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Assesment of Various Levels of Nitrogen and Planting Distance on Growth and Seed Yield of Onion (*Allium cepa* L.)

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ABSTRACT

A field experiment was conducted at the Research Farm of College of Agriculture, Rewa (M.P.) during Rabi season of 2013 -14. The study was conducted to investigate the Effect of various levels of nitrogen and planting distance on growth and seed yield of onion. For this study twelve treatment combinations were laid in factorial arrangement in randomized block design with four replications. Healthy bulbs with fairly uniform size of about 40-60g in weight were selected for planting. Four nitrogen levels (N_1-100 kg N/ ha, N_2-120 kg N/ ha, N_3-140 kg N/ ha and N_4- kg N/ ha) and three planting spacing (closest S_1- 60X10 cm, wider S_2-60X15 cm and widest S_3-60X20 cm) was considered in this experiment. The different nitrogen levels and planting distance had significant effect on growth parameters viz; plant height, number of leaves per plant, days required for fifty percent flowering and seed yield per hectare. The results revealed that the highest plant height (66.77 cm), minimum number of days required for fifty percent flowering (81.63 days) and highest seed yield (17.153 q) per hectare was obtained from the higher dose of nitrogen (160 kg/ha, N_4) with the closest spacing of 60×10 cm (S_1), while maximum number of leaves per plant (59.52) was found with higher dose of nitrogen (160 kg/ha, N_4) and widest spacing of 60×20 cm (S_3). The maximum net returns and cost benefit ratio (C:B ratio) were obtained with nitrogen level @ 160 kg/ha (N_4) and with spacing level of 60x10 cm (S_1) followed by N @ 140 kg/ha (N_3) with same level of spacing. Hence, higher dose of nitrogen with closest plant spacing is suggested for onion seed production in Rewa district of Madhya Pradesh.

***Key words**: Onion seed, Planting distance, Bulb, Seed yield, C: B ratio*

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important vegetable bulb crops; it is commercially grown in India on a large scale. Onion is grown in India since ancient times, as mention of few versatile vegetable crops which can safely be stored for a fairly long period including the onion crop is made in " Charak – Sanhita" a famous early medical treatise of India. It is valued for its distinct pungent flavour and antioxidental components like, allicin, alliinthiosulfates and sulphites etc. present in onion helps fighting against free radicals which causes cancer, high blood cholesterol, sugar, liver problems and intestinal problems.

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India is one of the largest producers of onion in the world second only to China, accounting for 24.47% of world area and 20.20% of production[1]. The area and production of onion in India are about 10.51 lakh hectares and 168.13 Lakh tonnes of bulb, respectively, with an average productivity of 16.0 t/ha[1]. The productivity is very low as compared to the world average productivity of 19.4 t/ha[1]. In M.P. it is grown in an area of 58.30 thousand hectare, with the production of 1021.50 thousand tones with 17.50 MT/ha productivity[1]. The area under onion is increasing from time to time mainly due to its high profitability per unit area, easy of production and the increases in small scale irrigation areas. Onion is grown not only as a vegetable crop for local consumption, but also as spice, it is largely exported to neighboring countries.

There are two basic methods of seed production, bulb- to- seed production and seed-to-seed production. Bulb- to – seed production has the advantage that it is possible to select the bulb to maintain the quality of the seed stalk and to discard the off types, like double bulbs misshapen bulbs or premature bolting. Onion seeds are poor in keeping quality and lose viability within a year. Therefore, it is essential to produce seeds afresh and use the same for bulb production. Lower productivity of onion in India could be attributed to the limited availability of quality seeds and associated production technologies used, among the others. India needs 6500 tonnes of onion seeds annually for covering 8 lakh hectares area. Organized sector contribute around 54% of the total seed requirement, produced by maintaining proper isolation distance and rest is met by farmers own seeds, often produced without meeting isolation requirement[2]. Since there is a wide gap between the demand and the production of seed it will be desirable to boost up the good quality seed production. Therefore, it becomes important to increase the supply of quality seed through the efficient use of the technology. True to type selection of bulb and planting distance are the basic ethics in the production and supply of quality onion seed. The time of planting and planting distance has great impact over the seed yield[3,4]. Onion requires long-day length for production and maturation of bulb but in India short-day length prevails in the growing season of onion. So, to minimize the cultivation and production problems, emphasis must be given to improve cultivation methods of onion, such as proper planting geometry, optimum other bulb size and planting time, accurate fertilization and other cultural practices viz., weeding and mulching. Many attempts were taken in the recent past to augment the yield and to improve the quality of onion seed. Difference in onion seed yield is caused by different planting distance[5]. Mosleh[6] indicated that planting distance had significant influence on growth and yield of onion seed production and closest planting were favourable for getting higher bulb and seed yield of onion. It is grown as a Rabi season crop in northern plains.

The low yield level could be due to low soil fertility, salinity effect and inappropriate cultural practice. The use of appropriate agronomic management has an undoubted contribution in increasing crop yield. One of the important measures to be taken in increasing the productivity of onion is to determine the optimum amount of fertilizers rates and spacing in each agro-ecology. Among the fertilizers, N containing ones is the most important, since it is being a component of amino acids and chlorophyll, promotes rapid vegetative growth, protein content and yield of the crop[7]. The optimum dose of nitrogen fertilizer is of utmost importance for obtaining sustained high seed yield. Planting geometry plays an important role as optimum-planting geometry provides favourable environmental conditions for growth and seed yield. This work was carried out to study how far the higher seed yields per unit area obtained at higher dose of nitrogen and close within row spacing.

MATERIALS AND METHODS

The experiment was conducted during rabi season of 2013-2014 at the Deptt. of Horticulture, JNKVV, College of Agriculture, Rewa (M.P.). Plant & row spacing with 3 levels (S_1-60x 10 cm, S_2-60x 15 cm, S_3-60x 20 cm) and Nitrogen with four levels (N_1-100 kg N/ha, N_2-120 kg N/ha, N_3-140 kg N/ha & N_4-160 kg N/ha) and all the twelve treatment combinations (S_1N_1, S_1N_2, S_1N_3, S_1N_4, S_2N_1, S_2N_2, S_2N_3, S_2N_4, S_3N_1, S_3N_2, S_3N_3 and S_3N_4) were used as randomly allotted to different plots in factorial arrangement under randomized block design. The mean weekly maximum temperature varied from 18.21 to 39.66 ^{0}C while minimum temperature range between 7.41 ^{0}C to 19 ^{0}C. The physico-chemical analysis of soil showed that the soil of experimental site was mixed red and black silty clay loam in texture, medium in organic carbon (0.565%) and normal in reaction (pH 7.25). The bulbs of almost the same size (45-50 g in weight) were planted on south side of the ridges of 60 cm ridges at 10, 15 and 20 cm within row spacing, in November 18th, 2013. The experimental units were in Factorial Randomized block design with four replications. They were irrigated at 7 days interval and the other cultural practices (fertilizer application, weeding and pest control) were done as recommended.

Harvesting:

Pickings of umbel were done in four installments, as umbel attains the maturity at different dates. Well matured umbel harvested and dried in shed. Seeds were extracted and cleaned and weighed.

Observations recorded:

The observations were recorded at various successive growth stages. The data obtained at the last growth stage were selected for statistical analysis after applying suitable transformation.

Plant height:

The height was measured in each treatment from ground level up to the tip of fully opened leaves with the help of meter scale at 25, 45, 65 and 85 days after planting.

Number of leaves per plant:

The number of leaves in five-tagged plant in each experimental plot was counted at 25, 45, 65 and 85 days after planting.

Days required for fifty percent flowering:

The data on which 50 percent plants were flowered was recorded and days required for fifty percent flowering were worked out from the data of planting.

Seed yield per hectare (q):

As per the area of net plot and seed harvest, the yield per hectare was calculated for each treatment.

$$\text{Seed yield/ha (q)} = \frac{\text{Seed yield/plot in kg X 10000}}{\text{Area of net plot in sq. m. x 100}}$$

RESULTS AND DISCUSSION

Plant Height (cm):

The significant difference in plant height at all the crop growth stages was observed due to various treatments. It is apparent from the Table 1. Significant differences in plant height were observed due to levels of nitrogen and spacing as well as interaction between them. Data with regards to mean plant height is indicated that there was a significant increase in the height as the levels of nitrogen was increased. The tallest plant of 60.20 cm was recorded with 160 kg N/ha (N_4) followed by 140 kg N/ha and superior to all other treatments, where as the minimum height (55.34 cm) was recorded with 100 kg N /ha (N_1). Maximum plant height (62.21cm) was found under 60x10 cm (S_1) spacing followed by 60x15 cm (57.29 cm). The effect of interaction was found to be significant variation in plant height. The treatment combination consisting of S_1 x N_4 (60x10 cm + 160 kg N/ha) produced significantly tallest plant (66.77 cm) followed by 60x10 cm + 140 kg N/ha (62.34 cm) as compared to all other treatment combinations. The minimum plant height (50.60 cm) was noticed under S_3 x N_1 (60x20 cm +100 kg N/ha) treatment combination. The increase in plant height with increase in nitrogen levels might be due to the increase in cell size and enhancement of cell division, which ultimately resulted in increased plant height. The spacing's are also responsible for changing the plant height. More plant height due to closer spacing may be the results of less space for lateral growth and more competition among the plant for light and air. Similar findings were also reported by[8-12]. Hizbullah[13] reported that various plant spacing resulted in varied plant heights, with the densest planting leading to growth of shorter plants due to high competition among plants for growth factors.

Number of leaves per plant:

Data presented in Table 2 revealed that significant differences in number of leaves were observed due to nitrogen and spacing as well as interaction between them. The data indicated that was significant increase in number of leaves as the levels of nitrogen increased. The maximum number of leaves (56.99) was recorded with 160 kg N/ha followed by 140 kg N/ha which were superior to all other treatments, where as the minimum number of leaves (48.82) was recorded with 100 kg N/ha (N_1). The spacing also significantly influenced the number of leaves. Maximum number of leaves (54.90) was recorded with 60x20 cm (S_3) followed by 60x15 cm (S_2). Minimum number of leaves 50.42 recorded at a closest spacing of 60x10 cm (S_1). The effect of interaction was found to be significant for variation in number of leaves/plant. The treatment combination consisting of 60x20 cm + 160 kg N/ha (S_3N_4) produced significantly maximum number of leaves (59.52) followed by 60x15 cm + 140 kg N/ha (S_2N_3, 57.26). The lowest number of leaves (46.61) was noticed fewer than 60x10 cm + 100 kg. N/ha (S_1N_1) treatment combination. The increase in number of leaves per plant may be due to more vegetative growth at higher dose of nitrogen and more number of leaves at wider spacing may be on account of sufficient light and air for the plant growth and also less competition among the plants. Sufficient light helped in increased photosynthesis process, which manufactured more carbohydrates for vegetative growth. The similar results which manufactured more carbohydrates for vegetative growth. The similar results have been reported by [8-12].

Number of Days Required For Fifty Percent Flowering:

It is evident for the data presented is Table 3. Significantly less number of days (83.39) were required for fifty percent flowering in plants supplied with 160 kg N/ha (N_4) followed by 140 kg N/ha (N_3), which were statistically significant in comparison to all other treatments. Plants required maximum number of days (87.19) for fifty percent flowering with 100 kg N/ha (N_1). Significantly less number of days (84.90) were required for fifty percent flowering with 60x10 cm (S_1) followed by 60x15 (N_2), which were superior all other spacing treatments. Plants required maximum number of days (86.29) for fifty percent with 60x20 cm (S_3). The treatments S_2 and S_3 were at par with each other. Lesser number of days (81.63 days) was required for fifty percent flowering under treatment combination 60x10 cm +160 kg N/ha. The maximum number of days (87.26 days) required for fifty percent flowering was noticed in 60x20 cm with 100 kg N /ha. The higher dose of nitrogen helped in more rapid growth of the plants leading to breaking of the scape of umbels. The similar results have been reported by [7-10, 12-13].

Seed yield per hectare (q):

Data indicated that there were significant differences in seed yield per hectare for the nitrogen levels and maximum seed yield per hectare was recorded under 160 kg N/ha (14.340 q) followed by 140 kg N/ha (12.471 q). The minimum seed yield hectare (10.839 was found with 100 kg N/ha. With regard to different spacings the maximum seed yield per hectare 14.169 q, was found under 60x10 cm spacing followed by 60x15 cm (11.657 q). These two spacing (S_1 &S_2) were significantly superior to the S_3, (60x20cm) level of spacing which gave the lowest seed yield per hectare of 11.293 q. The effect of interaction was found to be significant for variation in yield and highest seed yield per hectare of 17.153 q was noticed under treatment combination 60x10 cm + 160 kg N /ha, which was significantly superior to all other interactions. The lowest seed yield per hectare of 10.146 q, was noticed in 60x20 cm with 100 kg N/ha.

The treatment combination exhibited significant effect on the seed yield per hectare. The highest seed yield per hectare was associated in 60x10 cm spacing with 160 kg N/ha followed by 60x10 cm spacing with 140 kg N/ha and the lowest seed yield was recorded in 60x20 cm spacing with 100 kg N/ha. The higher seed yield on account of high nitrogen dose may be due to maximum vegetative growth, it may synthesize more food material as per source of sink theory might have translocated food material towards the production of seed and therefore application of 160 kg N/ha resulted in production of more seed yield. These results are in conformity with those results reported by [13-14]. The seed yield per hectare was more on account of maximum number of plants per unit area. Even though, per plant yield was more at wider spacing but per hectare seed yield was significantly more at closer spacing due to more plant population per unit area and the seed yield was maximum at the closer spacing of 60x10 cm than other spacing. A number of previous workers have also reported the identical finding [8, 16-18]. These results are in concurrence with the finding, who reported that closer planting spacing produced maximum seed yield of onion [9-11, 14, 17-18].

ECONOMICS

The maximum net returns and cost benefit ratio were obtained with nitrogen level @ 160 kg/ha and with spacing level of 60x10 (1:11.18) cm followed by N @ 140 kg/ha with same level of spacing (1:9.50). The cost benefit ration was the least with N@ 100 kg/ha along with spacing of 60x20 cm (1:6.75). Agarwal[4] also found that the gross returns were significantly higher at closer spacing. Dudhat[5] also reported similar results.

Table 1: Effect of various levels of nitrogen and planting distance on average plant height (cm) of onion

Spacing levels	Nitrogen levels				
	N1	**N2**	**N3**	**N4**	**Average**
S1	61.33	58.40	62.34	66.77	62.21
S2	54.10	57.52	57.27	60.30	57.29
S3	50.60	56.30	58.70	59.54	56.29
Average	55.34	57.41	59.44	62.20	

	SEm	**CD (P=0.05)**
Spacing (s)	0.234	0.673
Nitrogen (N)	0.270	0.777
Interaction (SxN)	0.467	1.344

Table 2: Effect of various levels of nitrogen and planting distance on average number of leaves / plant of onion

Spacing levels	Nitrogen levels				
	N1	N2	N3	N4	Average
S1	46.61	49.63	51.26	54.21	50.42
S2	48.44	51.54	57.26	52.83	52.83
S3	51.43	52.20	56.47	59.52	54.90
Average	48.82	51.12	53.95	56.99	

	SEm	**CD (P=0.05)**
Spacing (s)	0.117	0.337
Nitrogen (N)	0.135	0.389
Interaction (SxN)	0.234	0.675

Table 3: Effect of various levels of nitrogen and planting distance on average number of days required for fifty percent flowering of onion

Spacing levels	**Nitrogen levels**				
	N1	N2	N3	N4	Average
S1	87.10	86.53	84.53	81.63	84.90
S2	87.22	87.22	86.02	84.29	86.19
S3	87.26	87.12	86.55	84.24	86.29
Average	87.19	86.96	85.64	83.39	

	SEm	**CD (P=0.05)**
Spacing (s)	0.066	0.190
Nitrogen (N)	0.076	0.219
Interaction (SxN)	0.132	0.380

Table 4: Effect of various levels of nitrogen and planting distance on average seed yield per hectare of onion

Spacing levels	**Nitrogen levels**				
	N1	N2	N3	N4	Average
S1	11.990	13.049	14.482	17.153	14.169
S2	10.382	11.323	11.709	13.212	11.657
S3	10.146	11.146	11.222	12.656	11.293
Average	10.839	11.839	12.471	14.340	

	SEm	**CD (P=0.05)**
Spacing (s)	0.025	0.071
Nitrogen (N)	0.028	0.083
Interaction (SxN)	0.05	0.143

CONCLUSION

From the results of the present investigation, it can be conclude that for obtaining higher seed yield per hectare and maximum C: B ratio, planting of onion bulbs at spacing of 60x10 cm along with application of 160 kg nitrogen per hectare is beneficial under Rewa conditions.

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REFRENCES

1. Anonymous. Indian horticulture database, *National Horticulture Board*, pp. 2-255 (2013).
2. DOGR (Directorate of Onion and Garlic Research. *Onion seed production*.,http://www.dogr.res.in (2012).
3. Verlag, G. The Effect of Bulb Size and Plant Density on Yield and Quality of Onion (*Allium cepa* L.) Seed, at Ziway, Central Ethiopia. Google eBook - *Technology & Engineering*, pp. 70 (2013).
4. Agarwal, A., Gupta, S. and Ahmed, Z. Effect of bulb size and planting geometry on seed yield and economics of onion (*Allium cepa*). *Indian Journal of*

Agricultural Science., **80(4):** 333-334 (2010).

5. Dudhat, M.S., Chovatia, P.K., Sheta, B.T., Rank, H.D. and Patel, R.J. Effect of spacing, bulb size and fertilizers on growth and seed yield of onion (*Allium cepa* L.). *Intternational Journal of Plant Sciences.*, **5(20):** 627-629 (2010).
6. Mosleh, U.M. Effect of mother bulb size and planting time on growth, bulb and seed yield of onion. *Bangladesh Journal of Agriculture Research*., **33:** 531-537(2008).
7. Lemma, D. and Shimeles, A. Research experiences in onions production. Research report No. 55, EARO, Addis Ababa Ethiopia, pp. 52 (2003).
8. Latha,P., Jeyaraman, S. and Prabakaran, R. Effect of microbial and chemical fertilizer on egg plant (*Solanum melongena* Linn.) C.var CO-2. *International Journal of Pure & Applied Bioscience*., **2(4):** 119-124 (2014).
9. Patil, H.M., Shete, B.T. and Kolekar, P.T. Effect of integrated nutrient management on growth and yield of onion (*Allium cepa* L.) seed production. *International Journal of Agriculture Science.*, **3(2):** 83-86 (2007).
10. Gethe, R.M., Pawar, V.S., Pathan, S.H., Sonwane, D.A. and Kadlag, A.D. Influence of planting layouts, irrigation regimes and fertilizer levels on growth and yield of onion under micro sprinkler. *Journal of Maharashtra agriculture Univercity*., **31(3):** 272-274 (2006).
11. Tiwari, R.S., Agrawal, A. and Sengar, S.C. Effect of N doses and spacing on seed yield of onion cv. Pusa Red. *Seed Research*., **30 (2):** 230-233 (2002).
12. Siddiqui, M.A., Shah, Z.H., Tunio, S. and Chacchar, Q. Effect of different nitrogen (N) phosphorus (P) fertilizer and plant growth regulators gibberellic acid (GA3) and indole-3-acetic acid (IAA) on qualitative traits of Canola (*Brassica napus* L.) genotypes. *International Journal of Pure & Applied Bioscience*., **4 (2):** 238-244 (2016).
13. Hizbullah Khan, Muhammad Iqbal, Abdul Ghaffur and Kashif Waseem. Effect of various plant spacing and different nitrogen levels on the growth and yield of onion (*Allium cepa* L.). *Journal of Biological Sciences*., **2(8):** 545-547 (2002).
14. Shukla, N., Mehta, N., Singh, B. and Trivedi, J. Studies on seed production of onion (*Allium cepa* L) cultivar Agrifound Dark Red as influenced by bulb size and nitrogen levels. *Orissa Journal of Horticulture*., **36 (1):** 102-105 (2008).
15. Pandey, U.B., Panwar, D.S. and Sharma, V.P. Effect of spacings and levels of nitrogen on growth and seed yield of Kharif onion. *Seed Research*., **20:** 147-148 (1994).
16. Amin, M.M.U. and Rahim, M.A. Effect of plant density, planting time and nitrogen on the growth and yield of onion. *Progressive Agriculture*., **6:** 69-75 (1995).
17. Singh, S.R. and Sachan, B.P. Interaction of bulb size and spacing on seed yield and yield attributing trait of onion (*Allium cepa* L.) cv. Kalyanpur Runel Red. *Scientific Horticulture*., **6:** 125-18 (1999).
18. Atif, Y.Mahadeen. Effect of Bulb Size and Plant Density on Onion seed production under rainfed conditions. *Minufiya J. Agric Rres*., **29:** 1339-1346 (2004).