



**SEED INVIGORATION WITH ORGANIC PREPARATIONS FOR
ACCELERATED GERMINATION AND VIGOUR IN TOMATO
(*Lycopersicon esculentum* MILL.)**

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ABSTRACT

Present study was conducted in Iqbalcollege, peringammala, Thiruvananthapuram, kerala, during April to May 2017 to find out the effect of seed invigoration using organic preparations on germination and seedling characters in Tomato. The experiment was laid out completely randomized design with 5 treatments and 3 replications. The seed treatments comprised of T1- control (water), T2-goat urine, T3-panchagavya, T4-egg lemon jaggery extract, T5-fish jaggery extract, T6- mango juice, T7-watermelon juice extract. The seeds were treated in the respective organic preparations for 2 hours and then dried. The seed were sown in portrays filled with a medium containing coir pith, vermiculite and perlite in the ratio 3:1:1. The study indicated that seed invigoration with these organic preparations enhanced the seed germination and seedling characters. Maximum germination was observed in seeds treated with fish jaggery extract (T5) followed by seed soaking in watermelon juice extract (T7) compared to the control (T1). Significantly higher shoot and root length were recorded in seeds treated with fish jaggery extract (5.34 and 8.5 respectively), followed by seeds treated with watermelon juice extract (4.58 and 6 respectively). Seeds soaked in fish jaggery extracts gave the highest values of vigor index (1384) and seedling length (13.84cm) followed by watermelon juice extract treatment. It can

be conclude that seed quality could be improved by seed invigoration with organic preparation like fish jaggery extract, watermelon juice extract etc.

Key words: Seed invigoration, Panchagavya, Egg lemon jaggery extract, Fish jaggery extract

Introduction

Organic farming is an alternative agricultural system which originated early in the 20th century in reaction to rapidly changing farming practices. It is a method of crop and livestock production that avoids the use of pesticides, fertilizers, genetically modified organisms, antibiotics and growth hormones (Martin, 2009). Seed germination is of classical interest in plant biological research since a large part of conventional agriculture is engaged in growing plants from and for their seeds. The germination of seeds are affected or controlled by variety of external or internal factors such as access to water and air, a suitable range of temperature, freedom from higher inorganic salt concentration, poisons and inhibitors and for some plant the exposure to light. Many naturally occurring and synthetic compounds are known to have inhibitory effect on seed germination.

In organic farming, good quality seeds are needed for a better crop production. The different points taken into account while considering the seed quality are varietal purity, satisfactory germination vigor and freedom from other materials like plant debris, dead or broken seeds of other crops, weed seeds, noxious and parasitic weed seeds and freedom from seed borne pests and diseases. According to Mathews (1980), fast and uniform germination are important for superior crop production while slow and unreliable germination due to low vigor, lead to poor crop production.

The seed invigoration techniques are used to enhance germination and vigor of seeds and seedling growth. These techniques involve a period of controlled hydration of the seed to a point close to but before the emergence of the radicle after which the seeds are dried back to their initial moisture before sowing (Khan, 1992). All the methods prevent the radicle protrusion through seed coat but permit the seed to imbibe water to proceed to the first stage of germination (Janmohamadiet al., 2008). The idea of soaking seeds before sowing is aimed at shortening the lag phase in germination and to enhance seedling establishment thereby minimizing the risk in the early vegetative growth (Sabongari, and Allero, 2003).

Lycopersicon esculentum Mill (solanaceae) is one of the world's most important vegetable crops with a current worldwide fresh weight production of 80 million metric tons from a cropped area of approximately three million hectares (Johannes. *et. al.*, 2000). Tomato could be propagated vegetatively by stem cuttings, tissue culture, grafting or sowing seeds in the field. However, because of the prevalence of virus diseases which would be transmitted by vegetative propagation, seed is the safest and most reliable way of propagation (Yamaguchi, 1983). It belongs to the nightshade family Solanaceae. According to Bentham and Hooker's system of classification the *Lycopersicon esculentum* Mill. comes under the Class Dicotyledonae, sub class Gamopetalae, Series Bicarpellatae, order Polemoniales. According to the most modern APG system of classification *Lycopersicon esculentum* comes under the division Angiospermae, class Euasterids, order Solanales, of family Solanaceae.

Objective of the present study is to evaluate and compare the effects of seed invigoration treatments with organic preparations such as panchagavya, animal urine, fish, jaggery extract, egg, lemon extract and fruit juices and to develop an efficient seed invigoration treatment for tomato.

Materials and Methods

The experiment was conducted in a polyhouse at Iqbal College, Peringamma, Thiruvananthapuram, Kerala from March - June 2017. Tomato seeds variety FH-112, used for the present study are of good crop variety and were purchased from a farm house, Thiruvananthapuram. The potting mixture was prepared by using coco peat, vermiculite and perlite in the rate of 3: 1: 1.

Organic Preparations

Fish Jaggery Extract or Fish Amino Acid (FAA).

FAA is prepared by taking equal amount of fish and jaggery (1: 1 ratio by weight). Small sardine fishes are purchased from the local market. Clean and cut it into small pieces. Place fish and jaggery, layer by layer in an air tight fermentation container until the container is nearly full, ending with a layer of jaggery. Cover the container with lid and store in a cool dry place, by keeping it away from direct sunlight for 21 days. Pour off only the liquid portion and use as FAA. The remaining solids were used as compost.

Egg Lemon Jaggery Extract.

Egg lemon jaggery extract was prepared by the procedure outlined by Gopalakrishnan (2008). Fifteen chicken eggs were taken, placed in an air tight glass jar, containing twice volume of lemon juice in such a way that all the eggs are well immersed inside the solution. Close the jar with an air tight lid and keep it in the shade for about 10 days. On the 10th day, the eggs along with shells inside the solution would be well mixed. Added 250g of jaggery (baked and cooled) to this. Closed the glass jar tightly for again 7 days.

Panchagavya

Panchagavya was prepared following the procedure outlined by Kerala Agricultural University (2009). Cow dung (7kg) and cow ghee (1kg) were mixed in a clean container thoroughly stirred daily in morning and evening hours and kept aside for 3 days- 10 liters, each of cow urine and water are added. The mixture was kept for 15 days with regular mixing both in morning and evening hours. After 15 days, add cow milk (3 liters), cow curd (2 liters), jaggery (3 kg) and well ripened poovan banana (12 nos). Stirred the content twice a day in morning and evening for thirty days.

Fruit juices (mango and watermelon)

Fresh ripe fruits of mango and watermelon were purchased from market, grinded using mortar and pestle to form pulp. The fruit extracts were then filtered through filter paper and pure concentrated extracts of fruits were obtained.

Design and layout

The experiment was laid out in completely randomized design with seven treatments and 3 replications as follows:

R ₁	T ₁	T ₃	T ₂	T ₅	T ₄	T ₇	T ₆
R ₂	T ₆	T ₂	T ₅	T ₁	T ₄	T ₃	T ₇
R ₃	T ₇	T ₄	T ₂	T ₆	T ₁	T ₅	T ₃

Treatments:

T₁ : Water soaking for 2 hours followed by drying.

T₂ : Soaking in goat urine 12.5 % for two hours followed by drying.

T₃ : Soaking in Panchagavya 3% for 2 hours followed by drying.

T₄ : Soaking in egg lemon jiggery extract 0.1% for 2 hours followed by drying.

T₅ : Soaking in fish jiggery extract 0.5% for 2 hours followed by drying.

T₆ : Soaking in mango juice 1.5% for 2 hours followed by drying.

T₇ : Soaking in watermelon juice 1.5% for 2 hours followed by drying.

Methodology

A known number of Tomato seeds were washed with sterilized distilled water. Twenty five seeds were taken for each treatments and soaked in respective organic preparation in a glass beaker for 2 hours. One control treatment (water soaking) was also kept. The seeds were dried after hydration. The Tomato seeds were sown in portraits at one seed per cell; these trays were kept in a polyhouse at the Iqbal college campus. Regular watering was done and observations on germination percentage, seedling length, germination index and root biomass were taken (Jayalekshmi et al., 2009) at five days and 14 days after sowing.

The germination percentage of seeds was calculated on the 5th day using the formula proposed by IRRI (2001). Seedlings were allowed to grow up to 14 days and the root and shoot length were measured by selecting 5 seeds randomly for each treatments. Seedling Shoot length was measured from the base of the terminal leaf (top most) to the base of shoot and root length was measured from the tip of the primary root to the base of hypocotyls, with all measurements expressed in centimeter (Dash, 2012). Total seedling length was calculated by adding the shoot length and root length and expressed in centimeter. Vigour index was computed on 14 days after soaking, using the procedure suggested by Abdul Baki and Anderson (1973). Germination Index is calculated by using the formula as proposed by Gupta (1993). Fresh and dry weight of shoot and root were examined by using digital weight scales and expressed in grams. All measurements were according to the methods used by Dash (2012).

Statistical analysis

The data generated were subjected to analysis of variance (ANOVA) as applied to randomized block design (Panse and Sukhatema, 1985). Whenever the results were significant, the critical difference was worked out at the 5% level probability.

Results

The seed invigoration with different organic preparations significantly increased the germination compared to control. Treatment with organic preparations significantly improved the length of seedling shoot and root and its total length. Soaking seeds in different organic preparations influenced the vigor index also. Seed soaking treatments influenced the germination index over control i.e.; water soaking. The fresh weight of the shoot is influenced by the treatments, but the dry weight of shoot and root was not affected by the seed invigoration with organic preparations.

Germination percentage

The result showed that seed invigoration with organic preparations significantly increased the germination compared to control (Fig 1). The germination percent was the highest in the treatments T5 and T7 i.e.; seed treated with fish jaggery extract and watermelon juice extract. This was followed by treatments, T2 and T6 i.e.; seed treated with goat urine and mango juice extract. Except T1 (control) and T3 (panchagavya) treated seeds, all other treatments recorded a germination percentage above 90%.

Seedlings shoot length and root length

Seed invigoration studies with organic preparations significantly improved the length of seedling shoot and root (Fig 2). Seeds treated with fish jaggery extract (T5), recorded high shoot length (5.34cm). This was followed by the seeds treated with watermelon juice extract (T7), with shoot length 4.58cm and the seeds treated with goat urine (T2) with a shoot length of, 4.3cm. The seed treated with fish jaggery extract (T5) showed maximum seedling root length i.e., 8.5cm, followed by seeds treated with watermelon extract (T7), with 6.00cm.

Total Seedling length

The length of seedling i.e. total length was significantly influenced by the different seed invigoration treatments. The seed treatment, T5 (fish jaggery extract) recorded maximum seedling length of 13.84cm, followed by the seeds treated with watermelon juice extract (T7) and goat urine (T2) with 10.58cm in T7 and 9.9cm in T2 treated seeds (Fig 3).

Vigor index

Seed invigoration with organic preparations significantly improved the vigour index of seeds. Soaking seeds in fish jaggery extract (T5) recorded the highest vigour index (1384). It was followed by goat urine, T2 (950.4) and water melon juice extract, T7 (1058) treated seeds. In the control vigour index showed the lowest value ie; 383.68 (Fig 4).

Germination index

Seed soaking treatments influenced the germination index over control. The germination index was higher for the treatments T5 (5.0) and T7 (5.0) and was followed by the treatments T2 (4.8) and T6 (4.8). The lowest index was observed in the control (T1, 4.4). (Fig 5).

Fresh weight of shoot and root

The treatment T5 ie; fish jaggery extract recorded the highest fresh weight of shoot ie; 0.97g which was significantly different from all other treatments and it was followed by the treatment T7 (watermelon juice extract). Similarly, The fresh weight of root was high in seeds treated with fish jaggery extract (T5) ie; 0.40, and it was followed by the seeds treated with watermelon juice extract (T7) with 0.35g. (Fig 6).

Dry weight of shoot and root

The dry weight of shoot and root was not much affected by the seed invigoration with organic preparations. The treatment T2 ie goat urine recorded the highest dry weight of shoot (0.16g) followed by T5 ie; fish jaggery extract (0.15) and T3 ie; panchagavya (0.14g). Similarly, Seeds treated with goat urine (T2) recorded the highest dry root weight (0.04g) and was followed by T5 (0.039g) and T3 (0.038g). T4 has lowest dry root weight ie; egg lemon jaggery extract with only 0.035g. (Fig 7).

Fig. 1. Effect of seed invigoration with organic preparations on Germination percentage.

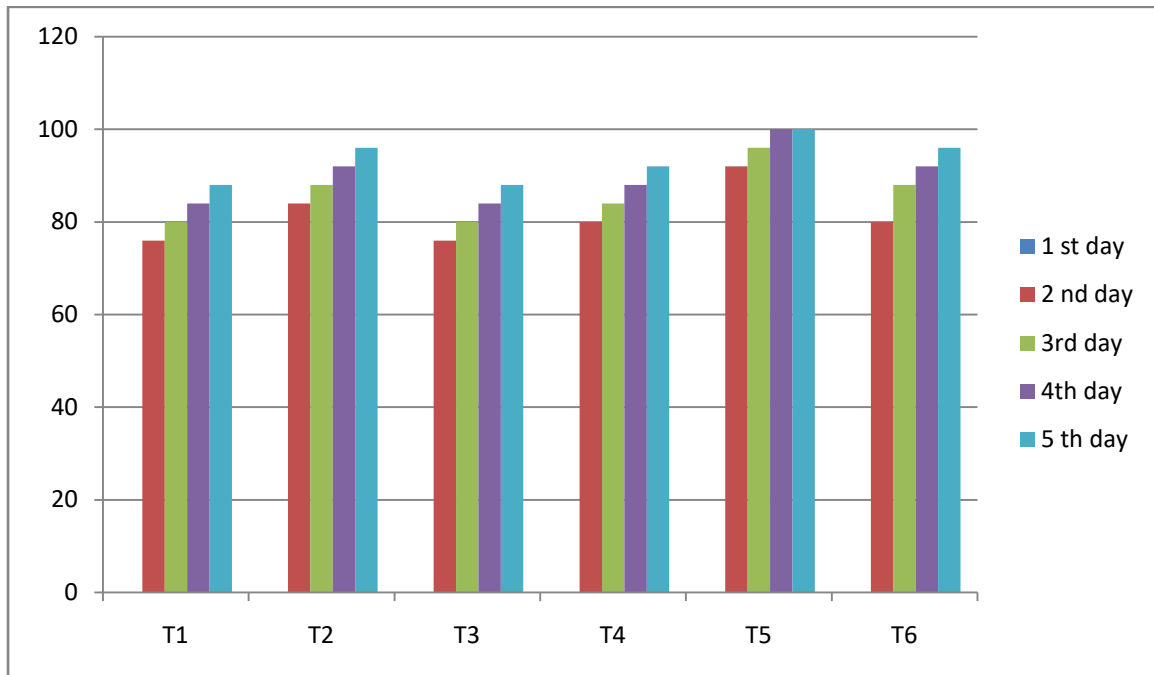


Fig.2. Effect of seed invigoration with organic preparations on seedling Shoot and Root length (cm).

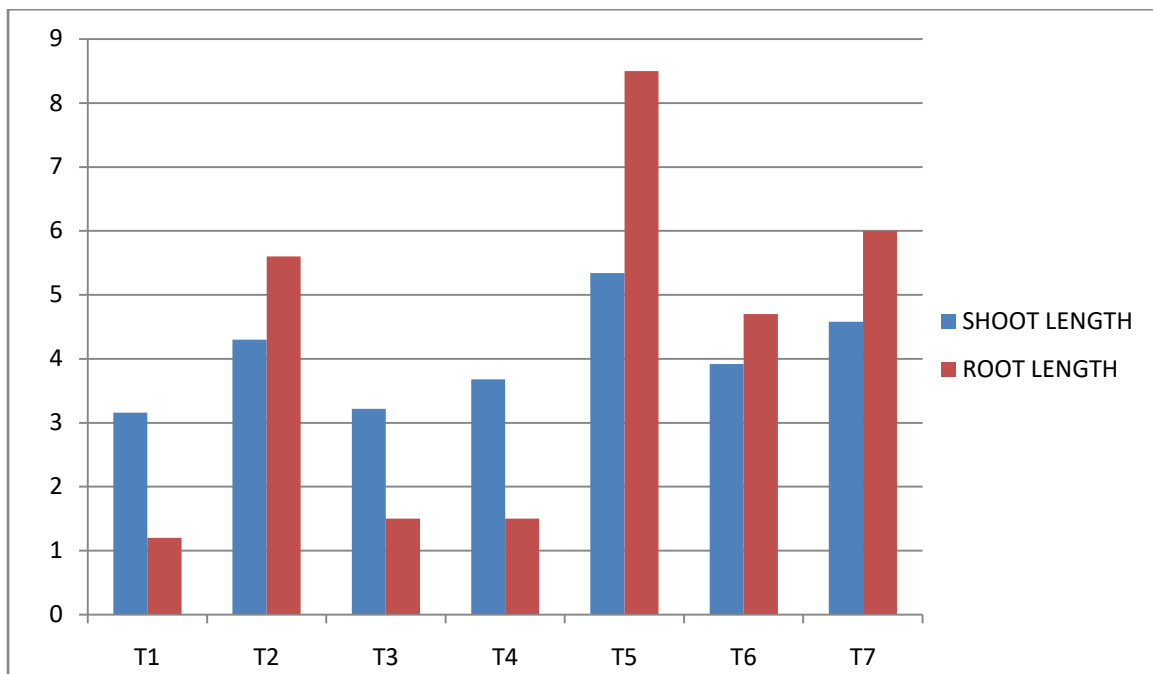


Fig.3. Effects of seed invigoration with organic preparations on Seedling length (cm).

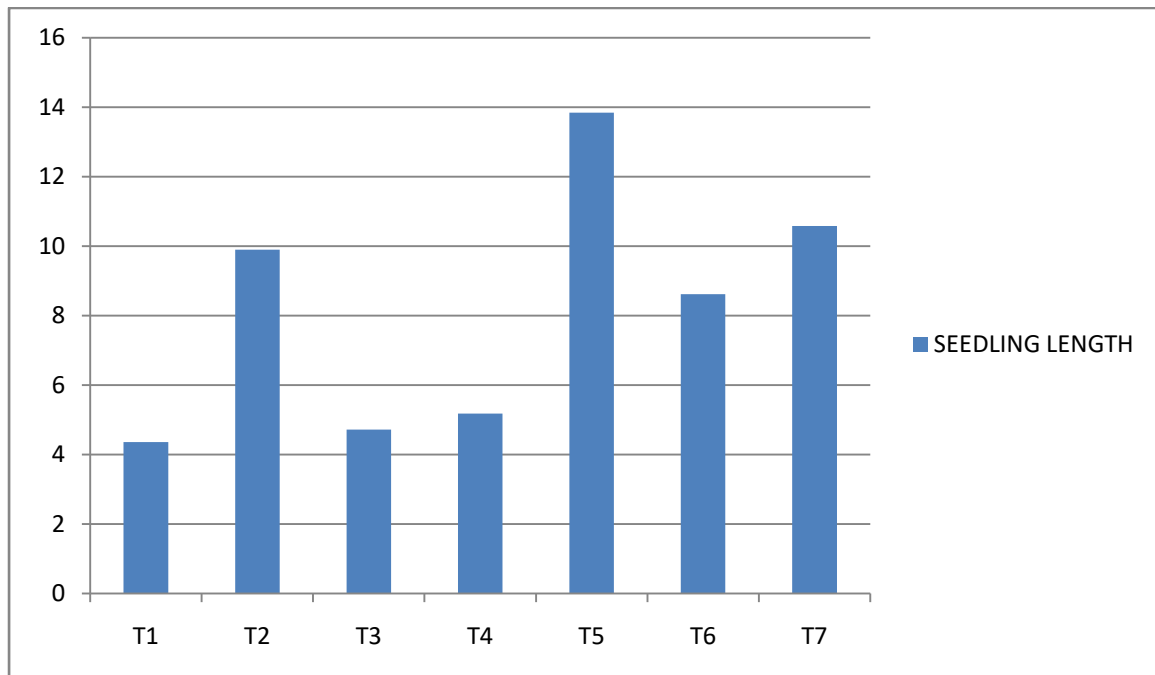


Fig.4. Effects of seed invigoration with organic preparations on seedling Vigour index.

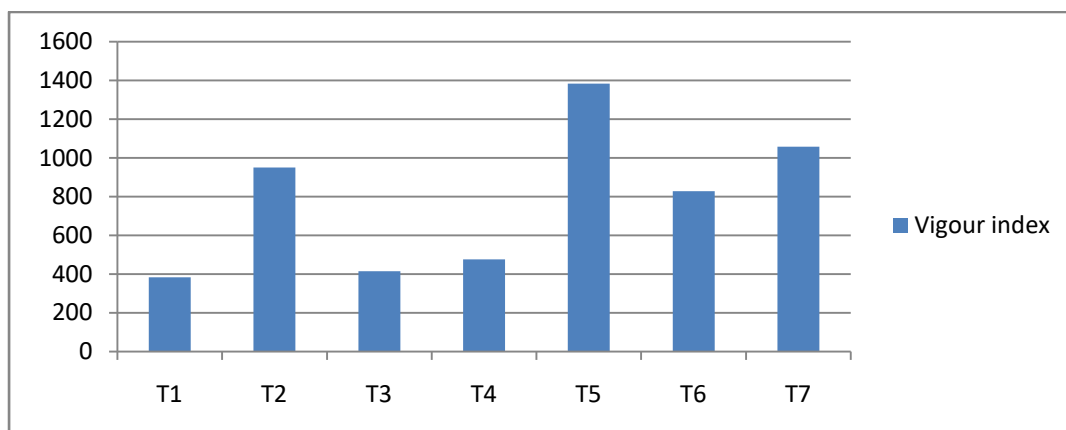


Fig.5.Effects of seed invigoration with organic preparations on Germination index (seeds/day).

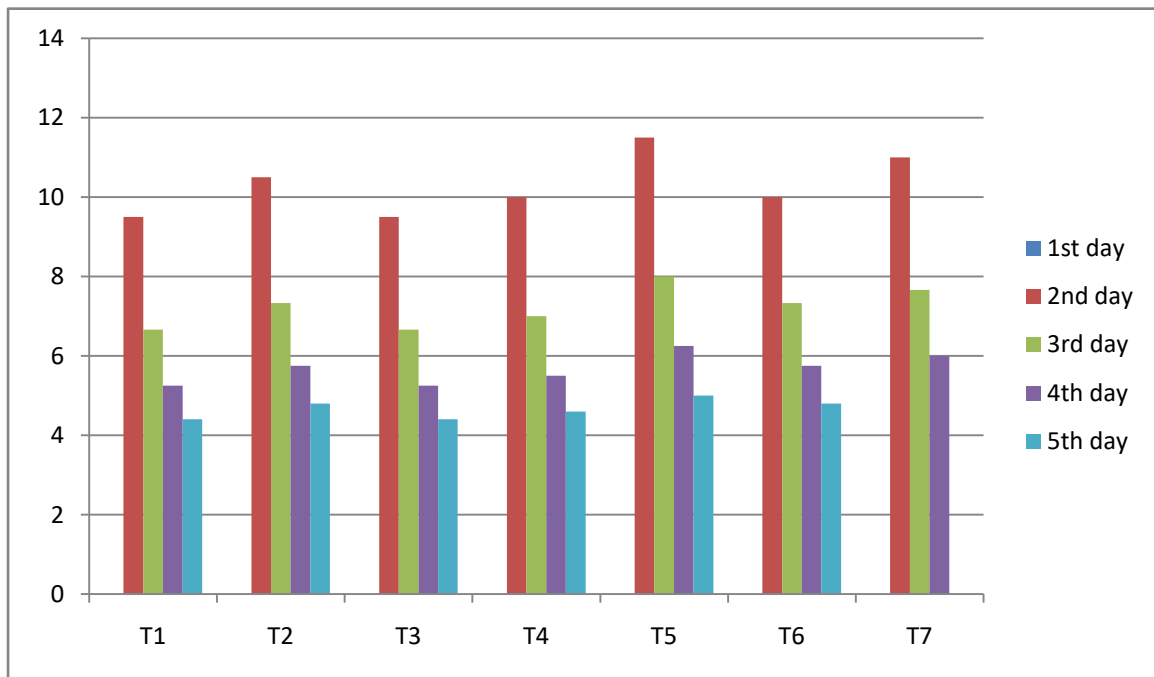


Fig.6.Effects of seed invigoration with organic preparations on Fresh weight of Shoot and Root (g).

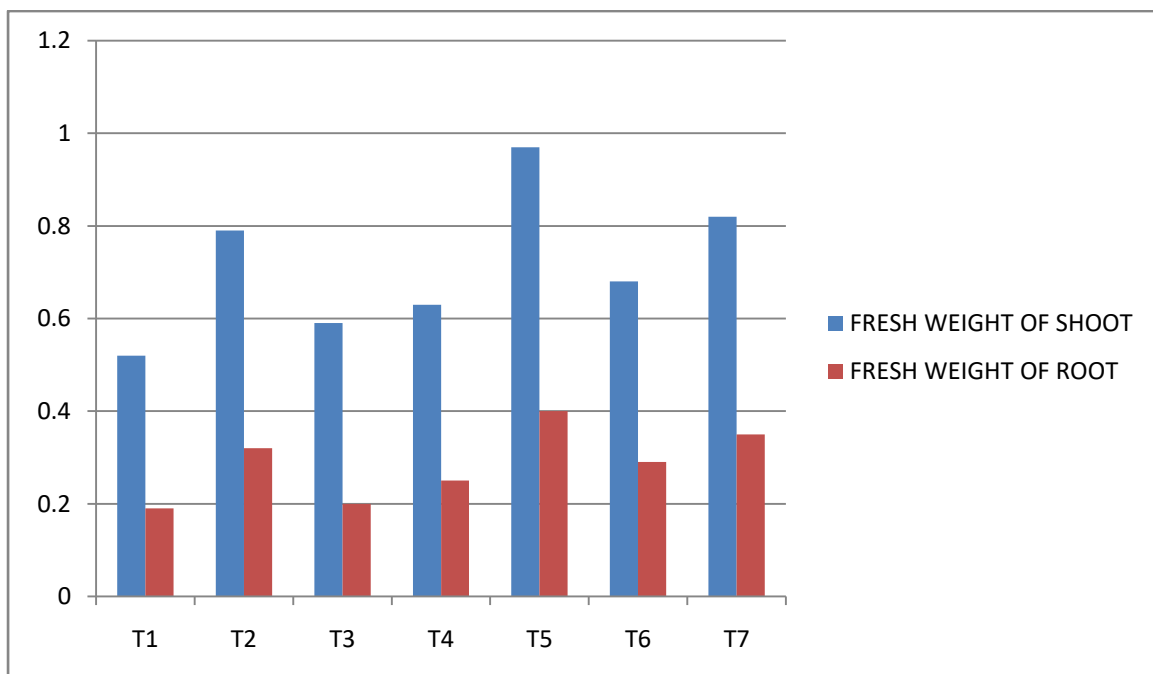
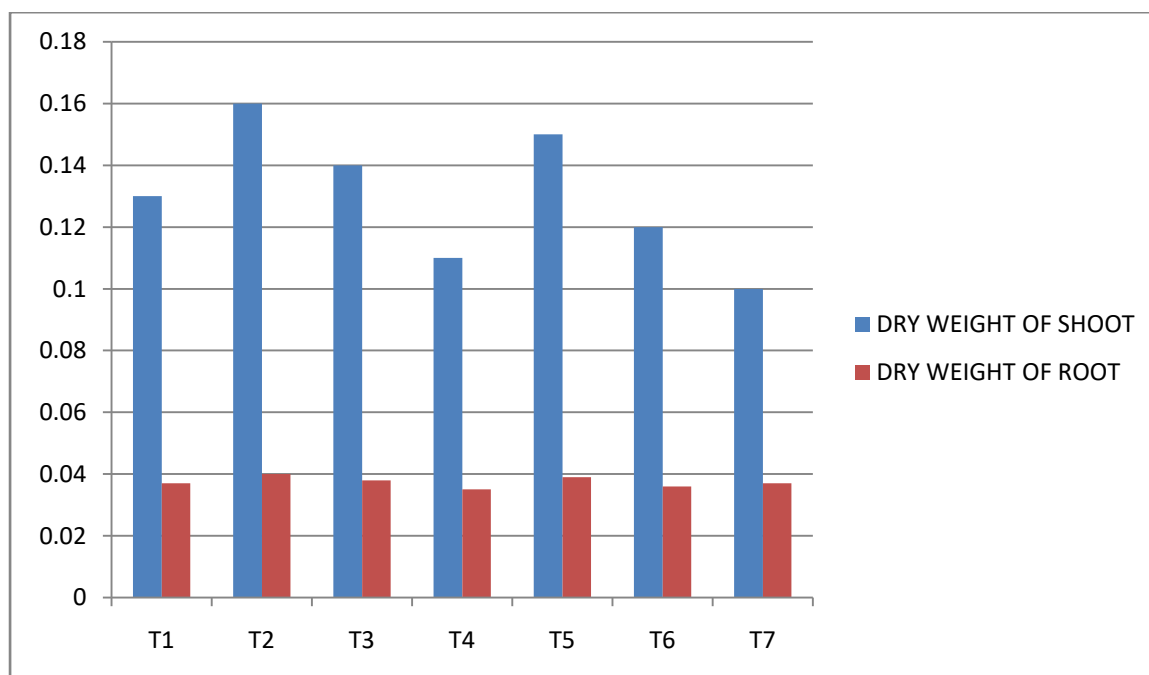


Fig.7.Effects of seed invigoration with organic preparations on Dry weight of Shoot and Root (g).



Discussion

The study clearly showed that there were significant improvement in germination, seedling length, vigour index, fresh and dry weight of shoot and root, when the seeds were treated with organic preparations; fish jaggery extract, watermelon juice extract, goat urine, mango juice extract, egg lemon jaggery extract and panchagavya. This might be due to the action of microorganisms, growth hormones and nutrients which are present in these organic preparations. It is also well documented that fish emulsion promotes seedling growth (Murray and Anderson, 2004), fruiting (Aung and Flick, 1980) and microbial action in soil (El-Tarabili et al., 2003) which are in conformation with the present study. The seed quality could be improved through presoaking treatments using cheap, non-toxic and eco-friendly organic sources as reported by Deshpande et al. (2008).

Seed invigoration using organic preparations i.e. organically available substances like organic growth stimulants or inputs or organically available sprout extracts or botanical leaf extract etc. is an effective method for enhanced germination (Nagaraj, 1996). It speeds up seed germination, promotes faster growth and produce higher yield. Seed treatment with organics i.e. cow's urine resulted in a significant increase in seed quality parameter of cluster bean seed (Shankrayya et al, 2014). A study conducted by Sakuntala et al.,(2012) revealed that

paddy seeds treated with beejamruta at 50% recoded higher germination percent (85.37%), seedling vigour index(2805), low dehydrogenase enzyme activity(0.300DD value) and lowest seed infection (2.64%), followed by panchagavya at 3% compared to untreated control at the end of nine months of storage period.

The present study suggest that seed quality could be improved through presoaking treatments using cheap, non-toxic and eco-friendly organic sources such as fish amino acid, egg-lemon-jaggery extract, panchagavya and fruit juices. There is a possibility of use of these organic treatments in controlling the seed infection as well as improving the seed vigour.

Conclusion

Seed invigorations using cheap and readily available organic preparations is a promising method for improving the performance of seeds with better uniformity in germination and seedling characters and emergence speed. This results in superior yield of crop. There are some on - farm seed priming methods and this includes seed invigorations using organic preparations. With this background the present investigation was carried out.

The experiment was conducted in a polyhouse at Iqbalcollege, Peringammaqla, Thiruvananthapuram, Kerala from March - June 2017. Tomato seeds variety FH-112, used for the present study are of good crop variety and were collected from a farm house, Thiruvananthapuram. The potting mixture was prepared by using coco peat, vermiculite and perlite in the rate of 3: 1: 1. Organic preparations like Fish Jaggery Extract or Fish Amino Acid, Egg Lemon Jaggery Extract, Panchagavya, and mango and watermelon fruit juices were prepared and used for seed invigoration along with control and goat urine.

The study indicated that seed invigoration with these organic preparations enhanced the germination and seedling characters. Maximum germination was noticed in seeds treated with fish jaggery extract, followed by seeds soaking in watermelon juice extract. Significantly higher shoot and root length were recorded in seeds treated with fish jaggery extract, followed by seeds treated with watermelon juice extract. Seeds soaked in fish jaggery extracts gave the highest values of vigor index and seedling length, followed by watermelon juice extract treatment. It can be conclude that seed quality could be improved by seed invigoration with organic preparation like fish jaggery extract.

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