RESEARCH ARTICLE

EFFECT OF SOAKING AND PLACEMENT OF SEED ON GERMINATION AND SEEDLING EMERGENCE IN LITCHI

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Received-06.05.2020, Revised-25.05.2020

Abstract: An experiment was conducted at ICAR-NRC on Litchi, Muzaffarpur during 2018 to assess the effect of soaking of seed, orientation and depth of seed sowing on germination and seedling emergence in litchi. Result indicated that soaking of seed in water before sowing had improved seed germination in litchi. The maximum germination was found in GandakiLalima with 92.58% as compared to without soaking (62.75%).There was a significant reduction in seedling emergence with an increase in burial depth. Seeds sown at 1 cm depth showed the highest seedling emergence with an average percentage of 79.81.The highest seed germination was found in lay flat orientation when seeds were sown at the depth of 1 cm.Litchi seedlingemergence was greatest and most rapid when seeds were sown 1 cm deep and positioned flat, on their sides.

Keywords: Effect, Germination, Litchi, Seed

INTRODUCTION

Litchi (*Litchi chinensis*Sonn.) is an evergreen subtropical fruit tree and important member of family Sapindaceae, which has strong mycorrhizal association (Lal and Nath, 2020). The litchi is one of the most environmentally sensitive (Lal et al., 2017a) fruit tree restricted to few a countries in the world and in few states in India. Recently, it has been reported that litchi is performing well in Southern parts of India where difference of temperature was less than 4 °C and humidity difference of about 6.5% during June-August (Nath et al., 2015) but major litchi producing states in India are Bihar, Uttarakhand, West Bengal, Punjab, Uttar Pradesh, Jharkhand and Tripura. Litchi commenced flowering during February-March in Bihar condition and intensity of flowering depends on previous years fruiting, temperature during floral bud differentiation, phenol content (Lal et al., 2019a) and age of plants (Lal and Nath, 2020). A single panicle produced hundreds to thousands of flowers (M1 flowers, Female flowers and M2 flowers) and success of fruit set depend on the pollen grain received from male parents (Lal et al., 2019 c and d).Heavy fruit drop has been reported in litchi (Lal et al., 2017b) and heavy fruit load affect fruit weight and quality in litchi (Nagraj et al., 2019).

Litchi is commercially propagated through marcottage but multiplication by seed is very important to create variability due to highly cross pollinated nature (Lal et al., 2019b). Seedling population gives enormous opportunity to select improved and desired traits specific new genetic stock or cultivars (Lal et al., 2019b). These all efforts depend on seed germinability. The germination performance of seeds and the seed placement in sowing are important to achieve seedlings (Aou-ouad et al., 2014; de Andrade et al., 2004). Litchi seeds are ‘‘recalcitrant’’ due to their high sensitivity to desiccation. They quickly lose their viability after extraction from the fruits. Litchi seeds completely lost viability when they were kept outdoors for 2 d or indoors for 6 d (Ray and Sharma, 1987). Xia et al. (1990) found that litchi seeds germinated fully when harvested at 10 d before fruit maturity or at fruit ripening time, but entirely lost seed viability after 6 d of natural drying. Ray and Sharma (1987) pointed out that seed germinability was positively correlated with seed moisture content above the critical limit of 20% moisture content. Therefore, the seed moisture content must be retained to ensure high seed germination rates.Seed imbibition is an important treatment for successful germination in any crops because sufficient water is necessary for loosening seed coat, rehydrating enzymes and their substrates, and provides energy to boost radicle. Especially, the first phase of imbibition characterized by the rapid water uptake plays a crucial role in seed germination success (Harb, 2013). Slow imbibe water from soil or unable to uptake sufficient water results early death of seed. Soaking before sowing enables a more rapid imbibition than is usually the case in a nursery bed, resulting in more rapid seed germination (Schmidt, 2000).

Seed orientation and sowing depth both play important roles in seed germination and seedling emergence (Aou-ouad et al., 2014; Huang et al., 2007). Recalcitrant seeds of coconut sown in horizontal orientation exhibited much quicker germination and better growth of seedlings (Thomas, 1978). Planting seeds of *Balanitesaegyptiaca* horizontally or vertically with stalk end down-ward showed better germination (Elfeel, 2012). The seedling emergence was slower when seeds were sown at deeper depth in *Rhamnusalaternus* and *R. ludovici-salvatoris* (Aou-ouad et al., 2014). Since 2013, we have started crossing technique in litchi and

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developed hundreds of hybrid seeds each year but could not get sufficient seed germination. We have observed good germination percentage near shade of nursery bed, good germination in some pockets of bed and wide variation due to bedding materials. We realized the importance of sowing of litchi seed. Therefore, studies are needed to get good seed germination in litchi. Therefore, an experiment was formulated with pre sowing soaking of seed, orientation and depth of seed sowing. The objectives of this experiment wereto find the best ways to improve seed germination and seedling emergence, which are important for raising sufficient variability.

MATERIALS AND METHODS

Fruit of different cultivars were collected from National Active Germplasm Site (NAGS), ICAR-National Research Centre on Litchi, Muzaffarpur, Bihar, at fully ripe stage and seed were extracted from fruits. Two hundred seeds of each cultivar were soaked in water and same quantities were sown immediately after extraction from fruits in prepared nursery bed. Seeds were soaked for 48 h in a plastic drum filled with water. Seeds were sown in three orientations (seed laid flat, seed laid vertically with the radicle upward, and seed laid vertically with the radicle downward). Seeds sown in each of the three orientations were placed in soil at five different depths of 1, 2, 3, 4 & 5 cm. Three replicates were used for each treatment and 20 seeds were sown in each replicate. A randomized block design was used in the experiment. Some seedlings began to emerge at the surface of soil on day 7, and the final percentage of seedling emergence was determined two weeks after sowing.The data of seed germination and seedling emergence were statistically analyzedusing SPSS version 16.0 Statistical Software. Pearson correlation tests were used to determine the correlations of soaking time with germination. ANOVA was used to test the differences in seedling emergence.

RESULTS AND DISCUSSION

Seed germination varied from 24.56 to 62.75 % with maximum in GandakiLalima and lowest in Bedana without soaking in water but varied from 43.56 to 92.58 % with maximum in GandakiLalima and lowest in Bedana when seed soaked in water (Fig 1). Soaking of seed in water before sowing had great impact on germination. Water soaking improved germination in litchi.Soaking of seeds in water helped to reduce the time required for germination and improved germination percentage. Zhang et al., (2015) reported that seeds of 'Yeshengli' litchi soaked in water showed a slightly higher germination percentage than seeds without the soaking treatment. The imbibition process occurred when seeds were submersed in water and soaking enabled a quicker imbibition and might be of benefit for rapid seed germination (Schmidt, 2000).

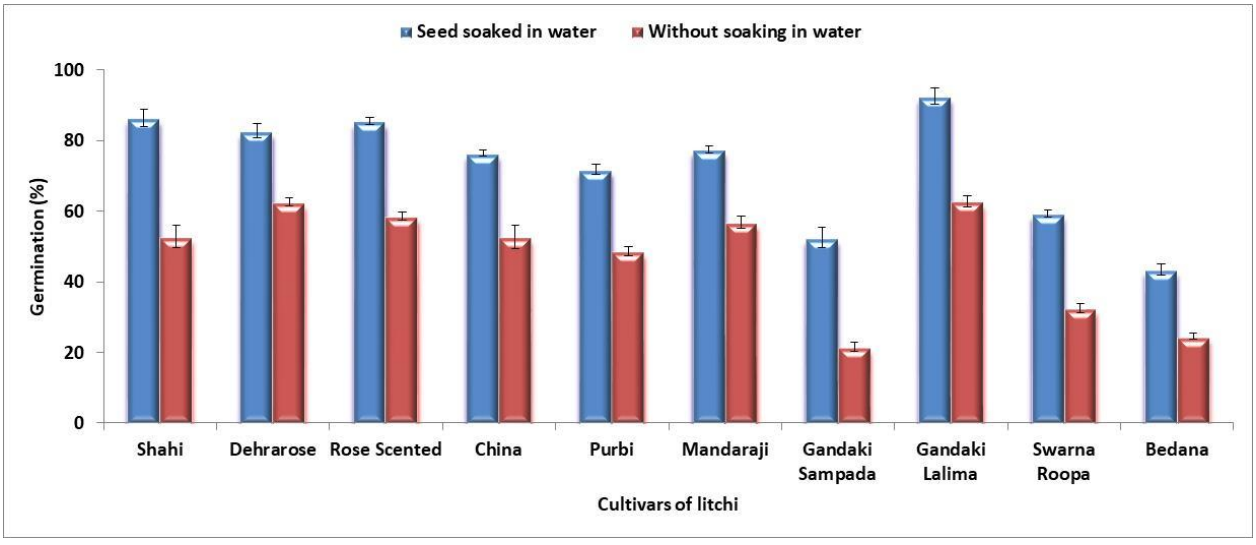

Fig. 1: Germination of seed (mean ± SD) in different cultivars of litchi.

The orientation and burial depth both significantly influenced germination and seedling growth in litchi. There was a significant reduction in seedling emergence with an increase in burial depth (Fig 2).Seeds sown at 1 cm depth showed the highest seedling emergence with an average percentage of 79.81. The highest seed germination was found in lay flat orientation when seeds were sown at the depth of 1 cm. The seedling emergence was lower and slower when seeds were sown radicle upward at the sowing depth of 1 cm (Fig. 2).The burial depth of seeds significantly influenced the seedling recruitment in litchi. There was a significant reduction in seedling emergence of litchi with depths below 2 cm. Planting seeds at deeper depths probably resulted in more consumption of the carbohydrate reserves during the

process of germination and seedling emergence (Huang et al., 2007).The seedling emergence was higher and quicker when seeds were placed flat, on their sides and radicle downward than those planted radicle upward at the burial depth of 1 cm. Therefore, growers should ensure seed placement avoids a vertical seed orientation with the radicle upward.In the present study, soaking increased seed germination percentage.Placing seeds flat and on their sides, orienting the radicle downward, and covering with 1 cm of medium exhibited the best seedling emergence.

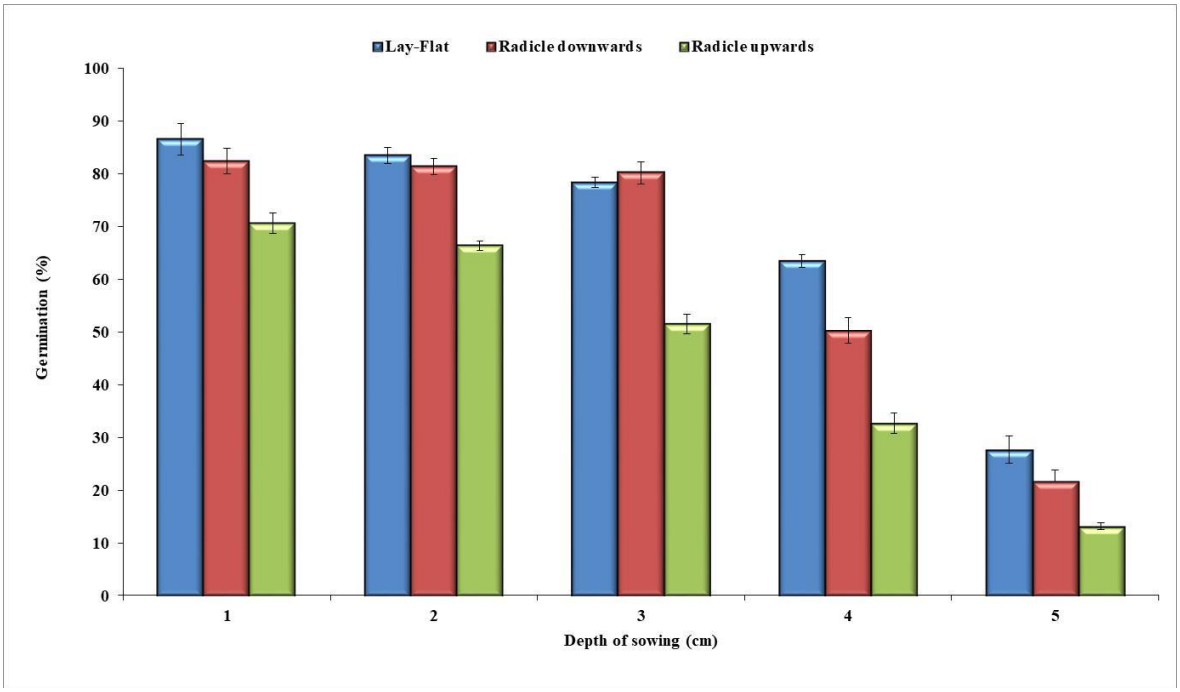

Fig. 2. Percentage of seedlings emergence (mean ± SD) at different seed orientations and burial depths in litchi.

CONCLUSION

It can be concluded that GandakiLalimahad good ability for germination with 92.58%. The seedling emergence reduced with an increase in burial depth. Seeds sown at 1 cm depth showed the highest seedling emergence with an average percentage of 79.81 in lay flat orientation.

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