

Germination Response of Eggplant (*Solanum melongena* L.) Seeds to Different Vinegar Concentration as Seed Priming Agents

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Abstract- Priming materials are important to enhance germination ability of seeds. One of the materials used was vinegar. This study was conducted to determine effect of vinegar on the germination of eggplant seeds and to identify, which vinegar concentration is suitable for seeds germination. A petri dish method was used in this study with six treatments, replicated three times and arranged Completely Randomized Design (CRD). The treatments composed of five vinegar concentration (10, 1, 0.1, 0.01 and 0.001%) and a control. The parameters includes germination percentage, germination rate and germination index. The result showed that application of 0.001% vinegar concentration showed significant effects in terms of percent germination and germination rate. Application of 10% vinegar concentration has detrimental effect of eggplant seeds. Thus, application of vinegar with 0.001% concentration is effective in germination of eggplant seeds.

Index Terms- germination index, germination percentage, germination rate, priming agent, *Solanum melongena* L

I. INTRODUCTION

Eggplant (*Solanum melongena* L.) is a plant of the family Solanaceae (also known as the nightshades) and from genus Solanum. Eggplant is well regarded among the vegetables increasingly sought by consumers, whose demand for food with potential health promoting effects, such as disease prevention, is escalating (Cardoso et al., 2009). It is said that eggplant fruits associate good nutritional value (Ribeiro et al., 1998) and therapeutic properties (Reis et al., 2007).

According to Bajehbaj (2010) that seed priming is an efficient method for increasing seed vigor and synchronization of germination, and in addition the growth of seedlings of many crops under stressful conditions. Heydecker and Coolbear (1977) stated that one of the long known main merits of priming treatments is to increase germination and emergence rate.

The advantage of seed priming is reducing the germination time and improving emergence in field and laboratory conditions. However, few detailed studies have been reported on the performance of osmotically treated seeds under field conditions. Priming of aged seeds of okra resulted in good germination and establishment in the field trials (Sanjaykumar et al., 1996). There are a lot of benefits derived from seed priming particularly in all crops which included; faster emergence, more and uniform stands, less need to re-sow, more vigorous plants,

drought tolerance, earlier flowering, earlier harvest maturity and higher seed yield (Chavan et al., 2014; Harris et al., 2001 and Assefa, 2008.). One of priming material used in seed germination is vinegar.

Evans and Blazich (1914) stated that vinegar is safer and can be used for species that do not have an extremely hard seed coat; the technique is the same as with sulfuric acid. According to Tóbiás, et.al, (2007), vinegar types seem to be environmental friendly, cheap, and perspective dressing materials in ecological seed treatment. Acetic acid, in vinegar, is one of the most anciently used preservatives. Acetic acid is still examined in other countries as seed treating material, but it was applied only against fungi in arable cultures. Other examinations are also developed new adequate methods for seed treatment in ecological vegetable production, for example: natural compounds (Tinivella et al., 2004), plant extracts (Hartman et al., 1995), essential oils, and natural acids), antagonistic microorganisms, physical treatments (aerated steam treatment, hot water treatment (Roberts et al., 2006). Vinegar also changes pH, so the new environment is not suitable for bacteria. Acetic acid is a natural substance with low oral toxicity to humans, birds, and others who have contact with it (Borgen, 2001). Hence, this study was conducted to determine effect of vinegar as priming agents on seed germination of eggplant seeds and to identify which vinegar concentration suitable for eggplant seeds germination.

II. METHODOLOGY

A. Seed Materials

Seeds of eggplant were obtained from the Department of Horticulture, Seed Physiology Laboratory, Visayas State University, Visca, Baybay City, Leyte. Viable seeds with uniform size were selected for this experiment.

B. Seed Treatment

All the seeds of eggplant were disinfected with ethanol 70% for three minutes and rinsed three times with distilled/sterilized water, before treatments.

C. Experimental Treatment and Design

Vinegar as priming materials was used in this study using Completely Randomized Design (CRD), with the following concentration as a treatment:

Treatments:

- T1 = control (distilled water)
- T2 = 10% vinegar
- T3 = 1% vinegar
- T4 = 0.1% vinegar
- T5 = 0.01% vinegar
- T6 = 0.001% vinegar

D. Vinegar Solution Preparation

Six beakers, cleaned with a 10% bleach solution and distilled water, was labeled with their corresponding vinegar concentration. The first beaker was filled with 50 mL of 100% vinegar. A pipette was next used to transfer 5 mL of the 100% solution to the second beaker (labeled 10%). Additionally, 45 mL of distilled water was added to the second beaker, and it was gently swirled. Likewise, 5 ml of the 10% solution was transferred to the third beaker (labeled 1%). It was diluted with 45 mL of distilled water and swirled. This dilution process was repeated for the remaining three solutions (0.1%, 0.01%, and 0.001%). Eggplant seeds were soaked in a 10% bleach solution for five minutes, rinsed with distilled water, and drained. Three of the Petri plates were labeled as “control”, while the remaining Petri plates were labeled with vinegar concentration (3 Petri plates per concentration). The appropriate vinegar solution was added to each of the Petri dishes (2 ml per dish), and distilled water was added to the control dishes. In an even-spaced fashion, ten soaked eggplant seeds was added to each dish. Finally, the Petri dishes will be wrapped in bond paper and allowed to sit at room temperature for five days. After this time, seeds were examined for germination (Potts, 2008).

E. Distilled Water Application

Seeds were placed into Petri dishes with filter paper moisten with distilled water. The Petri dishes were covered with bond paper, and the seeds were incubated at 20°C in the room temperature, because the seeds germinate favorably under these conditions. The experiments were directed in triple replication with 10 seeds per replicate.

F. Measurement of Germination

After priming, seed germination tests were carried out. Ten seeds each for each treatment were placed in Petri dishes with filter paper and each experiment was replicated three times. Seeds were considered germinated when there was a visible coleoptiles protrusion through the testa.

G. Data Gathered

Germination tests

The germination percentage is an estimate of the viability of seeds. Germinated seeds were counted daily for 14 days. Seeds were also considered germinated upon emergence of radicles (≥ 2 mm) (Sharma and Sharma, 2010). The following germination parameters were recorded:

1. Germination percentage (Gp) = (# seeds sprouted/ #total seeds sprouted) x 100
2. Germination rate (Gr) was calculated using the following formula:

$$\sum GT_i/T_1 + \dots + GT_n/T_n$$

Where, GT is seeds germinated each day and T refers to the day during the trial (Siti Aishah, et al, 2010).

3. The germination index (GI) was calculated as described in the Association of Official Seed Analysts (AOSA, 1983) by following formula:

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

H. Data analysis

The data was by one-way ANOVA for completely randomized design (CRD). The means were compared using Tukey’s Studentized Range (HSD) tests using the Statistical Package for Social Sciences (SPSS) ver. 15 and Statistic 6.

III. RESULTS AND DISCUSSIONS

Effect of vinegar on percentage seed germination

The number of seed germinated using vinegar as priming agent showed significant differences among treatments on the 7th and 11th day of germination but insignificant effect was observed on the 9th day after seeding (DAS) (Figure 1). On the 7th day the treatment 6 (0.001%) showed higher number of seed germinated compare other treatments but still comparable to control treatment and treatment 4 (0.1%) while on 11th day, similar pattern were observed in control, treatment 4 (0.1%), and treatment 6 (0.001%). This greatly explains that the use of vinegar as priming agent showed significant effect in germinating seeds, particularly in increasing the number of germination in early days such as on 7th day and 11th day. The result of this study was in agreement with the experiment of Borgen (2001) on vinegar in relation with concentrations’ effect and germination ability. Higher concentration have negative effect on seed germination ability seems to be proportional to the applied dose. In his study 0.5% of red and white wine vinegar and 5% of white wine vinegar have simulative effect on germination ability. In the experiments of Lövinson (1900) it retarded the germination of peas.

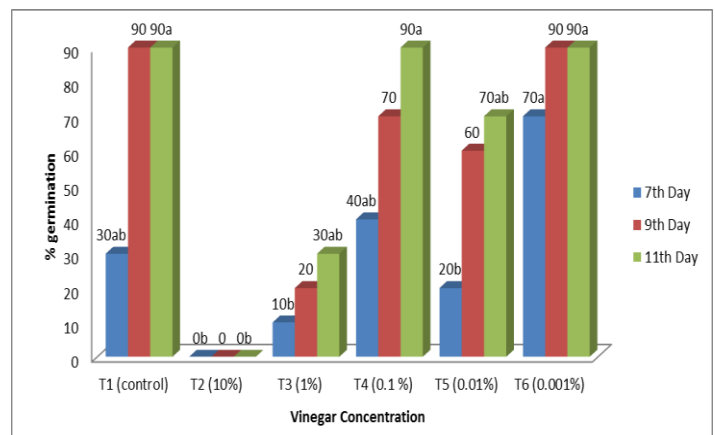


Figure 1. Effect of vinegar on seed germination percentage

Effect of vinegar on germination rate and germination index

Germination rate provides a measure of time course of seed germination (Saupe, 2009). The result showed that in treatment 6 (0.001%) of vinegar, obtained higher rate of seed

germination compared to other treatment but statistically comparable to control, T3, T4 and T5 (Figure 2). This can be noted that vinegar had significantly influenced the germination rate of eggplant seeds. This result is in agreement with the study of Tobias et al. (2007) on the germination ability test of vinegar in which the result did not show negative effect on seed germination ability with the use of vinegar except the vinegar in 5% concentration. On the other hand, the significant positive effect on was the germination ability. They also noted that the low concentration (0.5%) of red and white wine vinegar mend the germination capacity, but this effect is not significant. In the experiment of Tobias et al. (2007), results showed that the examined bacterial strains were more sensitive to acidic than alkaline circumstances and it was noticed on their experiment that the lowest examined concentration (0.5%) of vinegars had also bactericide impact. They also stated that in the alkaline materials it is necessary to use higher concentration of at least pH 13 (1.5% NaOH), but it had not impact in all case. They further noted that the highest soluble concentration of NaHCO₃ was 10% (pH 9). They concluded that all examined vinegar types could be useful in biological plant protection systems against bacterial diseases of tomato and pepper. However, Ling et al. (2009) noted that the germination indexes not only contained the number of germination, but also emphasized germination velocity and it was noticed that the seeds at different time played different roles in germination index. Therefore, germination index were a good indicator of seed vigor. However, the results of this study showed that a non-significant difference was observed on the germination index as applied with different concentration of vinegar (Figure 3).

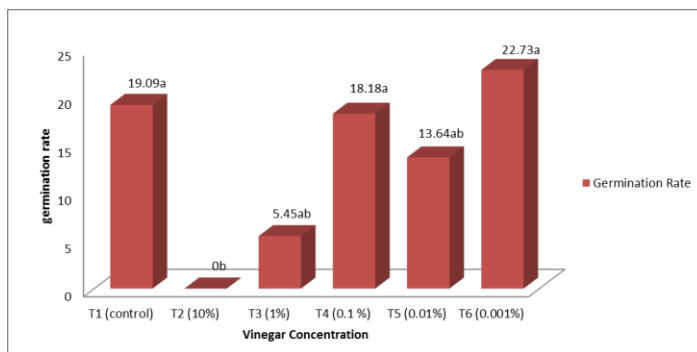


Figure 2. Effect of vinegar on germination rate

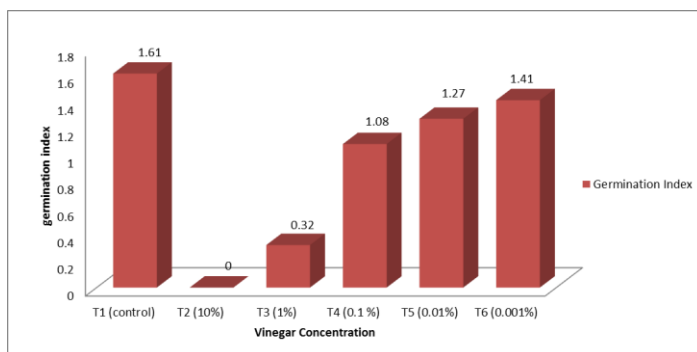


Figure 3. Effect of vinegar on germination index

IV. CONCLUSION

It can be concluded that the used of vinegar as priming material is effective in germinating the seeds. Application of 0.001% concentration showed significant effects on percent germination and germination rate. Thus, application of vinegar with 0.001% concentration has proved to have best effect on germination of eggplant seeds and application of 10% vinegar concentration showing detrimental effect.

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