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Studies on effect of varieties, transplant ages and transplant densities on qualitative characters of *rabi* onion (*Allium cepa* L.) under agroclimatic conditions of Chhattisgarh Plains

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Abstract
A field experiment, entitled "Studies on effect of varieties, transplant ages and transplant densities on quality parameter of rabi onion (*Allium cepa* L.) under agroclimatic conditions of Chhattisgarh plains" was conducted at Horticulture Research cum Instructional Farm, Department of Vegetable Science, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) during Rabi 2015-16 and 2016-17. Result revealed that the two years mean indicated that V_2- Agrifound light red X A_1-35 days old seedling X D_2-15 x 10 cm recorded significantly, higher qualitative characters like sulphur content in bulb, ascorbic acid content in bulb, neck- Diameter in bulb, days to crop maturity and chlorophyll content (a & b), during both the years (2015-16 and 2016-17) and on the basis of mean data.

Keywords: Varieties, transplant ages, transplant densities and quality

Introduction

Onion (*Allium cepa* L.) is the most common member of the family Amaryllidaceae (Alliaceae) (Hanlet, 1990) [7]. It is one of the most important vegetable crops grown throughout the world and said to be native of Central Asia and Mediterranean region (McCollum, 1976) [14]. It is widely grown herbaceous biennial vegetable crop with cross-pollinated and monocotyledonous behavior having diploid chromosomes number 2n=16 (Bassett, 1986). The name "Onia" is probably ranked to a city built by Onia in 1703 BC near the Gulf of Suez. Onion can be used as green or scallion or as a mature bulb. Green onion may be cooked or used raw as part of salads and mature also used as salad bulbs are widely used as a cooked vegetable in soups, stews and casseroles in addition to a flavoring agent in many additional dishes.

Onion possesses nutritional and medicinal importance. The onion has much quality and medicinal properties characteristic of onion is its pungency, which is due to a volatile oil known as (Allyl–propyl-disulphide). Onion is a rich source of various nutrients and vitamins, all the plant parts are edible, but the bulbs and the lower stem sections are the most popular as seasonings or as vegetables in stew fresh onion contains about moisture (86.6%), protein (1.2%), fat (0.1%), mineral matter (0.4%), fibre (0.6%), carbohydrates (11.1%) including 6-9 soluble sugar, calories (50 kcal), phosphorus (50mg/100g), potassium (127 mg/100g), calcium (46.9mg/100g), magnesium (16mg/100g), iron (0.6mg/100g), sodium (4mg/100g), copper (0.18mg/100g), vitamin C (11mg/100g), niacin (0.4mg/100g), thiamine (0.08mg/100g), riboflavin (0.01mg/100g), folic acid free (15mg/100g) and folic acid total (6mg/100g), traces of Al, Cu, Fe, Mn, Zn, pantothenic acid and vitamins (A, B, and C, respectively) (Rahman *et al*., 2012). The production and productivity of onion in Chhattisgarh is low in comparison to other states. The production of onion is affected due to several factors like varieties, sowing time of nursery, transplanting time, seedling age, plant geometry and several other cultural practices, all of which alone or in combination influence the crop yields. Very meager information is available on the effect of such kind of factors particularly under with reference to agro climatic conditions Chhattisgarh.

Among them varieties, transplant ages and spacing are one of the most important factors for production of onion. Onion varieties respond differently to day length and photoperiods in a particulate environmental condition. Proper age of seedling can produce better yield of bulb (Thomson and Kelly, 1957, Maurya *et al*., 1997 and Singh and Chaure, 1999) [21, 13].

Kanton *et al*., (2002) [10] found that maximum yield was produced from transplants seedlings that were of 20 to 40 days old and significantly 40 days old transplant seedling produced heaviest bulbs. Higher yield and better control over bulb size could be obtained if plants are grown at optimum density. Spacing influences the plant growth, size of bulbs, yields as well as the quality of the onion bulb (Badruddin and Haque, 1977) [2].

Materials and methods

A field experiment entitled "Studies on effect of varieties, transplant ages and transplant densities on growth, yield and quality of *rabi* onion (*Allium cepa* L.) under agroclimatic conditions of Chhattisgarh Plains'' was conducted during two consecutive rabi season of 2015-16 and 2016- 17. The detailed account of the treatments, observations recorded, procedures and techniques adopted during the course of investigation are presented in this chapter under following heads.

Location of experimental site

The experiment was conducted for two consecutive years of 2015-16 and 2016-17 during the *rabi* season at the Research cum Instructional Farm, Department of Vegetable Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.).

Geographical situation

Raipur is situated at 21º4′ N, latitude, 81º35′ E longitude and 290.20 metres altitude from the sea level. The region falls under the Eastern plateau and hill region (Ago-climatic zone-7) of India. Chhattisgarh state is classified into three agro-climatic zones, of which Raipur fall under the Chhattisgarh plains zone of the state.

Sulphur continent in bulbs

The parameter measured was elemental sulphur content (mg g^{-1}) of the onion bulbs. The plant sample is digested using 9:2 ratio of HNO_3 and $HClO_4$. Plant sample of 0.5 g was mixed with 10 ml of Di acid mixture in a 150 ml conical flask. The sample was kept overnight for wet digestion. Next day, heat the sample on hot plate containing sand. Allow it till the contents turn colourless. Filter the contents in 50 ml volumetric flask using filter paper. Make up the solution up to mark. Take 5 ml extract into 25 ml volumetric flask add pinch of $BaCl_2$ salt. Add 2 ml of gum acacia with injection. The contents were tilted once or twice. The volume was made up with distilled water. Reading was noted using spectrophotometer at 420 nm. AOAC, (1990)

Ascorbic acid continent in bulbs

The ascorbic acid content was expressed as mg $100g^{-1}$ of fresh sample. Samples of onion bulbs were analyzed for the ascorbic acid content using 2, 6- Dichlorophenol indophenol dye titrimetrically as per the modified procedure of AOAC (1960). Five grams of sample was macerated with 0.4 per cent oxalic acid. This was filtered through muslin cloth to get a clear juice. A five ml aliquot was titrated against 2, 6-dichlorophenol indophenol (Foyer C., 1993) [5]. dye till the pink end point which persisted for at least 15 seconds. Similar procedure was followed against acid mixture to get blank titre value and against standard solution made in 0.4 per cent oxalic acid to get standard titre value. The ascorbic acid content was estimated using the given formula and expressed as mg per 100 g.

$$\text{Ascorbic acid mg } 100g^{-1} = \frac{\text{Titrate value x dry weight x Volume x 100}}{\text{Extraction taken x Wt. of the sample for Est.}}$$

Days to maturity

The crop was harvested after attainment of maturity and days from transplanting to harvest were counted in each treatment to calculate the days to maturity.

Soluble solids (TSS Brix^0)

Total soluble solids of representated samples of mature bulbs were estimated by ERMA hand refractometer. The two fold muslin cloth was used to extract the juice of bulbs. A little amount of sample was taken on hand refractometer and TSS was recorded on the scale of the instrument.

Neck- diameter (mm)

Bulb and neck diameter are important quality characteristics of onions. Consumers prefer medium size onions (40-69 mm) (Bosch Serra & Currah, 2002) that will attain higher prices on the market than the extra small (10-34 mm), small (35-39 mm), large (70-89 mm) and extra-large (>90 mm) bulbs.

Chlorophyll continent (a & b)

Total chlorophyll content in leaves (mg g^{-1})

Total chlorophyll content of oven dried leaves was estimated by colorimetric method as suggested by Bruinsma (1982). Optical density of the extract was measured on double photo cell colorimeter by using red filter.

$$\text{Total chlorophyll (mg } g^{-1}) = \frac{\text{D652 x 1000}}{34.5} \quad \frac{V}{1000 \text{ x W}}$$

Where,

D = Optical density

V= Final volume of 80% acetone in ml

W = Dry weight of sample taken (g)

Results and discussion

Sulphur content in bulb (%)

The data on sulphur content in bulb as influenced by varieties, transplant ages and transplant densities are presented in Table no. 1 Between varieties, non-significant results were recorded for sulphur content in bulb in both years (2015-16 and 2016-17) and on the basis of mean data. However, V_2- Agrifound light red had maximum value of sulphur (7.92, 8.15 and 8.01 per cent respectively) in bulbs in both years (2015-16 and 2016-17) and on the basis of mean data.

Sulphur is considered essential for building up of sulphur containing amino acids and also for a good vegetative growth and bulb development in onion the highest sulphur concentration (5.66%) was found in variety Agrifound light red. This might be due to the fact that the combined effect of N from organic and inorganic sources played positive effect on sulphur accumulation in the bulb of *rabi* onion up to a certain limit (Anwar *et al*., 2001) [1]. These results are also in conformity with the findings of Singh *et al.* (1995) [1].

As regards to transplant ages, treatment A_1-35 days old seedling produced significantly highest sulphur content (8.31, 8.52 and 8.44 per cent respectively) in bulbs as compared to A_3-55 and A_4-65 days old seedling, but it was *at par* to A_2-45 days old seedling during both the years and on mean basis data. However, the minimum sulphur content (7.02, 7.30 and 7.15 per cent respectively) in bulb was recorded in A_4-65 days old seedling in both years (2015-16 and 2016-17) and on the basis of mean data. Singh *et al.* (2010) [20] Reported that the Sulphur content in leaves at 45 DAT was highest and it decreased with the advancement in age of the crop across the treatment. The reduction in the content at later stages is attributed to greater leaf: bulb ratio than at earlier stage.

Moreover, decrease in sulphur content in the later stage corresponded to greater translocation of photosynthates to structural and storage organs. Pasricha and Randhawa (1973) [16] reported decrease in sulphur content with advancement of crop age. Highest sulphur content was recorded in bulbs at 110 DAT followed by leaves during 75 DAT regardless of treatment. An increase in sulphur levels from upto 45 kg ha^{-1} increased sulphur content in leaves and bulbs which was 107-313% and 142-165% higher over the control (without sulphur). Further increase in sulphur rate (beyond 45 kg ha^{-1}) tended to decrease sulphur content in both the components. At higher levels of sulphur application availability of sulphur in the soil probably became excess as well as imbalance and thus resulted in decreased utilization. The lowest sulphur content was found in both the plant parts of onion when plants treated with 0 kg S ha^{-1} across the growth stages. Among transplant densities, treatment D_2-15 x 10 cm recorded significantly highest sulphur content (8.72, 9.15 and 8.93 per cent respectively) in bulb as compared to others in both years (2015-16 and 2016-17) and on the basis of mean data. However, the minimum sulphur content (6.67, 6.85 and 6.75 per cent respectively) in bulb was recorded in treatment D3-10 x 10 cm in both years (2015-16 and 2016-17) and on the basis of mean data.

Ascorbic acid content in bulb (mg 100 g^{-1})

The data on ascorbic acid content in bulb as influenced by varieties, transplant ages and transplant densities are presented in Table 1. Between varieties V_2- Agrifound light red recorded significantly highest ascorbic acid content in bulbs (2.73, 2.97 and 2.75 mg 100 g^{-1} respectively) in both years (2015-16 and 2016-17) and on the basis of mean data. However, the lowest ascorbic acid content (2.45, 2.65 and 2.55 mg 100 g^{-1} respectively) in bulbs was recorded in treatment V_1 -Nasik Red in both years (2015-16 and 2016-17) and on the basis of mean data. Similar results were reported by (Frappell *et al.*, 1977) [2] maximum ascorbic acid content was recorded in cv. Agrifound light red followed by Agrifound Rose where as minimum in Agrifound Light Red, Yurchishina also reported varietal differences with respect to chemical composition of onion, especially the ascorbic acid. Normally, ascorbic acid content in the wild onion varieties was in the range from 2.0 to 5.0 mg 100 g^{-1} fresh weight (Lawande, 2001) [12]. As regards to transplant ages, treatment A_1-35 days old seedling gave significantly higher ascorbic acid content (2.81, 3.04 and 2.92 mg 100 g^{-1} respectively) bulbs respectively, as compared to other treatments, but it was found at par to treatment A_2-45 days old seedling and A_3-55 days old seedling in both years (2015-16 and 2016-17) and on the basis of mean data. However, significantly lowest ascorbic acid content (2.17, 2.50 and 2.35 mg 100 g^{-1} respectively) bulb was recorded in treatment A_4-65 days old seedling in both years (2015-16 and 2016-17) and on the basis of mean data.

Among transplant densities, treatment D_1-15x 15 cm recorded significantly higher ascorbic acid content (3.80, 4.07 and 3.78 mg 100 g^{-1} respectively) bulbs respectively, than others in both years (2015-16 and 2016-17) and on the basis of mean data. However, the lowest ascorbic acid content (1.51, 1.63 and 1.58 mg 100 g^{-1} respectively) bulb was recorded in treatment D_3-10 x 10 cm in both years (2015-16 and 2016-17) and on the basis of mean data.

Neck- diameter (mm)

The data on neck- diameter of bulb as influenced by varieties, transplant ages and transplant densities are presented in Table 4.16(a). Between varieties V_2- Agrifound light red recorded highest neck-diameter (10.64, 11.87 and 11.25 mm respectively) which was significantly superior over V_1 -Nasik Red in both years (2015-16 and 2016-17) and on the basis of mean data. These results are supported by the findings of earlier workers (Sabota *et al.*, 1981) maximum neck thickness was recorded in cv. Agrifound light red followed by Agrifound Rose over other varieties whereas minimum neck thickness was recorded with cv. Multipler onion.

Table 1: Effect of varieties, transplant ages and transplant densities on sulphur content in bulbs, ascorbic acid content in bulb and Neck-diameter of onion

Treatment		Sulphur content in bulb (%)			Ascorbic acid content in bulb (mg.100 g^{-1})			Neck-diameter (mm)		
		2015-16	2016-17	Mean	2015-16	2016-17	Mean	2015-16	2016-17	Mean
Varieties										
V_1	Nasik Red	7.71	7.93	7.82	2.45	2.65	2.55	10.24	11.50	10.87
V_2	Agrifound Light Red	7.92	8.15	8.01	2.73	2.97	2.75	10.64	11.87	11.25
SE m±		0.09	0.10	0.09	0.08	0.08	0.02	0.11	0.12	0.11
CD (P=0.05)		NS	NS	NS	0.23	0.24	0.07	0.32	0.34	0.33
Transplant ages										
A_1	35 days	8.31	8.52	8.44	2.81	3.04	2.92	11.05	12.26	11.65
A_2	45 days	8.14	8.28	8.19	2.75	2.88	2.82	10.69	11.77	11.20
A_3	55 days	7.77	8.00	7.88	2.63	2.81	2.72	10.49	11.73	11.11
A_4	65 days	7.02	7.30	7.15	2.17	2.50	2.35	9.54	11.12	10.33
SE m±		0.13	0.13	0.13	0.11	0.12	0.11	0.16	0.17	0.16
CD (P=0.05)		0.38	0.38	0.38	0.32	0.34	0.32	0.46	0.48	0.47
Transplant densities										
D_1	15x 15 cm	8.05	8.12	8.07	3.80	4.07	3.78	10.81	11.92	11.36
D_2	15x 10 cm	8.72	9.15	8.93	2.47	2.73	2.60	11.68	12.72	12.20
D_3	10x 10 cm	6.67	6.85	6.75	1.51	1.63	1.58	8.84	10.52	9.68
SE m±		0.11	0.11	0.11	0.10	0.10	0.10	0.14	0.14	0.14
CD (P=0.05)		0.33	0.33	0.38	0.28	0.30	0.29	0.40	0.41	0.40

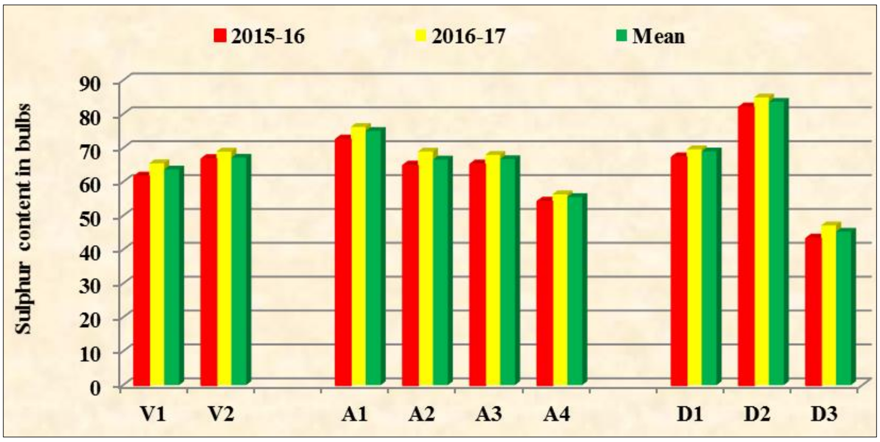

Fig 1: Effect of varieties, transplant ages and transplant densities on sulphur content (%) in bulbs

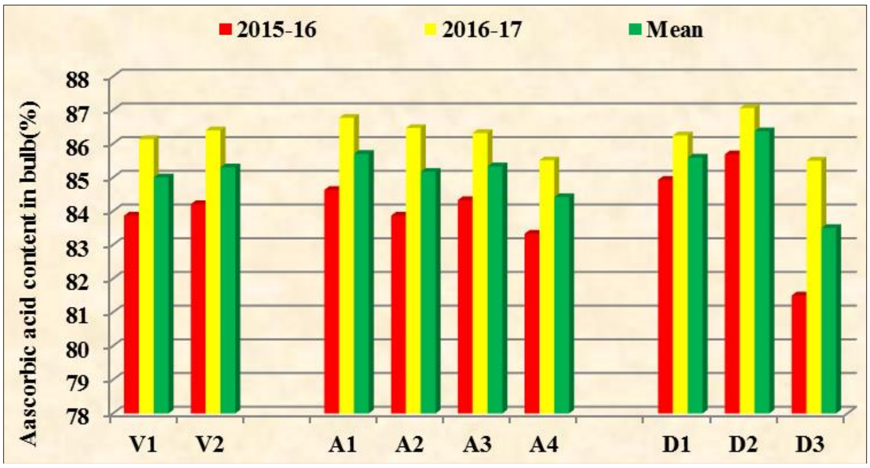

Fig 2: Effect of varieties, transplant ages and transplant densities on ascorbic acid content (mg 100^{-1}) in bulb of onion

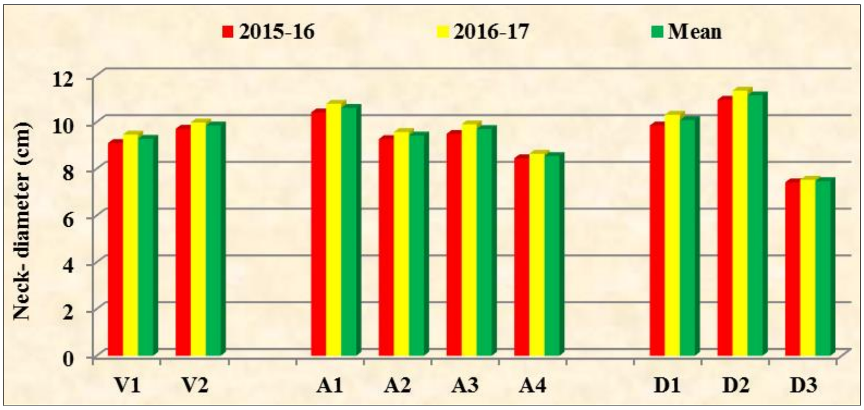

Fig 3: Effect of varieties, transplant ages and transplant densities on Neck- diameter (mm) of onion

As regards to transplant ages, treatment A_1-35 days old seedling gave significantly higher neck- diameter (11.05, 12.26 and 11.65 mm respectively) as compared to treatment A_3-55 and A_4-65 days old seedling, but it was *at par* to treatment A_2-45 days old seedling during both the years and on mean basis data. However, the lowest neck- diameter (9.54, 11.12 and 10.33 mm respectively) was recorded in treatment A_4-65 days old seedling in both years (2015-16 and 2016-17) and on the basis of mean data.

Among transplant densities, treatment D_2-15 x 10 cm gave significantly highest neck- diameter (11.68, 12.72 and 12.20 mm respectively) than other treatments, but it was *at par* to D_2-15 x 15 cm in both years (2015-16 and 2016-17) and on the basis of mean data. However, the lowest neck- diameter (8.84, 10.52 and 9.68 mm respectively) was recorded in treatment D_3-10 x 10 cm in both years (2015-16 and 2016-17) and on the basis of mean data. These results are similar to those obtained by (Dawar *et al*, 2005) [4] generally as planting density decreased the neck thickness was increased. The reason might be due to less competition of onion plants in wider spacing for different growth factors like moisture and nutrients The current result is in agreement with the work of Chaudhry *et al*. (1990) [3] and (Dawar *et al*., 2005) [4] who reported that lower planting density significantly increased neck thickness of bulbs. Jilani (2004) [9] also found bulbs of thick neck in plots of lowest planting density (20 plants m^{-2}), while the plots of highest density (40 plants m^{-2}) produced bulbs of less neck diameter. Patil and Kale (1985) [17] reported positive association between neck thickness and bulb diameter. Increments of the neck-thickness in wider spaced onion plants might be due to reduced competition for moisture, nutrients and light which might have resulted increased leaf formation and senescence of tissues (Jilani, 2004) [9].

Days to crop maturity

The data on days to crop maturity as influenced by varieties, transplant ages and transplant densities are presented in Table 2. Both the varieties failed to showed significant effect on days to crop maturity in both years (2015-16 and 2016-17) and on the basis of mean data.

As regards to transplant ages, treatment A_1-35 days old seedling took significantly longer days to crop maturity as compared to treatment A_4-65 days old seedling, but it was *at par* to treatment A_2-45 and A_3-55 days old seedling in both years (2015-16 and 2016-17) and on the basis of mean data. However, the minimum days to crop maturity was recorded in treatment A_4-65 days old seedling in both years (2015-16 and 2016-17) and on the basis of mean data.

Bulbing stimulus as rapidly as older ones and which might have attributed to more number of days to maturity in the present study. The younger seedling continued vegetable growth for a long time which was subject to favorable higher temperature for bulbing which may have enhanced the number of days to maturity. However, the results of these studies differ with Heath and Holdsworth (1948) [8] who indicated that competition for assimilates as a result of higher number of shoots normally induces early maturity. However, in the study inspits of having more number of leaves crop had experienced late maturity under transplanting of younger seedling. More over in the present study the aged seedlings experienced higher temperature during maturity stages which might have hastened crop maturity.

Among transplant densities, treatment D_2-15 x 10 cm took significantly longer days to crop maturity as compared to others in both years (2015-16 and 2016-17) and on the basis of mean data. The minimum days to crop maturity was recorded in treatment D_3-10 x 10 cm in both years (2015-16 and 2016-17) and on the basis of mean data. Similar results were also reported in onion crop by Khan *et al.* (2002) [11] the plants grown with the combination of highest inter row spacing of 15 cm and highest intra row spacing of 10 cm took longer time (125 days) for maturity. On the other hand, plants grown with the combination of the lowest inter row spacing of 15 cm and the lowest intra row spacing of 4 cm took shortest time 110 days for maturity. The combination of the lowest inter row spacing (15 cm) with lowest intra row spacing (4 cm) mature earlier by 15 days as compared to highest inter row spacing (25 cm) with highest intra row spacing (10 cm). The delay in maturity due to wider spacing could be possibly due to the fact that plants in wider intra-row spacing did not compete for resources *viz.,* (nutrients, sun light, water and space) so that they prolonged their vegetative stage. The current study identified the advantage of using closer spacing for early bulb yield to fetch maximum price from the early market.

Chlorophyll content (a)

The data on chlorophyll content (a) as influenced by varieties, transplant ages and transplant densities are presented in Table 1. Between varieties V_2- Agrifound light red recorded significantly highest chlorophyll content 'a' (0.50, 0.54 and 0.52 respectively) in both years (2015-16 and 2016-17) and on the basis of mean data. However, V_1 -Nasik Red recorded lowest chlorophyll content 'a' (0.46, 0.50 and 0.48 respectively) in both years (2015-16 and 2016-17) and on the basis of mean data. Chlorophyll is a green pigment present in chloroplast of all green plant cells and tissues. These are essential photosynthetic pigments capable of absorbing light energy for the synthesis of carbohydrates. Chlorophyll content of the plant tissue represents the photosynthetic capacity of the plant.

As regards to transplant ages, treatment A_1-35 days old seedling gave significantly higher chlorophyll content 'a' (0.52, 0.57 and 0.54 respectively) as compared to treatment A_4-45 and A_4-65 days old seedling, but it was at par to treatment A2-55 days old seedling in both years (2015-16 and 2016-17) and on the basis of mean data. However, the lowest chlorophyll content 'a' (0.44, 0.48 and 0.46 respectively) was recorded in treatment A_4-65 days old seedling in both years (2015-16 and 2016-17) and on the basis of mean data. Chlorophyll-a showed significant differences and maximum chlorophyll-a content recorded at 75 DAT. Drastic decrease in chlorophyll-a content was observed at later stages Chlorophyll-b was maximum at 70 and minimum at 105 DAT. Maximum total chlorophyll was observed at 70 and 75 DAT and minimum at 105 DAT. These results suggest that total chlorophyll content of the leaf was reduced which accelerated the senescence processes. Similar trend has been reported by Xhunga and Zafirati (1994) [22].

Among transplant densities, treatment D_2-15x 10 cm recorded significantly higher chlorophyll content 'a' (0.56, 0.61 and 0.59 respectively) than others in both years (2015-16 and 2016-17) and on the basis of mean data. However, the lowest chlorophyll content 'a' (0.40, 0.45 and 0.46 respectively) was recorded in treatment D3-10 x 10 cm in both years (2015-16 and 2016-17) and on the basis of mean data.

Chlorophyll content (b)

The data on chlorophyll content (b) as influenced by varieties, transplant ages and transplant densities are presented in Table 1. Between varieties V_2- Agrifound light red recorded significantly higher chlorophyll content 'b' (0.49, 0.61 and 0.55) However, the lowest chlorophyll content 'b' (0.44, 0.54 and 0.49 was recorded in treatment V_1 -Nasik Red in both years (2015-16 and 2016-17) and on the basis of mean data.

As regards to transplant ages, treatment A_1-35 days old seedling gave significantly higher chlorophyll content 'b' (0.55, 0.67 and 0.61 respectively) as compared to others in both years (2015-16 and 2016-17) and on the basis of mean data. However, the lowest chlorophyll content 'b' (0.36, 0.48 and 0.42 respectively) was recorded in treatment A_4-65 days old seedling in both years (2015-16 and 2016-17) and on the basis of mean data.

Among transplant densities, treatment D_2-15x 10 cm gave significantly higher chlorophyll content 'b' (0.63, 0.74 and 0.69 respectively in both years (2015-16 and 2016-17) and on the basis of mean data. However, the lowest chlorophyll content 'b' (0.26, 0.38 and 0.32 respectively) was recorded in treatment D_3-10 x 10 cm in both years (2015-16 and 2016-17) and on the basis of mean data.

Table 1: Effect of varieties, transplant ages and transplant densities on days to crop maturity, chlorophyll content (a) and chlorophyll content (b) in leaf of onion

Treatment		Days to crop maturity			Chlorophyll content (a)			Chlorophyll content (b)		
		2015-16	2016-17	Mean	2015-16	2016-17	Mean	2015-16	2016-17	Mean
Varieties										
V_1	Nasik Red	124.92	127.83	126.37	0.46	0.50	0.48	0.44	0.54	0.49
V_2	Agrifound Light Red	127.85	130.06	129.69	0.50	0.54	0.52	0.49	0.61	0.55
SE m±		1.15	1.18	1.34	0.006	0.006	0.006	0.005	0.005	0.005
CD (P=0.05)		NS	NS	NS	0.016	0.015	0.016	0.014	0.015	0.014
Transplant ages										
A_1	35 days	130.41	133.84	132.12	0.52	0.57	0.54	0.55	0.67	0.61
A_2	45 days	126.83	129.48	128.15	0.47	0.54	0.50	0.45	0.55	0.50
A_3	55 days	127.53	130.38	130.44	0.50	0.53	0.52	0.49	0.59	0.54
A_4	65 days	120.76	122.08	121.42	0.44	0.48	0.46	0.36	0.48	0.42
SE m±		1.63	1.60	1.89	0.008	0.008	0.008	0.007	0.007	0.007
CD (P=0.05)		4.65	4.75	5.39	0.023	0.022	0.023	0.021	0.022	0.021
Transplant densities										
D_1	15x15 cm	126.16	129.17	128.77	0.49	0.53	0.51	0.50	0.60	0.55
D_2	15x 10 cm	135.56	138.15	136.85	0.56	0.61	0.59	0.63	0.74	0.69
D_3	10x 10 cm	117.43	119.52	118.48	0.40	0.45	0.42	0.26	0.38	0.32
SE m±		1.41	1.44	1.64	0.007	0.007	0.007	0.007	0.007	0.007
CD (P=0.05)		4.02	4.12	4.67	0.020	0.019	0.020	0.021	0.020	0.021

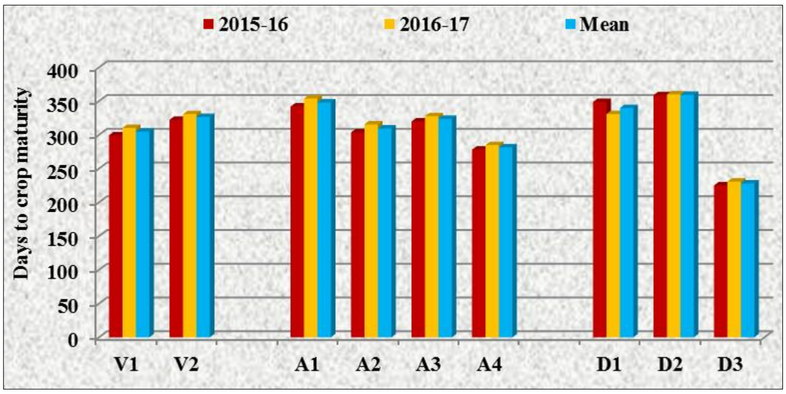

Fig 4: Effect of varieties, transplant ages and transplant densities on days to crop maturity of onion

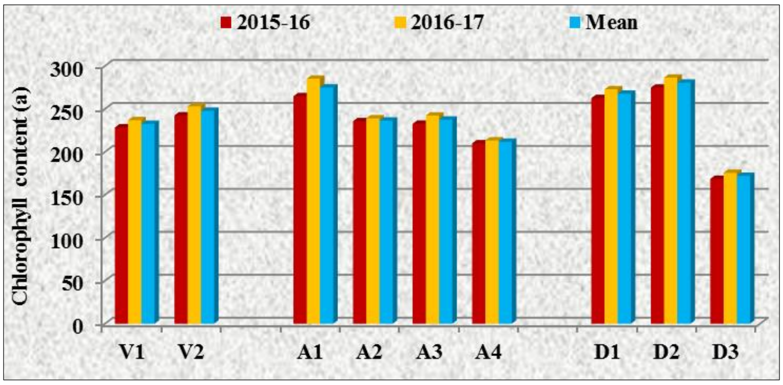

Fig 5: Effect of varieties, transplant ages and transplant densities on Chlorophyll content (a) in leaf of onion

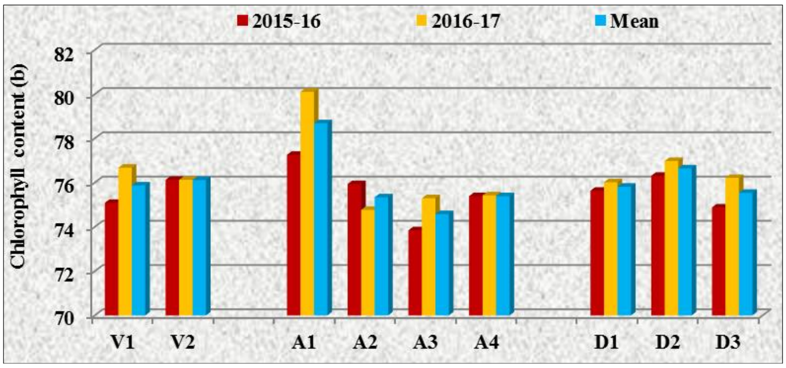

Fig 6: Effect of varieties, transplant ages and transplant densities on chlorophyll content (b) in leaf of onion

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