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Effect of Spacing and Transplanting Dates on Growth and Yield of Onion (*Allium cepa*. L) var. Agrifound Light Red

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ABSTRACT

A field experiment was conducted at Onion & Garlic Research and Development Centre, National Horticultural Research and Development Foundation, Talaja, Bhavnagar (Gujarat) during Rabi season of 2011-12 for evaluating the effect of spacing and transplanting dates on growth and yield of onion. The experiment was layout in a Factorial Randomized Block Design (FRBD) with three replications and 15 treatment, comprising of 5 levels of transplanting dates (P_1:5thDecember, P_2:15thDecember, P_3:25th December, P_4:5thJanuary and P_5:15thJanuary) and three levels of spacing (S_1: 7.5x15 cm, S_2: 10x15 cm, S_3: 12.5x15 cm).Results revealed that among the different dates of transplanting, early planting P_2 (15thDecember) recorded the highest vegetative growth, marketable yield and total yield. Among the different spacing, S_1 (7.5 x 15 cm) showed a significant effect on marketable yield, total yield and number of bulbs harvested per plot as compared to remaining treatments. Different transplanting dates and spacing indicated significant effect on different characters *viz*; plant height, polar diameter, equatorial diameter and number of leaves per plant but failed to show significant effect on days to maturity, % bolters, % doubles bulb and T.S.S. Onion cv. Agrifound Light Red transplanted on 15thDecember and 7.5 x 15 cm spacing significantly improved the number of bulbs harvested per plot, marketable yield and total yield.

KEYWORD

spacing, planting, varieties, yield

INTRODUCTION

Onion (*Allium cepa* L.) is an important bulbous crop of Alliaceae family believed to have its origin in Asia. Onion is grown throughout the world for its pungency and nutritive value. This crop is grown in India from the ancient time. It is annual for bulb production and biennial for seed production. It is a popular salad crop and also widely used as a cooked vegetable in soups, as a flavouring agent in many dishes. The outstanding characteristics of onion are the pungency which is due to a volatile oil known as "Allyl-propyl-disulphide"(C_6 H_{12} S_2). Because of its importance in cookery, onion is called " queen of the kitchen". India ranks second in area and production and third in export. Maharashtra, Gujarat, Karnataka, Tamil Nadu, Madhya Pradesh, Uttar Pradesh, Andhra Pradesh, BiharandWest Bengal are the major onion growing states in India.

The growth and yield of cultivated crop plants are mainly influenced by two principal factors *viz.*, genetically and cultural or management factor. The first factor deals with various breeding techniques for the improvement in crop varieties. The second factor deals with agronomical practices *viz.*, planting date, spacing, fertilizer, irrigation, cultivation, plant protection, weed control, *etc*. Both factors have been exploited by the various researchers in their respective fields with varied success. However, efforts are still continuing in these directions to gain further higher yields.

Spacing determines the plant density and is generally dependent upon the expected growth of a particular crop plant variety in a given agro-climatic region. Therefore, optimum plant population is one of the most important factors for optimum utilization of solar energy and soil nutrients to increase the yield per hectare of onion crop, where the only single underground bulb is produced per plant. Higher plant population can be achieved by reducing the distance between rows or between plants within the rows. Hence, the use of proper geometry to get the appropriate plant stand is a pre-requisite for higher crop yield per unit area.

Date of planting is one of the important factors, which influences the growth, yield and quality of the crop. Atmospheric temperature, humidity and day length, which affect the yield of onion bulbs. So, planting at different dates to test the suitable dates for good bulb production. Sowing of seeds and transplanting time of seedlings varied from region to region.

MATERIALS AND METHODS

A field experiment was conducted at Onion & Garlic Research and Development Centre, NHRDF, Talaza Bhavnagar (Gujarat). The experimental site lies 21°35' N latitude and 72°05' E longitude at an altitude of 19 m above mean sea level. The area experiences rainfall that stretches from June to September with the main rainy season from second fortnight of June to first fortnight of September. The area receives average annual rainfall is approximately 593 mm. The maximum temperature ranging from 15 to 45°C and average annual temperature is 27.1°C in Bhal and Costal agro climatic Zone. Field experiment was carried out during Rabi season of 2011-12. The Seeds were sown on 15th October, 25th October, 5th November,

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15th November and 25th November. The stocky, healthy, well developed, almost uniform and insect, pest and disease free true to type seedlings of 10 to 15 cm height with 3 to 4 leaves were ready for transplanting after 45 to 50 days onion cultivar of Agrifound Light Red were selected. The transplanting was done with great care on 5th December, 15th December, 25th December, 5th January and 15th January for treatments P1, P2, P3, P4 and P5, respectively and three plant spacing such as 7.5x15 cm, 10x15 cm and 12.5x15 cm, and treatments S1, S2 and S3, respectively, and plot size 2.4 x1 m^2 were used for study. The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replication.

The observation was made on the parameters viz. Plant height (cm), Number of leaves / plant, days to maturity after transplanting, bulb polar diameter (cm), bulb equatorial diameter (cm), doubles bulbs %, bolters bulbs %, marketable yield (t/ha), total yield (t/ha), average weight of marketable bulbs (g), number of bulbs harvested per plot. T.S.S. (%) and Benefit-Cost ratio. All the parameters were collected from five randomly selected plants of each treatment. The data collected for all the characters involved under study were subjected to the statistical analysis for proper interpretation. The treatment differences were tested by employing 'F' test at five percent level of significance. The appropriate standard errors (S.Em.±) were calculated in each case and the Critical Difference (CD) at five per cent level of probability was worked out to compare the two treatment means, where the treatment effects were found significant under 'F' test. The percentage coefficient of variation (CV) was also worked out for all the cases.

RESULT AND DISCUSSION

It is now well-known that the transplanting at proper date and spacing are indispensable components of modern vegetable production practices. Global climate change is expected to affect agricultural and horticultural crops through its direct and indirect effects. The rise in temperature will reduce crop duration, increase respiration rate, alter photosynthetic partitioning to the economic product, alter phonology, particularly flowering, fruiting and reduced chilling accumulation and hasten senescence and maturity. There are ample evidence available in the literature on the use of transplanting dates and spacing. But information on the combined use of transplanting dates and spacing in production of vegetable crops is scanty.

Plant growth attributes like plant height (cm), number of leaves per plant, days to maturity after transplanting, bulb polar diameter (cm), bulb equatorial diameter (cm), doubles bulb percentage and bolters bulb percentage (Table 1, 2 and 3) are the important parameters to assess the vigour of the plant. The results obtained under these growth& bulb attributes were accentuated and significantly influenced by different treatments under the present study.

The plant height was ranging from 53.80 cm to 40.72 cm. The maximum plant height 53.80 cm was recorded with the treatment S_3 P_1 (12.5 x 15 cm and 05thDecember) while, the minimum plant height (40.72 cm) was recorded under the treatment S_1 P_5 (7.5 x 15 cm and 15th January).The values for this character revealed that the first transplanting date P_1 (05th December) recorded the highest plant height (50.24 cm) and was superior to P_2, P_3, P_4 and P_5. Among spacing, S_3 (12.5 x 15 cm) recorded the highest plant height (50.15 cm) and was superior to S_1 and S_2. It was found that the transplanting dates and spacing significantly influenced the plant height but their interaction was found to be non-significant (Mc-Geary, 2012).

The number of leaves was ranging from 7 to 9. The maximum number of leaves (9) was recorded with the treatment S_3 P_1 (12.5 x 15 cm and 05th December) while, the minimum number of leaves (7) was recorded under the treatment S_1 P_5 (7.5 x 15 cm and 15th January). The values for this character revealed that the first transplanting date P_1 (05thDecember) recorded the highest number of leaves (9) and was superior to P2, P3, P4 and P5. Among spacing, S3 recorded the highest number of leaves (7) looking to the statistical analysis it was found that transplanting date and spacing's significantly influenced number of leaves per pants but their interaction was found to be non-significant (Kumar *et al.*, 2013).

Days to maturity ranged from 110.5 to 116.5. Lesser days to maturity (110.5) were taken by the treatment S_1P_1 (7.5 x 15cm and 05thDecember). Maximum days (116.5 days) to maturity were taken by the treatments S_3 P_5 (12.5 x 15 cm and 15thJanuary).The values for this character revealed that the second transplanting date, P_2 (15thDecember) took minimum days (114.5 days) to maturity. While among spacing, S_1 (7.5 x 15 cm) recorded minimum days to maturity (114.0 days).With regard to the mean values, the treatment effect of transplanting dates, spacing and their interactions (transplanting dates x spacing) were found non –significant (Kumar *et al.*, 2013).

Highest bulb polar diameter and bulb equatorial diameter (4.70 cm and 5.65 cm, respectively) were found at S_3 P_1 (12.5 x 15 cm and 05thDecember) treatment. However, bulb polar diameter and bulb equatorial diameter were reduced by delay in planting, which may be due to low temperature at early transplanting dates. Low temperature is favourable for bulb development. The wider spacing provides more area, light and less nutrient competition among plants, which increase bulb polar diameter and bulb equatorial diameter (Bijaya Devi *et al.*, 2008 and Jilani *et al.*, 2010).

Table (1, 2 and 3) indicated that transplanting dates, spacing and their interaction did not gavesignificant effect on the percentage of jointed bulbs in onion bulb crop. The influence of different transplanting dates and spacing treatments on bolting percentage along with statistical inferences have been furnished in Table (3).

The highest marketable yield (346.57 q ha^{-1}), total yield (353.04q ha^{-1}), number of bulbs harvested per ha (65005) were recorded in the treatment S_1 P_1 consisting of the combination of 7.5 x 10 cm spacing and 05thDecember

Table 1. Effect of spacing on growth, yield and quality characters of onion

Spacing	Plant height (cm)	Number of leaves / plant	Days to maturity after transplanting	Bulb polar diameter (cm)	Bulb equatorial diameter (cm)	Doubles bulbs (%)	Bolters bulbs (%)	Marketable yield (q/ha)	Total yield (q/ha)	Average weight of marketable bulbs (g)	Number of bulbs per ha	T.S.S. (%)
S1	43.73	7.89	114.0	3.64	4.13	0.22	2.39	327.65	335.97	68.68	644786	12.95
S2	47.83	8.42	115.6	3.78	4.49	0.23	2.42	279.37	284.58	73.08	427294	12.95
S3	50.15	8.62	115.2	4.31	5.05	0.21	2.55	220.26	224.41	78.43	321804	13.53
S.Em. ±	0.31	0.05	0.79	0.04	0.03	0.002	0.03	2.01	1.85	0.47	2648.73	0.07
C.D. at 5%	0.89	0.13	NS	0.10	0.08	NS	NS	5.82	5.36	1.37	7673	NS

Table 2. Effect of Transplanting date on growth, yield& quality characters of onion

Transplanting date	Plant height (cm)	Number of leaves / plant	Days to maturity after transplan-ting	Bulb polar diameter (cm)	Bulb equatorial diameter (cm)	Doubesl bulbs (%)	Bolters bulbs (%)	Marketable yield (q/ha)	Total yield (q/ha)	Average weight of marketable bulbs (g)	Number of bulbs per ha	TSS (%)
P1	50.24	9.14	114.6	4.70	5.13	0.20	2.46	298.77	305.84	80.43	46814	13.02
P2	49.79	8.19	114.5	4.43	4.74	0.22	2.27	288.82	293.12	76.32	466124	13.39
P3	46.74	8.21	115.5	4.60	4.55	0.22	2.65	269.14	278.62	73.46	46336	13.17
P4	45.10	8.02	115.5	3.96	4.24	0.24	2.46	258.86	262.45	68.55	46316	13.14
P5	44.30	7.99	114.7	3.85	4.13	0.21	2.41	263.21	268.25	68.24	46242	13.00
S.Em. ±	0.51	0.08	1.32	0.06	0.05	0.004	0.05	3.35	3.08	0.79	4414.55	0.11
C.D. at5%	1.49	0.22	NS	0.17	0.14	NS	NS	9.70	8.93	2.28	NS	NS

Table 3. Interaction effects of spacing and transplanting dates on growth, yield & quality characters

Transplanting date	Plant height (cm)	Number of leaves / plant	Days to maturity after transplanting	Bulb polar diameter (cm)	Bulb equatorial diameter (cm)	Doubles bulbs (%)	Bolters bulbs (%)	Marke-table yield (q/ha)	Total yield (q/ha)	Average weight of marketable bulbs (g)	Number of bulbs per ha	T.S.S. (%)
S1P1	46.89	8.85	110.5	4.21	4.69	0.18	2.51	346.57	353.04	73.80	65005	12.57
S1P2	46.54	7.99	115.2	3.97	4.33	0.24	2.33	332.11	343.98	70.39	643762	13.30
S1P3	43.59	7.59	116.2	3.41	4.09	0.22	2.82	323.27	338.08	69.93	64196	13.20
S1P4	41.45	7.60	115.2	3.27	3.87	0.25	2.31	313.63	317.21	65.71	64194	13.10
S1P5	40.72	7.42	113.2	3.37	3.70	0.19	1.96	322.68	327.52	63.58	64612	12.60
S2P1	50.95	9.14	117.2	4.24	5.04	0.21	2.64	309.21	316.53	81.80	43120	12.90
S2P2	49.46	8.35	116.2	3.71	4.75	0.23	2.31	291.73	291.76	75.94	431330	12.67
S2P3	47.19	8.63	114.5	3.83	4.64	0.26	2.30	275.42	281.69	71.71	42630	13.40
S2P4	46.57	8.12	115.8	3.61	4.06	0.23	2.38	257.81	264.30	67.12	42460	12.97
S2P5	45.36	7.86	114.5	3.50	3.94	0.21	2.48	262.70	268.64	68.86	42242	12.83
S3P1	53.80	9.45	116.2	4.70	5.65	0.22	2.23	240.52	247.94	85.68	32257	13.60
S3P2	53.37	8.40	112.2	4.43	5.15	0.19	2.19	242.63	243.63	82.64	323280	14.21
S3P3	49.44	8.34	115.8	4.60	4.92	0.19	2.84	208.73	216.08	78.73	32161	12.90
S3P4	47.29	8.24	115.5	3.96	4.79	0.22	2.68	205.16	205.85	72.82	32273	13.37
S3P5	46.83	8.09	116.5	3.85	4.74	0.22	2.80	204.25	208.58	72.30	31872	13.57
S.Em.±	2.64	0.39	6.88	0.31	0.25	0.02	0.01	17.40	16.01	4.08	22939	0.57
C.D.at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

transplanting date (Kumar *et al.*, 1998; Kumar *et al.*, 2013; Singh and Singh 2013; Jilani *et al.*, 2010). The highest average weight of marketable bulbs (85.68 g) was recorded in the treatment $S_3 P_1$ consisting of the combination of 12.5 x 15 cm spacing and 05thDecember transplanting date (Kumar *et al.*,1998 and Jilani *et al.*, 2010).

Analysis of T.S.S. data indicated that the T.S.S. content of onion bulb was varying from 14.21 to 12.57 percent. Among the treatments, $S_3 P_2$ consisting of 12.5 x 15 cm spacing and 15thDecember transplanting date recorded maximum T.S.S. content (14.21 percent). The minimum T.S.S. content of 12.57 percent was observed in treatment $S_1 P_1$ (7.5 x 15 cm spacing and 05thDecember transplanting date). Scrutiny of the results indicated that the treatment effects were non–significant reported by (Ahlawat and Singh, 2013).

CONCLUSIONS

The results of the study inferred that the combined application of transplanting dates and spacing were favourably influenced plant growth attributes. Based on the trend of yield and economical aspects of onion, it was concluded that for getting higher bulb yield of onion, combined application of 10 x 15 cm spacing and 05th December transplanting date (S2 P2) was necessary. These results, however, need to be further confirmed atmulti-locationon large scale trials before passing as recommendations to the onion growers of Saurashtra Gujarat.

REFERENCES

Ahlawat IPS and Singh H. 2013. A note on the effect of nitrogen levels, spacing and trimming ofseedlings on the yield and quality of onion (*Allumcepa* L.). *India Journal of Agronomy,* **18**(3): 386-388.

Bijaya Devi AK, Lavid AN, Singh G and Prasad A. 2008. Effect of spacing and bulb size on growth and bulb yield of onion. *Bhartiya Krushi Anusandhan Patrika,* **23**(1): 40-44.

Jilani MS, Ahmed P, Waseem and Kiran M. 2010. Effect of plant spacing on growth and yield of two varieties of onion (*Alliumcepa* L.). *Pakistan Journal of Science,* **62**(1): 37-41.

Kumar H, Singh JV, Ajay K, Singh M, Kumar A and Singh M. 1998.The effect of spacing on growth and yield of onion *(Allium cepa* L.) cv. 'Patna Red'.*Indian Journal of Agriculture Research,* **32**(2): 134-138.

Kumar D, Singh PV and Kumar A. 2013. Effect of different levels of spacing on growth and yield of onion (*Alliumcepa* L.). *Agricultural Science Digest,* **21**(2): 139-140.

Mc Geary DJ. 2012. The effect of plant density on the shape, size, uniformity, soluble solid content and yield of onion suitable for pickling. *Journal of Horticultural Sciences,* **60**(1): 83 -87.

Singh AK and Singh V. 2013. Combined effect of set size and planting distance on *kharif* onion bulb. *Indian Journal of Agriculture Research*, **37**(41): 287-290.