

Effect of Spacing and Different Cultivars on Growth and Yield of Onion under Lucknow Conditions (*Allium cepa* L.)

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ABSTRACT

The investigation was undertaken to determine the effect of spacing and cultivars on economic horticultural traits of onion. In trail different spacing was taken 7.5x10cm, 10x10cm, 12.5x10cm and 15x10cm. Three varieties viz. Agrifound Light Red, NHRDF Red-3 and NHRDF L-28 were used for study. The layout of experimental field was laid down in Factorial Randomized Block Design with 3 replications. It is clearly revealed that the significantly widest spacing (15x10cm) produced higher plant height (69.64cm), number of leaves (10.22) and neck diameter (4.44cm) of plant. The bulb length (6.63cm), diameter (6.97cm) and number of scale per bulb (8.00) also the same trend in widest spacing (15x10cm). The weight of individual bulb of onion (49.54g) was increased with the wider spacing (12.5x10cm). On the contrary, yield ha^{-1} was the highest (404.14 $q\ ha^{-1}$) at closer spacing (10x10cm) and the lowest was (362.47 $q\ ha^{-1}$) at wider spacing.

Key words: Onion, Spacing, Cultivars, Growth, Yield.

INTRODUCTION

Onion is a bulbous herbaceous biennial vegetable crop which belongs to family *Alliaceae* and widely grown as with cross-pollinated and monocotyledonous behavior having diploid chromosomes $2n=16^1$. Onion is the most important bulb crop cultivated commercially in most parts of the world. The crop is grown for consumption both in the green states as well as in mature bulbs. It is valued for its bulbs having characteristics odour, flavor, and pungency, which is due to the presence of a volatile oil-allyl-propyl-disulphide. Onion is the richest source of

flavonoids in the human diet and flavonoid consumption has been associated with a reduced risk of cancer, heart disease and diabetes. In addition, it is known for anti bacterial, antiviral, anti-allergenic and anti inflammatory potential. Even though the crop has great contribution both in economic and health issues, its production and productivity is not scaled to the required level. This is because use of appropriate agronomic management practices and improved technology inputs are still not highly used which have undoubted contribution in increasing crop yield potential.

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One of the important measures to be taken in increasing the productivity of onion is determining spacing for each agro-ecology since full package of information is required for each growing region the country to optimize onion productivity⁵.

Proper spacing ensures optimum plant growth through adequate utilization of moisture, light, spacing and nutrients¹⁰. The control of plant spacing is one of the cultural practices to control bulb size, shape and yield³. The higher yield and better control of over or under bulb size bulb size could be obtained if plants are grown at optimum density. Total bulb yield can be increased as population density increase⁶. Several researcher in many countries have shown that varieties and plant spacing had profound effects on the growth and yield of onion^{2,7,8}. Considering the above stated situations, the present study was undertaken to determine the effect of spacing on growth and yield of different cultivars of onion under Lucknow conditions (*allium cepa l.*).

MATERIAL AND METHODS

The experiment was conducted at Horticulture Research Farm-II of Babasaheb Bhimrao Ambedkar University, Vidya Vihar Rae Bareilly Road Lucknow (UP) during November 2015 to April 2016 under subtropical condition. The experiment site lies about 26° 56' N latitude and 80° 52' E longitude at an altitude of 111 m above sea level. The area experiences rainfall that stretches from April to October with the main rainy season from June to early September. The area receives average rainfall between 800-1000 mm with annual and maximum temperature ranging from 15 to 30°C. Three varieties viz. Agrifound Light Red, NHRDF Red-3 and NHRDF L-28 and four plant spacing such as 7.5x10cm, 10x10cm, 12.5x10cm and 15x10cm were used for study. The experiment was laid out in Factorial Randomized Block Design (RBD) and replicated in thrice. The observation was

made on the following parameters plant height (cm), number of leaves per plant, neck diameter (cm), bulb length (cm), bulb diameter (cm), number of scale per bulb, bulb weight (g) and yield of bulbs. All the parameters were collected from five randomly selected plants of each treatment. On set of the Rabi season these healthy bulb uniform shape and size were selected and transplanted well prepared field. Statistical analysis of the data obtained in different set of experiments was calculated following the standard procedure as stated by Panse and Sukhatme⁹.

RESULT AND DISCUSSION

Effect of varieties on growth and yield of onion

The data presented (Table.1) on growth and yield revealed that spacing and varieties showed significant effect in yield and yield attributing traits. Significant effect was found among the varieties for all parameter. Studied Highest yield (431.69 quintal/ha) was obtained from variety of NHRDF Red-3. It is identical to the yield (407.02 quintal/ha) of Agrifound Light Red. The lowest yield (383.66 quintal/ha) was produced by the variety NHRDF L-28. Identical performance was recorded in respect of plant height, number of leaves per plant, neck diameter of plant, bulb diameter, length of bulb, weight of bulb, and number of scale per bulb, yield kg per plot and yield quintal per hectare. No significant variation was found between the varieties Agrifound Light Red, NHRDF Red-3 and NHRDF L-28.

Effect of spacing on growth and yield of onion

The data depicted in (Table. 2) revealed that the significantly effect of different spacing on plant height, number of leaves per plant, neck diameter of plant, bulb diameter, length of bulb, weight of bulb, number of scale per bulb and yield ha⁻¹. Significantly the highest plant height and neck diameter of plant (69.64 cm and 4.41 cm) was observed from the widest

spacing 15x10 cm followed by the spacing 10x10 cm (68.61 cm and 3.67 cm) and the shortest plant height and neck diameter of plant (67.97 cm and 3.43) was observed from the spacing 7.5x10cm. The maximum number of leaves per plant (9.22) obtained from the spacing 15x10 cm followed by the spacing 10x10 cm (9.11) while minimum (8.33) number of leaves per plant was observed from the spacing 7.5x10 cm. The heaviest bulb (49.54 g) was produced from the spacing 15x10 cm followed by the spacing 12.5x10 cm (42.76 g) and the lowest spacing 7.5x10cm (40.38 g). The biggest (6.97 cm diameter and 6.63 cm bulb length) was obtained from the spacing 15x10 cm and followed by the spacing 10x10 cm (5.69 cm diameter and 5.28 cm bulb length) and the lowest by the spacing of 7.5x10 cm (5.43 cm diameter and 5.21 cm bulb length). The maximum (8.00) number of scale per plant was obtained from the spacing 15x10 cm followed by the spacing (7.33) and the minimum (6.29) number of scale per plant was observed from the spacing 7.5x10 cm. However, the closer spacing 10x10 cm produced higher yield (6.65 kg/plot and 443.70 q ha⁻¹) followed by the yield (6.29 kg/plot and 419.51 q ha⁻¹) of spacing 7.5x10 cm. The lowest yield (5.43 kg/plot and 362.47 q ha⁻¹) was obtained from the wider spacing 12.5x10 cm.

Interaction effect of spacing and different cultivars on growth and yield of onion

The interaction effect of spacing and different cultivars had influenced significantly on the parameters (Table 3). Significantly the highest plant height (70.50 cm) was obtained from the variety NHRDF L-28 with spacing 10x10cm. The shortest plant height (66.26 cm) was obtained from the variety Agrifound Light Red with spacing 7.5x10cm. The maximum (10.66) number of leaves per plant was obtained from the variety NHRDF L-28 with spacing 15x10cm followed by variety Agrifound Light Red and NHRDF L-28 with spacing 12.5x10cm and 15x10cm. The minimum

(8.00) number of leaves per plant was obtained from the variety Agrifound Light Red with spacing 7.5x10cm. The thicker plant stem diameter (4.66 cm) was obtained from the variety NHRDF L-28 with spacing 15x10cm. The lowest plant stem diameter (3.00 cm) was recorded from the variety Agrifound Light Red with spacing 7.5x10 cm. This accordance with Zubeldia and Gases¹⁰ obtained proper spacing ensures optimum plant growth through adequate utilization of moisture, light, spacing and nutrients. The biggest bulb diameter (7.06 cm) was recorded from the variety NHRDF Red-3 with 15x10cm followed by the variety Agrifound Light Red with spacing 15x10cm (6.86 cm). The lowest bulb diameter (5.01 cm) was obtained from the variety Agrifound Light Red with 7.5x10cm. The maximum (6.53 cm) length of bulb was recorded from the variety NHRDF Red-3 with spacing 15x10cm followed by variety NHRDF L-28 with 15x10cm cm. The minimum (4.86 cm) bulb length was obtained from the variety Agrifound Light Red with spacing 7.5x10cm. The maximum bulb weight (57.60 g) was obtained from the variety NHRDF L-28 with spacing 12.5x10cm followed by variety NHRDF L-28 with spacing 15x10cm (55.00 g). The minimum bulb weight was obtained from the variety Agrifound Light Red with 7.5x10cm. The number of scale per bulb was not significantly affected by the spacing and different cultivars interaction. The maximum yield (7.34 kg/plot and 489.77 q ha⁻¹) from the variety Agrifound Light Red with spacing 10x10cm followed by the variety 6.88 kg/plot and 458.77 q ha⁻¹). The minimum yield (4.67 kg/plot and 311.44 q ha⁻¹) was recorded from the variety Agrifound Light Red with spacing 12.5x10cm. Bulb size and bulb weight decreased with the decrease in spacing. This result is in agreement with the findings of Gupta and Gaffer⁴ reported yield increased with the plant density up to certain level. Kumar *et al*⁷, obtained the highest yield with a spacing of 15x10 cm.

Table 1: Effect of varieties on growth and yield of onion

Variety	Plant height (cm)	Number of leaves per plant	Neck diameter of plant (cm)	Bulb diameter (cm)	Length of bulb (cm)	Weight of bulb (g)	Number of scale per bulb	Yield (kg/plot)	Yield (q/ha)
Agrifound Light Red	21.63	8.91	3.40	5.52	5.55	32.49	7.33	6.10	407.02
NHRDF Red-3	22.10	9.00	3.95	5.93	5.58	47.06	7.33	6.47	431.69
NHRDF L-28	22.74	9.75	3.99	6.37	5.64	51.50	7.50	5.75	383.66
CD (P=0.05%)	1.59	0.55	0.42	0.27	0.40	4.93	0.63	0.11	7.42
SE (d)	0.66	0.26	0.20	0.13	0.19	2.36	0.30	0.05	3.55
SE (m)	0.46	0.19	0.35	0.16	0.13	1.67	0.21	0.03	2.51

Table 2: Effect of spacing on growth and yield of onion

Spacing (cm)	Plant height (cm)	Number of leaves per plant	Neck diameter of plant (cm)	Bulb diameter (cm)	Length of bulb (cm)	Weight of bulb (g)	Number of scale per bulb	Yield (kg/plot)	Yield (q/ha)
7.5x10cm	67.97	8.33	3.62	5.43	5.21	40.38	7.00	6.29	419.51
10x10cm	68.61	9.11	3.43	5.69	5.28	42.05	7.22	6.65	443.70
12.5x10cm	69.64	9.00	3.67	5.66	5.23	42.76	7.33	5.43	362.47
15x10cm	69.64	9.22	4.41	6.97	6.63	49.54	8.00	6.06	404.41
CD (P=0.05%)	0.79	0.48	0.36	0.24	0.22	4.27	0.63	0.11	6.43
SE (d)	0.37	0.23	0.17	0.11	0.16	2.36	0.30	0.05	3.55
SE (m)	0.26	0.16	0.12	0.08	0.11	1.44	0.21	0.03	2.51

Table 3: Interaction effect of spacing and different cultivars on growth and yield of onion

Variety× Spacing (cm)	Plant height (cm)	Number of leaves per plant	Neck diameter of plant (cm)	Bulb diameter (cm)	Length of bulb (cm)	Weight of bulb (g)	Number of scale per bulb	Yield (kg/plot)	Yield (q/ha)
Agrifound Light Red (7.5x10cm)	66.26	8.00	3.00	5.01	4.86	33.22	7.00	6.59	439.55
Agrifound Light Red (10x10cm)	68.00	8.66	3.23	5.05	5.40	36.00	7.00	7.34	489.77
Agrifound Light Red (12.5x10cm)	69.50	8.66	3.00	5.16	5.08	22.56	7.33	4.67	311.44
Agrifound Light Red (15x10cm)	69.50	10.33	4.40	6.86	6.86	38.20	8.00	5.81	387.33
NHRDF Red-3 (7.5x10cm)	68.50	8.33	4.23	5.49	5.40	44.33	7.00	6.88	458.77
NHRDF Red-3 (10x10cm)	67.33	9.66	3.36	5.48	5.36	40.36	7.33	6.47	431.77
NHRDF Red-3 (12.5x10cm)	69.33	8.33	4.06	5.68	5.03	48.13	7.33	5.83	388.88
NHRDF Red-3 (15x10cm)	69.33	9.66	4.16	7.06	6.53	55.43	7.66	6.71	447.33
NHRDF L-28 (7.5x10cm)	69.16	8.66	3.63	5.80	5.38	43.63	7.00	5.40	360.22
NHRDF L-28 (10x10cm)	70.50	9.33	3.70	6.52	5.10	49.80	7.33	6.14	409.55
NHRDF L-28 (12.5x10cm)	70.10	10.33	3.96	6.14	5.59	57.60	7.33	5.80	387.11
NHRDF L-28 (15x10cm)	70.10	10.66	4.66	7.00	6.51	55.00	8.33	5.66	377.77
CD (P=0.05%)	1.58	0.96	0.72	0.48	0.64	8.54	N/A	0.19	12.86
SE (d)	0.75	0.46	0.35	0.23	0.33	4.09	0.52	0.09	6.16
SE (m)	0.53	0.32	0.24	0.16	0.23	2.89	0.37	0.06	4.35

CONCLUSION

Our study was concerted to the combined application of different spacing and varieties favorably influenced plant growth attributes. Results clearly emphasized the importance of spacing as well as selection of varieties of onion, as the conjoint use of them yielded

higher and gave a remunerative return. Based on the trend of yield and economical aspects of onion observed in the present study; it was concluded that for getting higher bulb yield of onion, combined application of 10x10 cm spacing with var. Agrifound Light Red, was best under Lucknow condition by 7.5x10 cm

spacing with var. NHRDF Red-2 and 15x10 cm spacing with var. NHRDF Red-2.

These results however need to be further confirmed on multi locations large scale trials before passing as recommendations to the onion growers of Lucknow.

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