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## Low cost hydroponic seed germination technique for Rangpur lime (*Citrus limonia*)

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**ABSTRACT :** Citrus seed being recalcitrant seed, 100 per cent germination is difficult under the field condition. In the hydroponic technique of seed germination, Rangpur Lime germination started after 13 days with the germination percentage of 98.9 per cent as compared to 21.4 per cent in the field condition which germinated after 30-35 days after sowing. This experiment proved to be cheap and better seed germination for the citrus seed, which could be used for the seed propagation for raising rootstock.

**KEY WORDS :** Rangpur lime, Hydroponics, Field condition, Germination

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Citrus is a long lived perennial evergreen tree and it is the world's leading tree fruit crop due to its adaptable to wide range of soil, terrain, planting and cultural management. Over 100 nations reported citrus production in the world and the area (Reltz, 1984) and production have increased many folds in the past 30 years particularly in Japan, Brazil, Israel, Turkey and Cuba. The economic life spans of this fruit crop in some countries is about fifty years and in some cases of good management live 100 years or more (Bose *et al.*, 2001). The total mandarin area is 324,000 ha with the production of 32.55 lakh tones having the productivity of 10t/ha (Anonymous, 2011). In the North East region (Assam, Arunachal Pradesh, Manipur, Tripura and Meghalaya), a type of mandarin called Khasi mandarin occupied an important place among the other varieties of mandarin orange. It is loose-skinned oranges, belonging to species *Citrus reticulata* Blanco are commonly designated as mandarins. Out of the total production of mandarin production in India, Assam contribute (5%), Manipur,

Tripura and Meghalaya (1% each) contributed in the national mandarin production (Anonymous, 2011).

Although Khasi mandarins are popularly grown in N-E regions, there are certain important growing belt *viz.*, in Assam (Tinsukia, NC Hills, Karbi Anglong), Tripura (Jampui hill), Meghalaya (East and West Khasi, Ri-Bhoi, Garo Hills, Jaintia Hills), Manipur (Tamenglong) and Arunachal Pradesh (East Siang) are the main producing zone of this fruit crop. In Arunachal Pradesh, which is known for its organic khasi mandarin production is facing problems of citrus decline problem due to tristiza virus (quick decline in citrus) or slow decline due to improper maintenance of soil fertility, irrigation, pest and diseases resulting them in citrus (Chadha, 2006). In order to control such problems rootstock *viz.*, Rangpur lime play an important role since Rangpur lime is resistant to citrus tristiza virus (CTV) and tolerant to drought, high saline and calcareous soil condition (Ray, 2006). However, seed of such rootstock are recalcitrant in nature and germination in the field condition is poor. Therefore, in

order to evaluate a better seed germination of the seedling of such rootstock this experiment was done *in situ* (hydroponic) and *ex situ* (field) condition for the evaluation.

## RESEARCH METHODS

The present investigations were carried out at the Department of Fruit science, College of Horticulture and Forestry, Pasighat, Arunachal Pradesh during the year 2014-2015 to evaluate the better seed germination percentage under the field and hydroponic condition. The average altitude of the sites of the experiment is about 155 m MSL and represent a typical subtropical zone with short cool, dry and windy winter, a hot summer and a heavy monsoon season. Study site represents a subtropical, hot and humid climate; in the lower valleys, summer temperatures in June, July, and August typically rise to about 30°C, while winter temperatures in December, January, and February usually drops to 13°C. Annual rainfall in the state averages about 130 inches (3,300 mm), mostly between April and September. To investigate the experiment, the seeds of Rangpur lime were collected from the NRC (Citrus)-Nagpur, Maharashtra for the rootstock purpose of Khasi mandarin which are growing in large scale in Arunachal Pradesh particularly in the East Siang, West Siang and upper Siang districts. These rootstocks are used for budding purpose (I budding) with the scion (Khasi mandarin) when it reached the pencil thickness size. Fruits were cut into two halves with a sterile knife and seeds were collected over sieves. Extracted seeds were washed in running tap water several times to remove the mucilage. Seeds

were dried over filter paper. Extracted seeds were treated with captan fungicide @ 1 per cent for about 1 hour to protect against fungal attack (Fig. 1). Fungicide treated seeds were kept inside the BOD for 25°C in the plastic tray (30x30cm size) which have the capacity around 2200 seeds per tray. In the plastic tray blotting paper were kept in between the thin bamboo stick (Fig 3). In case for the field condition, seeds were sown in the raised bed with 1 m width and conventional length spacing of 2 x 2 cm at a depth of 2 cm (Fig 2). After sowing, seeds were irrigated regularly. Oliveira and Walkyria (2007) also reported that 1-2 cm depth for the trifoliolate seed sowing give better seed germination.



Fig. 1 : Seeds treated with fungicide



Fig. 2 : Germination of seeds in field condition



Fig. 3 : Seed sowing in the hydroponic

## RESEARCH FINDINGS AND DISCUSSION

The hydroponic effect on seed germination in the winter season has been observed in the lab condition

**Table 1 : Performance of seeds germination of in hydroponic method (*In-situ* condition)**

No. of seeds/row in the bamboo strip	No. of bamboo strip in 1 tray (30x30cm)	Total number of seed / tray (30x30cm)	Total germinated seeds	Germinated seeds (%)
50	44	2200	2177	98.9%

**Table 2 : Performance of seeds germination in field condition (*Ex-situ* condition)**

No. of seeds/row (Spacing 2x2cm)	No. of replication	Total number of seeds	No. of seeds germinated/row (out of 50 seeds)	Total germinated seeds	Germinated seeds (%)
50	10	500	32, 17, 23, 18, 16,12,17,14,16,11	176	21.4%

under the biological oxygen demand (BOD) which maintain at 25°C. It was compared with the seed sowing in the field condition providing irrigation every day. Seeds which were sown under the hydroponic method provided moisture through the wet blotting paper which was in contact with the water. Such technique of seed germination started germination from 13 days and completed within 22 days with the germination percentage of 98.9 per cent (Table 1) whereas under the field condition showed 21.4 per cent success (Table 2). The seeds which were germinated in hydroponic method in the tray were frequently treated with fungicide (Captan @ 1g/litre of water) in order to avoid fungus infection. Hamilton *et al.* (2008) also reported that citrus seeds are recalcitrant which can tolerate 8 per cent of the moisture desiccation indicating that continuous moisture supply are needed for the seed germination. Makeen *et al.* (2007) also reported that the desiccation of the seed of *Citrus suhuiensis* cv. LIMA MADU progressively reduced the percentage of germination of the seeds of limau madu and the viability is almost lost at water contents below 0.08 g H<sub>2</sub>O g<sup>-1</sup> dw. After the complete germination of seeds in the BOD within one month the germinated seeds were kept outside the BOD but inside the partial shade condition in order to develop the chlorophyll to the plants. Development of chlorophyll completed within one week after that the plants were transplanted to the polythene bag which were mixed with 2:1:1 (Soil: Sand: FYM) and kept under the insect proof net house for budding purpose.

The better success for germination of this method is might be due the continuous moisture supply to the seeds through the absorption by the blotting paper. Further, fungicide was poured over the seed at 2-3 days intervals and it also absorbed by it from the root zone through blotting paper preventing the fungus growth, which maintained at continuously moderate temperature of 25°C provide quick germination and better per cent of

germination as compared with the normal seed sowing in the open field condition. Angel and Maria (2005) also reported that the storage of seeds with 14.7 per cent of moisture content with fungicide treatment resulted higher percentages of germination 59.3 per cent while in seeds without chemical treatment with lower seed germination 33.3 per cent in the field condition. Besides, there is no weed management in such technique of seed germination but in case of field condition hand weeding once per week interval are required. In the future this technique can be recommended for the seed propagation for the rootstock purpose since nearly 100 per cent seed germination can be obtained and such method is low cost and easy to maintenance.

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