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Effects of planting date and GA₃ on growth, yield and quality of onion seeds grown from sets

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Abstract

An experiment was conducted at the Horticulture Farm, Bangladesh Agricultural University (BAU), Mymensingh during the period from October, 2002 to April, 2003 to study the effects of planting date and concentration of GA₃ on the growth, yield and quality of onion seeds. There were two planting dates viz., 30 October and 20 November and five concentrations of GA₃ viz., 0, 25, 50, 75 and 100 ppm. The two-factor experiment was laid out in the split plot design with three replications. The planting date and concentration of GA₃ showed significant influence on the growth of plant and yield of onion seed. The highest yield of 392.27 kg/ha was obtained from 30 October planting. The maximum seed yield (389.67 kg) was found at the concentration of 75 ppm GA₃ and the lowest seed yield 379.60 kg per hectare was noticed from the control plant. The treatment combination of 30 October planting × 75 ppm GA₃ gave the highest seed yield (398.67 kg/ha). The quality of onion seeds varied significantly due to planting time and concentration of GA₃ used. The highest weight of thousand seeds (3.15 g) was obtained from 20 November planting time and 75 ppm GA₃. The highest germination percentage (78.90) was recorded from the treatment combination of 30 October planting × 75 ppm GA₃.

Keywords: Planting date, Conc. of GA₃, Yield, Quality, Onion seed

Introduction

Onion (*Allium cepa* L.) is one of the most important spices as well as vegetable crops in the world including Bangladesh. Among the spice crops grown in Bangladesh, onion ranks top in respect of production and second in area (BBS, 2003). Bangladesh produced 134 thousand tons of onion bulb from 34 thousand hectare of land during 2000-2001 growing season (BBS, 2003). It is estimated that in Bangladesh 150 tones onion seeds are produced per against the requirement of 300 tones per year (Rahim *et al.*, 1993). The lack of high quality seed in the number one problem for the low yield of onion in Bangladesh.

Many attempts were taken in the recent past to augment the seed yield and to improve the quality of onion seed (Wagh and Deore, 1995; Bhonde *et al.*, 1996). But no definite and profitable technologies have yet been developed which can be recommended to farmers for growing onion seed at a commercial scale. A few well-adopted indigenous varieties such as Taherpuri, Zhitka and Faridpurbhati are used to produce onion seeds in limited areas of Bangladesh. Workers of different onion growing countries of the world have defined the optimum time for raising seed crops in their own countries (Patil, 1959; Jones and Emsweller, 1939). Planting time is one of the important factors that greatly influences the growth and seed yield of onion. Adjustment of planting time is very important because of the short winter seasons of Bangladesh. Mondal and Hussain (1980) considered 23 October as the best planting time for the highest yield and better quality of onion seeds.

The growth regulators are considered as key factors in vegetative growth, flowering, fruit setting and seed production in plant but a few researchers carried out experiments involving growth regulators as influencing for in onion seed production. It is revealed from experiments conducted in various parts of the world that IAA, NAA, GA₃, ethrel at various concentrations

had remarkable effects on bulb initiation, production of leaf, plant height, number of flowers per umbel, umbel size, bulb and quality seed production of onion (El-Habbasha *et al.*, 1985). Although many references are available in the literature dealing with the effect of growth regulators and time of planting on seed production of onion, but those information's cannot be used directly in case of varieties of Bangladesh because of varied soil and climatic conditions. Therefore, the present experiment was undertaken to study the performance of BARI- piaz-1 on growth, yield and quality of onion seeds in optimum date of planting and in optimum dose of GA₃ for the production of quality seeds of onion. No systematic study involving these two factors viz. Planting date and conc. Of GA₃. The present experiment was therefore undertaken to evaluate the effect of planting date and conc. Of GA₃ on the yield and quality of onion seeds.

Materials and Methods

The present experiment was conducted at the Horticulture Farm, Bangladesh Agricultural University, Mymensingh, during the period from October, 2002 to April, 2003. In the research work, the onion bulbs (sets) were used as experimental materials. The weight of the bulbs required for each treatment was made uniform by weighing before planting. In this experiment the onion cultivars BARI Piaz 1, ; two planting dates viz., 30 October, 2002 and 20 November, 2002; and five concentrations of GA₃ viz., 0 (Control), 25, 50, 75 and 100 ppm were used.

The experiment was laid out in a split plot design with three replications. In each replication the land was divided into two main plots, each plot was divided into five sub-plots. The size of each unit plot was 1.0 m × 1.0 m. The distance between main plot to main plot was 1 m, replication to replication was 1 m and distance between two unit plots was 50 cm. The planting dates were assigned to the main plots, and the concentrations of GA₃ into the sub-plots. Medium bulbs of uniform size (6-7 g) were planted on 30 October, and 20 November, 2002. The distance between row to row was 20 cm and plant to plant in each row was 20 cm. Bulbs were set upright (Novak, 1979) and at a depth of 2.5 cm (Bhardwaj *et al.*, 1991).

The experimental plots were observed frequently to record changes in plants characters at different stages of growth. Five plants were selected randomly from each plot and data were recorded on individual plant basis from the selected plant in respect of the maximum plant height, maximum number of leaves per plants, height of flowering stalk, number of flowering stalk per plant, number of flowers per umbel, number of seeded fruits per umbel, percentage of fruit set, weight of seeds per plant, seed yield per hectare and thousand seed weight. The computer using statistical package program MSTAT-C developed by Russel (1986) statistically analyzed data collected on different parameters and the difference between pair of means was performed by Least Significant Difference (LSD) test (Gomez and Gomez, 1984).

Results and Discussion

Main effects of planting time and conc. of GA₃

Two planting dates had significantly influenced on the maximum plant height, number of leaves, no. of flowers per umbel no. of seeded fruits per umbel. The maximum plant height, number of leaves, no. of flowers per umbel. no. of seeded fruits per umbel (43.19 cm, 21.25,

237.38, 181.19 respectively) were recorded in 30 October planting and the lowest on the same parameters (40.98 cm, 21.24, 217.99 and 164.80 respectively) were recorded from 20 November planting. Maximum height of flowering stalk (62.99 cm) and number of flowering stalk per plant (3.67) were found in 20 November planting. The highest seed yields per plant and per hectare and highest germination percentage (1.14 g, 392.27 kg and 77.79 respectively) were recorded in 30 October planting and the lowest on the same parameters (1.04 g, 375.92 kg and 76.60 respectively) were recorded in 20 November planting. On the other hand in respect of these characters 75 ppm conc. of GA₃ performed best and 0 ppm of GA₃ was the worst in consideration with the others.

Interaction effect between planting time and conc. of GA₃

In consideration with the interaction effect between planting time and conc. of GA₃, maximum number of leaves, height of flowering stalk, no. of flowers per umbel, no. of seeded fruits per umbel, seed yields per plant and per hectare, weight of 1000 seeds and germination percentage showed significant effect. On the other hand maximum plant height and number of flowering stalks were statistically non significant.

Interaction and combined effect between planting time and conc. of GA₃

The interaction effect between planting time and concentration of GA₃ on maximum plant height was found to be statistically non-significant. The maximum plant height (46.35cm) was found from the treatment combination of 30 October planting × 75 ppm GA₃ which was statistically identical (44.52 cm) with the treatment combination of 30 October planting × 50 ppm GA₃ and the lowest (38.22 cm) was found from the treatment combination of D₂C₀ (20 November planting × 0 ppm GA₃). On the other hand interaction effect between planting time and concentration of GA₃ on the number of leaves per plant at maximum vegetative growth stage was found to be statistically significant and their combined effect was also significant. The maximum number of leaves per plant (24.33) was recorded from the treatment combination of 30 October planting time × 100 ppm GA₃ while the lowest number of leaves (18.18) was recorded from the 20 November planting × 50 ppm GA₃.

The interaction effect between planting time and concentration of GA₃ on the length of flowering stalk was found to be statistically significant and their combined effect was also significant. The maximum length (65.93 cm) was obtained from the treatment combination of 20 November planting × 75 ppm GA₃ and the lowest (58.47 cm) was found from the treatment combination of 30 October planting × 50 ppm GA₃. The highest number of flowers per umbel (248.67) was obtained from the treatment combination of 30 October planting × 75 ppm GA₃ and the lowest (213.06) was found from the treatment combination of 20 November planting × 50 ppm GA₃. Maximum Number of seeded fruits per umbel (187.51) was obtained from the treatment combination of 30 October planting × 100 ppm GA₃ and the lowest (161.92) was found from the treatment combination of 20 November planting × 100 ppm GA₃. Again the interaction and combined effects of planting time and concentration of GA₃ on seed yields per plant and per hectare were found to be statistically significant. The highest seed yield per plant (1.18 g) was obtained from the 30 October planting × 75 ppm GA₃ and the lowest (0.98 g) was obtained from 20 November planting × 50 ppm GA₃. The maximum seed yield per hectare (398.67 kg) was found from the treatment combination of 30 October planting × 75 ppm GA₃ followed by (393.17 kg) treatment combination of 30 October planting × 50 ppm GA₃. On the other hand the lowest seed yield (371.00 kg) was found from the treatment combination of 20 November planting × 0 ppm GA₃.

Table 1. Effect of planting date and concentration of GA₃ on growth, yield and quality of onion seeds

Planting date	Maximum plant height (cm)	Maximum No. of leaves	Height of flowering stalk (cm)	No. of flowering stalks/plant	No. of flowers/umbel	No. of seeded fruits per umbel	Weight of seeds per plant (g)	Seed yield (kg/ha)	1000 seeds weight (g)	Germination percentage (%)
D ₁	43.19	21.25	60.20	3.31	237.38	181.19	1.14	392.27	3.07	77.79
D ₂	40.98	21.24	62.99	3.67	217.99	164.80	1.04	375.92	3.10	76.60
LSD (0.01)	1.90	-	0.303	0.229	7.090	4.768	0.049	0.584	0.069	0.850
Conc. of GA ₃										
C ₀	39.37	20.82	60.81	3.39	221.19	170.28	1.10	379.60	3.05	77.01
C ₁	40.62	18.89	61.35	3.67	225.55	174.05	1.13	381.67	3.09	76.07
C ₂	42.92	18.93	61.00	3.38	224.34	169.79	1.06	385.05	3.09	76.28
C ₃	45.12	23.79	64.23	3.61	237.23	176.15	1.09	389.67	3.12	78.42
C ₄	42.40	23.79	60.58	3.40	230.10	174.72	1.07	384.50	3.10	78.20
LSD (0.01)	1.408	0.482	0.546	0.177	1.636	3.903	0.053	1.357	0.029	0.626

D₁: 30 October, 2002
D₂: 20 November, 2002

C₀: 0 ppm (control)
C₁: 25 ppm
C₂: 50 ppm
C₃: 75 ppm
C₄: 100 ppm

Table 2. Interaction between planting date and concentration of GA₃ on growth, yield and quality of onion seeds

Planting date × Concentration of GA ₃	Maximum plant height (cm)	Maximum No. of leaves	Height of flowering stalk (cm)	No. of flowering stalks/plant	No. of flowers/ umbel	No. of seeded fruits per umbel	Weight of seeds per plant (g)	Seed yield (kg/ha)	1000 seeds weight (g)	Germination percentage (%)
D ₁ C ₀	40.52	20.33	60.16	3.16	227.40	174.28	1.10	388.20	3.07	77.07
D ₁ C ₁	41.59	18.66	61.31	3.40	233.52	184.50	1.12	391.83	3.08	77.17
D ₁ C ₂	44.52	19.68	58.51	3.19	235.61	173.93	1.13	393.17	3.07	77.20
D ₁ C ₃	46.35	23.25	62.53	3.64	248.67	185.72	1.18	398.67	3.08	78.90
D ₁ C ₄	42.97	24.33	58.47	3.14	241.68	187.51	1.16	389.50	3.06	78.63
D ₂ C ₀	38.22	21.31	61.46	3.63	214.97	166.27	1.10	371.00	3.02	76.95
D ₂ C ₁	39.65	19.11	61.38	3.94	217.58	163.59	1.13	371.50	3.10	74.97
D ₂ C ₂	41.32	18.18	63.49	3.57	213.06	165.65	0.98	376.93	3.12	75.37
D ₂ C ₃	43.89	24.33	65.93	3.57	225.79	166.57	0.99	380.67	3.15	77.94
D ₂ C ₄	41.83	23.24	62.69	3.65	218.52	161.92	0.98	379.50	3.13	77.77
LSD (0.01)	-	0.682	0.772	-	2.313	5.520	0.075	1.920	0.041	0.886

D₁: 30 October, 2002
D₂: 20 November, 2002

C₀: 0 ppm (control)
C₁: 25 ppm
C₂: 50 ppm
C₃: 75 ppm
C₄: 100 ppm

The interaction and combined effect of planting time and concentration of GA₃ on the thousand seed weight and germination percentage were found to be statistically significant. The highest weight of thousand seeds (3.15 g) was recorded from the treatment combination of 20 November planting × 75 ppm GA₃ and the lowest (3.02 g) was from 20 November planting × 0 ppm GA₃. The highest germination percentage (78.90) was recorded from the treatment combination of 30 October planting × 75 ppm GA₃ and the lowest (74.97) was from 20 November planting × 25 ppm GA₃.

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