

Effect of Dates of Planting, Bulb Size and Bulb Spacing on Growth and Seed Yield of Onion (*Allium cepa* L.)

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ABSTRACT Field investigation were carried out to study the effect of planting time, bulb size and bulb spacing on plant growth and seed yield attributes of onion cultivar RO-1 during rabi of 1995-96, 1996-97 and 1997-98 at Agricultural Research Station, Durgapura (Jaipur) of Rajasthan Agricultural University (Bikaner). Maximum seed yield (10.95 q/ha) was obtained in 11th October planting followed by 1st October (10.05 q/ha). The bulb diameter (6.0x4.5 cm) and bulb spacing (45x30 cm) had given maximum seed yield of 9.87 q/ha and 9.76 q/ha, respectively. The maximum net return of Rs. 78145 per hectare and highest cost-benefit ratio of 1.0:3.36 were recorded when 4.5 x 3.0 cm diameter bulbs were planted at 45 x 30 cm spacing on 11th October for seed production of onion cultivar RO-1.

Keywords: Onion, bulb spacing, bulb size, dates of planting, seed yield, cost-benefit ratio

Onion (*Allium cepa* L.) is one of the major vegetable crops grown throughout the country and occupy 0.40 m ha area with the production of 4.5 million tones of dry bulbs. It is one of those few versatile vegetable crops that can be stored for a longer period under ambient and safely withstands the hazards of rough handling and transportation. It is the only vegetable in which India figures prominently in the world for its production and export. But the average productivity of onion is still very low. The reasons behind the lower productivity are limited availability of quality seed and poor application of production technology. The size of bulb and time of planting are known to affect the seed yield and seed quality in onion [1, 2]. The bulb spacing also play an important role for harvesting better seed quality. So far limited research has been done on the standardization of agro-techniques for quality seed production of onion. Therefore, an experiment on the optimum time of planting, bulb size and bulb spacing to harness the higher seed yield, better quality in onion

cultivar RO-1 under Jaipur conditions of Rajasthan was carried out as this area is suitable for onion seed production.

MATERIALS AND METHODS

The experiment was conducted at Agricultural Research Station, Durgapura (Jaipur), during rabi 1995-96, 1996-97 and 1997-98. There were five dates of planting viz., 1st October (D₁), 11th October (D₂), 21st October (D₃), 31st October (D₄) and 11th of November (D₅) with two bulb spacing i.e. 45 x 30 cm (S₁) and 60 x 30 cm (S₂) along with two size of bulbs viz. 6.0 x 4.5 cm (B₁) and 4.5 x 3.0 cm (B₂) in the experiment. The experiment was laid out in a split plot design with three replications, consisting of 20 treatment combinations in each replication and the net plot size was kept 5.4 m². All agronomical practices were followed as per recommendations for production of the onion seed crop. The onion cultivar RO-1, released by Rajasthan Agricultural University for Rajasthan state was selected for this study. Data

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Table 1. Effect of dates of planting, bulb size and bulb spacing on growth and seed yield of onion (var. RO-1) (mean of pooled data of 1995-96, 96-97 and 97-98)

Treatment	Plant height (cm)	Days to flowering	Size of umbel (cm)	1000 seed weight (g)	Seed yield/umbel (g)	Seed yield (q/ha)
Dates of planting						
D ₁ -1 st October	104.97	126.67	6.54	3.69	3.66	10.05
D ₂ -11 th October	104.95	127.33	6.83	3.71	3.74	10.95
D ₃ -21 st October	99.95	118.28	6.25	3.58	3.48	9.86
D ₄ -31 st October	97.21	109.83	5.54	3.48	3.30	8.50
D ₅ -11 th November	92.65	96.00	5.43	3.43	3.12	6.15
CD at 5%	1.24	0.58	0.21	0.02	0.28	1.72
Bulb size (cm)						
B ₁ -4.5X3.0	99.00	114.70	5.98	3.55	3.46	8.34
B ₂ -6.0X4.5	100.81	116.67	6.25	3.61	3.72	9.87
CD at 5%	0.50	0.37	0.12	0.01	0.24	0.51
Bulb spacing (cm)						
S ₁ -45X30	99.38	114.07	5.91	3.55	3.36	9.76
S ₂ -60X30	100.43	116.60	6.33	3.61	3.58	8.45
CD at 5%	0.50	0.13	0.12	0.01	0.20	0.52

Table 2. Average weather data of three years during the period of seed crop growth

Month	Temperature (°C)		Relative Humidity (%)	
	Minimum	Maximum	Minimum	Maximum
October	16.8	35.6	30	75
November	10.2	29.6	34	78
December	7.3	24.8	32	86
January	8.5	26.5	27	76
February	11.3	30.6	33	75
March	18.4	34.0	26	65
April	20.6	36.5	20	58
May	27.0	42.0	13	40

related to plant height, days to flowering, size of umbel, 1000 seed weight, seed yield/umbel and seed yield (q/ha) were recorded and three years data were pooled and subjected to statistical analysis.

RESULTS AND DISCUSION

Effect of planting dates: The analysis of variance (ANOVA) of pooled data revealed that time of planting of onion bulbs has significant effect on plant

height, days to flower, size of umbel, 1000 seed weight, seed yield per umbel and total seed yield (Table 1). The 11th October planting produced highest size of umbel (6.83 cm in diameter) and significantly higher seed yield per umbel (3.74 g/umbel), 1000 seed weight (3.71 g) and highest total seed yield (10.95 q/ha) over the treatments were planted late (Oct-Nov). First October planting which was statistically at par in all aspects of plant growth and seed yield of onion seed crop. The lower seed yield

Table 3. Economics of seed production in onion (var. RO-1)

Treatments		Mean seed yield (q/ha)	Cost of production (Rs/ha)	Gross income (Rs./ha)	Net income (Rs./ha)	Cost-benefit ratio
D ₁	S ₁ B ₁	9.46	33555	94600	61045	2.81
	S ₁ B ₂	11.70	49110	7000	67890	2.38
	S ₂ B ₁	9.23	31110	92300	61190	2.96
	S ₂ B ₂	9.83	40220	98300	58080	2.44
D ₂	S ₁ B ₁	11.12	33055	111200	78145	3.36
	S ₁ B ₂	12.53	48610	125300	76690	2.57
	S ₂ B ₁	9.81	30610	98100	67490	3.20
	S ₂ B ₂	10.36	39720	103600	63880	2.68
D ₃	S ₁ B ₁	9.88	32550	98800	66250	3.03
	S ₁ B ₂	11.78	48110	117800	69690	2.44
	S ₂ B ₁	8.00	30110	80000	49890	2.65
	S ₂ B ₂	9.78	39220	97800	58580	2.49
D ₄	S ₁ B ₁	8.14	32055	81400	49345	2.53
	S ₁ B ₂	9.95	47610	99500	51890	2.08
	S ₂ B ₁	7.15	29610	71500	41890	2.41
	S ₂ B ₂	8.77	38720	87700	48980	2.26
D ₅	S ₁ B ₁	5.65	31555	56500	24945	1.79
	S ₁ B ₂	7.41	47110	74100	26900	1.57
	S ₂ B ₁	4.93	29110	49300	20190	1.69
	S ₂ B ₂	6.62	38220	66200	27980	1.73

and reduction in other attributes under late planting (Oct-Nov) could be due to early onset of high temperature during seed maturation under Jaipur condition (Table 2). These results are in agreement with Rathore *et al.* [3, 4]. The November planted onion seed crop under Jaipur condition performed poorly in all aspect of plant growth and seed yield due to early maturity of the seed crop.

Effect of bulb size: The perusal of the data presented in Table 1 showed that the size of the mother bulb had significant effect on plant height, size of umbel, 1000 seed weight, seed yield per umbel and total seed yield. Maximum plant height (100.81 cm), size of umbel (6.25 cm in diameter), 1000 seed weight (3.61 gm), seed yield per umbel (3.72 gm/umbel) and total seed yield (9.87 q/ha) was recorded with 6.0x4.5 cm size of bulbs as compared to smaller size bulb (4.5x3.0 cm). It could be due to availability of more food material and nutrient in large size bulbs [5]. These results are in conformity with the findings of other workers [6, 7, 8].

Effect of bulb spacing: Bulb spacing had significant effect on plant growth and seed yield (Table 1). The maximum plant height (100.43 cm), size of umbel (6.33 cm in diameter), 1000 seed weight (3.61 gm) and seed yield per umbel (3.58 gm) were recorded under wider spacing of 60 x 30 cm. However, total seed yield was significantly higher (9.76 q/ha) in closer spacing (45 x 30 cm) as compared to wider spacing (60 x 30 cm). The significant higher seed yield in closer spacing is due to more plant population per hectare. These results are in agreement with other workers [6, 7]. The interaction among the date of planting, bulb size and spacing were non-significant.

Economics of seed production: Data related to economics of onion seed production (Table 3) revealed that 11th October planting of smaller size of bulbs (4.5 x 3.0 cm in diameter) at close spacing i.e. 45x30 cm gave maximum net returns (Rs. 78145/ha) with a maximum cost-benefit ratio of 1.0:3.36 as compared to all other time of plantings, size of bulbs and spacing of bulbs under semi-arid conditions of Jaipur (Rajasthan).

Therefore it is recommended that planting of onion bulb for seed crop (cultivar RO-1) be done in second week of October with small size of bulbs (4.5x3.0 cm) at a spacing of 45x 30 cm to achieve maximum seed yield, net return and cost-benefit ratio (1:3.36) under semi-arid condition of Rajasthan.

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