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Effect of planting time on seed yield of onion cv. Akola Safed

Shrikant G Wankhade, Dr. SM Ghawade and Rutuja N Deshmukh

Abstract
A field experiment entitled "Effect of planting time on seed yield of onion cv. Akola Safed" was conducted at Chilli and Vegetable Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during *rabi* season of 2017-2018, with an objective to study the effect of planting time on yield and quality of onion seed.
The statistical design adopted for experiment was randomized block design (RBD) with three replications and seven treatments. Bulbs were planted at 15 days interval from 15th October 2017 to 15th January 2018 and observations were recorded. The observations recorded for vegetative growth in terms of plant height and number of leaves, emergence of primary and secondary flower stalk, as regards to reproductive parameters, maximum umbel diameter and number of umbels, yield parameters *viz*. number of seeds per plant, yield per plant, yield per plot and yield per hectare, seed quality in terms of test weight, germination per cent and graded seed yield. The results of present investigation revealed that, bulbs were planted during second week of November were found to be superior for the above studied parameters.

Keywords: Akola, planting, onion, Safed, Chilli

Introduction
Onion (*Allium cepa* L.) is the most common member of the family Alliaceae and it is native of Asia and perhaps introduced from Palestine to India. It is widely grown as an herbaceous biannual vegetable crop with cross-pollinated and monocotyledonous behaviour having diploid chromosome number 2n=16 (Bassett, 1986) [1]. Onion is one of the most important vegetable cash crops grown for vegetable in green stage as well as for mature bulb. Onion also contains an essential volatile oil chiefly constituting 'Allyl-propyl-disulphide', which imparts characteristic pungency.
Onion being extensively cultivated crop, there is a heavy demand for fresh seeds every year. Seed is the most important input component for productive agriculture. Good quality seed acts as a catalyst for realizing the potential of other inputs in agriculture and horticulture too. Onion is sensitive to temperature and photoperiod. Temperature is important factor for seed production so, proper planting time play key role in quality seed yield.
Flowering and seed formation occurs in the late spring or early summer in response to a vernalization treatment during the winter. The onion inflorescence is an umbel, which produces 50 to 2000 flowers. Flowering can be as long as two weeks and is not uniform since the umbel consists of aggregations of smaller 5 to 10 flowered inflorescence called cymes. More flower stalks are produced on plants grown from bulbs than those grown from seed.
Considering importance of pure, true-to-type seed, it is essential to standardize technology of onion seed production. Quality and quantity of seed produced per unit area greatly varies with the variety, spacing, size of mother bulbs, method of seed production and environmental conditions. Furthermore, in addition to this, planting time play an important role in quality seed production and increase the seed yield of onion considerably.
Onion has great demand in domestic as well as in foreign market. Hence, it is important to produce good quality bulbs for export purpose to gate high value to this crop. The results obtained from the present investigation, may serve as a guideline to the onion growers to adopt suitable planting time for increasing the yield and quality of onion seed.
Considering changing climatic situation in last decades, the various vegetables grown in Vidarbha region were facing lot of problems towards time of planting. Ultimately the planting time governs the yield and quality of seeds, which will change the fate of next generation of same vegetable. Also, appropriate time of planting in the bulbous crop like onion has definite meaning in earning of the farmers. Hence, there would be lot of scope for the researchers,

farmers and extension workers with respect to the propose study on "Effect of planting time on seed yield of onion cv. Akola Safed."

Materials and Methods

The present investigation entitled "Effect of planting time on seed yield of onion cv. Akola Safed" was carried out at Chilli and Vegetable Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during *Rabi* season of 2017-18.

Planting material

The bulbs of onion variety 'Akola Safed' were obtained from Chilli and Vegetable Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The bulbs with uniform size, shape, and average weight of 50 to 60 g. were selected for the planting purpose.

Planting of bulbs

The layout of the experiment was irrigated 3-4 days before the planting, so as to facilitate easy planting. The planting was undertaken according to dates of treatments. The bulbs of 4-6 cm diameter and having 50-60 g weight were planted along one side of the ridge at a spacing of 60 cm x 30 cm and then plots were irrigated after planting.

Fertilizer application

Well decomposed FYM was used as a source of organic fertilizer and was applied as per recommended dose i.e., 25 cartloads per hectare and mixed in soil by harrowing. Chemical fertilizers were applied @ of 100 kg/ha N, 50 kg/ha P_2O_5, 50 kg/ha K_2O in form of Urea, Single Super Phosphate and Murate of Potash, respectively.

Irrigation

The experimental field was irrigated at 8 to 10 days interval throughout the growing season of the crop. The first irrigation was given immediately after bulb planting. In all, twenty-nine irrigations were given to the seed crop of onion.

Harvesting and curing

The crop was harvested as per maturity of umbels of onion i.e., the umbels turned yellow to brown and started drying. The irrigation was partially restricted before every harvesting. The harvesting was undertaken by cutting of umbels with a quick turn of the hand, leaving a short piece of stem attached. They were allowed to dry on clean threshing floor in a thin layer of 15 cm, which help in curing and proper maturing of the seeds. Then threshing and cleaning of seeds were undertaken manually from each of the treatment plot of the experiment, separately.

Seed storage

Clean onion seeds from each of the treatment plot of the experimentation were stored in container i.e., cloth bags. Care has been taken to maintain the ambient temperature and humidity of 65% in the storage conditions.

Table 1: Experimental Detail

1.	**Crop**	**:**	**Onion**
2.	Variety	**:**	Akola Safed
3.	Season	**:**	Rabi
4.	Experimental Design	**:**	Randomized Block Design (RBD)
5.	Replications	**:**	03
6.	Treatments	**:**	07
7.	Spacing	**:**	Row to Row 60 cm Plant to Plant 30 cm
8.	Gross plot size	**:**	2.7m × 3.3m
9.	Net plot size	**:**	2.1m × 3m
10.	No. of plant per plot	**:**	35

Table 2: Treatment Details

T_1	**:**	**Planting of onion bulbs during 2nd week of October 2017.**
T_2	:	Planting of onion bulbs during 4th week of October 2017.
T_3	:	Planting of onion bulbs during 2nd week of November 2017.
T_4	:	Planting of onion bulbs during 4th week of November 2017.
T_5	:	Planting of onion bulbs during 2nd week of December 2017.
T_6	:	Planting of onion bulbs during 4th week of December 2017.
T_7	:	Planting of onion bulbs during 2nd week of January 2018.

Observations

For recording biometric observations on growth, yield and seed quality, five plants were selected at random from each plot. The selected plants were labeled and the observations on height and number of leaves per plant were recorded periodically. First observation was taken 20 days after planting. Subsequent observations were recorded at an interval of 30 days till harvesting stage of the crop.

Result and Discussion

Vegetative growth parameters

Effect of planting time on days required to sprouting of onion bulbs: The data regarding the days required to sprouting of onion bulbs was recorded and presented in table The data indicated that, there was significant delay in sprouting of onion bulbs with late planting dates. Further, significantly the maximum (5.00) days to sprouting were recorded in the treatment T_7 (Planting of onion bulbs during 2nd week of January 2018.), which was at par (4.87 days) with treatment T_6 (Planting of onion bulbs on 4th week of December 2017). However, the minimum (3.87) days were recorded with treatment T_1 (Planting of onion bulbs during 2nd week of October 2017).

The earlier sprouting which might be due to availability of higher soil temperature, relative humidity and rainfall prevailed during initiation and completion of bulbs to the

onion bulbs planted earlier than rest of the treatments, which would result in early sprouting of the bulbs. These results are similar to the findings of Rohini and Paramaguru (2016) [9] under Coimbatore (Tamil Nadu) conditions.

Table 3: Effect of planting time on days required to sprouting of onion bulbs

Treatments	Days required for sprouting of onion bulbs
T_1 - Planting of onion bulbs during 2nd week of October, 2017.	3.87
T_2 - Planting of onion bulbs during 4th week of October, 2017.	3.93
T_3 - Planting of onion bulbs during 2nd week of November, 2017.	4.07
T_4 - Planting of onion bulbs during 4th week of November, 2017.	4.27
T_5 - Planting of onion bulbs during 2nd week of December, 2017.	4.40
T_6 - Planting of onion bulbs during 4th week of December, 2017.	4.87
T_7 – Planting of onion bulbs during 2nd week of January, 2018.	5.00
'F' test	Sig
SE(m)±	0.14
CD at 5%	0.43

Effect of planting time on plant height in onion

The height of onion plant was significantly influenced by different panting time. The plant height measured at 30, 60, 90 and 120 DAP were presented in table 2

Table 4: Effect of planting time on plant height in onion (cm) and Number of leaves

Tr.	Plant height (cm)				Number of leaves			
	30 DAP	60 DAP	90 DAP	120 DAP	30 DAP	60 DAP	90 DAP	120 DAP
T_1	30.40	46.33	58.60	73.67	25.87	44.60	48.80	46.07
T_2	30.73	46.66	59.73	75.93	27.93	46.60	56.47	52.13
T_3	30.93	48.33	62.53	79.17	28.57	56.13	59.80	56.57
T_4	28.60	44.46	57.67	72.33	22.73	41.07	44.80	42.13
T_5	28.40	44.13	57.07	68.83	22.53	39.73	42.50	40.43
T_6	27.80	42.06	55.80	64.33	19.30	39.60	41.13	37.87
T_7	26.93	41.26	52.60	61.33	14.67	37.27	37.93	35.60
'F' test	NS	NS	Sig	Sig	NS	NS	Sig	Sig
SE(m)±	1.37	1.78	1.55	1.5	2.87	4.41	2.97	3.1
CD at 5%	-	-	4.84	4.67	-	-	9.27	9.7

At 120 DAT, significantly the maximum (79.17 cm) plant height in onion crop was obtained in the treatment T_3 (planting of onion bulbs during second week of November), which is found at par (75.93 cm) with T_2 (planting of onion bulbs on fourth week of October). Whereas, the minimum (61.33 cm) plant height was observed in treatment T_7 (planting of onion bulbs during second week of January).

The probable reason could be the undesirable temperature, which do not permit the onion plant to grow with its optimum height compared to early planting dates. Similar results were also reported by Mollah *et al.* (2015) [8] and Manna *et al.* (2016) [5] in onion.

Effect of planting time on number of leaves in onion.

The data regarding the number of leaves per plant as influenced by application of different dates of planting were recorded and presented in table 2. At 120 DAP, significantly the maximum (56.57) leaves in onion crop were observed in the treatment T_3 (planting of onion bulbs on second week of November), which was found at par with treatment T_2 (planting of onion bulbs on fourth week of October). Whereas, the minimum (35.60) leaves were produced in treatment T_7 (planting of onion bulbs on second week of January).

Whereas, delayed planting of onion bulbs showed the reduction in number of leaves per plant in onion. This may be due to the fact that, onion plants received optimum cooler period in second week of November planting compared to first week of January planting. The cooler period stimulate cytokinins and gibberellins accumulation which modify the hormonal balance and might leading the plant to increase number of leaves and other plant development. Quite similar results were found by Mollah *et al.* (2015) [8] under Bangladesh conditions, Manna *et al.* (2016) [5] under West Bengal conditions, and Maria *et al.* (2018) [6] in onion, under conditions of North-Eastern Ethiopia.

Effect of planting time on emergence of flower stalk in onion

The data in respect of days required to emergence of flower stalk influenced by different planting time was recorded and are presented in table 3. Data indicated the significant differences among the treatments. Significantly the minimum (37.53) days to emergence of primary flower stalk were taken by in the T_6 (planting of onion bulbs during fourth week of December), which was at par with T_7 (planting of onion bulbs during second week of January). Whereas, the maximum (58.07) days were required to emergence of primary flower stalk were recorded in T_1 (planting of onion bulbs during second week of October).

As the emergence of secondary flower stalk, significantly the minimum (65.33) days were taken by the T_7 (planting of onion bulbs during second week of January). Whereas, the maximum (90.50) days were required to emergence of secondary flower stalk were recorded in T_1 (planting of onion bulbs during second week of October).

Table 5: Effect of planting time on days required to emergence of flower stalk in onion, diameter of umbel (cm) and number of umbels/plant

Tr.	Days required for emergence		Diameter of umbel (cm)		No. of umbels/plant	
	Primary flower stalk	Secondary flower stalk	Primary umbel	Secondary umbel	Primary umbels/plant	Secondary umbels /plant
T_1	58.07	90.50	6.49	5.80	5.17	2.60
T_2	57.87	88.67	6.54	6.12	6.33	2.93
T_3	55.67	79.60	6.86	6.31	6.53	3.87
T_4	48.40	75.10	6.46	5.77	5.13	2.40
T_5	47.67	70.60	6.12	5.53	4.87	1.73
T_6	37.53	68.83	6.10	5.27	4.47	1.40
T_7	38.87	65.33	5.64	4.53	3.00	1.20
'F' test	Sig	Sig	Sig.	Sig.	Sig.	Sig.
SE(m)±	1.06	1.56	0.21	0.33	0.59	0.22
CD at 5%	3.30	4.85	0.65	1.03	1.85	0.68

The more number of days required for emergence of primary and secondary umbels in the present study with earlier planted bulbs might be thus insured that, during the growth period October planted bulbs received required temperature range, however, those planted later i.e. in the month of November to January received earlier, which might be the reason for difference in the time taken by plant for emergence of flower stalk. These results are in line with the findings of Jagtap *et al.* (2014) [3], Lamani and Deshpande (2017) [4] in onion.

Yield contributing characters of onion

Effect of planting time on number of umbels per plant

The data regarding the number of umbels per plant as influenced by different dates of planting were recorded and presented in table 3. Significantly the maximum (6.53) number of primary umbels were recorded in the treatment T_3 (planting of onion bulbs during second week of November), which was found at par with treatment T_2, T_1 and T_4. Whereas, the minimum (3.00) number of primary umbels were recorded in treatment T_7 (planting of onion bulbs during second week of January).

Significantly the maximum (3.87) number of secondary umbels were produced in the treatment T_3 (planting of onion bulbs during second week of November), followed by (2.93) treatment T_2 (Planting of onion bulbs during fourth week of October). Whereas, the minimum (1.20) number of secondary umbels were obtained in treatment T_7 (planting of onion bulbs during second week of January).

This might have happen in the onion bulbs, the apex of main axis and apices of many lateral buds developed into inflorescence in combination with appropriate climatic conditions, which might produce more number of umbels per plant in onion. In the present investigation, onion bulbs planted during second week of November (T_3) gate the temperature range of 8.7 °C to 9.4 °C for a period of week along with 8.1 hrs. of bright sunshine, due to which such bulbs might get more number of umbels, as against rest of the treatments. These results are in line with findings of Jagtap *et al.* (2014) [3] and Mathankar *et al.* (1990) [7].

Effect of planting time on diameter of umbels in onion (cm): The data regarding the diameter of umbels as influenced by different dates of planting were recorded and presented in table 3. The data depicted in Table 3 clearly indicated that, significantly the maximum (6.86 cm) diameter of primary umbel in onion crop was produced in the treatment T_3 (planting of onion bulbs during second week of November), which was statistically at par with treatment T_1, T_2 and T_4. However, the minimum (5.64 cm) diameter of primary umbel was recorded with the treatment T_7 (planting of onion bulbs during second week of January)

As far as the diameter of secondary umbel, it was obtained significantly the maximum (6.31 cm) in onion crop planted during second week of November (T_3). However, the minimum (4.53 cm) diameter of secondary umbel was recorded with the treatment T_7 (planting of onion bulbs during second week of January).

The maximum umbel diameter in early-planted onion crop as compared to January planted crop might be due the availability of longer low temperature period i.e., 24 to 31 December (13th and 14th MW) having a lower temperature in the range of 10.3 °C to 10.7 °C in the present study, which is prerequisite for better development of the crop. Similar results were also found by Helay and Karam (2012) [2] under climatic condition of Giza (Egypt) and Mollah *et al.* (2015) [8] under Bogra, (Bangladesh) conditions in onion.

Effect of planting time on seed yield of onion.

Effect of planting time on number of seeds per plant in onion: The data regarding the number of seeds per plant as influenced by different dates of planting was recorded and presented in table 4. The data depicted in Table 4 clearly indicated that, significantly the maximum (8,040) number of seeds per plant in onion crop was produced in the treatment T_3 (planting of onion bulbs during second week of November), which was at par (6,279) with treatment T_2. However, the minimum (1,995) number of seeds per plant were recorded with the treatment T_7.

The more number of seeds per plant in mid-November planted crop as compare to mid-January planted crop might be due the production of large sized umbels due to the availability of longer low temperature period to the crop, which is prerequisite for better development of the crop. The similar results were also reported by Mollah *et al.* (2015) [8] under Bogra (Bangladesh) and Manna *et al.* (2016) [5] under Mondouri (West Bengol) conditions in onion crop.

Effect of planting time on seed yield of onion

The data related to yield per plant, yield per plot and yield per hectare of onion seeds as influenced due to different dates of planting are presented in table 4. The data presented in table 4, revealed that, significantly the maximum seed yield per plant (29.13 g), seed yield per plot (1.019 kg) and yield per hectare (11.44 q) were obtained from the treatment T_3 (planting of onion bulbs during second week of November). However, it was recorded the minimum yield per plant (8.08 g), yield per plot (0.282 kg) and yield per hectare (3.17 q) of onion seeds with treatment T_7 (planting of onion bulbs during second week of January) in onion crop.

Table 4: Effect of planting time on seed yield of onion

Tr.	No. of seeds/plant	Seed yield/ plant (g)	Seed yield/ plot (kg)	Seed yield/ hectare (q)
T_1	5,189	21.83	0.764	8.58
T_2	6,279	22.76	0.797	8.94
T_3	8,040	29.13	1.019	11.44
T_4	4,593	20.22	0.708	7.94
T_5	4,408	17.87	0.626	7.02
T_6	2,572	10.33	0.361	4.06
T_7	1,995	8.08	0.282	3.17
'F' test	Sig.	Sig.	Sig.	Sig.
SE(m)±	806.3	3.22	0.113	1.26
CD at 5%	2,512	10.03	0.351	3.94

There was gradual increase in the seed yield per plant from second week of October planted onion bulbs upto second week of November planted onion bulbs. Then, after there were gradual decrease in seed yield per plant, per plot, per ha with later dates of planting. This might be due to the fact that, onion seed crop raised from second week of October upto second week of November got desired minimum temperature in range of 10.3 °C to 11.8 °C, which favours conditioning process in onion and thus produces more number of flowers per umbel. These results are in line with findings of Krishnaveni *et al.* (1990) [10], Helay and Karam (2012) [2] under climatic conditions of Giza (Egypt) and Jagtap *et al.* (2014) [3] under Pune (M.S.) conditions in onion.

Effect of planting time on seed quality parameters in onion

Effect of planting time on test weight of onion seed. (g)

The data regarding the test weight of onion seed as influenced by different dates of planting was noticed and presented in table 5. The data depicted in Table 5 revealed that, significantly the maximum (4.15 g) test weight was recorded in the treatment T_3 (planting of onion bulbs on second week of November). However, the minimum (3.63 g) test weight was recorded with the treatment T_7 (planting of onion bulbs on second week of January).

The maximum test weight was recorded in crop planted in second week of November, whereas, the minimum test weight was recorded in crop planted in second week of January, which might be due to the fact that, longer time i.e 24 to 31 December (13th to 17th MW) was available for the development of seeds in 2nd week of November planted crop as compared to second week of January planted crop, thereby resulting in bolder seeds. Similar results were found by Helay and Karam (2012) [2] under Giza (Egypt) condition, Mollah (2015) [8] in Bangladesh conditions and Jagtap *et al.* (2014) [3] under Pune (M.S.) conditions in onion.

Effect of planting time on germination (%) of onion seed

The data in respect to germination of onion seeds was recorded and presented in table 5. The data depicted in table 5, indicated that, significantly the maximum (98.00%) germination was found in the treatment T_3 (Planting of onion bulbs during 2nd week of November 2017). However, the minimum (90.00%) germination was recorded with the treatment T_7 (Planting of onion bulbs during 2nd week of January) in onion.

The higher seed germination in crop planted during second week of November might be due to availability of favourable temperature and other climatic conditions for setting seeds and their development process forming well defined structure of seed, which might be resulted in better germination percentage. These results are similar to the findings of Helay and Karam (2012) [2] under Giza (Egypt) conditions. Jagtap *et al.* (2014) [3] under Pune (M.S.) condition and Mollah (2015) [8] under Bangladesh condition reported similar results.

Table 5: Effect of planting time on test weight of onion seed (g), germination of onion seed (%) and graded seed yield of onion (%)

Tr.	Test weight (g)	Germination per cent (%)	Graded seed yield (%)
T_1	4.07	96.67	96.07
T_2	4.08	97.33	96.97
T_3	4.15	98.00	97.63
T_4	3.97	97.00	96.10
T_5	3.97	96.00	95.70
T_6	3.72	94.67	94.70
T_7	3.63	90.00	91.73
'F' test	Sig.	Sig.	Sig.
SE(m)±	0.08	1.50	0.57
CD at 5%	0.24	4.66	1.77

Effect of planting time on graded seed yield of onion

The data regarding to graded seed yield of onion seeds was recorded and presented in table 5. The data opined that, significantly the maximum (97.63%) graded seed yield was recorded in the treatment T_3 (Planting of onion bulbs on 2nd week of November 2017). However, the minimum (91.73%) graded seed yield was recorded with treatment T_7 (Planting of onion bulbs on 2nd week of January 2018) in onion.

Maximum graded seed yield was obtained from seeds harvested from onion crop planted during second week of November, which might be due to the fact that, longer time, i.e. 24 to 31 December (13th to 17th MW) was available for the development of seeds in 2nd week of November planted crop as compared to second week of January planted crop, for development of seed, in the present investigation which might be resulted in the formation of bolder seeds.

Conclusion

On the basis of results obtained from the present experiment, following conclusions could be drawn. It could be concluded that, with delay in planting of onion bulb from 2nd week of October at an equal interval of 15 days up to 2nd fortnight of January, there were comparatively less production of seed yield with first two dates of planting, hike in 3rd and 4th date of planting and it continues gradual decrease up to 7th date of planting i.e., 15th January

Significantly, the maximum plant height, number of leaves were found in the seed onion crop planted during 2nd week of November. As regard to seed yield of onion per plant, per ha these were found maximum in similar treatment T_3 i.e., planting of onion bulbs during second week of November. The test weight, germination percent and graded seed yield in present investigation were found better in the treatment consisting of planting the onion bulbs during second week of November.

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