RESEARCH ARTICLE

# INFLUENCE OF PRE-SOAKING ON SEED NUT GERMINATION IN COMMERCIAL CASHEW SOFT WOOD GRAFT NURSERY IN KERALA

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*Received-05.05.2021, Revised-14.05.2021, Accepted-26.05.2021*

**Abstract:** Evaluation of different pre-soaking treatments and soaking duration on germination of seed nut in a commercial cashew rootstock nursery revealed that the seed nuts pre-soaked in water for 72 hours resulted in highest germination of 95.3 per cent. While soaking in water or 0.1 per cent salt solution induced early germination. The emergence of sprout was noticed in 3.3 days after sowing when seeds are presoaked for 96 hours, either in water or 0.1per cent salt solution and recorded 9.3 days for fifty per cent germination. Presoaking cashew seed nuts in water for 72 hours recorded the lowest mean germination time of 8.6 days and 11.0 days for fifty percent germination and 5.0 days for emergence of first sprout. Thus, low cost pre-soaking treatment of cashew seed nut in water , by changing water daily can hasten the emergence of sprout, time to germinate, total germination per cent and which in turn may reduce the cost of production of cashew grafts in a commercial nursery.

**Keywords:** Germination, Cashew seed nut, Kerala

## INTRODUCTION

Kerala, with its tropical humid climate having twenty-three agro-ecological units bears an array of cash crops such as cardamom, pepper, rubber, cashew *etc*. Cashew, *Anacardium occidentale* L., belonging to the family Anacardiaceae, was introduced mainly as a soil and water conservation crop and being cultivated in marginal land, dry tracts and abandoned hills, hillocks and foot hills of Kerala. It is a hardy, fast growing, drought tolerant tree and can be cultivated even in less endowed environments with minimum care. Premium product from cashew is its kernel having high nutritive value. Cashew nut Shell liquid is the other industrial product. Now the value-added products such as juice, wine, vinegar, jam, pickle *etc* from cashew apple also have economic benefits.

The grafted cashew trees are good to cashew planters for developing new plantations to improve the productivity. In the recommended soft wood grafting, scion sticks from selected high yielding good mother plants are grafted on the top of two- to three-month-old root stock seedlings. It has the advantage of the well-developed and strong root system with all desirable qualities of mother plant. The soft wood grafts will reduce the gestation period of crop and tend to yield by second year with full bearing by sixth year and stabilized yield by tenth year. Uniform nut size with good market potential can also be ensured.

Seed nuts are vital to the propagation of the cashew plants (Udoh *et al.*, 2005; FAO, 2007). In a commercial nursery with an average graft production in tune of lakhs, the rootstock materials are required in a short span of two months. The germination of viable seed nuts is a product of many variables, but of significant importance is water imbibition, which depends on other factors *viz.*, seed size, level of water available in the seed and the permeability of the seed nut coat (Oyewole and Ibikunle, 2010). Cashew nuts possess thick seed coat thus requiring considerable time for water imbibition to prompt nut germination. Slow imbibition of dry intact seed nuts is reported to be the main cause of delayed germination in cashew (Subbaiah, 1983), a problem which is greatest in the larger seeds (Turner, 1956; Auckland, 1961; Ibikunle and Komolafe, 1973).

In nursery, the seed nuts sown in poly bags remain for 15 to 20 days for germination and by that time, weeds may emerge in poly bags. This increases the cost of production of grafts and also hinders proper growth of rootstocks as weeding can shake the germinating seed nuts. Early germination can be induced by various stratification and scarification methods. But in a commercial nursery, low cost and simple pre-soaking treatments are needed to hasten the seed nut germination and thus early weeding in the rootstock nursery can be avoided which in turn reduces the cost of production. Pre-soaking is a pre sowing physiological seed enhancement treatment that permits pre-germinative metabolic activity to proceed and thus increases the seed vigor, the germination speed, total germination rate and seedling uniformity. In this background, the present study was undertaken to evaluate the influence of pre-soaking on seed germination and initial seedling establishment under nursery conditions in cashew.

## MATERIALS AND METHODS

An investigation was carried out at Cashew Research Station, Madakkathara under Kerala Agricultural University, to get an early germination in rootstock nursery by pre-soaking the seeds. Cashew seeds collected from the experimental plot of the station

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were sun-dried for 3 days and stored at room temperature till the initiation of experiment. Seed nuts weighing 6-8 g were selected for the study. Healthy seeds were selected based on "sinker and floater" methods (Mandal, 2000) and those seeds which sink in water were only used for the experiment. The experimental design adopted was Completely Randomized Design (CRD) with 13 treatments and three replications. After pre-soaking, the seeds were sown in polythene bags (30 seeds per treatment) containing potting mixture of coir pith compost , soil and cow dung in the ratio of 1:1:1. The treatments were S2 (soaking in water for 8 hours ), S3 (soaking in water for overnight), S4 (soaking in water for 24 hours), S5 (soaking in water for 48 hours), S6 (soaking in water for 72 hours), S7 (soaking in water for 96 hours), S8 (soaking in 0.1% salt solution for 8 hours), S9 (soaking in 0.1% salt solution for overnight), S10 (soaking in 0.1% salt solution for 24 hours ), S11(soaking in 0.1% salt solution for 48 hours), S12 (soaking in 0.1% salt solution for 72 hours), S13 (soaking in 0.1% salt solution for 96 hours) and a control S1 without pre-soaking. In each presoaking treatment, the water or salt solution was changed daily.

The number of seeds germinated was recorded daily for 20 days and the following parameters were observed before, at the beginning and during the germination process:

1. Days for emergence of sprout (DES) is defined as the time elapsed between sowing and first germination
2. Germination per cent (%) is defined as the ratio between the number of seeds germinated (G) and the number of seeds sown (N) (Hamawa et al., 2019)
3. Mean germination time (MGT) (Ellis and Roberts, 1980)

   $$MGT = \frac{\sum_{i=1}^{k} n_i d_i}{\sum_{i=1}^{k} n_i}$$

   Where $d_i$ is the time from the start of the experiment to the $i^{th}$ interval, $n_i$ is the number of seeds germinated in the $i^{th}$ time interval (not the accumulated number, but the number corresponding to the $i^{th}$ interval) and $k$ is the total number of time intervals.
4. Days to fifty per cent germination

   The data on seed germination were subjected to analysis of variance (ANOVA) in general R based analysis and the association between pre-soaking treatments and per cent germination were represented graphically and interpreted.

## RESULTS AND DISCUSSION

Seed germination in cashew root stock nursery responded significantly (P>0.05) to presoaking treatments investigated (Table 1). Soaking nuts in water or salt solution significantly reduced days to sprout emergence as compared with the control. The treatments, S7 (pre-soaking for 96 hours in water) and S13 (soaking in 0.1% salt solution for 96 hours) recorded the least days for emergence of sprout (3.3 days). The control, without any presoaking treatments recorded 9.3 days for emergence of first sprout in the nursery. While pre-soaking nuts in 0.1% salt solution for 8 hours (S8) was not significantly different from the control treatment, with 10.0 days to sprout emergence. These treatments (S8 and control) continue to lag behind until 16 days to achieve 50 per cent germination (Table 1). Days to 50 per cent germination were found to be the lowest (9.3 days) in S7 and S13 indicating the effect of presoaking duration on sprout emergence.

Mean germination time (MGT), the reciprocal of the rate of germination, is an indicative of emergence performance in seed lots (Mavi *et al., 2*010). MGT can be used as a possible quick and reliable test to rank the relative emergence of pre-soaked seed lots of cashew in rootstock nursery. Mean generation time was the lowest in the treatments S6 (soaking in water for 72 hours), S7 (soaking in water for 96 hours) , S11(soaking in 0.1% salt solution for 48 hours), S12 (soaking in 0.1% salt solution for 72 hours), and S13 (soaking in 0.1% salt solution for 96 hours)

Pre-soaking nuts for 24-36 hours was reported to promote imbibition and reduce the time taken for seeds to germinate and increase the proportion of seeds germinating (Turner, 1956; Auckland, 1961; Kravchenko, 1961; Hartmann, 1967; Joley and Opitz, 1971; Ibikunle and Komolafe, 1973 ). The outcome of this research is therefore in line with previous findings as least time taken for sprout emergence and 50per cent germination and high germination rate was observed in the seed nuts presoaked for longer period.

At the end of data recording (20 days), seed nuts soaked in water for 72 hours (S6) recorded the highest germination (95.3%) and was on par with S7 (soaking nuts in water for 96 hours) recording a germination of 90.3per cent (Table 1). Days to sprout emergence was found to be 5.0 days and 3.3 days respectively (Table 1). The per cent germination in each treatment from 1$^{st}$ to 20$^{th}$ day after sowing was depicted in Fig 1. A line chart is used to display the trend in germination of presoaked seed nuts in cashew rootstock nursery over the 20 days' time period. In most of the presoaking treatments, maximum germination was obtained on the 9$^{th}$ day after sowing while, in control and S2, the germination was maximum on 15$^{th}$ day after sowing.

**Table 1.** Effect of pre-soaking treatments on germination of cashew seed nuts

| Treatments | DES (days) | Days to 50% germination | Germination (%) | MGT (days) |
|---|---|---|---|---|
| S1 | 9.3$^{ab}$ | 16.7$^{a}$ | 51.3 $^{e}$ | 14.7$^{a}$ |
| S2 | 8.3$^{abcd}$ | 15.0$^{ab}$ | 57.0 $^{de}$ | 14.3$^{a}$ |
| S3 | 8.7$^{abc}$ | 13.3$^{bcd}$ | 59.67 $^{d}$ | 12.2$^{b}$ |
| S4 | 6.7$^{def}$ | 12.7$^{cde}$ | 71.0 $^{c}$ | 10.8$^{cd}$ |
| S5 | 5.7$^{ef}$ | 11.7$^{cde}$ | 87.0 $^{b}$ | 9.9$^{de}$ |
| S6 | 5.0$^{fg}$ | 11.0$^{ef}$ | 95.3 $^{a}$ | 8.6$^{e}$ |
| S7 | 3.3$^{g}$ | 9.3$^{f}$ | 90.3 $^{ab}$ | 8.9$^{e}$ |
| S8 | 10.0$^{a}$ | 16.0$^{a}$ | 56.3 $^{de}$ | 13.9 $^{a}$ |
| S9 | 7.0$^{cde}$ | 13.0$^{bcde}$ | 57.0 $^{de}$ | 11.9$^{bc}$ |
| S10 | 7.7$^{bcd}$ | 13.7$^{bc}$ | 58.7 $^{d}$ | 12.0$^{bc}$ |
| S11 | 5.3$^{ef}$ | 11.3$^{def}$ | 75.7 $^{c}$ | 9.1$^{e}$ |
| S12 | 5.7$^{ef}$ | 11.7$^{cde}$ | 74.7 $^{c}$ | 9.3$^{e}$ |
| S13 | 3.3$^{g}$ | 9.3$^{f}$ | 86.7 $^{b}$ | 8.7$^{e}$ |
| SE(d) | 0.92 | 1.06 | 0.02 | 0.61 |
| SE(m) | 0.65 | 0.75 | 0.02 | 0.43 |
| CV (%) | 16.94 | 10.27 | 5.04 | 6.81 |
| CD | 1.88 | 2.18 | 0.06 | 1.27 |

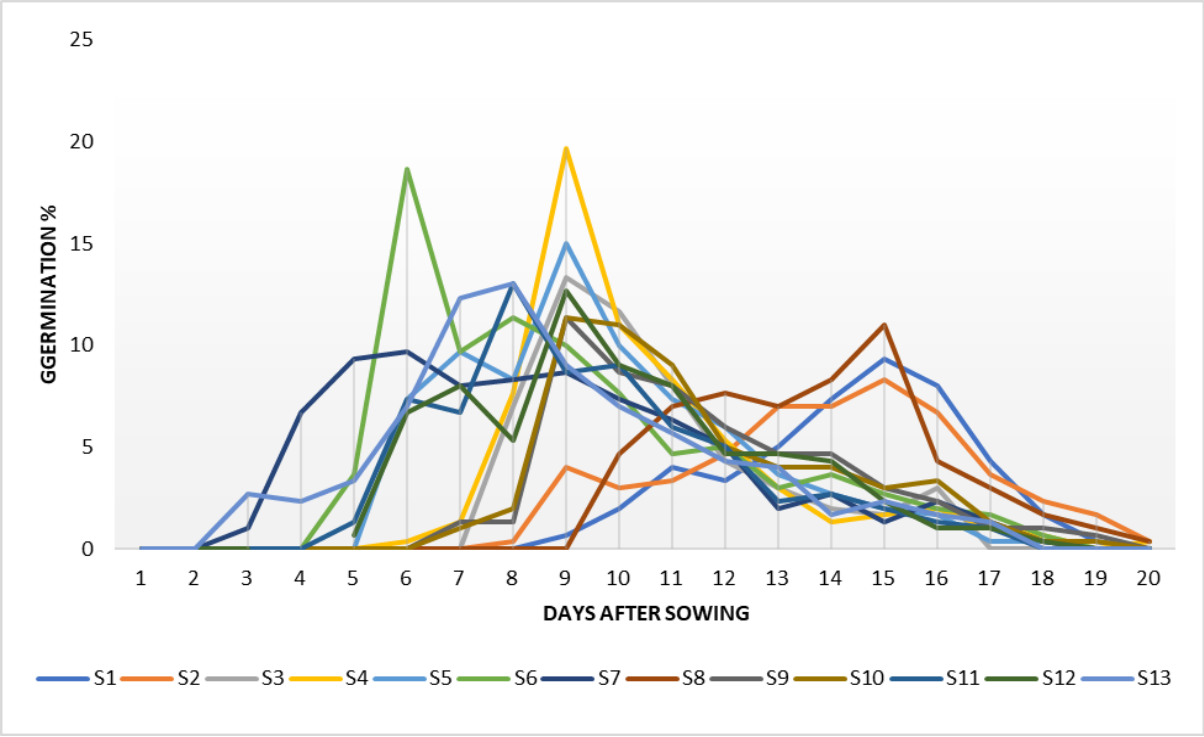


**Fig. 1.** Germination percentage in different treatments from 1 to 20 Days After Sowing (DAS)

## CONCLUSION

Cashew seed nuts responded to pre-soaking treatments and its duration. Soaking nuts in water before sowing was resulted in early germination and better germination compared to control treatment without any presoaking. Hence, these low-cost pre-soaking treatments can be recommended for commercial cashew nurseries in raising root stock which may help to reduce the management cost in

the nursery. Presoaking cashew seed nuts in water for 72 hours recorded the highest germination percent, lowest mean germination time.

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