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RESEARCHARTICLE

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Effects of different Seed Priming Treatments on Germination and Seedling Traits of Okra (*Abelmoschus esculentus* L.)

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Abstract
Okra (*Abelmoschus esculentus* L.) is an annual vegetable crop in tropical and sub-tropical parts of the world. It is a member of the Malvaceae Family. Seed priming is pre-sowing soaking treatment for enhancing crop stand and yield performance in many crops. This study was conducted to check the effects of different seed priming treatments on Okra germination and seedling traits in the Department of Plant Breeding and Genetics at University of Agriculture Faisalabad. Okra seed of two distinct varieties were used in this experiment and okra seed were primed with KNO3 1%, KNO3 2%, KNO3 3%, PEG-(0Mpa), PEG-(-0.5Mpa), PEG-(-1Mpa), CaCl2-0.1%, CaCl2-0.5%, CaCl2-1% and no priming. After priming seeds was sown in pots filled with sand. Experimental attributes, i.e. germination percentage, germination rate, root length, shoot length, dry weight of seedling and fresh weight of seedling. The experiment was laid out in Latin Square Design (LSD) with a factorial arrangement keeping two replications. Results showed that seed priming is beneficial for seedling traits of okra but does not perform much better for germination. Control seed (No priming) obtain higher germination percentage, and germination rate but priming with Priming with KNO3 3%, Priming with PEG-(0Mpa).

KEYWORDS
Okra, Seed priming, Germination, Seedling trait, Yield performance.

1 |INTRODUCTION

One of the most well-known and frequently used species of the Malvaceae family and an annual vegetable crop in tropical and subtropical regions of the world is okra (Adelakun et al., 2011). Okra is often referred to as gumbo or lady's fingers. It's a well-liked summer crop. Okra is a powerhouse of essential nutrients and offers several health advantages. Okra, a meal with a high antioxidant content, may help with the improvement of digestive disorders, type 2 diabetes, cardiovascular and coronary heart disease, and even some cancers. Okra pods can be eaten fresh (raw), dried, boiled, frozen, fried, and pickled, among other preparations.

Okra crops have hard seeds, which makes maintenance more difficult. The percentage of hard-seededness rises as the seed ages and its moisture content decreases. Another element that affects seed hardness is seed moisture content. The seeds disperse from the parent plant and fall into the soil's surface litter, where they may be able to live for extended durations by continuously ingesting high water content or periodically ingesting I (Khan et al., 2009).

For agriculture, it is crucial that seeds are uniform and quickly germination. Various treatments, such as priming, are employed to enhance the germination characteristics of seeds (Badek et al., 2006). Pre-sowing seed priming is a technique to improve seed performance, particularly in terms of pace and uniformity of germination, which in turn improves seedling stand and makes it possible for improved crop establishment (Job et al., 2000). It is an easy, affordable, and efficient method for promoting early seedling development and output in both stressful and unstressed circumstances. By lowering the rate of lipid peroxidation and boosting the activity of anti-oxidative mechanisms, priming can help seeds become more active and facilitate some of the metabolic processes necessary for germination. Seed priming is a crucial technique for enhancing the ability of seeds cultivated in a certain environment to germinate since it hastens both the germination and

growth of the seeds. SA, an endogenous growth regulator that is a phenolic acid representative and results in membrane permeability, stomatal closure, ionic transport, and photosynthesis in plants. The rate of germination and growth is also accelerated (Hussain, 2017). Different priming techniques have been developed to enhance seed quality, including hydro priming, halo priming, osmo priming, matrix priming, osmo hardening, on-farm priming, Nuti priming, hormonal priming, bio-priming or treatment of seeds with microorganisms like Pseudomonas aureofaciens, Trichoderma spp., and nanoparticle priming (NPs). Every crop requires a special and effective priming technique. According to research, each cultivar's storage conditions (temperature, moisture, oxygen demand, etc.), treatment period, primed or coated substance, seed strength, and other factors are standardised (Farooq et al., 2008).

Different priming techniques have been developed to enhance seed quality. Okra seeds should be primed for 24 hours before sowing, according to the authors. Lower days to emergence were also obtained by hydro-priming capsicum seeds for 0 to 12 hours. The seedling emergence, energy of emergence, vigour, and emergence index all increased as hydro-priming durations increased. According to Nirmala and Umarani (2014), showed that the radicle protrusion, germination percentage, germination speed, days for 50% germination, and days for maximum germination all increased after hydropriming okra seeds. Even after just one day of treatment, omopriming (polyethylene glycol 6000) of okra for 15 days in two osmotica (PEG 6000) (-1 Mpa and -1.5 Mpa) increased seed germination and germination speed. Halopriming with KNO3 was harmful regardless of the therapy's duration or intensity. In an experiment to investigate the effects of temperature and NaCl on the germination and emergence of local variety (Marsaouia) okra seeds, the percentage of germination was higher at 10, 15, 25, and 40o C.

Thus, the proposed study is planned to evaluate the effects of different seed priming treatments on germination and seedling traits of okra. The study's purpose was to investigate the influence of seed priming with various compounds on okra germination and seedling vigor.

2 METERIAL AND METHOD

This study will evaluate the effects of different seed priming treatments on germination and seedling traits of okra at University of Agriculture Faisalabad. Okra seed of two different varieties will be provided by Department of Plant Breeding and Genetics, University of Agriculture Faisalabad. The pots experiment will be conducted with three replications using a factorial under completely randomized design (CRD). For priming seeds will be dipped in KNO3 1%, KNO3 2%, KNO3 3%, PEG-(0Mpa), PEG-(-0.5Mpa), PEG-(-1Mpa), CaCl2-0.1%, CaCl2-0.5%, CaCl2-1% after priming seeds will be sown in pots filled with sand.

3.1 Experiment

The experiment will include two treatment factors as Factor A with nine level and B with two level.

3.1.1. Factor A: Seed Priming

P0: Control (no priming)
P1: Priming with KNO3 1%
P2: Priming with KNO3 2%
P3: Priming with KNO3 3%
P4: Priming with PEG-(0Mpa)
P5: Priming with PEG-(-0.5Mpa)
P6: Priming with PEG-(-1Mpa)
P7: Priming with CaCl2-0.1%
P8: Priming with CaCl2-0.5%
P9: Priming with CaCl2-1%

3.1.3. Observations Recorded from Experiment

1) Seed Germination Testing

By depositing 100 seeds from randomly chosen seed samples in sterile, well-moisturized blotting paper, the germination of these seeds was assessed. Four identical replications were then made to test a total of 400 seeds (ISTA, 2015). Five days following the germination test, the first germination count was performed, and thirteen days later, the second germination count. When a 2 mm radical was discernible, seeds were considered to have germinated. A germination test was carried out at 25 °C.

2) Germination Index

Germination index (GI) was calculated as described by the Association of Official Seed Analysts (AOSA, 2009) using formulae

$$\mathrm{GI} = \frac{\text{No. of germinated seeds}}{\text{Days of first count}} + \cdots \frac{\text{No. of germinated seeds}}{\text{Days of final count}}$$

3) Final Germination Percentage

Germination percentage was recorded at the final day of germination test. It represents the ratio, in percentage, of final number of germinated seeds to total number of seeds that were used per replicate.

$$\text{Final Germination } (\%) = \frac{\text{Number of seeds germinated}}{\text{Total number of seeds}} \times 100$$

4) Fresh Root length (cm)

After fifteen days of growth, the seedlings were removed and washed with water to get rid of the foreign sand particles. Ten randomly selected seedlings from each replicate had their roots measured in centimetres (cm) from the hypocotyl base to the tip of the longest root using a metre scale. Each replication's average was computed.

5) Fresh Root weight of Seedling (g)

The seedlings have filter paper covering them to drain any remaining water from their leaves and shoots after measuring the root and shoot lengths. A digital balance was then used to determine new weights.

6) Dry Root weight of seedling (g)

From each replication, ten plants were chosen at random were gathered, put in paper bags, and dried for 72 hours at 700C in a Memmert-110 oven in Schawabach. The dry weights of the seedlings were estimated using a digital scale under the heading "dry weight seedling."

7) Fresh Shoot Weight Of Seedling (g)

The seedlings have filter paper covering them to drain any remaining water from their leaves and shoots after measuring the root and shoot lengths. A digital balance was then used to determine new weights.

8) Dry Shoot Weight of Seedling (g)

From each replication, ten plants were chosen at random were gathered, put in paper bags, and dried for 72 hours at 700C in a Memmert-110 oven in Schawabach. The dry weights of the seedlings were estimated using a digital scale under the heading "dry weight seedling."

3.1.4. Statistical Design and data Analysis

The experiment was set up using a factorial arrangement and a Latin square design (LSD) with two replications.

3 RESULTS & DISCUSSION

The results of experiment performed to check the effects of different seed priming treatments on germination and seedling traits of okra are described and discussed below

1. Dry Shoot Weight

Analysis of variance showed that there was highly significant difference between the treatments, varieties and its interaction (Treatments×Varieties) for dry shoot weight of okra (Table 1). Maximum dry shoot weight (410.00mg) was observed when okra seed was primed with 3% KNO3 followed by when okra seed priming with 1% KNO3, (398.33 mg) while minimum dry shoot weight (300.00 mg) was observed for okra seed priming with PEG-(-0.5Mpa) (Fig. 1) (Adelakun et al., 2011).

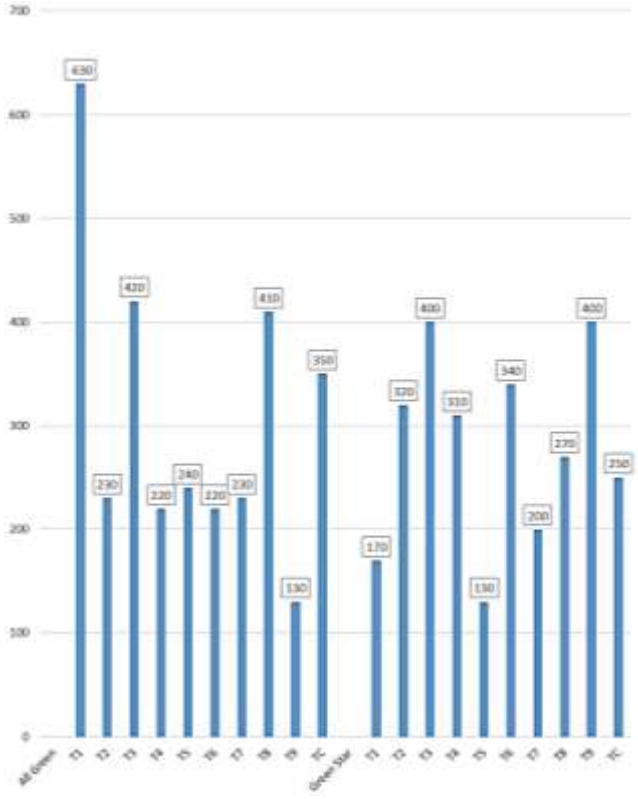

Fig. 1: Mean perform of two okra genotypes for dry shoot weight (DSW) under different priming treatments.

2. Dry Root Weight

Dry root weight had highly significant difference between the treatments and its interaction (Treatments×Varieties) while non-significant difference between varieties for dry root weight of okra (Table 1). Maximum dry root weight (92.500mg) was noticed when okra seed primed with 3% KNO3 followed by when okra seed was primed with (T6) PEG-(-1Mpa) (87.500 mg) while minimum dry root weight (52.500 mg) was noticed for okra seed primed with (T1) KNO3 1% (Fig 2) (Adelakun et al., 2011).

3. Fresh root length

A highly significant difference between the treatments and its interaction (Treatments × Varieties) while non-significant difference between varieties for fresh root length of okra (Table 1). Maximum fresh root

Table 1: Mean square values for various traits in wheat varieties under different priming treatments

SOV	Dry shoot weight	Dry root weight	Fresh root length	Fresh root weight	Fresh shoot length	Fresh shoot weight	Time to start germination	Germination percentage	Germination rate
Treatments	31233.3	1001.67	0.19156	2918.20	8.42148	101391	8.80741	28.6431	5.43924
Varieties	12906.7	15.00	0.03267	79.67	0.96267	482	0.26667	11.7042	1.66667
Treatments*Varieties	58762.2	440.00	0.35489	1329.38	2.23415	161537	1.22963	0.5097	0.11033
Error	106.7	25.00	0.00967	154.70	0.02967	107	0.08333	0.6208	0.15603

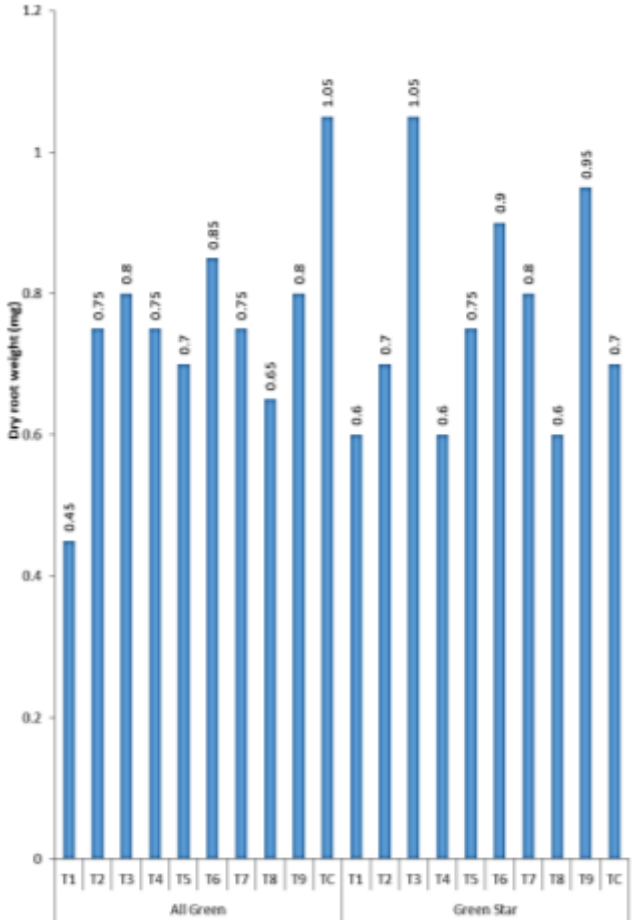

Fig. 2: Mean perform of two okra genotypes for dry root weight (DRW) under different priming treatments.

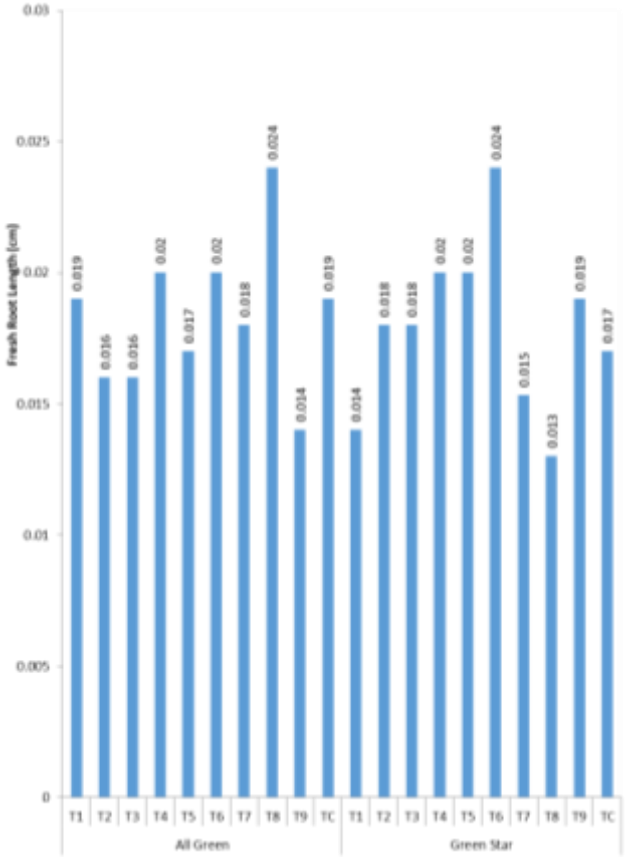

Fig. 3: Mean comparison of two okra genotypes for fresh root length (FRL) under different priming treatments.

length (2.2000cm) was observed when okra seed was primed with (T6) PEG-(-1Mpa) while minimum fresh root length (165.00cm) was observed for okra seed primed with (T1) KNO3 1% followed by (165.00cm) when priming with (T9) CaCl2-1% (Fig.3).

4. Fresh Root Weight

Fresh root weight had highly significant difference between the treatments and its interaction (T×V) while non-significant difference between varieties for fresh root weight of okra (Table 1). Maximum fresh root weight (175.00mg) was noticed when okra seed was primed with (T7) CaCl2-0.1% while minimum fresh root weight (100.00 mg) was noticed for okra seed primed with (T1) KNO3 1% (Fig. 4).

5. Fresh Shoot Length

Analysis of variance showed that there was highly significant difference between the treatments, varieties and its interaction (Treatments×Varieties) for fresh shoot length of okra (Table 1) Maximum fresh shoot length (9.1500cm) was observed when okra seed was primed with (T4) PEG-(0Mpa) while minimum fresh shoot length (6.2833cm) was observed for okra seed primed with (T2) KNO3 2%. Green star (V2) okra genotype showed maximum (7.3727cm) fresh shoot length (Fig. 5) (Farooq et al., 2008).

6. Fresh Shoot Weight

A highly significant difference between the treatments and its interaction (Treatments×Varieties) while significant difference between varieties for fresh shoot weight of okra

(Table 1) (Farooq et al., 2008). Maximum fresh shoot weight (865.00mg) was recorded when okra seed was primed with (T3) KNO3 3% while minimum fresh shoot weight (500.00 mg) was recorded for okra seed primed with (T7) CaCl2-0.1%. Green star (V2) okra genotype showed maximum (619.67mg) fresh shoot weight (Fig. 6).

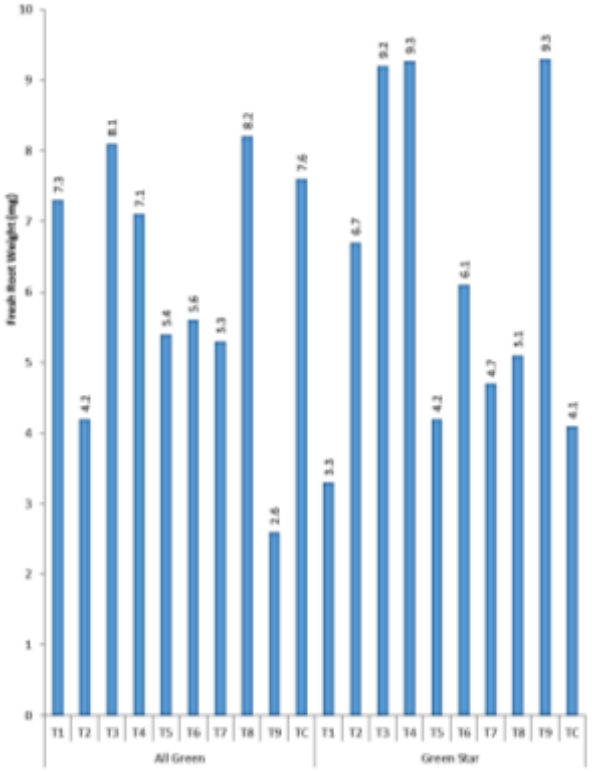

Fig. 4: Mean performance of two okra genotypes for fresh root weight (FRW) under different priming treatments.

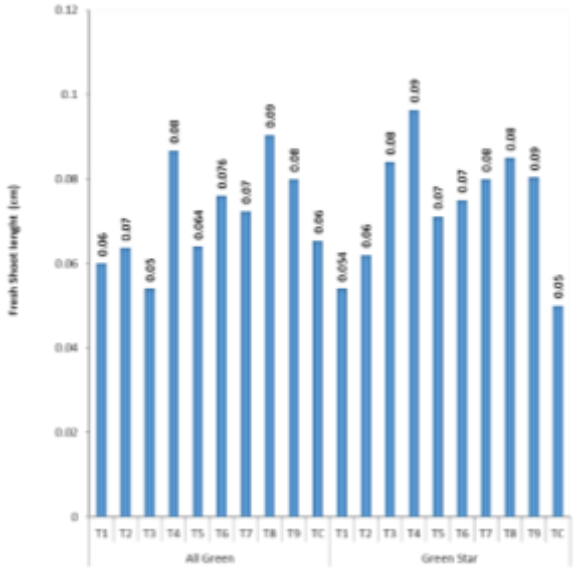

Fig. 5: Mean perform of two okra genotypes for fresh shoot length (FSL) under different priming treatments.

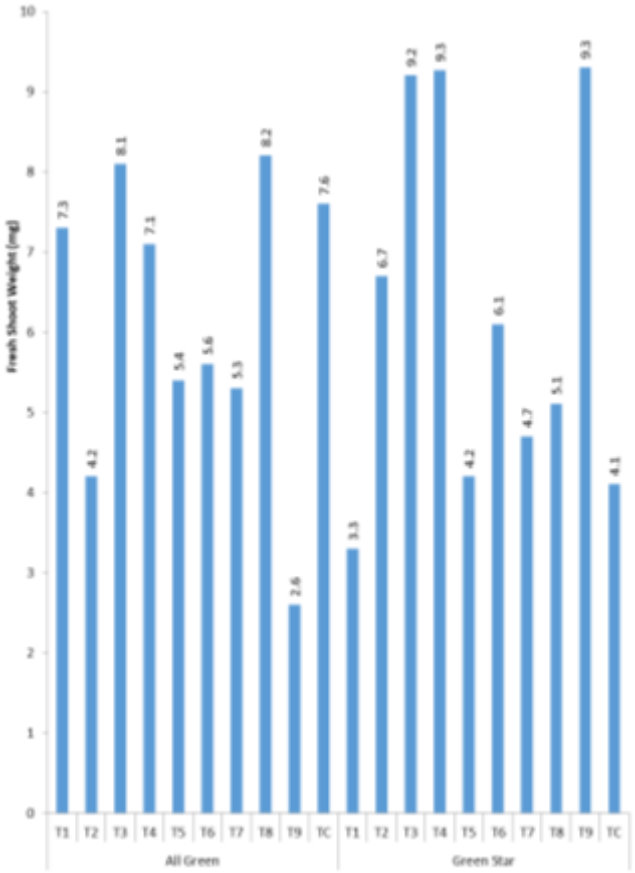

Fig. 6: Mean perform of two okra genotypes for fresh shoot weight (FSW) under different priming treatments.

7. Germination Percentage

Germination percentage had highly significant difference between the treatments and varieties while non-significant difference between its interactions (Treatments×Varieties) for germination percentage of okra (Table 1) (Farooq et al., 2008). Maximum germination percentage (99.083%) was observed when okra seed at control (T10) no priming while minimum germination percentage (92.083%) was observed for okra seed primed with (T1) KNO3 1% (Fig. 7).

8. Time to start Germination

A highly significant difference between the treatments and its interaction (Treatments×Varieties) while non-significant difference between varieties for time to start germination of okra (Table 1). Maximum time to start germination (5.5000) was recorded when okra seed was primed with (T2) KNO3 2% followed by when okra seed primed with (T3) KNO3 3% (5.0000) while minimum time to start germination (1.8333) was noticed for okra seed primed with (T9) CaCl2-1% (Fig. 8).

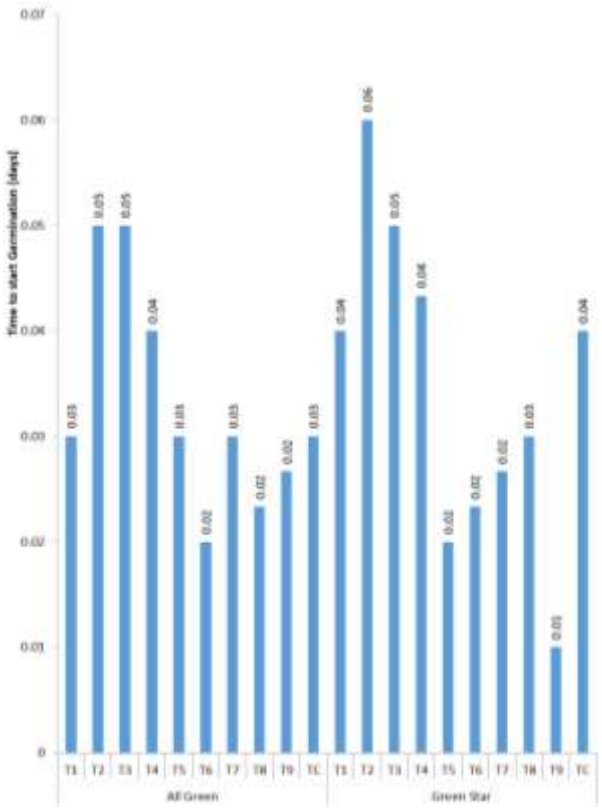

Fig. 7: Mean perform of two okra genotypes for time to start germination under different priming treatments.

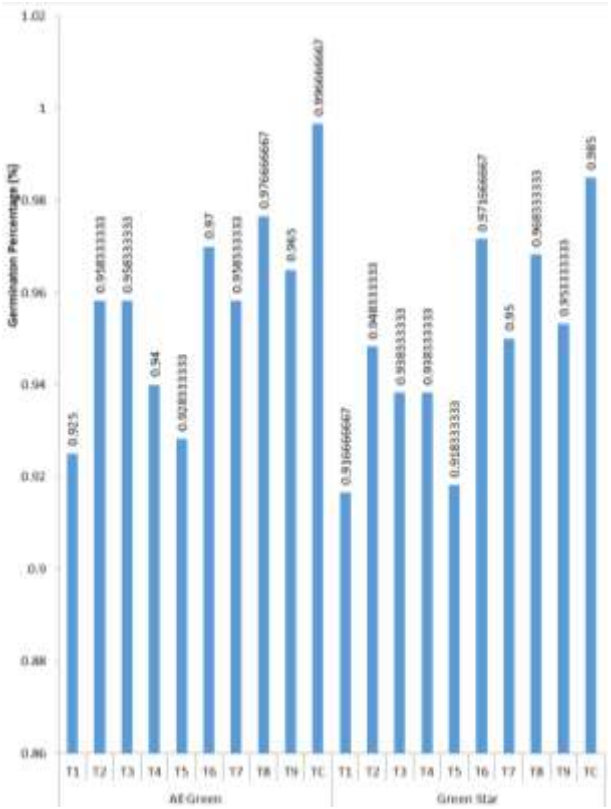

Fig. 8: Mean perform of two okra genotypes for germination percentage under different priming treatments.

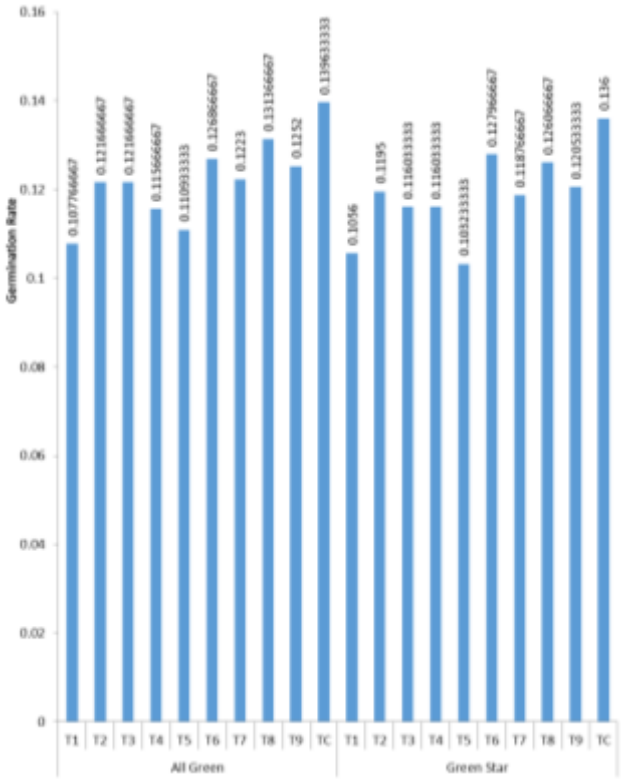

Fig. 9: Mean perform of two okra genotypes for germination rate of okra under different priming treatments.

9. Germination rate

Treatments and varieties effect exerted highly significant variation on germination percentage while non-significant difference between its interactions (Treatments × Varieties) for germination rate of okra (Farooq et al., 2008). Maximum germination rate (13.78) was recorded at control okra seed was no priming while minimum germination rate (10.668) was noticed for okra seed primed with (T1) KNO3 1% (Fig. 9).

Conclusion

Present study investigated to assess the effects of different seed priming treatments on germination and seedling traits of okra. The objectives of this study are study the effect of seed priming with different chemicals on okra germination and seedling vigor and to study differences in response of different genotypes of okra to seed priming at germination and seedling stage Results showed that Control seed (No priming) obtain higher germination percentage, germination rate but priming with P3: Priming with KNO3 3%, P4: Priming with PEG-(0Mpa), P7: Priming with CaCl2-0.1% obtain maximum root, shoot length, seedling dry weight and seedling fresh weight. Seed priming is beneficial for seedling traits of okra but not perform much better for germination.

REFERENCES

Adelakun O.E., & Oyelade O.J. (2011). Chapter 19 - Potential use of okra seed (Abelmoschus esculentus Moench) flour for food fortification and effects of processing. Flour and breads and their fortification in health and disease prevention. 205-212.

Khan, H. A., Ayub, C. M., Pervez, M. A., Bilal, R. M., Shahid, M. A. and Ziaf, K. (2009). Effect of seed priming with NaCl on salinity tolerance of hot pepper (Capsicum annuum L.) at seedling stage. Soil Environ. 28: 81-87

Badek, B., B.V. Duijn and M. Grzesik. (2006). Effects of water supply methods and seed moisture content on germination of okra (Abelmoschus esculentus L) and tomato (Lycopersicon esculentun Mill.) seeds. Eur. J. Agron. 24:45-51

Job, D., I. Carpronand and C. Job. (2000). Identification of specific protein markers and their use in seed priming technology. Seed Sci. Res. 7:449-459.

Hussain, S., H. Yin, S. Peng, F. Khan, M. Sameeullah and H. Hussain. (2017). Comparative transcriptional profiling of primed and non-primed rice seedlings under submergence stress. Front. Plant Sci. 7:1125.

Farooq, M., S.M.A. Basra, H. Rehman and B.A. Saleem. (2008). Seed priming enhances the performance of late sown okra by improving chilling tolerance. J. Agron. Crop. Sci. 194:55-60.

Nirmala, K. and Umarani, R. (2014). Storage potential of primed seeds of okra (Abelmoschus esculentus) and beet root (Beta vulgaris). Ausrtalian Journal of Crop Science 8: 1290-1297.