



# Effects of planting geometry and cultivars on growth tuber yield of onion (*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. NHRDF Red-3, NHRDF Red-2 and Agrifound Light Red 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 (70.65cm), number of leaves (9.45) and neck diameter (4.48cm) of plant. The bulb length (6.78cm), diameter (7.20 cm) and number of scale per bulb (8.50) also the same trend in widest spacing (15x10cm). The weight of individual bulb of onion (50.56g) was increased with the wider spacing (12.5x10cm). On the contrary, yield ha<sup>-1</sup> was the highest (406.45 q ha<sup>-1</sup>) at closer spacing (10x10cm) and the lowest was (365.50 q ha<sup>-1</sup>) at wider spacing.

**Keywords :** Onion, Spacing, Cultivars, Growth, Yield

### ARTICLE INFO

Received on : 17/11/2017  
Accepted on : 16/02/2018  
Published online : 27/02/2018

## 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. 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 antibacterial, 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. 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 productivity (Hafiz *et al.*, 2015).

Proper spacing ensures optimum plant growth through adequate utilization of moisture, light, spacing and nutrients (Nooprom *et al.*, 2013) and (Saikia *et al.*, 2010). The control of plant spacing is one of the cultural practices to control bulb size, shape and yield (Geremew *et al.*, 2010).

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 increase (Hossain *et al.*, 2011). Several researchers in many countries have shown that varieties and plant spacing had profound effects on the growth and yield of onion (Chaudhari *et al.*, 2015), (Karistsapol *et al.*, 2013) and (Kumar *et al.*, 2013). 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 Indore conditions.

## MATERIAL AND METHODS

The experiment was conducted farmer field at Sanwer near by NHRDF Indore (M.P.). The experiment sitelies about 220 45 N latitude and 750 52 E longitude at an altitude of 550 m above sea level. The area experiences rainfall that stretches from June to October with the main rainy season from second fortnight of June to first fortnight of September. The area receives average rainfall between 1370-2150 mm with annual and maximum temperature ranging from 17 to 40°C during November to April for two seasons under Malwa plateau agro climatic zone. Field experiment was carried out during two sessions. Crop occupies field during November to April. Three varieties viz. NHRDF Red-3, NHRDF Red-2 and Agrifound Light Red and four plant spacing such as 7.5x10cm, 10x10cm, 12.5x10cm and 15x10cm and plot size 1x1.5 meter were used for study.

The experiment was laid out in Factorial Randomized Block Design (RBD) and replicated in three. 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. Onset 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

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was calculated following the standard procedure as stated by Lavanya *et al.*, 2014.

## RESULT SAND DISCUSSIONS

### 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 (441.70 quintal/ha) was obtained from variety of NHRDF Red-

2. It is identical to the yield (408.05 quintal/ha) of NHRDF Red-3. The lowest yield (388.76 quintal/ha) was produced by the variety Agrifound Light Red. 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 NHRDF Red-3, NHRDF-2 and Agrifound Light Red.

**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)
NHRDF Red-3	22.10	9.00	3.50	5.83	5.65	33.49	7.53	6.35	408.05
NHRDF Red-2	23.20	9.35	3.99	6.13	5.68	48.06	7.53	6.72	441.70
Agrifound Light Red	23.84	10.10	4.10	6.57	5.74	52.50	7.80	6.10	388.76
CD (P=0.05%)	1.61	0.56	0.43	0.29	0.41	4.92	0.65	0.12	8.42
SE (d)	0.65	0.26	0.20	0.13	0.19	2.36	0.30	0.05	3.55
SE (m)	0.45	0.19	0.35	0.16	0.13	1.67	0.21	0.03	2.51

### 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 (70.65 cm and 4.48 cm) was observed from the widest spacing 15x10 cm followed by the spacing 10x10 cm (69.71 cm and 3.74 cm) and the shortest plant height and neck diameter of plant (68.98 cm and 3.50) was observed from the spacing 7.5x10cm.

The maximum number of leaves per plant (9.45) obtained from the spacing 15x10 cm followed by the spacing 10x10 cm (9.28) while minimum (8.50) number of leaves per plant was observed from the spacing 7.5x10 cm. The heaviest bulb (50.56

g) was produced from the spacing 15x10 cm followed by the spacing 12.5x10 cm (43.86 g) and the lowest spacing 7.5x10cm (41.38 g). The biggest (7.20 cm diameter and 6.78 cm bulb length) was obtained from the spacing 15x10 cm and followed by the spacing 10x10 cm (5.89 cm diameter and 5.40 cm bulb length) and the lowest by the spacing of 7.5x10 cm (5.63 cm diameter and 5.25 cm bulb length). The maximum (8.50) number of scale per plant was obtained from the spacing 15x10 cm followed by the spacing (7.83) and the minimum (7.50) number of scale per plant was observed from the spacing 7.5x10 cm. However, the closer spacing 10x10 cm produced higher yield (7.10 kg/plot and 445.65 q ha-1) followed by the yield (6.73 kg/plot and 420.51 q ha-1) of spacing 7.5x10 cm. The lowest yield (5.83 kg/plot and 365.50 q ha-1) was obtained from the wider spacing 12.5x10 cm.

**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	68.98	8.50	3.70	5.63	5.25	41.38	7.50	6.73	420.51
10x10cm	69.71	9.28	3.50	5.89	5.40	43.10	7.72	7.10	445.65
12.5x10cm	70.65	9.22	3.74	5.86	5.30	43.86	7.83	5.83	365.50
15x10cm	70.65	9.45	4.48	7.20	6.78	50.56	8.50	6.66	406.45
CD (P=0.05%)	0.80	0.49	0.38	0.25	0.23	4.28	0.65	0.12	6.73
SE (d)	0.37	0.23	0.17	0.11	0.16	2.36	0.30	0.05	3.56
SE (m)	0.26	0.16	0.12	0.08	0.11	1.44	0.21	0.03	2.51

### 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 (71.50 cm) was obtained from the variety Agrifound Light Red with spacing 10x10cm. The shortest plant height (67.30 cm) was obtained from the

variety NHRDF Red-3 with spacing 7.5x10cm. The maximum (11.00) number of leaves per plant was obtained from the variety Agrifound Light Red with spacing 15x10cm followed by variety NHRDF Red-3 and Agrifound Light Red with spacing 12.5x10cm and 15x10cm. The minimum (8.10) number of leaves per plant was obtained from the variety NHRDF Red-3 with spacing 7.5x10cm. The thicker plant stem

diameter (4.76 cm) was obtained from the variety Agrifound Light Red with spacing 15x10cm. The lowest plant stem diameter (3.10 cm) was recorded from the variety NHRDF Red-3 with spacing 7.5x10 cm (Nooprom *et al.*, 2013). obtained proper spacing ensures optimum plant growth through adequate utilization of moisture, light, spacing and nutrients. The biggest bulb diameter (7.16 cm) was recorded from the variety NHRDF Red-2 with 15x10cm followed by the variety NHRDF Red-3 with spacing 15x10cm (6.96 cm). The lowest bulb diameter (5.11 cm) was obtained from the variety NHRDF Red-3 with 7.5x10cm. The maximum (6.63 cm) length of bulb was recorded from the variety NHRDF Red-2 with spacing 15x10cm followed by variety Agrifound Light Red with 15x10cm cm.

The minimum (4.96 cm) bulb length was obtained from the variety NHRDF Red-3 with spacing 7.5x10cm. The maximum

bulb weight (58.60 g) was obtained from the variety Agrifound Light Red with spacing 12.5x10cm followed by variety Agrifound Light Red with spacing 15x10cm (56.00 g). The minimum bulb weight was obtained from the variety NHRDF Red-3 with 7.5x10cm. The number of scale per bulb was not significantly affected by the spacing and different cultivars interaction.

The maximum yield (8.34 kg/plot and 494.78 q ha<sup>-1</sup>) from the variety NHRDF Red-3 with spacing 10x10cm followed by the variety 7.88 kg/plot and 463.80 q ha<sup>-1</sup>). The minimum yield (5.67 kg/plot and 316.50 q ha<sup>-1</sup>) was recorded from the variety NHRDF Red-3 with spacing 12.5x10cm. Bulb size and bulb weight decreased with the decrease in spacing. This result is in agreement with the findings of Sermenli *et al.*, 2011. Kumar *et al.* (2013) also reported yield increased with spacing of 15x10 cm.

**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)
NHRDF Red-3 (7.5x10cm)	67.30	8.10	3.10	5.11	4.96	34.22	7.15	7.59	444.65
NHRDF Red-3 (10x10cm)	69.10	8.78	3.33	5.16	5.50	37.00	7.15	8.34	494.78
NHRDF Red-3 (12.5x10cm)	70.50	8.78	3.10	5.26	5.18	23.56	7.48	5.67	316.50
NHRDF Red-3 (15x10cm)	70.50	10.83	4.50	6.96	6.96	39.20	8.15	6.81	392.40
NHRDF Red-2 (7.5x10cm)	69.50	8.83	4.33	5.59	5.50	45.33	7.15	7.88	463.80
NHRDF Red-2 (10x10cm)	68.35	10.00	3.46	5.58	5.46	41.36	7.48	7.47	436.80
NHRDF Red-2 (12.5x10cm)	70.35	8.83	4.16	5.78	5.13	49.13	7.48	6.86	393.88
NHRDF Red-2 (15x10cm)	70.35	10.00	4.26	7.16	6.63	56.43	7.81	7.75	452.40
Agrifound Light Red (7.5x10cm)	70.17	8.78	3.73	5.90	5.48	44.63	7.15	6.40	365.25
Agrifound Light Red (10x10cm)	71.50	9.83	3.80	6.62	5.20	50.80	7.48	7.24	414.65
Agrifound Light Red (12.5x10cm)	71.50	10.83	4.06	6.24	5.69	58.60	7.48	6.81	392.21
Agrifound Light Red (15x10cm)	71.50	11.00	4.76	7.15	6.61	56.00	8.48	6.68	382.80
CD (P=0.05%)	1.60	0.98	0.73	0.49	0.64	8.64	N/A	0.20	12.88
SE (d)	0.74	0.45	0.35	0.23	0.33	4.09	0.53	0.09	6.15
SE (m)	0.53	0.32	0.24	0.16	0.23	2.89	0.37	0.06	4.34

### 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. NHRDF Red-3 was best under Malwa region/condition by 7.5x10 cm spacing with var. NHRDF Red-2 and 15x10 cm spacing with var. Agrifound Light Red. These results however need to be further confirmed on multi locations large scale trials before passing as recommendations to the onion growers of Indore/ Malwa region.

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**Citation:**

Singh HM and Singh SK. 2018. Effects of planting geometry and cultivars on growth tuber yield of onion (*Allium cepa* L.). *Journal of AgriSearch* **5** (1): 40-43