Fresh weight of leaves (g)

The leaves of selected sample plants were removed and

weighed on pan balance and recorded the weight in g.

Dry weight of leaves (g)

After taking the fresh weight of leaves dried in the electronic oven and weighed out on physical balance in g.

Fresh weight of head (g)

The selected three heads removed and weighed on balance and recorded the weight in g.

Dry weight of head (g)

After taking the fresh weight of head dried in the electronic oven and weighed out on physical balance in g.

Total Yield

The total yield per sub-plot was recorded by weighing in (g.) and multiplied by plant population and divided by 10000 and finally divided by 100 for yield quintal per hectare.

Statistical Analysis of Data

The observations recorded on various characters were subjected to statistical analysis to find out the significant of the treatment on the characters under study. The experiment was conducted in randomized block designs. The sum of square and the mean sum of squares for the various treatment effects as well as replication were calculated in usual way.

Results

The experiment, spacing 30, 45, 60 cm and different days stage 40, 60, 80 day were given to the cauliflower plants to find out the most suitable distance at which they should be placed to grow well and yield the maximum the distance at which the least value of each growth characters was obtained, was taken as standard to compare with the values obtained with regards to the particular growth characters at other distance to find out the significant effect at placing.

At 40 days stage the plant height were 34.37cm observed under 60 cm. distances, the plant height were 21.23cm observed under 45cm distance, the plant height was 14.96 cm observed under 30cm distance. At 60 days stage the plant height were 52.81 cm observed under 60 cm distances, the plant height were 52.43 cm observed under 45cm distance, the plant height was 51.93 cm observed under 30cm distance. At 80 days stage the plant height were 56.35 cm observed under 60 cm. distances, the plant height were 55.47 cm observed under 45cm distance, the plant height was 55.37 cm observed under 30cm distance.

At 40 days stage the fresh weight of the plant was 140.22 g, were observed under 60cm. distance, the fresh weight of the plant was 119.75g. were observed under 45cm distance, the fresh weight of the plant was 111.04g. were observed under 30 cm distance. At 60 days stage the fresh weight of the plant was 344.21g, were observed under 60cm. distance, the fresh weight of the plant was 319.73g. were observed under 45cm distance, the fresh weight of the plant was 295.67g. were observed under 30 cm distance. At 80 days stage the fresh weight of the plant was 394.67g, were observed under 60cm. distance, the fresh weight of the plant was 375.73g. were observed under 45cm distance, the fresh weight of the plant was 334.32g. were observed under 30 cm distance.

At 40 days stage the number of the leaves was 31.89 were observed under 60 cm distance, the number of the leaves was 26.71 were observed under 45 cm distance, the number of the leaves was 19.23 were observed under 30 cm distance. At 60

days stage the number of the leaves was 34.57 were observed under 60 cm distance, the number of the leaves was 33.22 were observed under 45 cm distance, the number of the leaves was 31.88 were observed under 30 cm distance. At 80 days stage the number of the leaves was 39.18 were observed under 60 cm distance, the number of the leaves was 37.89 were observed under 45 cm distance, the number of the leaves was 36.21 were observed under 30 cm distance.

At 40 days stage the fresh weight of the leaves was 124.54g were observed under 60cm distance, the fresh weight of the leaves was 111.14g were observed under 45cm distance, the fresh weight of the leaves was 96.14g were observed under 30cm distance. At 60 days stage the fresh weight of the leaves was 329.54g were observed under 60cm distance, the fresh weight of the leaves was 308.10g were observed under 45cm distance, the fresh weight of the leaves was 264.43g were observed under 30cm distance. At 80 days stage the fresh weight of the leaves was 342.44g were observed under 60cm distance, the fresh weight of the leaves was 320.77g were observed under 45cm distance, the fresh weight of the leaves was 290.67g were observed under 30cm distance.

At 40 days stage the dry weight of the leaves was 12.62g were observed under 60 cm distance, the dry weight of the leaves was 9.82g were observed under 45 cm distance, the dry weight of the leaves was 8.90g were observed under 30 cm distance. At 60 days stage the dry weight of the leaves was 34.95g were observed under 60 cm distance, the dry weight of the leaves was 32.92g were observed under 45 cm distance, the dry weight of the leaves was 29.80g were observed under 30 cm distance. At 80 days stage the dry weight of the leaves was 37.46g were observed under 60 cm distance, the dry weight of the leaves was 36.28g were observed under 45 cm distance, the dry weight of the leaves was 35.27g were observed under 30 cm distance.

At 40 days stage the fresh weight of curd was 175.61g were observed under 60cm distance, the fresh weight of curd was 215.21g were observed under 45cm distance, the fresh weight of curd was 197.62g were observed under 30cm distance. At 60 days stage the fresh weight of curd was 282.96g were observed under 60cm distance, the fresh weight of curd was 236.29g were observed under 45cm distance, the fresh weight of curd 225.55g were observed under 30cm distance. At 80 days stage the fresh weight of curd was 469.48g were observed under 60cm distance, the fresh weight of curd was 384.19g were observed under 45cm distance, the fresh weight of curd was 348.49g were observed under 30cm distance.

At 40 days stage the dry weight of curd was 37.15g were observed under 60cm distance, the dry weight of curd was 32.47g were observed under 45 cm distance, the dry weight of the curd was 28.52g were observed under 30cm distance. At 60 days stage the dry weight of curd was 52.58g were observed under 60cm distance, the dry weight of curd was 45.56g were observed under 45 cm distance, the dry weight of the curd 39.26g were observed under 30cm distance. At 80 days stage the dry weight of curd 86.13g were observed under

60cm distance, the dry weight of curd 63.59g were observed under 45 cm distance, the dry weight of the curd 55.54g were observed under 30cm distance. The population of plant per hectare 10013.67 were observed under 60×60cm row to row× plant to plant distance, population of plant per hectare 13740.33 were observed under 45×60cm row to row× plant to plant distance and population of plant per hectare 19666.67 were observed under 30×60cm row to row× plant to plant distance.

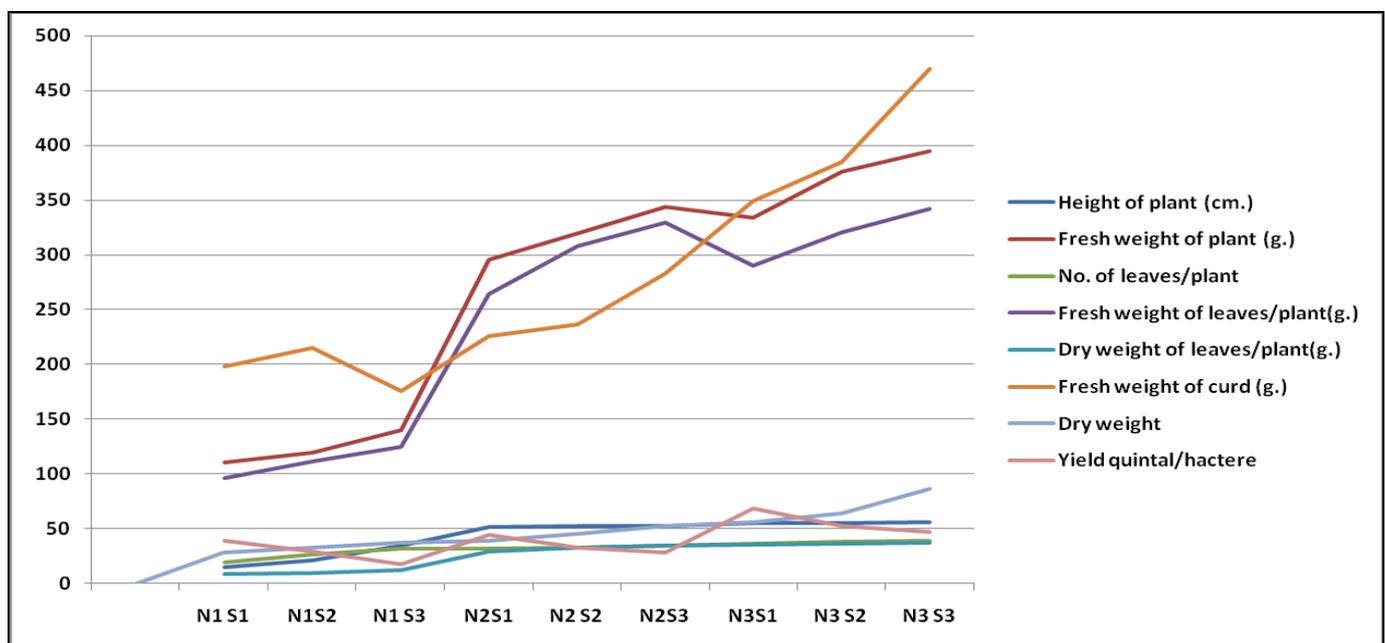
The calculated values for yield in quintals per hectare were obtained at 40 days stage 17.58quintals per hectare under 60cm distance, the yield in quintals per hectare 29.56 observed under 45 cm distance and the yield in quintals per hectare 38.86 observed under 30cm distance. At 60 days stage yield in quintals per hectare were obtained 28.33 under 60 cm distances, the yield in quintals per hectare 32.46 observed under 45 cm distance and the yield in quintals per hectare 44.46 observed under 30cm distance. At 80 days stage yield in quintals per hectare were obtained 47.00 under 60 cm distances, the yield in quintals per hectare 52.79 observed under 45 cm distance and the yield in quintals per hectare 68.53 observed under 30cm distance.

Discussion

Number of plants mostly dependent upon spacing which also plays an important role in its development. The height of plant was found to increase maximum at 60cm spacing. The plants of the spacing of 45cm were smaller than 60cm spacing at 30cm spacing plants were significantly shorter. Plants which were grown in wider spacing improved their fresh and dry weight characters, number of leaves, showed best results at 60cm spacing and with decrease in spacing the characters were decreased and worst results were obtained at 30cm spacing. On the country, 30cm spacing product was poor in quality and leaf character but this gave highest result in yield because in less spacing more number of plant were planted per unit area as well as per hectare. The findings were in agreement to Davey, J.B. (1965) ^[5], Mathur, M.M. and Vashishtha, K.S. (1976) ^[8]; Lewandowska, A.M. and Skapski, H. (1977) ^[7]; Akrotanakul *et al* (1977) ^[1]; Sharma, R. P. and Arora, P. N. (1984); Whitwell, J.D. and D. Senior, (1988) ^[10]; Atlee *et al.* (2000) ^[3]; Arora *et al.* (2002) ^[2], Durate, O. and Velez Fortuno, J. (2005) ^[4] and Patil *et al.* (2007) ^[9]. The aforesaid findings may be discussed under the heading of "struggle for existence. Always there is a competition among the plants to draw more matter from the media growth. If less spacing is left for plants there will be automatically less amount of nutrients for each plant. This will not help to improve quality and yield of curd, and with the more spacing there is less competition. The individual plant and its organs responded favorably to wider spacing the yield per hectare was adversely affected. Yield is increased as the density of population is increased. The important of higher plant population per hectare for getting higher yields is therefore quite obvious.

Table 1: The response of cauliflower Var. Snowball affected by different day stages level (N₁=40 days, N₂=60days, N₃=80 days and panting distance between rows (S₁=30cm, S₂=45cm, S₃=60cm) spacing x different day stages level.

S. N.	Treatment	Height of plant (cm.)	Fresh weight of plant (g.)	No. of leaves/plant	Fresh weight of leaves /plant (g.)	Dry weight of leaves /plant (g.)	Fresh weight of curd (g.)	Dry weight of curd (g.)	Plant population / hectare	Yield quintal /hectare
1	N ₁ S ₁	14.96	111.04	19.23	96.14	8.90	197.62	28.52	19666.67	38.86
2	N ₁ S ₂	21.23	119.75	26.71	111.14	9.82	215.21	32.47	13740.33	29.56
3	N ₁ S ₃	34.37	140.22	31.89	124.54	12.62	175.61	37.15	10013.67	17.58
4	N ₂ S ₁	51.93	295.67	31.88	264.43	29.80	225.55	39.26	19666.67	44.36
5	N ₂ S ₂	52.43	319.73	33.22	308.10	32.92	236.29	45.56	13740.33	32.46
6	N ₂ S ₃	52.81	344.21	34.57	329.54	34.95	282.96	52.58	10013.67	28.33
7	N ₃ S ₁	55.37	334.32	36.21	290.67	35.27	348.49	55.54	19666.67	68.53
8	N ₃ S ₂	55.47	375.73	37.87	320.77	36.28	384.19	63.59	13740.33	52.79
9	N ₃ S ₃	56.35	394.67	39.18	342.44	37.46	469.48	86.13	10013.67	47.00
SEm±		0.91	0.99	2.608						
CD at 5%		2.75	3.01	0.862						

**Fig 1:** The response of cauliflower Var. Snowball affected by different day stages level (N₁=40 days, N₂=60days, N₃=80 days and panting distance between rows (S₁=30cm, S₂=45cm, S₃=60cm) spacing x different day stages level.

References

- Akratanakul W, Baggett JR, Mack HJ. Effects of plant spacing, fertilizer and transplanting on axillary heading in cabbage. *Horticulture Science* 1977; 12(1):56-57.
- Arora PN, Jashind BS, Pandey SL. Vegetable crops in India (Book). *Indian Hort*, 2002; 15:19-20.
- Atlee CB, Sciaroni RH, Heagilivary JH. Varietal spacing trials with Brussels sprouts. *Veg. Crop. Scr. Univ. Calif., Dvairs*. 2000; 136:11.
- Durate O, Velez Fortuno J. Effect of spacing on the behavior of 2 cabbage hybrid El. Salvador. In 24th Annual Congress of the American Society for Horticultural Sciences, Tropical Region. Mayagwe Puerto Rico 2005, 394-409.
- Davey JB. Spacing cabbages to regulate head size old *Agriculture Journal* 1965; 91:104-109.
- Gorski SF, Armstrong DM. The influence of spacing and nitrogen rate on yield and hollow stem in broccoli. *Research Circular, Ohio Agricultural Research and Development Center*. 1985; 288:16-18.
- Lewandowska AM, Skapski H. The effect of variety, spacing and level of nitrogen fertilization on the quantity and quality of broccoli yield. *Biul. Warzywn Hort. Abst.* 1977; 20:99-118 49(1):398.
- Mathur MM, Vashishtha KS. Effect of different spacing cum nitrogen dose on the yield of cauliflower. *Udyanika*. 1976; 2:45-47
- Patil JD, Ranpise SA, Rahman M, Iqbal M, Jilani MS, Waseem K. Effect of different plant spacing on the production of cauliflower (*Brassica oleraceavar. botrytis*). *Pakistan J. of Bio. Sci.*, 2007; 10:4531-4534.
- Sharma RP, Arora PN. Response of mid-season cauliflower to rates and time of nitrogen application and plant density. *Indian J. Agron.* 1984; 29:468-470.
- Whitwell JD, Senior D. Effect of plant spacing of autumn cauliflower on head size, curd yield and quality for processing. *Acta, Hort.* 1988; 220:235-244