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RESPONSE OF THREE VARIETIES OF ONIONS (*ALLIUM CEPA* L.) TO DIFFERENT PLANT DENSITIES AND THEIR EFFECT ON GROWTH AND YIELD ADJECTIVES

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Abstract

The study was conducted in the vegetable field of the Department of Horticulture and Garden Engineering College of Agriculture and Forestry, University of Mosul during season 2018-2019 and in the soil mixture to show the effect of plant density and varieties on the adjectives Growth and yield in onions. The experiment was laid out in RCBD with 3 replications which included two factors: varieties, that were laying within the main plot of the experiment while the plant density was placed under sub plot . The results showed the superiority of the prolate white cultivars in the yield of the plant and the total yield. but No significant differences were found in the other traits. The plants under the high plant density gave high values in the traits of the plant yield and the total yield. While the interaction of the prolate white variety under high plant density gave the highest values in both plant yield and total yield values t/h.

Key words: *Allium cepa*, RCBD, planting density, yield.

Introduction

Onion (*Allium cepa* L.), belonging to the family Amaryllidaceae (Alliaceae), is one of the most important strategic vegetables grown in Iraq after the crop of tomatoes and potatoes (Hazra and Som, 2006). and the widely grown herbaceous biennial vegetable crop with cross-pollinated and monocotyledonous behavior having diploid chromosomes number 2n = 16 (Bassett, 1986). It is cultivated in all governorates of the Iraq. This family contains more than 90 plant species And is followed by about 6100 species and is believed to be native to northern Iran or the region extending from Palestine to India from the continent of Asia (mtilub *et al.,* 1989). (Al-Khafaji and Jubouri, 2010), which is high in energy content, medium in protein content and slightly in the content of mineral materials and vitamins (Hassan, 1994), so the different countries have sought to cultivate it and increase the space The total cultivated area in Iraq for 2017 of green onions is about 30403 dunums with an average productivity of 1416.3 kg/dunum and a production rate of 43061 tons according to the (Central Statistical Organization 2017).

The optimum use of spacing or plant population has dual advantages (Geremew *et al.,* 2010). It avoids strong competition between plants for growth factors such as water, nutrient and light. In addition optimum plant population enables efficient use of available cropland without wastage. Pakyurek *et al.,* (1994) and Rizk (1997) observed that the highest sowing rate (planting density) produced a noticeably higher yield of good quality bulbs than the lower sowing rate. Verma *et al.,* (1994) found that average branch length increased between the low and medium spacing. Weerasinghe *et al.,* (1994) investigated that increasing plant competition significantly reduced seedling leaf number. Farrag (1995) emphasized that high planting density significantly increased single-bulb, double-bulb and total yields, as well as reducing bulb weight and diameter. Coleo *et al.,* (1996) reported that highest commercial bulb yield was recorded at higher planting density, while the highest proportion of large bulbs and average bulb weight were examined at lower planting density. Stoffella (1996) apprehended that percentage of small and medium-sized bulbs increased and percentage of large bulbs decreased as in-row spacing decreased. Viegas (1996) found that close of larger bulbs decreased on contrast to the yield of small bulbs, which was highest at the highest density.

Pakyurek *et al.,* (1994) tested various varieties for

yield and quality and concluded that not all the varieties gave the similar response. Similarly, Rumpel and Felezynski, (1997) reported that greater yield was produced by Mercato and lower yield was obtained in Summit Fl. Singh and Sachan (1999) compared two varieties Kalyanpur Round Red and Nasik Red for seed yield and observed that Kalyanpur Round Red was superior to Nasik Red; comparing onion varieties, highest yield was obtained in Swift and Radar and lowest by Glacier (Vanparys, 1999) Rumpel *et al.,* (2000) reported that in both varieties, the highest yield being obtained with the smallest spacing and the greater commercial yield in 1st experiment was produced by Texas Grano PRR, while in the 2nd experiment was recorded in Alfa Tropical . Hailu *et al.,* (2015) found that The largest bulb size, produced by the larger intra-row spacing, showed highest rotting percentage compared to the smaller ones. Average bulb weight loss during storage also was higher at the intra-row spacing. The present study was therefore, undertaken to investigate the effects of different plant density on the growth, yield, quality and shelf life of onion varieties with the following specific objectives.

1- To determine the best plant density for better shelf life of some onion varieties.

2- To study the interaction effect of plant density and onion varieties on shelf life.

Materials and methods

The study was carried out in the field of agricultural research of the Faculty of Agriculture and Forestr/ University of Mosul during the autumn season 2018 - 2019 in the soil mixed to evaluate three varieties of onions (*Allium cepa* L.) (white (long white) and (white spherical) and (red and elongated) Under the influence of two levels of the first plant densities (25 plants/m^2) and the second (17 plants/m^2) and their effect on the growth and yield characteristics of onion varieties.

The cultivation debauchery three varieties on 12/10/ 2018 after plowing soil good plowing plow disc, was chosen and the isolation of debauchery homogeneous as much as possible and appropriate for agriculture and the exclusion of debauchery sizes is appropriate for the cultivation of which diameters ranged from (2-3cm). Ojerit process Cultivation of the three species on a 2 meter long maruse and on one side of the mezzanine and with a plant density 25 plants for rice and 17 plants for rice. The distance between Merz and the last 50 cm and 75 cm between one and another, according to Randomized Complete Block Design (RCBD) The three items were placed in main plots and distributed T plant density on the items in the secondary blocks (Sub plots) and repeated each transaction three times after the distribution of transactions at random within each repeater. Thus, the number of transactions in the experiment and each duplicate (6) global treatment (3 × 2) and the total number of experimental units in the study (18) experimental unit considering that there are three replicates. Agricultural operations conducted during the study period starting from planting until harvest time and all the experimental units and equally and in accordance with the recommendations adopted in the cultivation of onion, conducted control continuous Hcherta fly onion Thrips onion using the pesticide Super serine concentration of 1.5 cm 3/liter, as protective spray insecticide mildew Beltanol at a rate of 1.5 Cm^3/L to control the disease of white fluffy, and the spraying process whenever needed. The harvest was done by hand and all the units were tested on 7/3/2019 when the plants reached the stage of green marketing and the beginning of the appearance of the flowering date.

Ten plants were randomly selected for each experimental unit to study the characteristics of (double percentage, plant height (cm), number of leaves/plant, length, neck diameter (cm), length and diameter of bulb (cm), weight of bulb (g), plant yield (g) The results were statistically analyzed according to the design used by the electronic computer using the SAS program (1996). The averages were compared using the multimodal Duncan test at a 5% probability level.

Results and Discussion

Effect of plant density on the growth and yield of three varieties of onions

The results of the analysis in table 1 showed the effect of plant density on growth and onion traits. Plant cultivated under plant density (17 plants/m^2) recorded the highest values in the percentage of double pores which reached (83%) compared to the lowest values of cultivated plants under plant density (25 plants/m^2) which amounted to (43%).

Table 1: Effect of plant density on growth and yield of three varieties of onions.

Plant density	Double percentage	Plant height cm	N. of leaf/plant	neck ocean cm	Length bulb cm	diameter bulb cm	weight bulb g	Yield per plant g	Total yield t/h
25 plant/m^2	0.43	90.48 a	7.14 b	3.000 b	7.22 a	3.83 b	34.0 b	219 a	43.6 a
17 plant/m^2	0.83 a	70.68 b	10.16 a	4.01 a	5.77 b	4.90 a	48.3 a	175 b	23.3 b

While the cultivated plants within the plant density (25 plants/m^2) exceeded the plant height (90.48) cm compared with the plants planted under plant density (17 plants/m^2), which amounted to (70.68) cm and for the number of leaves, the plants cultivated within the plant density (17 plants/m^2) the value (10.16) compared to the lowest values of cultivated plants under the narrow plant density (25 plants/m^2) and the value (7.14) The characteristics of the diameter of the neck, the diameter of the bulb and the weight of the bulb varied positively and positively with the number of leaves under plant density (17 plants/m^2) compared to the lowest values of cultivated plants under narrow plant density (25 plants/m^2). This is consistent with Nasir *et al.,* (2007).

Also, we note the superiority of plants under plant density (25 plants/m^2) in the traits of bulb length, plant yield and total yield with values of (7.22) cm, 219 g and 43.6 t/Plant (17 plants/m^2) was (5.77) cm, (175) g, (23.3) t/h, respectively.

The reason for the superiority of plants under plant density (25 plants/m^2) is due to the competition between plants on water, light and nutrients for plant growth and development. Conversely, plants planted under plant density (17 plants/m^2) out-performed double bulbs, (17 plants/m^2) due to the availability of light and the elements necessary for growth. This is reflected in the increase in the number of leaves associated with the diameter of the neck, the diameter of the bulb and the weight of the bulb, As well The increase in the sum of plant and increase the number of plants per unit area has led to an increase in the total yield.

Effect of varieties on the growth and yield of three varieties of onions

Table 2 shows plant response to plant intensities, where no significant differences were observed in the characteristics of duality ratio, plant height, neck diameter, bulb length, and bulb weight.

While the white spherical was the highest in the number of leaves (9.217) compared to the lowest number of leaves which was recorded under the red-tiled (7.9), while the white variant exceeded the characteristics of the diameter of the bulb (4.717) cm and the plant yield (249.9) And the total number (41.79) I/H compared with the red-tailed species, which recorded the lowest values in those qualities, which amounted to (3.917) cm, (156.2 g), (26.22) I/H, respectively may be due to the association of genetic traits of those qualities.

Effect of interaction on the growth and yield of three varieties of onions.

Table 3 shows the superiority of the spherical white under plant density (17 plants/m^2) in the highest of duality ratio (95%) compared to the lowest values of the red variety (30%). While the superiority of cultivars red in the height of plant under plant density (25 plants/m^2) (92.8 cm) compared with the same variety and the plant density (17 plants/m^2), where the lowest values (67.87) cm and this is in line with the single effect of the factors studied.

As for the number of leaves, the plant cultivated under plant density (17 plants/m^2) and the white variety (10.8) were recorded compared to the lowest values and the same cultivars under plant density (25 plants/m^2) and reached (6.867) The white spherical species under the plant density (17 plants/m^2) in the diameter of the neck (4.133) cm compared with The lowest values and the same variety within the plant density (25 plants/m^2), where the record (2.8) cm, while gave the class red flounder under plant density(25 plants/m^2) the lowest values in the length and length of the bulb and the value (5.6) cm and (3.4 cm), respectively, compared to the highest values of red and white spherical species under plant density (17 plants/m^2), which reached (7.5) cm and (5.367) cm, respectively.

The spherical white under plant density (17 plants/m^2) gave the highest values for the weight of the bulb

Table 2: Effect of varieties on growth and yield of three varieties of onions.

Cultivars	Double percentage	Plant height cm	N. of leaf/plant	neck ocean cm	Length bulb cm	diameter bulb cm	weight bulb g	Yield per plant g	Total yield t/h
Prolate Crystel	0.58 a	81.35 a	8.833 ab	3.550 a	6.45 a	4.72 a	44.32 a	249.9 a	41.79 a
Globate Crystal	0.74 a	80.33 a	9.217 a	3.467 a	6.49 a	4.46 ab	43.25 a	184.0 ab	32.40 ab
Long red	0.57 a	80.05 a	7.900 b	3.500 a	6.55 a	3.92 b	35.95 a	156.2 b	26.22 b

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Prolate Crystel	0.58 a	81.35 a	8.833 ab	3.550 a	6.45 a	4.72 a	44.32 a	249.9 a	41.79 a
Globate Crystal	0.74 a	80.33 a	9.217 a	3.467 a	6.49 a	4.46 ab	43.25 a	184.0 ab	32.40 ab
Long red	0.57 a	80.05 a	7.900 b	3.500 a	6.55 a	3.92 b	35.95 a	156.2 b	26.22 b

Table 3: Effect of interaction on growth and yield of three varieties of onions.

Plant density	Cultivars	Double percentage	Plant height cm	N. of leaf/plant	neck ocean cm	Length bulb cm	diameter bulb cm	weight bulb g	Yield per plant g	Total yield t/h
25 plant/m^2	Prolate Crystel	0.47 cd	89.7 a	6.8 d	3.0 b	5.97 bcd	4.46 ab	36.7 b	257.7 a	51.3 a
	Globate Crystal	0.53 bcd	88.9 a	8.0 cd	2.8 b	5.75 cd	3.55 b	51.9 a	242.0 ab	47.3 a
	Long red	0.30 d	92.8 a	6.6 d	3.2 b	5.60 d	3.46 b	32.9 b	161.8 ab	32.4 ab
17 plant/m^2	Prolate Crystel	0.69 abc	73.03 b	10.8 a	4.1 a	6.93 abc	4.96 a	32.4 b	236.3 ab	32.3 ab
	Globate Crystal	0.95 a	71.3 b	10.4 ab	4.1 a	7.23 ab	5.36 a	54.0 a	131.6 b	17.5 b
	Long red	0.84 ab	67.8 b	9.2 bc	3.8 a	7.50 a	4.36 ab	38.9 b	150.5 ab	20.1 b

Where it recorded (54.07) gm compared to less The values for the white cultivars and the same plant density reached (32.43) g As for the plant yield and the total yield, the white cultivar (25 plants/m^2)was given the best value values It reached (257.7)g and(51.27)t/h Respectively, compared with the lowest values for the white spherical type under the plant density (17 plants/ m^2) where recorded (131.6) g and (17.53) t/h.

Higher results at 17 plant/m^2 were probably due to less interplant competition for water, nutrients and light. This result has an agreement with the results of Rashid and Rashid (1976), Kumar *et al.,* (1998), Khushk *et al*., (1990); Rizk *et al*., (1991); Mehla *et al*., (1993), The increased results at the 17 plant/m^2 were probably due to the availability of more nutrients, moisture, light and space etc. But this result is contradictory with the findings of Harun-or-Rashid (1998), who obtained taller plant and yield per plant and total yield t/h from closer spacing with the findings Sikder *et al.,* (2010) Walle *et al.,* (2018). In agreement with the present results, Jilani *et al.,* (2009), This is due to the reality that as high plant density, total plant population increases and this in turn contributes to increase in total bulb yield, but the bulb dimension and weight decrease. The current result is in agreement with works of different authors. Jan *et al.,* (2003) recorded the highest yield at spacing of 17×4.5 cm and the lowest yield at 27×14.5 cm spacing. Russo (2008) also found similar results. Rekowska and Skupien (2007) also reported significantly higher yield of bulbs and green leaves of garlic in closer intra-row spacing. In addition, the prolate white variety is longer than the diameter of the bulb and the yield plant and the total yield t/h The present finding is supported by different investigations previously done. Jilani and Ghaffoor (2003) and Jilani *et al.,* (2009) suggested that varieties could have different yield potential in different agro-ecologies due to their genetic potential and genetic environment interaction effect. Kahsay *et al.,* (2013) Shah and malik (2015) also reported that the highest yield per plant of onion was obtained from 5 cm plant spacing as compared to higher plant spacing of 10 cm.

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