Effect of date of transplanting, method of cultivation and varieties on growth, yield and quality of white onion (*Allium cepa* L)

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ABSTRACT

The study was undertaken to assess the effect of date of transplanting, method of cultivation and different varieties on growth, yield and quality of white onion (*Allium cepa* L). Under growth parameters higher plant height, number of leaves and neck thickness were recorded in the crop sown on 17 Dec in the flat bed in case of Agrifound White and Gujarat White Onion-1 varieties. Days taken to maturity were lower in crop sown late on 1 January in ridge bed in case of Akola Safed. Bolting and purple blotch were lower in case of early sown crop (17 December) in flat bed under variety Agrifound White. The quality and yield parameters like weight of bulb at harvest, marketable yield of bulb per plot and per hectare, total bulb yield per hectare, diameter of bulb, neck thickness after curing and total soluble solids were higher in the crop sown on 17 Dec in flat bed. The varieties Agrifound White and Gujarat White Onion-1 gave better weight of bulb at harvest, marketable yield of bulb per plot and per hectare, total bulb yield per hectare, diameter of bulb, neck thickness after curing and total soluble solids. The unmarketable yield of bulb per plot and per hectare was recorded in the late sown crop on 1 January in the ridge bed in case of variety Agrifound White. Results showed that the better growth, highest yield and superior quality of white onion can be achieved by growing Agrifound White variety on 17th December in flat bed.

Keywords: Transplanting; cultivation; varieties; onion; yield quality

INTRODUCTION

Onion (*Allium cepa* L, Alliaceae) is also designated as 'queen of the kitchen' (Selvaraj 1976). Onion is preferred because of its green leaves and immature and mature bulbs and is either eaten raw or cooked as vegetable. Among onions mild-flavoured are often preferred for salads. The bulbs are indispensable part in several preparations like soups, sauces, condiments, spices, medicines etc. It is used in seasoning of many foods and now a days many value-added products like powder and flakes of onion are also available.

Onion has many uses as folk medicine and recent reports suggest that onion has several neutraceutical properties. It is very good source of different vitamins, minerals, dietary fibres, flavonoids, antioxidants and sulphur-containing compounds. In India two types of varieties are popular viz red and white. Among them red types are preferred for raw consumption at domestic level while in export market and for processing white onion has edge over others. During the last few years the requirement of white onion for flakes and powder processing industries and its export has increased.

Different cultural practices and growing environments are known to influence growth and yield of every crop. There are several methods of planting like flat bed, raised bed, ridge and furrow etc. Kanwar and Akbar (2013) have concluded after comparing the different methods of planting that planting of onion in flat land produced statistically highest net bulb weight, bulb diameter, neck diameter and yield per ha in flat bed condition. Choice of method of planting depends upon several factors like type of soil, time of planting and climatic conditions. Another production factor is

planting date as atmospheric temperature, humidity and day length influence the growth, quality and yield of onion bulbs. Early planting leads to bolting besides reduction in yield and quality whereas late planting gives poor yield. Date of planting of onion varies from region to region. Growth, bulb production and bolting responses of date of planting have been reported by Ahmed et al (2013) in onion crop. As a matter of fact adjustments in transplanting dates is one of the cultural tools of disease and pest management which ultimately turns into satisfactory yields with minimum chemical intervention. Though north Gujarat is a potential belt of onion very little research work has been done on different aspects of yield. Keeping above facts in mind the present investigations were planned and executed to find out the effect of date of transplanting, method of cultivation and varieties on growth, yield and quality of white onion (*A cepa* L).

MATERIAL and METHODS

An experiment was carried out to evaluate the effect of different varieties, method of cultivation and date of transplanting on growth, yield and quality of white onion during 2014-15 at Horticulture Instructional Farm, Department of Horticulture, CP College of Agriculture, SD Agricultural University, Sardarkrushinagar, Gujarat. It represents the north Gujarat Agro-climatic Zone IV. Experiment was laid out in split plot design (SPD), one main treatment factor and two sub-plot treatment factors. The treatments used were date of transplanting D_1 (17 December and D_2 (1st January), sub-plot treatment methods of cultivation M_1 (flat bed) and M_2 (ridge bed) and varieties V_1 (Agrifound White), V_2 (Akola Safed) and V_3 (Gujarat White Onion-1) with three replications. Observations were made on different growth, yield and quality parameters. The data were analyzed as suggested by Panse and Shukhatme (1978).

RESULTS and DISCUSSION

Growth attributes

Data given in Table 1 indicate that higher plant height was recorded in the crop sown on 17 Dec (D_1, 34.99 cm) in the flat beds (M_1, 35.40 cm) in case of Agrifound White (V_1, 34.13 cm) and Gujarat White Onion-1 (V_3, 33.68 cm) varieties (the two varieties being at par) as compared to their respective counterpart treatments at 45 DAT. The trend was same even at 90 DAT wherein D_1, M_1, V_1 and V_3 resulted in plant height of 64.28, 64.26, 63.16 and 60.94 cm respectively. The number of leaves was higher in case of D_1 (6.07), M_1 (6.01), V_1 (5.88) and V_3 (5.78) at 45 DAT and D_1 (8.74), M_1 (8.57), V_1 (8.46) and V_3 (8.45) at 90 DAT. The neck thickness was higher in D_1 (9.04 cm), M_1 (8.99 cm), V_1 (8.84 cm) and V_3 (8.77 cm) at 45 DAT and in D_1 (20.69 cm), M_1 (21.02 cm) and V_1 (20.75 cm) at 90 DAT. Days taken to maturity were lower in case of D_2, M_2 and V_2 (135.36, 136.16 and 135.41 respectively). Bolting and purple blotch were lower in case of D_1 (7.45 and 27.33% respectively), M_1 (6.71 and 25.35% respectively) and V_1 (7.44 and 26.23% respectively). This shows that early sowing of the crop ie on 17 December as compared to 1 January and in flat bed as compared to ridge bed may be preferred for better growth attributes. The Agrifound White variety proved better than the two other varieties tested namely Akola Safed and Gujarat White Onion-1. Abdulsalam and Hamaiel (2004) also recorded same findings in onion. As the onion is a shallow-rooted crop it might have performed better in the flat beds than ridge bed (Kanwar and Akbar 2013). Similar results were obtained by Arian et al (2004). Varietal difference reported due to the genotypic difference was major cause of difference in growth of onion. These findings are in accordance with the findings of Jilani and Ghaffoor (2003).

The development of bolters is a physiological phenomenon which is highly influenced by environmental factors. A slight fluctuation in temperature, time of planting etc may cause its emergence. To some extent it is a genetic character also. In the present study different environmental conditions created by dates, soil conditions created by method of planting and difference in varieties might be responsible for difference in bolting. The results are confirmed by the results of Ahmed and Hassan (1978), Bhamburkar et al (1986) and Gautam et al (2006).

Yield attributes and yield

Data given in Table 2 depict that the quality and yield parameters like weight of bulb at harvest, marketable yield of bulb per plot and per hectare, total bulb yield per hectare, diameter of bulb, neck thickness after curing and total soluble solids were higher in the crop sown on 17 Dec (113.19 g, 17.14 kg, 488.48 q, 491.29 q, 5.28 cm, 4.33 cm and 14.21°B respectively) in flat bed (109.43 g, 17.49 kg, 498.50 q, 500.26 q, 5.13 cm, 4.61 cm and 13.71°B respectively). The varieties Agrifound White and Gujarat White Onion-1 gave better weight of bulb at harvest (108.73 and 107.00 respectively), marketable yield of bulb per plot (17.31

Table 1. Performance of different varieties of white onion (*Allium cepa* L) and effect of date of transplanting and method of cultivation on growth

Treatment	Plant height (cm) at		Number of leaves at		Neck thickness (cm) at		Days taken to maturity	Bolting (%)	Purple blotch (%)
	45 DAT	90 DAT	45 DAT	90 DAT	45 DAT	90 DAT			
D_1 (17 December)	34.99	64.28	6.07	8.74	9.04	20.69	141.64	7.45	27.33
D_2 (1 January)	31.32	57.15	5.41	7.81	7.87	18.56	135.36	9.96	30.21
SEm±	0.59	1.08	0.09	0.15	0.13	0.32	0.70	0.13	0.47
$CD_{0.05}$	3.63	6.58	0.59	0.91	0.82	1.95	4.29	0.81	2.88
CV (%)	7.64	7.56	7.24	7.68	6.82	6.94	2.16	6.48	6.98
M_1 (flat bed)	35.40	64.26	6.01	8.57	8.99	21.02	140.85	6.71	25.35
M_2 (ridge bed)	30.91	57.18	5.46	7.98	7.91	18.23	136.16	10.70	32.19
SEm±	0.55	1.02	0.09	0.14	0.12	0.30	0.62	0.12	0.45
$CD_{0.05}$	2.18	4.01	0.36	0.55	0.50	1.20	2.46	0.50	1.76
CV (%)	7.12	7.15	6.86	7.24	6.46	6.63	1.92	6.25	6.64
V_1 (Agrifound White)	34.13	63.16	5.88	8.46	8.84	20.75	141.51	7.44	26.23
V_2 (Akola Safed)	31.65	58.06	5.55	7.92	7.75	18.64	135.41	10.55	31.87
V_3 (Gujarat White Onion-1)	33.68	60.94	5.78	8.45	8.77	19.48	138.58	8.13	28.21
SEm±	0.65	1.21	0.10	0.16	0.14	0.35	0.65	0.14	0.50
$CD_{0.05}$	1.95	3.65	NS	0.48	0.44	1.06	1.97	0.44	1.52
CV (%)	6.80	6.95	6.23	6.82	6.12	6.28	1.65	5.88	6.11

Table 2. Performance of different varieties of white onion (*Allium cepa* L) and effect of date of transplanting and method of cultivation on yield and quality

Treatment	Weight of bulb at harvest (g)	Marketable yield of bulb/ plot (kg)	Unmarketable yield of bulb/ plot (kg)	Marketable yield of bulb (q/ha)	Unmarketable yield of bulb (q/ha)	Total bulb yield (q/ha)	Diameter of bulb (cm)	Neck thickness after curing (cm)	Total soluble solids (°Brix)
D_1 (17 December)	113.19	17.14	0.09	488.48	2.81	491.29	5.28	4.33	14.21
D_2 (1 January)	94.96	14.30	0.12	407.45	3.55	411.00	4.57	3.89	12.95
SEm±	2.81	0.45	0.003	13.00	0.09	13.07	0.11	0.07	0.06
$CD_{0.05}$	17.11	2.77	0.02	79.14	0.55	79.55	0.69	0.44	0.37
CV (%)	11.47	12.31	12.20	12.32	12.21	12.29	9.86	7.45	1.92
M_1 (flat bed)	109.43	17.49	0.06	498.50	1.76	500.26	5.13	4.61	13.71
M_2 (ridge bed)	98.72	13.95	0.16	397.43	4.60	402.04	4.71	3.62	13.44
SEm±	2.72	0.44	0.003	12.79	0.09	12.80	0.10	0.07	0.05
$CD_{0.05}$	10.69	1.76	0.01	50.22	0.35	50.27	0.42	0.27	0.22
CV (%)	11.11	12.12	11.87	12.12	11.86	12.04	9.38	7.27	1.78
V_1 (Agrifound White)	108.73	17.31	0.07	493.43	2.09	495.52	5.11	4.31	13.68
V_2 (Akola Safed)	96.49	13.62	0.14	388.03	4.22	392.26	4.65	3.88	13.37
V_3 (Gujarat White Onion-1)	107.00	16.23	0.11	462.43	3.23	465.67	5.00	4.15	13.68
SEm±	3.24	0.54	0.004	15.49	0.10	15.50	0.12	0.08	0.06
$CD_{0.05}$	9.73	1.63	0.01	46.45	0.31	46.49	0.38	0.24	0.20
CV (%)	10.81	11.98	11.52	11.98	11.52	11.91	8.93	6.98	1.74

and 16.23 kg respectively) and per hectare (493.43 and 462.43 q respectively), total bulb yield per hectare (495.52 and 465.67 q respectively), diameter of bulb (5.11 and 5.00 cm respectively), neck thickness after curing (4.31 and 4.15 cm respectively) and total soluble solids (13.68°B each). The unmarketable yield of bulb per plot and per hectare was recorded in the late sown crop on 1 January (0.09 kg and 2.81 q respectively) in the ridge bed (0.06 kg and 1.76 q respectively) in case of variety Agrifound White (0.07 kg and 2.09 q respectively). Therefore the results showed that for better quality and higher yield the crop may be sown earlier (17 December as compared to 1 January), in flat beds rather than ridge bed and Agrifound White variety may be preferred over Akola Safed and Gujarat White Onion-1 varieties.

The significant variation in bulb weight under the influence of different dates of planting might be due to variation in temperature and humidity at different stages of plant growth. Gautam et al (2006) and Goldy (2010) have also found the similar results.

Planting in flat bed resulted in higher weight of bulb which might be due to the enhanced crop growth which further resulted in better utilization of photosynthates (Sharma et al 2009). Results obtained in the present investigations are in accordance with the work of Haque et al (2002) and Arian et al (2004). Variation in varieties is a common and well known fact due to the reason that every variety has its own genetic makeup.

The vigorous vegetative growth due to more photosynthates and favourable weather conditions might have helped to increase the marketable yield of bulb. The increase in marketable yield of bulb could be due to its positive correlation with bulb diameter and bulb weight. As a matter of fact the better quality bulbs have lesser unmarketable quality. Present findings are according to the findings of Singh et al (2010) in garlic.

The diameter of bulb was directly influenced by its size and length. Better size of bulbs is responsible for their improved diameter of bulb because it is directly correlated to plant height, neck thickness and bulb weight. The results are in accordance with the findings of Kanwar and Akbar (2013) in onion and Haque et al (2002) in garlic. Reason for variation in TSS may be attributed to the different treatments. TSS is a plant index which is affected by several factors like temperature, humidity, sunlight, supply of nutrients and other inputs, variety and even micro-climate of crop. Similar findings are reported by Singh et al (2010) in garlic, Kanwar and Akbar (2013) and Mohanty and Prusti (2001) in onion. According to findings of the research the better growth, highest yield and superior quality of white onion can be achieved by growing Agrifound White variety on 17th December in flat bed.

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