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Influence of different spacing and cultivars on yield components and biochemical parameters of onion (*Allium cepa L.*)

Saurabh Kishor, R. B. Ram, M.L. Meena*, Sachin Kishor, D. C. Meena and Anil Kumar

Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Vidya Vihar Rae Bareli Road Lucknow (UP), India

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 7.5 × 10 cm, 10 × 10 cm, 12.5 × 10 cm and 15 × 10 cm. 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 contrary, yield ha^{-1} was the highest (404.14 q ha^{-1}) at closer spacing (10 × 10 cm) and the lowest was (362.47 q ha^{-1}) at wider spacing 15 × 10 cm. The weight of individual bulb of onion (49.54 g) was increased with the wider spacing (12.5 × 10 cm). The bulb length (6.63 cm), diameter (6.97 cm) and number of scale per bulb (8.00) also the same trend in widest spacing (15 × 10 cm). The interaction of spacing and different cultivars had influenced significantly on total soluble solids and ascorbic acid of onion bulb. Significant effect was found among the varieties for total soluble solids, ascorbic acid, reducing sugar. Studied highest total soluble solids (13.960Brix), ascorbic acid (10.03), reducing sugar (8.50), non reducing (9.70%) and total sugars (17.70%) respectively.

KEY WORDS: ONION, SPACING, CULTIVARS, GROWTH AND YIELD

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**Corresponding Author: drmeena1997@gmail.com*
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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 (Bassett, 1986). 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, (Kantona *et al.,* 2003 and Habtamu *et al.,* 2016 and Kishor *et al.,* 2017).

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. 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 (Gupta, et al., 1994). Proper spacing ensures optimum plant growth through adequate utilization of moisture, light, spacing and nutrients (Zubeldia and Gases, 1977). 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 (Kantona et al., 2003 and Habtamu et al., 2016 and Kishor et al., 2017).

Several researchers in many countries have shown that varieties and plant spacing had profound effects on the growth and yield of onion (Pandey *et al.,* 1991; Bhonden *et al.,* 1995 and Kumar *et al.,* 1998, Kishor *et al.,* 2017). 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 Bareli Road Lucknow (UP) during November 2015 to April 2016 under subtropical condition. The experiment site lies about 260 56 N latitude and 800 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 300C. Three varieties viz. Agrifound Light Red, NHRDF Red-3 and NHRDF L-28 and four plant spacing such as 7.5 × 10 cm, 10 × 10 cm, 12.5 × 10 cm and 15 × 10 cm were used for study. The experiment was laid out in Factorial Randomized Block Design (RBD) and replicated in thrice. Standard analytical methods were followed for recording various parameters. The observation was made on the following parameters yield kg/plot, yield kg/ha, weight of bulb, bulb length (cm), bulb diameter (cm), number of scale per bulb, total soluble solids (0Brix) was measured with the help of an Erma hand refractometer and were corrected using standard reference table and express in terms of (0Brix) at 200, ascorbic acid (mg/100g) Ascorbic acid content was determined by diluting the known volume of juice with 3% meta-phosphoric acid and titrating with 2,6- dichlorophenol-indo-phenol solution, reducing sugar (%), non reducing sugar (%) and total sugars (%) were determined by titrating the sample against Fehlings solution using methylene blue as an indicator. 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 Sukhatme, 1989).

RESULT AND DISCUSSION

YIELD COMPONENTS

The results obtained during the investigation in respect to yield components parameters viz., yield kg/plot, yield kg/ha, weight of bulb, bulb length (cm), bulb diameter (cm), number of scale per bulb, total soluble solids (^{0}Brix), ascorbic acid (mg/100g), reducing sugar (%), non reducing sugar (%) and total sugars (%) Table 1. The interaction effect of spacing and different cultivars had influenced significantly on the parameters. The maximum yield (7.34 kg/plot and 489.77 q ha^{-1}) was recorded from the variety Agrifound Light Red with spacing 10 × 10 cm followed by the variety NHRDF Red-3 (6.88 kg/plot and 458.77 q ha^{-1}) with spacing 7.5 × 10 cm. The minimum yield (4.67 kg/plot and 311.44 q ha^{-1}) was recorded from the variety Agrifound Light Red with spacing 12.5 × 10 cm. While the heaviest bulb (57.60 g) was recorded from

the variety NHRDF L-28 with spacing 12.5 × 10 cm followed by variety NHRDF L-28 with spacing 15 × 10 cm (55.00 g) and lightest bulb was obtained from the variety Agrifound Light Red with 7.5 × 10 cm. While the biggest bulb diameter (7.06 cm) was recorded from the variety NHRDF Red-3 with 15 × 10 cm followed by the variety Agrifound Light Red with spacing 15 × 10 cm (6.86 cm).

The lowest bulb diameter (5.01 cm) was recorded from the variety Agrifound Light Red with 7.5 × 10 cm. While the length of bulb and number of scale per bulb was not significantly influenced by the different spacing and cultivars. However, the highest length of bulb (6.86 cm) was recorded from the variety Agrifound Light Red with spacing 15 × 10 cm followed by variety NHRDF Red-3 with 15x10cm cm (6.53 cm) and the lowest bulb length (4.86 cm) was recorded from the variety Agrifound Light Red with spacing 7.5 × 10 cm. Thus, the number of scale per bulb (8.33) was increased from the variety NHRDF L-28 with spacing 15 × 10 cm followed by variety Agrifound Light Red with spacing 15 × 10 cm (8.00). This is due to proper spacing ensures optimum growth and weight of bulb through adequate utilization of moisture, light, spacing and nutrients (Zubeldia and Gases, 1977 Habtamu et al., 2016). These results are conformity with (Kumar *et al.,* 1998), the highest yield with a spacing of 15 × 10 cm, (Kantona *et al.,* 2003) and (Khan *et al., 2003*) total bulb yield can be increased as population density increase and (Gupta and Gaffer, 1980) bulb size and bulb weight decreased with the decrease in spacing (Kishor *et al.,* 2017).

Table 1 indicated that interaction of spacing and different cultivars had influenced significantly on total soluble solids and ascorbic acid of onion bulb. The maximum total soluble solids (13.96^{0}Brix) were obtained from variety NHRDF Red-3 with spacing 10 × 10 cm followed by variety NHRDF L-28 with spacing 7.5 × 10 cm (13.50^{0}Brix) and minimum (10.66^{0}Brix) was recorded from variety Agrifound Light Red with spacing 7.5 × 10 cm. While ascorbic acid (9.93 mg/100g) was increased from variety NHRDF RED-3 with spacing 15 × 10 cm followed by variety NHRDF RED-3 with spacing 12.5 × 10 cm (9.20 mg/100g) and minimum (7.43 mg/100g) amount of ascorbic acid was recorded from variety Agrifound Light Red with spacing 7.5 × 10 cm.

Thus reducing sugar, non reducing sugar and total sugars were not significantly influenced by the different spacing and cultivars interaction. However, the maximum reducing sugar (8.50%) was recorded from variety NHRDF L-28 with spacing 15 × 10 cm followed by variety NHRDF Red-3 with spacing 15 × 10 cm (8.23%) and minimum (5.50%) was recorded from variety Agrifound Light Red with spacing 7.5 × 10 cm. While maximum non reducing (9.70%) and total sugars (17.70%) were recorded from variety Agrifound Light Red with spacing 15 × 10 cm followed by spacing 7.5 × 10 cm and 15 × 10 cm with variety

Table 1. Influence of different spacing and cultivars on yield components and biochemical parameters f Onion

Varieties	Spacing	Yield (kg/plot)	Yield (q/ha)	Weight of bulb (g)	Bulb diameter (cm)	Length of bulb (cm)	Number of scale per bulb	Total soluble solids (^{0}Brix)	Ascorbic acid (mg/100g)	Reducing sugar (%)	Non reducing sugar (%)	Total sugars (%)
Agrifoun Light Red	(7.5x10cm)	6.59	439.55	33.22	5.01	4.86	7.00	10.66	7.43	5.50	8.47	13.97
Agrifoun Light Red	(10x10cm)	7.34	489.77	36.00	5.05	5.40	7.00	10.76	8.60	6.63	8.37	15.00
Agrifoun Light Red	(12.5x10cm)	4.67	311.44	22.56	5.16	5.08	7.33	12.33	8.90	6.27	8.67	14.93
Agrifoun Light Red	(15x10cm)	5.81	387.33	38.20	6.86	6.86	8.00	12.53	8.83	7.93	9.77	17.70
NHRDF Red-3	(7.5x10cm)	6.88	458.77	44.33	5.49	5.40	7.00	12.50	8.83	7.73	8.83	16.57
NHRDF Red-3	(10x10cm)	6.47	431.77	40.36	5.48	5.36	7.33	13.96	8.43	7.37	8.67	16.03
NHRDF Red-3	(12.5x10cm)	5.83	388.88	48.13	5.68	5.03	7.33	12.76	9.20	7.83	8.57	16.40
NHRDF Red-3	(15x10cm)	6.71	447.33	55.43	7.06	6.53	7.66	12.06	9.93	8.23	8.67	16.90
NHRDF L-28	(7.5x10cm)	5.40	360.22	43.63	5.80	5.38	7.00	13.50	9.13	7.13	9.60	16.73
NHRDF L-28	(10x10cm)	6.14	409.55	49.80	6.52	5.10	7.33	13.23	8.40	7.60	9.00	16.60
NHRDF L-28	(12.5x10cm)	5.80	387.11	57.60	6.14	5.59	7.33	12.26	8.76	7.63	9.07	16.70
NHRDF L-28	(15x10cm)	5.66	377.77	55.00	7.00	6.51	8.33	11.86	10.03	8.50	8.97	17.47
	CD (P=0.05)	0.19	12.86	8.54	0.48	N/S	N/S	0.80	0.82	N/S	N/S	N/S
	SE(m)±	0.06	4.35	2.89	0.16	0.23	0.37	0.27	0.27	0.56	0.38	0.67

NHRDF L-28. This result is in agreement with the findings of (Gupta and Gaffer 1980), (Khan *et al.,* 2003) in onion and (Kumar *et al.,* 1998) obtained the better quality with spacing of 15x10 cm in onion.

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 10 × 10 cm spacing with var. Agrifound Light Red, was best under Lucknow conditions by 7.5 × 10 cm spacing with var. NHRDF Red-2 and 15 × 10 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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