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Effect of levels of nitrogen and spacing's on growth and yield of Rabi onion (*Allium cepa* L.)

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Abstract
A field experiment was conducted during winter season 2015-16 and 2016-17 at Main Experiment Station, Department of Vegetable Science, Narendra Deva University of Agriculture and Technology, Faizabad (U.P.) to study the response of different levels of nitrogen and spacing on growth, yield of rabi onion. The experiment was laid out in randomised block design (factorial) consisting of ten treatments combination with three replication. The treatment tried under present investigation were 0, 90, 110, 130 and 140 kg N/ha with 15x10 cm and 15x15 cm spacing along with constant dose of 60 kg P_2O_5 and K_2O ha^{-1}. Growth attributes were recorded at five stages of plant growth 30, 45, 75 and 90 DAS. While yield attributes were taken at the time of harvesting. The result revealed that the N_4(140 kg/ha) was found best suitable on growth, yield of onion. The S_1 (15×10cm) was found best suitable on growth, yield of onion. The N_3 (130Kg) combined with S_1(15×10) of nitrogen and spacing was found best suitable on growth, yield of onion.

Keywords: Nitrogen, Spacing, Growth, Yield

Introduction
Onion (*Allium cepa* L.) is bulbous crops grown all above the world belongs to family Amaryllidaceae. The crop is very useful for human beings because it has several nutritional values. It contains vitamins, proteins, carbohydrates, iron, fibre and pungency which is due to volatile oil contain i.e. Allyl propyl disulphide ($C_6H_{12}O_2$). Onion is day length sensitive, several onion types exist depending upon the latitude at which they grow. It is estimated that around the world, over 3,642,000 ha (NHB 2014-15) of onions are grown annually. On a worldwide scale, around 80 million metric tons of onions are produced per year. China is by far the top onion area and producing country in the world, accounting for approximately 28% of the world's onion production, followed by India i.e. area of 1225 thousand hactare with production of 20991 thousand million tonns. (NHB 2015-2016). Nitrogen is considered to be the most important and readly available plant nutrient of the major elements. It has a great stimulating influence on the development of the vegetable parts. Nitrogen application has shown marked influence in the development of the onion bulbs. Nitrogen plays an important role for optimum yield of onion and is found to be essential to increase the bulb size and yield. Increasing nitrogen application rates significantly enhances plant height, number of green leaves per plant and weight of bulb, marketable yield. Nitrogen is required in much greater quantities than most of the nutrients. Spacing is an important factor for the production of onion since it affects bulb yield.

Experimental methods
The present investigation was conducted at the Main Experiment Station of the Vegetable Science, Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj) Faizabad, (U.P.) India during the winter season. The field experiment was laid out in randomized block design (Factorial), consisting of five levels of nitrogen (0,90,110,130 and 140 Kg/ha) and two spacing (15x10 and 15x15) with constant dose of dose of 60 kg P_2O_5 and K_2O ha^{-1}. The experiment was replicated thrice accommodating 30 experimental units, each plot measuring 2.5x1.9 m^2. Half of the scheduled dose of nitrogen and completed dose of phosphorus and potassium were applied by broad cast method as a basal dressing to the respective treatments. The remaining half dose of nitrogen was applied one month after transplanting. Treatments were distributed randomly. Standard cultural practices were followed to grow the crop during rabi. Observation recorded are plant height (cm), number of leaves per plant, fresh weight of bulb (g), dry weight of bulb (g), fresh weight of leaves (g), dry weight of leaves (g), diameter of bulb (cm), number and weight of marketable bulb (g),

number and weight of unmarketable bulb (g), total yield (q/ha) of onion bulb. Data recorded during the course of experimentation was subjected to statistical analysis by adopting appropriate methods of "Analysis of Variance" suggested by Panse and Sukhatme (1978). Statistical significance was tested with the help of F-test at 5% level of probability. The difference among treatment means was tested using the critical difference (C.D) at 5% level of probability (Gomez and Gomez, 1984).

Result and discussion

(A) Growth attributes

Plant height (cm): The data on plant height at various stages of growth as influenced by different levels of nitrogen have been presented in table 1.The persual of data indicated that the plant height of onion increased progressively with advancement of age of the crop upto 90 days. The mean plant height such as 37.96, 49.73, 55.88, 65.13 and 63.70 cm clearly indicated that the rate of growth was much faster between 30-45 DAS. The significantly higher plant height such as 41.70, 54.40, 61.25, 70.25 was measured at 30, 45, 60, 75 and days after that the slight decrease in plant height at 90 day stage under the treatment of 140 kg N/ha. However, the minimum plant height was measure under 0 kg N/ha at all stages of plant growth. Each successive levels of nitrogen had touch the level of significance. The increasing trend of growth attributes due to increasing levels of nitrogen would have been due to the proper utilization of carbohydrates in plant with the supply of nitrogen. Nitrogen is builder of protein and it forms the main constituents of protoplasm in plants. Nitrogen being an important constituent of auxin in the plants and their parts caused significant increase in plant height. Critical analysis of data presented in table 1. showed increasing trend in the plant height at both the spacing in all stages of growth.

Number of leaves per plant

Different nitrogen levels, spacing and interaction between two factors significantly affected the number of leaves. The results at 30, 45, 60, 75 and 90 days showed that there was significant increase in number of leaves per plant at 140 kg N/ha (8.05, 12.65, 12.95, 15.45) at 30-75 day after that the slight decrease in number of leaves per plant at 90 day stage shown in table 2. However the minimum number of leaves per plant was measured under 0 kg N/ha at all the stages of plant growth. This might be due to nitrogen is builder of protein and it forms the main constituents of protoplasm also an important constituent of auxin which are responsible for formation of new leaves.

Spacing exerted significant effect on number of leaves per plant at all the stages of plant growth. Spacing of 15x15 cm gives higher values than 15x10 cm. This might be due to better availability of plant nutrients and sun light exposure under wider spacing. Similar views have also been expressed by a number of investigators like Patel (2008), Resend *et al.* (1999).

Fresh weight of bulb (g): Fresh weight of bulb increased with increase in nitrogen level from 0-140 kg/ha. The maximum fresh weight was 74.75g in case of highest nitrogen level (140 kg). This parameter was significantly decreased with the decrease in nitrogen level thus the lowest value (43.40g) was noted in case of no nitrogen. Similarly, wider spacing between plants proved advantageous in increasing the fresh weight of bulbs. Thus 15x15 cm spacing registered significantly higher fresh weight upto 69.54g than 15x10 cm spacing. The lowest value (59.24g) was noted in case of 15x10 cm spacing. (Table 3).The best treatment interaction was 140 kg N/ha with 15x15 cm spacing which recorded significantly higher fresh weight (80g) over 15x10 cm spacing. The significantly lower value were recorded under spacing of 15x10 cm at each level of nitrogen it was 40.20g at o level of nitrogen.

Dry weight of bulb (g): The data in table 3 pertaining dry weight of bulb owing to various treatments have been presented as follows. The dry weight of bulb increase significantly with the increase in the nitrogen level from 0-140 kg N/ha. The maximum dry weight was 8.85g in case of highest nitrogen level (140kg). this parameter was significantly decrease with the decrease in the nitrogen level. Thus the lowest value (6.60g) was noted in case of no nitrogen. Similarly, wider spacing between plants proved advantageous in increasing the dry weight of bulb. Thus spacing of 15x15 cm registered significantly higher dry weight upto 8.30g over spacing of 15x10 cm and the lowest value (7.74g) was noted in case of 15x10 cm spacing. The best treatment interaction was 140kg N/ha with 15x15 cm spacing which recorded significantly dry weight (9.10g) over 15x10 cm spacing. The significantly lower values were recorded under spacing of 15x10 cm in each level of nitrogen. It was 6.50g at 0 level of nitrogen.

Fresh weight of leaves (g): The data in table 3 indicates that the nitrogen level and spacing as well as their interactions were found to exert significant impact upon this parameter. The fresh weight of leaves increased significantly with the increase in the nitrogen level from 0-140 kg/ha. The maximum fresh weight was 61.88g in case of highest nitrogen level (140 kg). This parameter was significantly decreased with the decrease in nitrogen level thus the lowest value (41.55g) was noted in case of no nitrogen. Similarly, wider spacing between plants proved advantageous in increasing the fresh weight of bulbs. Thus 15x15 cm spacing registered significantly higher fresh weight up to 63.62g than 15x10 cm spacing. The lowest value (60.14g) was noted in case of 15x10 cm spacing. The best treatment interaction was 140 kg N/ha with 15x15 cm spacing which recorded significantly higher fresh weight (73g) over 15x10 cm spacing. The significantly lower value was recorded under spacing of 15x10 cm at each level of nitrogen it was 40.50g at 0 level of nitrogen.

Dry weight of leaves (g): The maximum dry weight was 5.39g in case of highest nitrogen level (140kg) while minimum dry weight noticed in case of no nitrogen. The data in table 3 pertaining dry weight of leaves owing to various treatments.

Similarly, wider spacing between plants proved advantageous in increasing the dry weight of leaves. Thus spacing of 15x15 cm registered significantly higher dry weight upto 5.56g over spacing of 15x10 cm and the lowest value (5.21g) was noted in case of 15x10 cm spacing. The best treatment interaction was 140kg N/ha with 15x15 cm spacing which recorded significantly dry weight (6.40g) over 15x10 cm spacing. The significantly lower values were recorded under spacing of 15x10 cm in each level of nitrogen. It was 3.95g at 0 level of nitrogen.

(B) Yield attributes and yield

Number of marketable bulbs

The total number of marketable bulbs per plot was influence by various treatments presented in table 4. The increasing level of nitrogen at 130 kg/ha increase the number of marketable bulbs per plot than 0 kg N/ha. But 90 kg N/ha, 110 kg N/ha and 140 kg N/ha did not show significant increase in number of marketable bulbs. Spacing has also significant influence on the number of marketable bulbs. Spacing of 15x10 cm gives more number of marketable bulbs (228.25) than 15x15 cm spacing (154.14).

Number of unmarketable bulbs

Data pertaining to the number of unmarketable bulbs per plot was influenced by various treatments presented in table 4.

A critical examination of data revealed that the increasing level of nitrogen decreases the number of unmarketable bulbs per plot the maximum mean number of unmarketable bulbs was recorded at 0 kg N/ha (62.24) which was significantly higher than number of unmarketable bulbs recorded at 140 kg N/ha (37.07), whereas the decrease in number of unmarketable bulbs were found not significant at 90 kg N/ha, 110 kg N/ha, 130 kg N/ha such as 38.25, 34.14 and 29.84 respectively.

Weight of marketable bulbs (kg/plot)

The influence of nitrogen and spacing on weight of marketable bulbs have been presented in table 4. It is obvious from values shown in table that weight of marketable bulbs per plot was increased by increasing level of nitrogen. The weight of marketable bulbs at 140 kg N/ha was significant over the 0 kg N/ha. However the 90 kg N/ha, 110 kg N/ha and 130 kg N/ha was not found significant over 140 kg N/ha.

Spacing showed significant difference in mean weight of marketable bulb between the spacing 15x10 and 15x15 cm give 13.76 and 10.94 kg respectively.

Weight of unmarketable bulbs (kg/plot)

The influence of nitrogen and spacing on weight of unmarketable bulbs have been presented in table 4. It is quite clear from the data that the dose of 130 kg N/ha reduce the weight of unmarketable bulbs per plot. The maximum weight of unmarketable bulbs was obtained at 140 kg N/ha (1.62kg) which was significantly higher than weight of unmarketable bulb at 0 kg N/ha (1.59kg). This might be due to the lower nitrogen level would have inhibited the plant growth and thus resulted in uneven maturity of bulb as well as under sized bulbs.

Spacing had also show that the significant response on weight of unmarketable bulb. The 15x10 cm spacing had significant increase over 15x15 cm spacing. Which were 1.80 kg and 1.09 kg respectively.

Diameter of bulb (cm): The data with respect to diameter of bulb are presented in table 4. The diameter of bulb was influenced significantly due to different treatment as well as treatment interactions. Each increment in the nitrogen level upto 140 kg/ha increased this parameter upto significant extent. Thus the highest bulb diameter (6.10cm) was recorded in case of 140 kg N as against only 4.90 cm in case of 0 level of nitrogen.

The widest spacing upto 15x15 cm brought about significantly higher diameter (5.94 cm) over the spacing of 15x10 cm. the significantly lowest bulb diameter (5.30cm) was noted in case of 15x10 cm spacing. The best treatment interaction was 140 kg nitrogen with 15x15 cm spacing which resulted in significantly higher bulb diameter upto 6.50 cm over all the remaining interactions. The diameter decreased when nitrogen level was decreases and spacing between plant was also decreases. Thus the significantly lowest value (4.80 cm) was noted under 0 kg nitrogen with 15x10 cm spacing.

Total yield (q/ha): Data concerning yield of bulbs per hectare were subjected to statistical analysis and results obtained are presented in the Table 4, which demonstrated highly significant results for different nitrogen levels, spacing and their interaction. Each interaction in nitrogen level from 0-140 kg nitrogen resulted in significant rise in the bulb yield. Thus the maximum bulb yield (364.80q/ha) was secured from 140 kg nitrogen dose which was significantly higher to the lower nitrogen levels was only 244.63q/ha. The increased yield due to higher level of nitrogen may be explained on the basis that the net assimilation rate was accelerated by the increased chlorophyll content of the nitrogen fed plants and the observed nitrogen help in permission of more food preserves due to higher photosynthetic activity of plant.

The bulb yield was found significantly higher up to 363.95q/ha in case of 15x15 cm spacing over spacing of 15x10 cm. The best treatment interaction was 140 kg nitrogen with 15x10 cm spacing which resulted in significantly higher bulb yield up to 411.94q/ha over the remaining interaction. The yield was reduced with the reduction in the nitrogen level under each spacing. Thus the significantly lowest bulb yield was recorded in case of 0 kg nitrogen with 15x15 cm spacing (150.64q/ha).

Table 1: Effect of levels of nitrogen and spacing on growth parameter (plant height) of onion at different intervals

Nitrogen Levels (kg/ha)	Spacing(cm) 30 DAT		Mean	Spacing(cm) 45 DAT		Mean	Spacing(cm) 60 DAT		Mean	Spacing(cm) 75 DAT		Mean	Spacing(cm) 90 DAT		Mean
	S_1(15×10)	S_2(15×15)		S_1(15×10)	S_2(15×15)		S_1(15×10)	S_2(15×15)		S_1(15×10)	S_2(15×15)		S_1(15×10)	S_2(15×15)	
N_0(0)	29.40	33.30	31.35	40.50	43.30	41.90	46.20	52.20	49.20	52.30	58.60	55.45	50.70	57.40	54.05
N_1(90)	35.60	37.50	36.55	45.70	50.20	47.95	51.50	55.40	53.45	63.50	64.20	63.85	61.40	63.10	62.25
N_2(110)	38.70	39.80	39.25	48.40	53.30	50.85	54.80	58.60	56.70	66.70	67.60	67.15	65.30	65.90	65.60
N_3(130)	40.40	41.50	40.95	52.60	54.50	53.55	57.30	60.30	58.80	68.10	69.80	68.95	66.90	68.20	67.55
N_4(140)	41.20	42.20	41.70	53.70	55.10	54.40	60.40	62.10	61.25	69.30	71.20	70.25	68.10	70.00	69.05
Mean	37.06	38.86	37.96	48.18	51.28	49.73	54.04	57.72	55.88	63.98	66.28	65.13	62.48	64.92	63.70
	S.E.m±	C.D (p=0.05)		S.E.m±	C.D (p=0.05)		S.E.m±	C.D (p=0.05)		S.E.m±	C.D (p=0.05)		S.E.m±	C.D(p=0.05)	
N	1.320	3.923		1.650	4.901		1.361	4.045		1.543	4.585		1.490	4.427	
S	NS	NS		1.043	3.100		0.861	2.559		NS	NS		NS	NS	
N×S	NS	NS		NS	NS		NS	NS		NS	NS		NS	NS	

Table 2: Effect of levels of nitrogen and spacing on growth parameter (number of leaves) of onion at different intervals.

Nitrogen Levels (kg/ha)	Spacing (cm) 30 DAT		Mean	Spacing (cm) 45 DAT		Mean	Spacing (cm) 60 DAT		Mean	Spacing (cm) 75 DAT		Mean	Spacing (cm) 90 DAT		Mean
	S_1 (15×10)	S_2 (15×15)		S_1 (15×10)	S_2 (15×15)		S_1 (15×10)	S_2 (15×15)		S_1 (15×10)	S_2 (15×15)		S_1 (15×10)	S_2 (15×15)	
N_0(0)	5.70	6.20	5.95	7.00	8.30	7.65	8.40	10.20	9.30	10.90	11.80	11.35	12.90	12.80	12.85
N_1(90)	6.90	7.40	7.15	9.10	9.40	9.25	9.20	11.10	10.15	11.70	12.10	11.90	13.40	13.90	13.65
N_2(110)	7.10	7.90	7.50	10.20	10.20	10.20	11.30	12.00	11.65	13.20	14.60	13.90	13.80	14.80	14.30
N_3(130)	7.50	8.20	7.85	11.90	12.10	12.00	11.90	13.10	12.50	13.80	15.40	14.60	14.20	15.50	14.85
N_4(140)	7.80	8.30	8.05	12.50	12.80	12.65	12.00	13.90	12.95	14.70	16.20	15.45	14.40	16.20	15.30
Mean	7.00	7.60	7.30	10.14	10.56	10.35	10.56	12.06	11.31	12.86	14.02	13.44	13.74	14.64	14.19
	S.E.m±	C.D (p=0.05)		S.E.m±	C.D(p=0.05)		S.E.m±	C.D(p=0.05)		S.E.m±	C.D(p=0.05)		S.E.m±	C.D (p=0.05)	
N	0.221	0.656		0.350	1.041		0.314	0.934		0.335	0.995		0.412	1.225	
S	0.140	0.415		NS	NS		0.199	0.591		0.212	0.629		0.261	0.775	
N×S	NS	NS		NS	NS		NS	NS		0.474	1.407		0.583	1.732	

Table 3: Effect of levels of nitrogen and spacing on different growth parameters of onion at different intervals.

	Fresh weight of bulb			Dry weight of bulb			Fresh weight of leaves			Dry weight of leaves		
Nitrogen Levels (kg/ha)	S_1(15×10cm)	S_2(15×15cm)	Mean	S_1(15×10 cm)	S_2(15×15cm)	Mean	S_1(15×10 cm)	S_2(15×15 cm)	Mean	S_1(15×10 cm)	S_2(15×15 cm)	Mean
N_1 (0)	40.20	46.60	43.40	6.50	6.70	6.60	40.50	42.60	41.55	3.95	4.20	4.08
N_2 (90)	58.30	66.30	62.30	7.40	8.10	7.75	55.40	60.50	57.55	4.80	5.20	5.00
N_3 (110)	64.70	75.70	70.20	7.80	8.70	8.25	66.30	69.80	68.05	5.40	5.80	5.60
N_4 (130)	63.50	79.10	71.30	8.40	8.90	8.65	68.50	72.20	70.35	5.90	6.20	6.05
N_5 (140)	69.50	80.00	74.75	8.60	9.10	8.85	70.00	73.00	71.50	6.00	6.40	6.20
Mean	59.24	69.54	64.39	7.74	8.30	8.02	60.14	63.62	61.88	5.21	5.56	5.39
	S.E.m±	C.D (p=0.05)		S.E.m±	C.D (p=0.05)		S.E.m±	C.D (p=0.05)		S.E.m±	C.D (p=0.05)	
N	2.017	5.992		0.220	0.654		2.125	6.314		0.149	0.444	
S	1.275	3.790		0.139	0.414		1.334	3.994		0.094	0.281	
NXS	NS	NS		NS	NS		NS	NS		NS	NS	

Table 4: Effect of levels of nitrogen and spacing on yield and yield attributes of onion at different intervals.

	Number of marketable bulbs			**Number of unmarketable bulbs**			**Weight of marketable bulbs**			**Weight of unmarketable bulbs**			**Diameter of bulb of onion**			**Yield of bulbs**		
Nitrogen Levels	**S_1**	**S_2**	**Mean**	**S_1**	**S_1**	**mean**	**S_1**	**S_2**	**Mean**	**S_1**	**S_2**	**Mean**	**S_1**	**S_2**	**Mean**	**S_1**	**S_2**	**Mean**
N_0	182.00	119.52	150.76	78.00	46.48	62.24	7.32	5.57	6.44	1.88	1.30	1.59	4.80	5.00	4.90	201.71	150.64	176.17
N_1	225.50	153.00	189.25	49.50	27.00	38.25	13.15	10.14	11.65	1.73	1.07	1.40	5.00	5.80	5.40	326.28	246.01	286.14
N_2	241.92	162.80	202.36	46.08	22.20	34.14	15.65	12.32	13.99	1.79	1.01	1.40	5.40	6.10	5.75	382.48	292.37	337.43
N_3	251.12	169.20	210.16	40.88	18.80	29.84	15.95	13.38	14.66	1.56	0.89	1.22	5.60	6.30	5.95	383.85	313.07	348.46
N_4	240.70	166.17	203.44	49.30	24.83	37.07	16.73	13.29	15.01	2.06	1.19	1.62	5.70	6.50	6.10	411.94	317.66	364.80
Mean	228.25	154.14	119.19	52.75	27.86	40.31	13.76	10.94	12.35	1.80	1.09	1.45	5.30	5.94	5.62	341.25	363.95	302.60
	S.E.m±	C.D(p=0.05)	C.V%	S.E.m±	C.D (p=0.05)	C.V%	S.E.m±	C.D(p=0.05)	C.V%	S.E.m±	C.D(p=0.05)	C.V%	S.E.m±	C.D(p=0.05)	C.V%	S.E.m±	C.D(p=0.05)	C.V%
N	6.624	19.682	8.487	1.308	3.886	7.948	0.330	0.980	6.539	0.042	0.124	7.066	0.163	0.485	7.121	10.286	30.562	8.326
S	4.190	12.448	--	0.827	2.458	_	0.209	0.620	--	0.026	0.078	--	0.103	0.307	--	6.505	19.329	--
S×N	NS	NS	--	NS	NS	_	NS	NS	--	NS	NS	--	NS	NS	--	NS	NS	--

References

1. Ali M, Rab A, Muhammad H, Ali J, Ahmad H, Ahmad W *et al*. Influence of transplanting dates and population densities on the growth and yield of onion. Basic Research Journal of Agricultural Science and Review. 2015; 4(4):112-118.
2. Amin MMU, Rahim MA, Hushem MA. Influence of planting time and nitrogen on the growth and yield of onion. Bangladesh J. Sci. and Indust. Res. 1995; 30(2-3):275-279.
3. Banafer RNS, Sharma PK, Gupta NK, Pathak AC. Effect of fertilizers on growth, quality and yield on onion. Annual Report Soil Res. 2001, 3.
4. Bhonde SR, Chougule AB, Singh NB. Effect of irrigation and nitrogen level on seed crop performance on onion. Annual Report Soil Res. 2001; 3(1):70-73.
5. Boff P, Stuker H, Goncalves PAS. Influence da densidate na ocorrencia de doencas foliares c production de bulbos de cebola. Fitopatologia – Brasilerira, 1998; 23(4):448-452.
6. Dev H. Standardization of Planting Time and Spacing in Onion (A*llium cepa* L.*)* under Sub-tropical Conditions of Himachal Pradesh. Indian Journal of Hill Farming. 2011; 24(1):7-9.
7. Harris KD, Suthaharan S, Geretharan T. Effect of spacing and levels of nitrogen on growth and bulb yield of red onion (*Allium cepa* var. ascalonicum). International Journal of Advanced Research and Review, 2016; 1(3):39-50.
8. Hussain MA, Amans EB. Yield, bulb size distribution and storability of onion (*Allium cepa* L.) under different levels of N fertilization and irrigation regime. Trop. Agric. 2000; 77(3):145-149.
9. Jilani MS, Ghaffoor A, Waseem K, Farooqi JI. Effect of Different Levels of Nitrogen on Growth and Yield of Three Onion Varieties. International Journal of Agriculture & Biology. 2004; 6(3):507-51.
10. Kashyap Y. Determination of nitrogen requirement of onion (*Allium cepa* L.) in Kahramanmaras. Turkish J. of Agric and Forestry. 1994; 18(5):393-396.
11. Khan HM, Iqbal Ghaffoor A, Waseem K. Effect of various plant spacing and different nitrogen levels on growth and yield of onion (*Allium cepa* L.). J. Biological sci. 2002; 2:545-547.66.
12. Kilgoni MJ, Moggii MD, Yakubu Al. Effect of plant spacing and date of planting on yield of two Garlic cultivars in Soloto, Nigeria, American Eurosion J. Agri. And Environ. Sci. 2007; 2(2):15-18.
13. Kumar D, Kumar S, Kumar A. Effect OF different levels of nitrogen on growth and yield of onion(*Allium cepa* L.) Indian Agril. Sci. Digest. 2001; 2(21):121-123.
14. Messele M. Effects of Nitrogen and Phosphorus Rates on Growth, Yield, and Quality of Onion (*Allium cepa* L.) At Menschen Für Menschen Demonstration Site, Harar, Ethiopia. Agricultural Research & Technology. 2016, 1(3).