Development of effective propagation techniques for Elabatu (*Solanum melongena* var. insanum)

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Abstract

A series of pot experiments were conducted at the Faculty of Agriculture, University of Ruhuna to develop effective seed and vegetative propagation techniques for the preservation and multiplication of Elabatu (*Solanum melongena* var. insanum), identified as an endangered plant.
For seed propagation studies, different levels of Nitric acid (HNO_3) (i.e. 20%, 30%, 40%) and Gibberellic Acid (GA) (i.e. 50 µmol, 100 µmol, 150 µmol and 200 µmol) combined with two soaking periods, 12 and 24 hours, on seed germination were tested. For the vegetative propagation, effects of maturity of cuttings (i.e. soft wood, semi-hard wood and hard-wood) and different frequencies of watering, on shoot length, root length and dry matter yield of plants were studied.
Percentage germination of seeds treated with HNO_3 increased significantly irrespective of dipping periods, compared to the control treatment. The highest rate was recorded for the treatment with 30% of HNO_3 dipping. Germination % of seeds was considerably reduced with increasing period of soaking time from 12 to 24 hrs. Seed germination also decreased with increasing period of storage and the highest germination was recorded for fresh seeds, soon after extraction. Among different levels of GA treatments, significantly higher seed germination was recorded at 100 µmol.
Results revealed that with maturity of cuttings, growth parameters (i.e. number of leaves, shoot height, root length and dry matter yield of plants) tend to decrease. Also numbers of leaves, shoot height, root length and dry matter yield of plants decreased significantly with increasing frequency of watering.
From the results, it can be concluded that seeds treated with 20% HNO_3 and 20 µmol GA enhanced seed germination, while germination was low under normal conditions. Among different types of cuttings (i.e. soft- wood, semi-hard wood and hard-wood), soft-wood cuttings were more suitable for vegetative propagation than other types.

Introduction

In Sri Lanka about 550 flowering plants have been identified as medicinal plants, of which several species have been identified as endangered plants. From biodiversity viewpoint there is a felt need for conservation of all endangered plant species, for future use. "Elabatu" (*Solanum melongena* var. insanum/*Solanum insanum*) is one such species, identified as an endangered plant. Elabatu belongs to the family *Solanaceae* and similar to the eggplant. Elabatu is found in the plains of India and neighbouring countries growing under semi-wild state around villages. *S. insanum* occurs in wild or semi-wild state with high prickliness and small (2.5cm diam.) oval or spherical, often white, inedible fruits; *S. melongena* on the other hand, is the cultivated form, often not prickly and has large coloured edible fruits of variously shapes ((Roxburg 1832, Prain 1903, Duthie 1911 and Gamble 1921). The interrelationship and the taxonomic status of *S. insanum* are still not fully understood. Hepper (1987) in his enumeration of *Solanaceae* from Sri Lanka mentioned the polymorphism prevalent in *S. insanum* populations. Neither of the authors, however, provided significant morphological features of the Elabatu. Elabatu, which is grown in many parts of Sri Lanka, shows variable characters and true Elabatu plant populations are dwindling from its natural habitats. On the other hand, most people describe Elabatu as "Thalanabatu". *S. melongena and S. insanum* are highly diverse species although no distinction has been made taxonomically (Hepper 1987).
Elabatu is a highly cross-pollinated plant and does not produce true to type plants. Due to the dwindling populations of elabatu from its natural habitat, it would be necessary to select and identify pure Elabatu plants. Once this process is completed, it would be necessary to develop an effective vegetative propagation technique for rapid multiplication and produce a large population of pure Elabatu plants. Further multiplication could be made by inducing self-pollination on this population and through seed propagation.
Seed germination of elabatu is very low, may be due to dormancy of seeds and there is hardly any literature available on possible seed treatments to break the seed dormancy of elabatu. But there are

several recommended treatments for breaking the seed dormancy of some other crops. For example, Tomer *et al.* (1997) standardized several dormancy breaking treatments such as predrying (400C), hot water treatment (800C) for 24 hrs. for tree seeds), scarification with sand paper, conc. H_2SO_4 treatment for 60 and 120 seconds, KNO3 (0.02%), Ethanol (5.50 ppm), GA3 (300-500 ppm), HNO3 (0.3 N), prechilling, low moisture, pre washing 30-45 minutes in running water, stratification, alternating wetting and drying and soaking in water etc. were applied. The dormancy breaking treatments were applied as per type of dormancy, kind of species/crops/trees etc. The same types of treatments have been recommended by ISTA (1985), ASOA; Seed Testing Manual (Chalam *et al.* 1967), Puri and Khosla 1993 and Verma *et al.* 1990.

A series of preliminary experiment was conducted using all seed treatments mentioned above but here we discuss a few effective seed treatments only.

The main objective of this study is to develop "effective propagation techniques for Elabatu" for large scale multiplication and cultivation as a medicinal plant.

Materials and methods

A series of pot experiments on seed and vegetative propagation were carried out at the Faculty of Agriculture, University of Ruhuna, Kamburupitiya during the period - April 2000 - August 2001. All experiments were set up following the Complete Randomized Design with three replications.

Seed propagation

Two separate experiments were conducted on seed propagation. Seeds of Elabatu were collected from mature fruits and washed thoroughly for about 30 minutes. Fresh seeds were dried in the shade for a week and stored in a dry, cool place until the commencement of experiments.

In these experiments, effect of different concentrations of Nitric Acid (Experiment 1) and Gibberellic Acid (Experiment 2) on seed germination was tested. Seeds, stored for different periods (fresh seeds, 2, 4, 8, 12, 16 and 20 weeks of storage) (Experiment 3) were used for the experiments. All seeds were allowed to soak for 12 hours and 24 hours in tap water. Soaked seeds were treated with either different concentrations of Nitric Acid (i.e. 20%, 30%, and 40%) for 1 and 2 minutes (Experiment 1) and or different concentrations of Gibberellic Acid (i.e. 50µmol, 100µmol, 150µmol and 200µmol) (Experiment 2). Seeds in all treatments were placed on petry dishes lined with wet filter papers at the bottom and covered with lids. Each replicate had 100 seeds. Seeds were allowed to germinate for a period of six weeks. The filter papers were kept moist continuously by adding small quantity of tap water and kept in a laboratory.

Vegetative propagation

Few elabatu plants were identified in a natural forest at Anuradhapura, North-Central Province of Sri Lanka and cuttings taken from these plants were multiplied vegetatively. After getting enough planting materials as mother plants vegetatively, vegetative propagation studies were started. Three types of cuttings (i.e. hard wood, semi-hard wood and soft-wood) were used for the experiment. A well matured, gray coloured pencil thickness cuttings were taken as hard-wood cuttings. The green coloured middle part of the stem was used as semi-hard wood cuttings and top most part of the stem taken as soft-wood cuttings. The length of the cuttings was about 15-20cm. All leaves were removed from cuttings and dipped in a commercially available hormonal solution of Clonex (i.e. IBA) for about 2 minutes. Treated cuttings were planted in polybags, filled with potting mixture of 1:1:1 - top soil, sand and compost. Just after planting, plants were watered and watering was continued daily for about 10 days and thereafter watering was done according to assigned treatments (i.e. daily, once in 2 days, once in 3 days and once in 4 days). Number of leaves, plant height, root length and dry weights of plants were recorded 8 weeks after planting.

Results and Discussion

Seed Propagation

Seed germination increased significantly in response to HNO3 treatment irrespective of dipping periods of 1 and 2 minutes, when compared to the control treatment. The highest germination rate was recorded at 30% level. Chalam *et al.* 1967 reported that seed dormancy of cereals and oil seeds can be removed by

HNO_3 (0.3N). Even though the trend was similar, germination was reduced considerably when soaking period increased from 12 hrs. to 24 hrs (Figure 1).

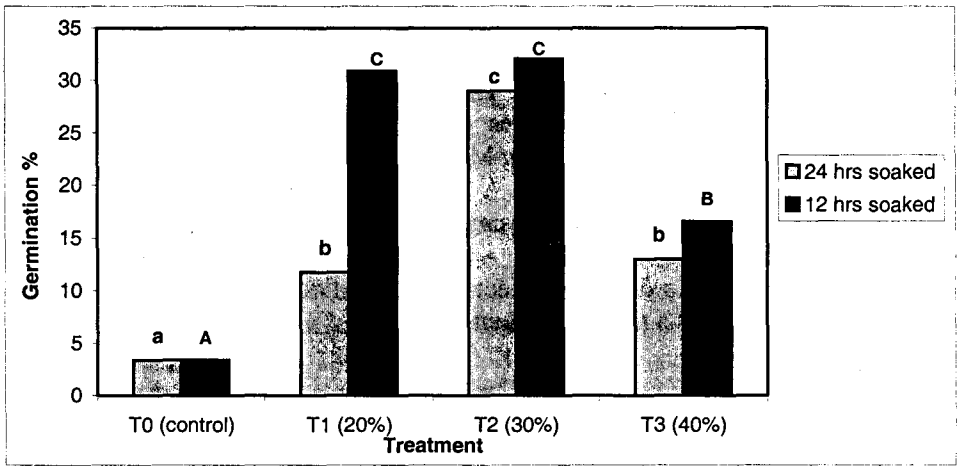

Figure 1. Effect of different concentrations of HNO_3 acid and different soaking periods on seed germination

Means with the same letter on the bar are not significantly different at $P \leq 0.05$.

The highest germination was recorded when fresh seeds were used just after the extraction, irrespective of the soaking period (12 and 24 hrs.) over all other treatments. Seed germination decreased with increasing period of storage and it was almost negligible 4-5 months after extraction of seeds (Figure 2). The viability of seeds decreased with increasing period of storage and that may be the reason for decreasing germination when seeds are stored for a long period of time.

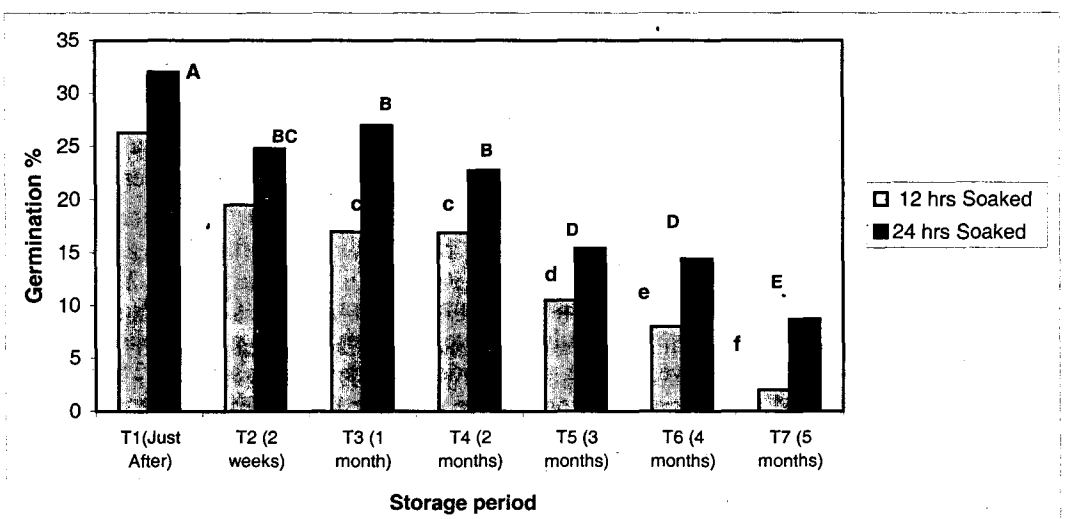

Figure 2. Effect of different storage and soaking time on seed germination

Means with the same letter on the bar are not significantly different at $P \leq 0.05$.

Since seed germination decreased with increasing periods of soaking from 12 hrs. to 24 hrs., and highest germination was recorded in fresh seeds, we used only fresh seeds, just after extracted and soaked only for 12 hrs. Seed germination was significantly higher in all treatments when compared to the control. Even though seed germination between 100 µmol and 200 µmol of GA was not significantly different, highest germination was recorded at 100 µmol level (Figure 3). Chalam *et al.* (1967) and Puri and Khosla (1993) reported similar results in cereal seeds and oil seeds that dormancy can be broken by applying Gibberellic Acid, 300-500 ppm.

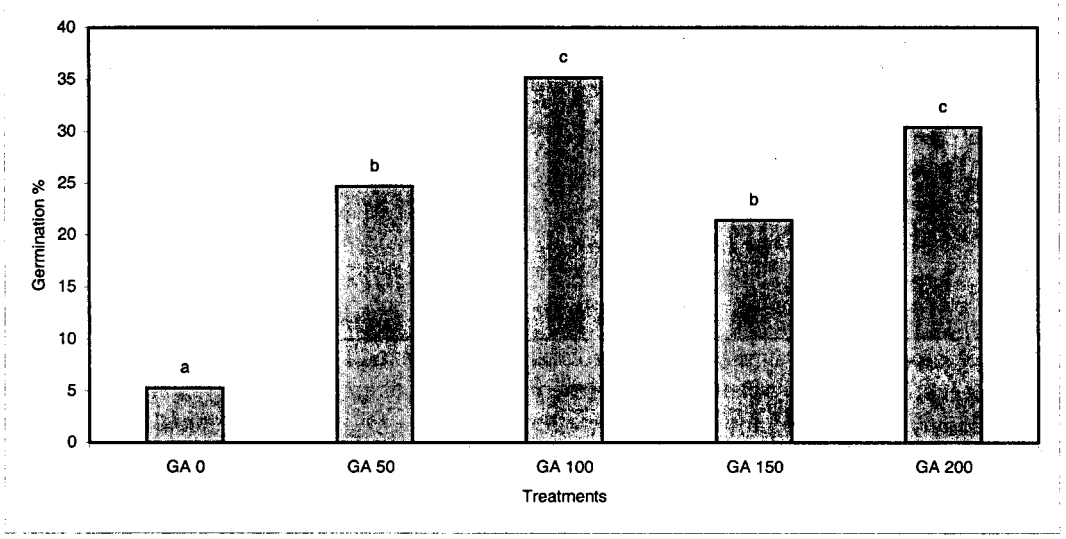

Figure 3. Effect of different concentrations of Gibberalic acid on seed germination
Means with the same letter on the bar are not significantly different at $P \leq 0.05$.

Vegetative propagation

Results revealed that soft-wood cuttings are more suitable for vegetative propagation than other two types. In regard to the dry matter yield, it could be argued that hard wood cuttings gave the highest dry matter yield mainly because of higher initial weight of hard-wood cuttings at planting. Otherwise there was no significant difference in other growth parameters (i.e. number of leaves, shoot height and root length etc.) in response to stage of maturity of cuttings (Figure 4).

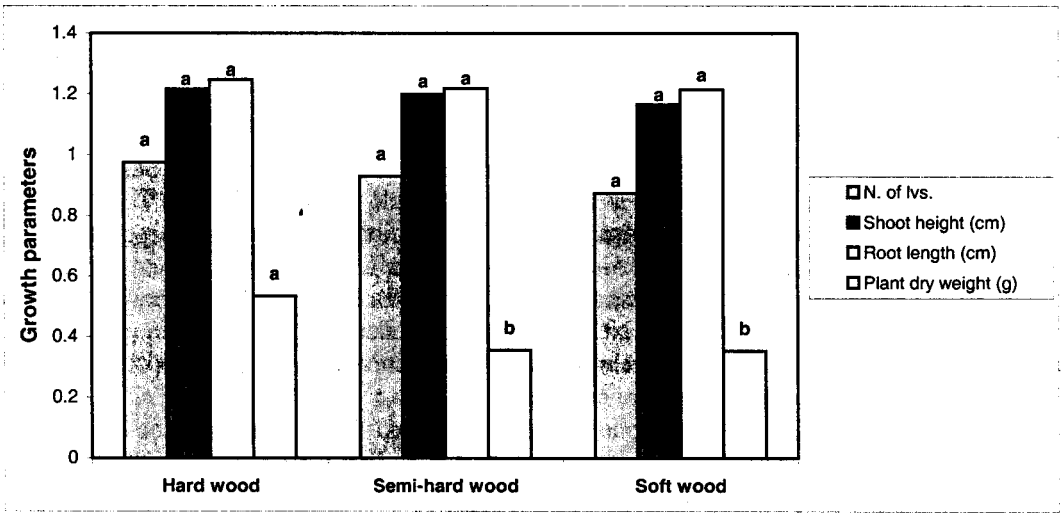

Figure 4. Effect of maturity of cuttings on growth parameters of Elabatu

Number of leaves, shoot height, root length and dry matter yields of plants significantly decreased by increasing the frequency of watering. The highest values of all the above parameters were obtained from cuttings watered daily, followed by once in 2 days, once in 3 days and once in 4 days (Figure 5).

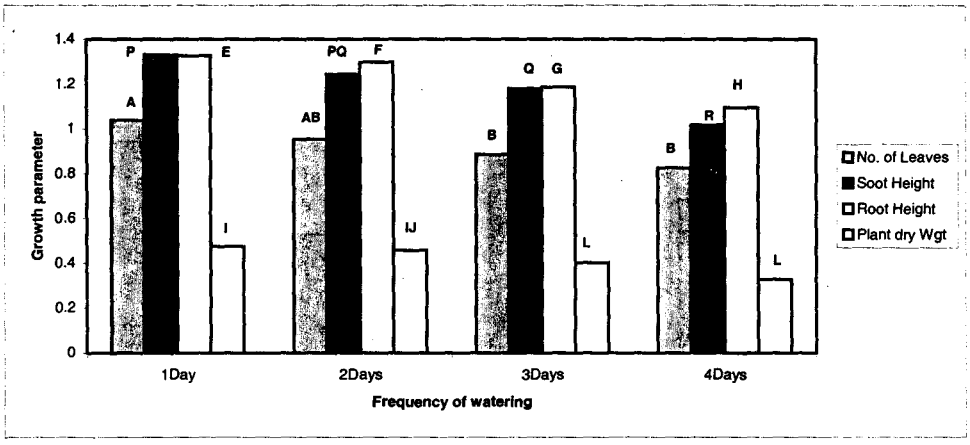

Figure 5. Effect of different frequencies of watering on growth parameters of Elabatu
Means with the same letter on the bar are not significantly different at $P \leq 0.05$.

Conclusions

Fresh seeds, immediately after extraction, treated with 30% HNO3 and 200 µmol GA could be recommended as treatments induced higher percentage of germination. All cuttings (soft, semi-hard and hard-wood) types could be recommended for vegetative propagation, but soft-wood cuttings were better than other types. The higher growth performance can be obtained by watering plants daily.

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