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Effect of Levels of Spacing and Varieties on Growth of Onion (*Allium cepa* L)

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A B S T R A C T

The present investigations entitled "Effect of levels of spacing and varieties on growth of onion (*Allium cepa* L)" were carried out at the Horticulture Research Farm-2, Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University, Lucknow (Uttar Pradesh) during the rabi season of November 2018 to April 2019. Three different spacing [15×10 cm(S_1), 15×15cm (S_2) and 15×20cm(S_3)] and three varieties [NHRDF-2(V_1), Agrifound Dark Red (V_2) and Agrifound Light Red (V_3)] was taken for study. The layout of experimental field was laid down in Factorial Randomized Block Design with three replications and nine different treatment combination viz. T_1 (S_1 V_1), T_2 (S_2 V_1),T_3(S_3 V_1), T_4(S_1 V_2), T_5(S_2 V_2), T_6(S_3 V_2), T_7(S_1 V_3), T_8(S_2 V_3) and T_9(S_3 V_3). The growth characters like plant height (cm), number of leaves per plant and neck diameter (cm) are recorded periodically on 30, 60, 90 and 120days after transplanting. The study shows that the combined application of 15×15cm (S_2) spacing with variety Agrifound Dark Red(V_2) was best under Lucknow condition followed by 15×10 cm(S_1) spacing with variety NHRDF-2(V_1) and 15×20cm(S_3) spacing with variety Agrifound Light Red (V_3).

Introduction

Onion (*Allium cepa* L.) is regarded as queen of the kitchen (Selvaraj, 1976) belongs to family Alliaceae and widely grown as herbaceous biennial vegetable crop with cross pollinated and monocotyledonous behavior having diploid chromosomes 2n=16 (Bassett, 1986). The onions are grouped into short-days and long days depending on the day length requirements. A relative high temperature and long photoperiod are required for bulb formation and for seed production; temperature is of immense importance than day length (Baloch, 1994). Onion is used in many homes almost daily for a wide variety of

dishes.It can be eaten raw or cooked. Mild flavour or colorful onion bulb i.e. Early Grano & Udaipur- 101is used for salad purpose and also used in processed form like flakes powder for making pickles, etc. (Bhachandani *et al.*, 1980). Onion is one of the largest vegetable produced and consumed not only in India but also in the world. Although, it is classified as vegetable, it has special qualities, which add to taste and flavour to food and hence, it is mainly used in Indian cuisine and culinary preparation. Onion is consumed by all the classes of people. Onion possesses very good nutritive and medicinal values. The nutritive values of onion are as follows (quantity per 100g). Water 86.60 g, carbohydrates 11.00 g, protein 1.20 g, fats 0.10 g, minerals 0.40 g, calcium 0.18 g, phosphorus 0.05 g, iron 0.07 g, vitamin B_1 120 mg, vitamin C 11 mg, nicotinic acid 0.4 mg, riboflavin 10 mg and calorific value 51 g. Onion is used for treating digestion problems including loss of appetite, upset stomach, and gall bladder disorder; for treating heart and blood vessel problems including chest pain (angina) and high blood pressure; and for preventing "hardening of the arteries" (Singh *et al.*, 2001). It is also used for treating sore throat, whooping cough, bronchitis, asthma, dehydration, intestinal gas, parasitic worms and diabetes. Onion is applied directly to the skin for insect bites, wounds, light burns, boils, warts and bruises. The growth and yield of cultivated crop plants are mainly influenced by two principal factor 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 the agronomical practices i.e. spacing, planting date, fertilizers, irrigation, cultivation, plant protection, weed control etc. Bulb size depends on variety and growing conditions. If a large bulb is desired, choose a variety which is capable of producing a large bulb, and develop a large vigorous plant before bulb formation. Higher plant population can be achieved by reducing the distance between two rows or between two plants within the row. Hence, the use of proper geometry to get appropriate plant stand is a pre-requisite for higher crop yield per unit area.

Materials and Methods

A field experiment entitled "Effect of levels of spacing and varieties on growth of onion (*Allium cepa* L)."was conducted during the rabi season of November 2018 to April 2019 were carried out at the Horticulture Research Farm-2, Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University, Lucknow (Uttar Pradesh). The experimental field is geographically, situated at an elevation of 111 meter above mean sea level in the sub tropical climate of central Uttar Pradesh at 26^0 56' North latitude and 80^0 52' East longitude. The climate ranges from 22^0 C to 45^0 C in summer, minimum temperature ranging from 3.5^0 C to 15^0 C in winter and relative humidity ranges from 60-80%. It required sandy loam to clay soil of the experimental site was acidic having a pH6.1 which is suitable for onion production. In trial three different spacing [15×10 cm(S_1), 15×15cm(S_2) and 15×20cm(S_3)] and three varieties [NHRDF-2(V_1), Agrifound Dark Red(V_2) and Agrifound Light Red (V_3)] was taken for study the layout of experimental field was laid down in Factorial Randomized Block Design with three replications and 9^{th} different treatment combination viz. T_1 (S_1 V_1), T_2 (S_2 V_1),T_3(S_3 V_1), T_4(S_1 V_2), T_5(S_2 V_2), T_6(S_3 V_2), T_7(S_1 V_3), T_8(S_2 V_3) and T_9(S_3 V_3).

The growth characters like plant height (cm), Number of leaves per plant and neck diameter (cm) are recorded to be periodically (30, 60, 90 and 120days). Statistical analysis of data obtained in different set of experiments was calculated following the standard procedure as state by Panse and Sukhatme.

Results and Discussion

Perusal of data on various "Effect of levels of spacing and varieties on growth of onion (*Allium cepa* L)" presented in Table -1. The growth parameter, were recorded periodically like plant height (cm), number of leaves and neck diameter (cm). The recorded data revealed that there was significant effect of plant spacing on growth parameter. The interaction data on combined effect should be indicate that plant spacing was found significant effect of plant height, number of leaves and neck thickness were recorded during study.

Plant height is considered to be an important factor to judge the vigor in onion. The Vegetative growth is an essential prerequisite for higher yield. The combination application of different spacing and varieties influenced plant height and recorded the favorable values at 30 days plant height were no-significantly affected by spacing and varieties. The maximum plant height at 60 days was 46.53 cm was under treatment T_5 (S_2V_2) spacing (15x15) cm and variety Agrifound Dark Red), while, the minimum plant height (40.75 cm)Was recorded under treatment (T_1) S_1V_1 (NHRDF Red-2). Different spacing S_2 (15x 15 cm) recorded the height plant height (42.50 cm)and was superior to S_1 and S_3. The maximum plant height at 90days (72.69cm) was recorded with treatment S_2V_2 (15x15 cm and variey Agrifound Dark Red) while, the minimum plant height (56.65cm) was recorded under treatment S_1V_1(NHRDF Red-2). The maximum plant height at 120 days (68.01cm) was recorded with treatment S_2V_2 (15x15 cm and variety Agrifound Dark Red), while the minimum plant height (58.36cm) was recorded under treatment S_1V_1, (NHRDF Red-2). The present findings explain that the proper spacing provides favorable environment for growing. Among variety Agrifound Dark Red performs well at wider spacing of 15x15 cm and recorded the highest plant height (72.69cm) and was superior to V_1 and V_3 This is due to wider spacing of plant, which help to utilize more water, nutrition, air and light for better growth those of Srivastava *et al.,* (1992) found that the highest plant height (127.87 cm) and number of primary branches per plant (9.73) were registered with 60 x 60 cm spacing in radish this finding is also supported by Rajas *et al.,* (1993) reported that onion Cv. PusaRed gave highest yield (28.11 t/ha) with plant spacing 10 x 15 cm as compared to other plant spacing (15 x 15 cm, 20 x 15 cm, respectively).

The maximum number of leaves at 30 days (3.91) was recorded with treatment S_2V_2(15x15 cm spacing with variety Agrifound Dark Red) While, the minimum number of leaves $S_1V_1$with spacing 15x10 cm (2.58) at 60 days number of leaves were non-significantly affected by spacing and varieties. The maximum number of leaves at 90 days (10.83) was recorded with treatment S_2V_2(15x15 cm with variety Agrifound Dark Red)while, the minimum number of leaves $S_1V_1$with spacing 15x10 cm (7.00 cm).

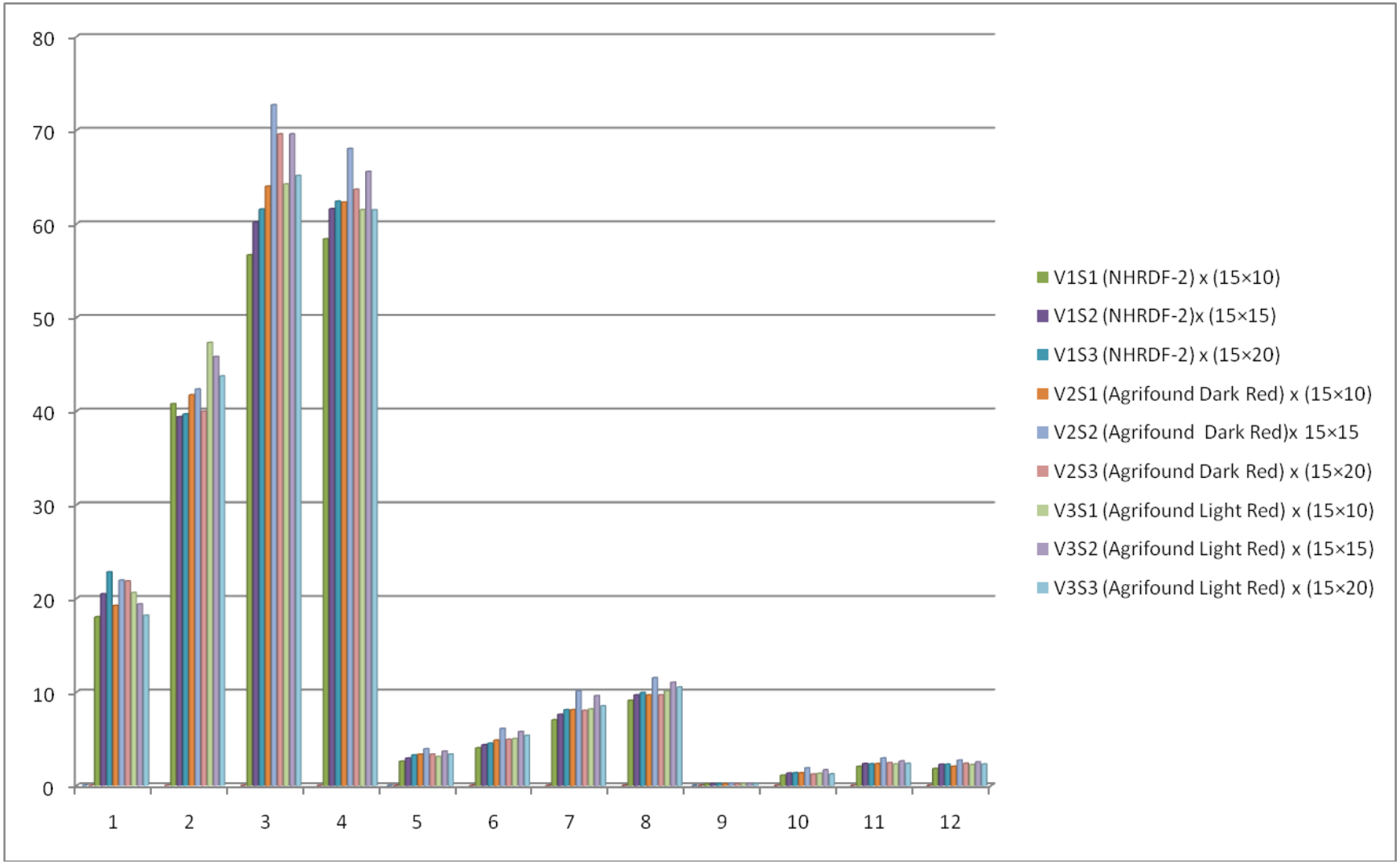
The maximum number of leaves at 120 days (11.50) was recorded with treatment S_2V_2 (15xI5cm spacing with variety Agrifound Dark Red) while, the minimum number of leaves S_1V_1withSpacing 15x10 cm (9.08).

Among spacing S_2 (15x15 cm) recorded the highest number of leaves (10.83) and was superior S_1 and S_3.This might be due to wider spacing of plants, which help the individual plant to utilize more soil, water, nutrition, air and light for better growth than those having closer spacing. These results are in conformity with earlier reports Ngullie (2017), Mari *et al.*, (1997) and Rizk (1997) also revealed that lower plant density resulted in higher numbers of leaves per plant Khan *et al.*, (2003), Kumar *et al.*, (2013) (Fig. 1).

Table.1 Effect of levels of spacing and varieties on growth of onion (*Allium cepa* L)

Treatment		Plant height (cm)				Number of leaves/plants				Neck thickness (cm)			
		30DAP	60DAP	90DAP	120DAP	30DAP	60DAP	90DAP	120DAP	30DAP	60DAP	90DAP	120DAP
Effect of varieties													
NHRDF-2	V_1	16.98	39.93	59.45	60.68	2.91	4.27	7.55	9.55	0.17	1.24	2.22	2.11
Agrifound Dark Red	V_2	19.40	41.33	66.56	64.65	3.52	5.27	8.72	10.27	0.19	1.47	2.55	2.36
Agrifound Light Red	V_3	19.10	45.59	66.31	62.83	3.36	5.36	8.75	10.52	0.19	1.39	2.41	2.33
SEm±		**1.52**	**2.31**	**0.86**	**0.63**	**0.03**	**0.08**	**0.15**	**0.13**	**0.04**	**0.05**	**0.04**	**0.04**
CD (P=0.05)		**0.00**	**0.00**	**2.62**	**1.93**	**0.10**	**0.26**	**0.45**	**0.40**	**0.01**	**0.16**	**0.12**	**0.12**
Effect of spacing													
15×10	S_1	17.26	43.25	61.62	60.71	3.00	4.61	7.75	9.61	0.17	1.23	2.20	2.02
15×15	S_2	20.42	42.50	67.48	65.05	3.50	5.38	9.08	10.72	0.21	1.61	2.62	2.48
15×20	S_3	17.80	51.11	63.22	62.50	3.30	4.91	8.19	10.02	0.17	1.26	2.35	2.29
SEm±		**1.52**	**2.31**	**0.86**	**0.63**	**0.03**	**0.08**	**0.15**	**0.13**	**0.04**	**0.05**	**0.04**	**0.04**
CD (P=0.05)		**0.00**	**0.00**	**2.62**	**1.93**	**0.11**	**0.26**	**0.45**	**0.40**	**0.01**	**0.16**	**0.12**	**0.12**
Interaction effect (V×S)													
V_1S_1		**18.00**	**40.75**	**56.65**	**58.36**	**2.58**	**4.00**	**7.00**	**9.08**	**0.14**	**1.08**	**2.02**	**1.81**
V_1S_2		20.46	39.37	60.16	61.58	2.91	4.33	7.58	9.66	0.180	1.30	2.34	2.25
V_1S_3		22.79	39.67	61.54	62.39	3.25	4.50	8.08	9.91	0.193	1.35	2.29	2.26
V_2S_1		19.21	41.71	63.99	62.29	3.33	4.83	8.08	9.66	0.170	1.34	2.32	2.03
V_2S_2		**21.92**	**46.53**	**72.69**	**68.01**	**3.91**	**6.08**	**10.08**	**11.50**	**0.23**	**1.87**	**2.92**	**2.69**
V_2S_3		21.83	39.96	69.57	63.65	3.33	4.91	8.00	9.66	0.183	1.21	2.41	2.35
V_3S_1		20.58	44.29	64.22	61.48	3.08	5.00	8.16	10.08	0.197	1.28	2.28	2.22
V_3S_2		19.37	45.79	69.57	65.56	3.66	5.75	9.58	11.00	0.217	1.67	2.60	2.50
V_3S_3		18.16	43.71	65.13	61.46	3.33	5.33	8.50	10.50	0.177	1.22	2.35	2.27
SEm±		**2.63**	**4.01**	**1.50**	**1.10**	**0.06**	**0.15**	**0.26**	**0.22**	**0.08**	**0.0**	**0.07**	**0.07**
CD (P=0.05)		**0.00**	**0.00**	**4.54**	**3.86**	**0.18**	**0.45**	**0.78**	**0.69**	**0.02**	**0.28**	**0.21**	**0.20**

Fig.1 Effect of levels of spacing and varieties on growth of onion (*Allium cepa* L.)



The maximum neck diameter at 30 days with spacing (15x15 cm) with varietiesS_2V_2 (Agrifound Dark Red) is 0.233 cm was recorded while, the minimum neck diameter0.147 cm with variety NHRDF Red-2 was recorded under treatment S_1V_1. Different spacingS_2 (15x 1S cm) recorded the highest neck diameter (0.233 cm) and was superior to S_1 and S_3.The maximum neck diameter at 60 days are (1.87 cm) with spacing (15x15 cm) and varieties S_2V_2 (Agrifound Dark Red) recorded while, the minimum neck diameter NHRDFRed-2 with 1.08 cm and spacing (15x15 cm) with treatment S_1V_1. Different spacing S_2 (15x15 cm) recorded the highest neck diameter (1.87 cm) and was superior to S_1 and S_3. The maximum neck diameter (2.92 cm) was recorded with treatment S_2V_2 (15x15 cm and variety Agrifound Dark Red) while, the minimum neck diameter NHRDF Red-2 with 2.02cm was recorded under treatment $S_1V_1$and The maximum neck diameter at 120 days with spacing (15x15 cm) and varieties S_2V_2 (Agrifound Dark Red) is 2.69 cm was recorded while, the minimum neck diameter 1.81 cm with variety NHRDF Red-2 was recorded under treatment S_1V_1. The present findings explain that the proper spacing provides favorable environment for growth. Among variety Agrifound Dark Red performs well at wider spacing of 15x15 cm and recorded the highest neck diameter (2.92 cm) was superior to $V_1$and V_3. This is due to wider spacing of plant, which help to utilize more water, nutrition, air and light for better growth similar work results have also obtained by Singh (1972), Mc-Gear y (1985), Muhammad, *et al.,* (1990); Kumar *et al.,* (1998), Singh and Singh (2003).

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 15x15 cm spacing with var. Agrifound Dark Red, was best under Lucknow condition by 15x10 cm spacing with var. NHRDF Red-2 and 15x20 cm spacing with var. Agrifound Light Red. The results however need to be further confirmed on multi-location large scale trials before passing as recommendation to the onion growers of Lucknow.

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