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Studies on Effect of Planting Dates on Seed Quality of Onion (*Allium cepa L.*) in North Eastern Dry Zone of Karnataka, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: To study the effect of planting dates on seed quality of onion varieties.
Study Design: Split plot design and FCRD.

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Place and Duration of Study: Agricultural Research Station, Hagari, University of Agricultural Sciences, Raichur (Karnataka) during *Rabi* 2023-24.
Methodology: Two varieties as main plot with five planting dates as sub plots.
Results: The results revealed that significantly highest seed germination (89.3 %), shoot length (8.97 cm), root length (7.02 cm) and seedling vigour index I and II (1428 and 1294, respectively) in D_1 (1st fortnight of November). While, lowest seed germination (84.7 %), shoot length (7.65 cm), root length (6.04 cm), and seedling vigour index I and II (1250 and 1047, respectively) in D_5 (1st fortnight of January). Among the varieties, Bhima super (V_2) registered significantly highest seed germination (87.8 cm), shoot length (8.49 cm), root length (6.18 cm), and seedling vigour index I and II (1291 and 1116, respectively). Whereas, lowest seed germination (86.5 cm), shoot length (8.07 cm), root length (5.89 cm), and seedling vigour index I and II (1209 and 978, respectively) recorded in Bellary red (V_1).
Conclusion: The results of present investigation revealed that, bulbs planted during 1st fortnight of November and Bhima super were found to be superior for high quality seed production of onion.

Keywords: Planting dates; onion varieties; seed germination and seed moisture.

1. INTRODUCTION

Onion (*Allium cepa* L.) belonging to family Alliaceae. It is the second important vegetable crop of the world after tomato and one of the major vegetable crops cultivated in India. It is an indispensable item in every kitchen as vegetable and condiment, used to flavour many of the food stuffs. It is also used as salad and pickles. It is known fact that seed is a basic and crucial input in agriculture, but it is the quality of the seed that decides the commercial success of a crop or variety. Obviously, the bumper harvest could be possible only when the planting seed possess high quality standards viz., genetic purity, germination, uniformity in weight and size apart from freedom from insect pest and diseases. These quality traits are known to be influenced largely by interaction of environment, cultural practices, harvest and post-harvest management practices at both field and storage levels.

Quality seed is very much essential for enhancing the productivity of a crop plant. However, the availability of quality seeds of desirable variety is seems to be the major constrain for crop production in developing countries like India. The quality of the seed is highest when it completes structural and functional development on plant itself. Thereafter, the quality deteriorates irreparably and irreversibly at varying rates (Delouche et al., 1973). As most of the vegetable crops are propagated sexually through seeds, thus the productivity of vegetable crops depends primarily not only on the genetic constitution of the variety but also the environmental conditions of a particular region. Both genetical as well as agronomical principles of seed production should be adopted for enhancing the crop productivity successfully.

Onion is photo-thermo sensitive plant (Jones and Mann, 1963), therefore, any fluctuation in environmental conditions largely affects the yield and quality of the seed. Planting time is one of the most important factors that greatly influence the plant growth, seed yield and quality of onion (Mondal et al., l986). Onion seeds being very short lived in nature, thus the percent and rate of germination of onion seeds also vary considerably among the seed lots leading to difficulties in establishing optimum plant population in the field condition. Onion seeds loose vigour and viability comparatively faster than other vegetables crop seeds and failed to remain viable for more than one year under ambient condition (Justice and Bass, 1979). Initial seed moisture, storage temperature and relative humidity have been found to affect the seed quality. The time of production and interaction of genotypes also determine the quality of seed as the crop produced at different times being exposed to varying environmental conditions especially during seed maturation stage. Seed is the basic and most vital input of agriculture (Malik et al. 1999) and the seed industry must be able to continue to deliver the quantities of quality seed required for this purpose. Climate change poses several challenges for the continued production of high quality seed (Singh et al. 2013). In view of this, the experiment was undertaken to find out the suitable variety and optimum planting time to produce high quality onion seeds.

2. MATERIALS AND METHODS

The field experiment was conducted during *Rabi* 2023-24 at Agricultural Research Station, Hagari, UAS, Raichur, Karnataka (15 0 14' North latitude and 77 0 07' East longitude with an altitude of

414 m). The soil of the experimental site is black clay loam textured soil. The freshly harvested onion bulbs of Bhima Super variety were obtained from the University of Horticultural Sciences, Bagalkot, Karnataka and bulbs of Bellary Red were obtained from private market, Ballari for further seed production programme. The laboratory experiment was laid out in Factorial completely randomised design with four replications. The experimental material comprises with two onion varieties *viz.,* V_1-Bellary Red and V_2- Bhima Super and five planting dates: D_1-1st fortnight of November, D_2-2nd fortnight of November, D_3-1st fortnight of December, D_4-2nd fortnight of December and D_5-1st fortnight of January. The crop was harvested when it reached physiological maturity *i.e*., Umbels were harvested when 50 per cent of seeds in the umbel turned to black coloured and seeds were exposed (120-125 DAP) and seed from all the treatments under this investigation was collected separately. The seed obtained from field experiment was used to assess the seed quality parameters.

Five plants were randomly selected from each net plot. The selected plants were tagged and labelled using paper tags wrapped inside a transparent polythene cover. All the seed quality observations were recorded from these tagged plants.

2.1 Seed Moisture (%)

The moisture content of seeds was determined by the oven dry (103 $\pm$ 1^0C for 17 hours) method as per ISTA rules.

2.2 Seed Germination (%)

The seed germination test was conducted as per ISTA, 2013 rules and expressed in percentage.

2.3 Shoot and Root Length (cm)

From the germination test, ten normal seedlings were randomly selected from each treatment on final count and root and the shoot length was measured and expressed in centimeters.

2.4 Seedling Vigour Index [SVI]

The seedling vigour index was calculated as per the formula given by Abdul -Baki and Anderson (1973).

SVI-I = Germination (%) x Mean seedling length (cm)

SVI-II = Germination (%) × Seedling dry weight (mg)

2.5 Seedling Dry Weight (mg)

The randomly selected ten seedlings were kept in butter paper covers and dried in hot air oven maintained at 70^o C±2^OC for 24 hours. Then the paper bags were removed and cooled in a desiccator for 30 minutes and weighed on an electronic balance and expressed as milligram.

The data pertaining to several characteristics of seed quality were statistically analysed using the methodology outlined by Panse and Sukhatme (1978).

3. RESULTS AND DISCUSSION

The results showed that varieties and planting dates had shown significance difference for germination (%), shoot and root length, seedling vigour index-I and Seedling vigour index-II. But, for seed moisture and seedling dry weight varieties had shown a non significance difference. Interaction effect of varieties and planting dates found to be non significant.

The variety Bhima Super (V_2) recorded maximum germination (87.8 %) over Bellary Red (V_1) (86.5 %). Among different planting dates, the crop planted on 1st fortnight of November (D_1) registered significantly maximum germination (89.3 %). Whereas, crop planted on 1st fortnight of January (D_5) recorded less germination (84.9 %) (Table 1). The reason for increasing the percentage of seed germination in early planting may be due to the highest seed size, seed weight and their food reserves which enhances the germinated of the seeds. These results are similar to the findings of Tesfaye et al*.* (2018) and Jagtap et al*.* (2014) in onion. Additionally, Saini et al*.* (1980) and Kanwar et al*.* (2000) reported that onion seeds produced from late planting adversely affected seed quality.

Significantly higher shoot and root length (8.49 and 6.18 cm, respectively) were found in Bhima Super (V_2) over Bellary Red(V_1) (8.07 and 5.89 cm, respectively). Among different planting dates, resultant seeds of 1st fortnight of November (D_1) recorded higher soot and root length (8.97 and 7.02 cm, respectively) and lower shoot and root length (7.65 and 5.54 cm,

respectively) was found in crop which was planted on 1st fortnight of January (D_5). As the planting delayed, the plants had undergone into severe environmental stresses leading to shortening of the growth cycle of the plants. This has led to partial seed filling where the 1000 seed weight reduced significantly over the planting dates. This might have been led to the reduced shoot and root length of the plants as the planting was delayed**.** This result is conformity with the findings of Das et al. (2021), Lamani and Deshpande (2016) and Kumar et al. (2015) in onion.

Seed moisture and seedling dry weight had shown a non significance difference between varieties. Whereas, planting dates had shown a significance difference. Among different planting dates, the resultant seeds of 1st fortnight of November (D_1) registered highest Seed moisture (8.52 %) and Seedling dry weight (14.48 mg). While, the seeds from the crop which was planted on 1st fortnight of December (D_3) registered lowest seed moisture (7.66 %) due to high temperature that led to loss of seed moisture content at harvest. As the plants were under the heat stress it might have made plants to limit its water uptake during its growth stage hence the sink might have received less moisture content. The similar findings were recorded by Arvind et al. (2017) and Rade et al. (2012) in alfalfa. While, the lowest seedling dry weight (9.53 mg) was registered in the resultant seeds of 1st fortnight of January (D_5). This may be due to accumulation of more photosynthates or food reserve in the seeds of 1st fortnight of November (D_1), ultimately leading to higher seedling dry weight. 1st fortnight of January (D_5) has recorded lowest seedling dry weight may be because the seeds did not accumulate as much food reserves (Singh et al., 2017).

Table 1. Seed quality parameters of onion as influenced by varieties and planting dates

Treatment	Seed germination (%)	Seed moisture (%)	Shoot length (cm)	Root length (cm)	Seedling dry weight (mg)	Seedling vigour index-I	Seedling vigour index-II
Varieties							
V_1- Bellary Red	86.5	8.20	8.07	5.89	11.75	1209	978
V_2- Bhima Super	87.8	7.99	8.49	6.18	12.15	1291	1116
S.Em. ±	0.3	0.09	0.09	0.06	0.12	14	12
CD @ 1%	1.0	NS	0.34	0.24	NS	54	47
Planting dates							
D_1-1st fortnight of November	89.3	8.52	8.97	7.02	14.48	1428	1294
D_2-2nd fortnight of November	88.1	8.13	8.52	6.23	13.67	1301	1209
D_3-1st fortnight of December	87.5	7.66	8.32	5.78	11.72	1235	1030
D_4-2nd fortnight of December	86.0	8.10	7.94	5.63	10.38	1167	893
D_5-1st fortnight of January	84.9	8.06	7.65	5.54	9.53	1121	810
S.Em. ±	0.6	0.15	0.14	0.24	0.19	21	18
CD @ 1%	1.6	0.41	0.54	0.38	0.76	86	74
Varieties × Planting dates							
V_1D_1	88.4	8.79	8.67	6.65	14.40	1354	1213
V_1D_2	87.0	8.15	8.31	5.97	13.35	1243	1111
V_1D_3	86.4	7.80	8.10	5.76	11.30	1199	940
V_1D_4	85.9	8.16	7.80	5.61	10.25	1151	850
V_1D_5	84.7	8.12	7.48	5.48	9.45	1099	776
V_2D_1	90.2	8.25	9.26	7.38	14.55	1501	1376
V_2D_2	89.3	8.11	8.73	6.48	13.98	1358	1307
V_2D_3	88.6	7.52	8.53	5.80	12.13	1271	1119
V_2D_4	86.1	8.05	8.09	5.65	10.50	1183	936
V_2D_5	85.1	8.00	7.82	5.60	9.60	1142	843
S.Em. ±	0.8	0.21	0.19	0.13	0.27	30	26
CD @ 1%	NS	NS	NS	NS	NS	NS	NS

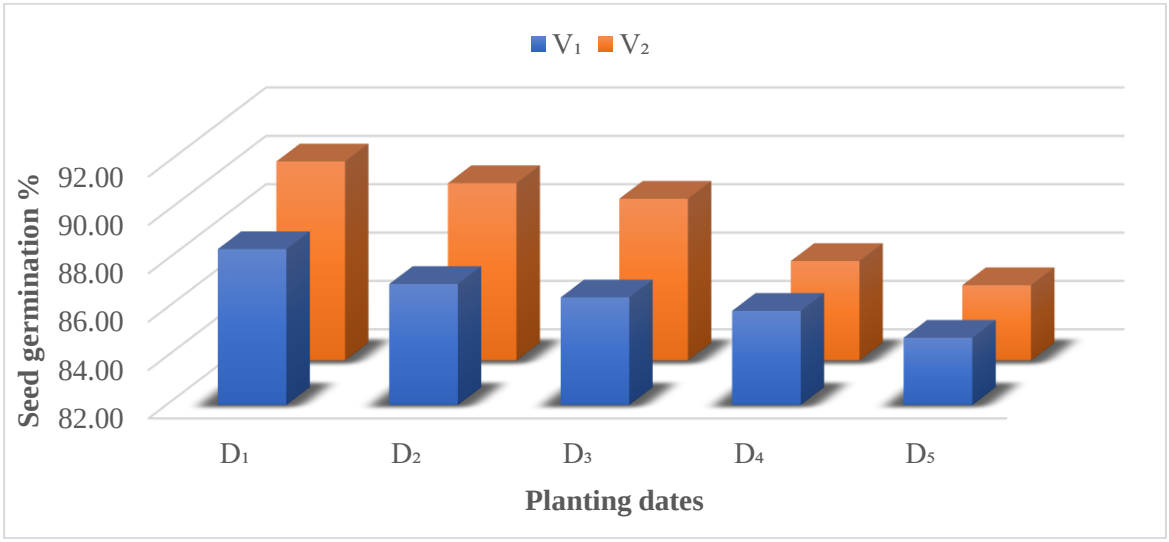

Fig. 1. Effect of planting dates on seed germination in onion varieties

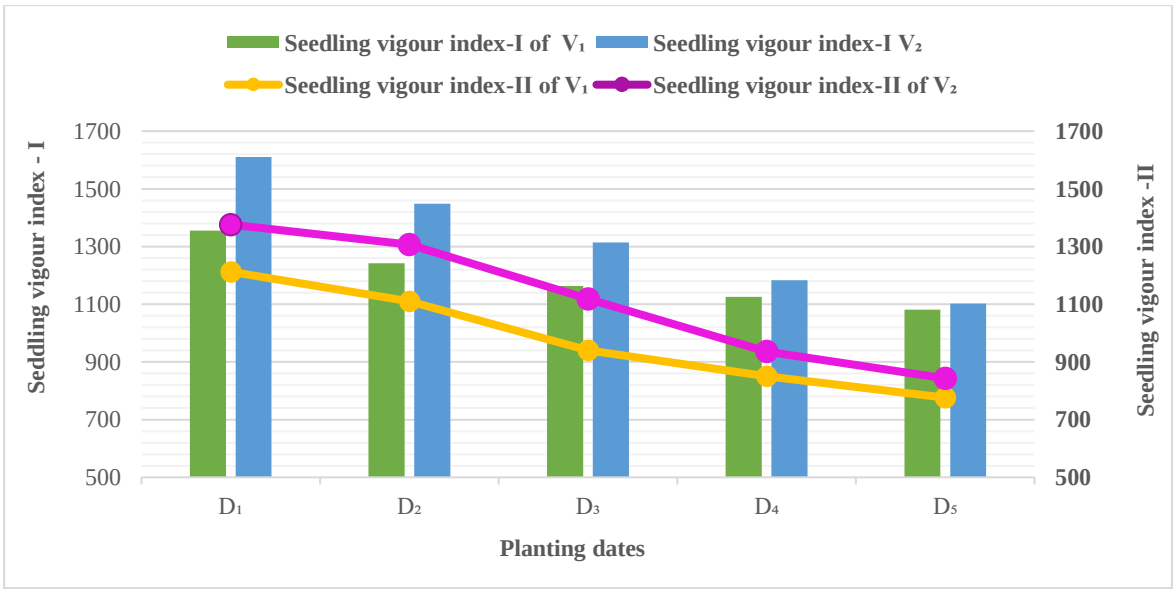

Fig. 2. Effect of planting dates on Seedling vigour indices in onion varieties

Planting dates
D1: *1st fortnight of November*
D2: *2nd fortnight of November*
D3: *1st fortnight of December*
D4: *2nd fortnight of December*
D5: *1st fortnight of January*

Varieties
V1: *Bellary Red*
V2: *Bhima Super*

Assessment of seedling vigour index-I and seedling vigour index-II revealed wide range of variation for varieties and planting dates (Table 1). In case of varieties, Bhima super (V_2) recorded highest seedling vigour index-I and seedling vigour index-II (1291 and 1116, respectively) than Bellary Red (V_1) (1291 and 978, respectively). This might be due to steady accumulation growing Degree Days (GDDs), temperature, moisture content of seed and early maturity in early sowings (Gochar et al., 2024). Among planting dates, significantly higher seedling vigour index-I and seedling vigour index-II (1428 and 1294, respectively) was recorded from resultant seeds of 1st fortnight of November (D_1) planting bulbs. While, lowest seedling vigour index-I and seedling vigour index-II (1121 and 810, respectively) recorded from the resultant seeds of 1st fortnight of January (D_5) planted bulbs. This might be

because higher germination percentage was obtained in 1st fortnight of November (D_1) and robust seedlings obtained due to proper accumulation of food reserves in the seeds. As the planting gets delayed, seed germination percentage, seedling length and seedling dry weight reduced, this has led to the decrease in seedling vigour index - I and II when date of planting was delayed. This was consistent with Malik et al. (1999), Ashagrie et al. (2014) and Das et al. (2021).

It was found that there was a non-significant difference for the interaction of varieties and planting dates for all the seed quality parameters.

4. CONCLUSION and RECOMMENDATION

From the study it can be concluded that Bhima Super was found to superior for all the seed quality parameters than Bellary Red. Among the different date of planting, the seed harvested from 1st fortnight of November sown crop had high seed quality standards compared to delayed planting *i.e.,* 1st fortnight of January.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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