



RESEARCH ARTICLE

EFFECT OF MICROBIAL BIOFERTILIZERS ON GROWTH AND BIOMASS ACCUMULATION IN
POLYPOTTED *Limonia acidissima* L. SEEDLINGS

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ABSTRACT

An experiment was carried out with *Limonia acidissima* L. seedlings to find out the effective biofertilizer in single or in combination for better growth and productivity. Seedlings were grown in the polybags inoculated with *Rhizobium*, *Azospirillum*, VAM, Phosphobacterium and mixture. The seedling growth parameters were noted in every 15 days up to 150 days. Phosphobacterium-inoculated seedlings exhibited highest shoot growth. The combined application of all the four biofertilizers increased the leaf production and root length. The total biomass was higher in plants treated with phosphobacterium compared to other biofertilizers. The seedlings treated with VAM showed least growth and biomass production than control.

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INTRODUCTION

Wood-apple (*Limonia acidissima* L.) is a member of the family Rutaceae, sub-family Aurantioideae (Chopra *et al.*, 1968). It is moderate sized religious tree widely distributed throughout India, Bangladesh, Sri Lanka and Indonesia. The fruits are edible and considered to be a stomachic, astringent, diuretic, cardiotonic and tonic to the liver and lungs. The leaves are aromatic and carminative and are used for the treatment of indigestion and minor bowel infections of children. The roots are sometimes given as antidote to snake bites. To produce good trees and sustainable productivity high quality elite seedlings are a must. Biofertilizers are apparently ecofriendly, which enhance the uptake of macro and micronutrients and protection from pathogens (Marwaha, 1995). Moreover, they are very cheap and maintain the quality of soil.

MATERIALS AND METHODS

The present study on *Limonia acidissima* (L.) was carried out at the Department of Botany, Kongunadu Arts and Science College, Coimbatore, Tamil Nadu. The fruits were collected from about 20 years old tree from the Institute of Forest Genetics and Tree Breeding, Coimbatore. The seeds were extracted and the seedlings raised in plastic trays containing sand and red soil (1:1). Then fifteen days old healthy seedlings of wood apple were used to study the response of seedlings to soil inoculation of bio-fertilizers namely, VAM fungi, *Rhizobium*, *Azospirillum* and Phosphobacteria. The bio-fertilizers were obtained from the Department of Agricultural Microbiology, Tamilnadu Agricultural University, Coimbatore. The polybags of 30 x 40 cm size were filled with a soil mixture containing red soil, sand

and FYM in the ratio of 1:1:1. Then the soil in the polybags was inoculated with biofertilizers as detailed below:

- T₁: Uninoculated control.
- T₂: Soil inoculation of VAM fungi @ 20g per polybag.
- T₃: Soil inoculation of *Rhizobium* @ 20g per polybag.
- T₄: Soil inoculation of *Azospirillum* @ 20g per polybag.
- T₅: Soil inoculation of Phosphobacterium @ 20g per polybag.
- T₆: Soil inoculation of VAM (5g) + *Rhizobium* (5g) + *Azospirillum* (5g) + Phosphobacterium (5g) @ 20g per polybag.

Ten replications were maintained for each treatment. Then the polybags were watered sufficiently and then the 15 days old wood apple seedlings of uniform height were transplanted. Periodical watering was done to the polybags to produce healthy seedlings. The height and number of leaves of each plant were noted for every 15 days after planting the seedlings and the data were tabulated for five months (150 days). After 150 days the plants were uprooted and the seedling growth parameters such as root and shoot length, fresh and dry weight estimations were made. The experiment was replicated thrice and the data were statistically analyzed using critical difference at 5% level of significance.

RESULTS AND DISCUSSION

The seedlings of *L. acidissima* respond differently when exposed to various bio-fertilizers (Table I). The better performance in shoot growth of *L. acidissima* seedlings exposed to phosphobacterium is in accordance with the enhanced growth found in *Albizia lebbek* when exposed to phosphobacterium (Heeralal *et al.*, 2004). The relative enhancement in shoot length and fresh weight of leaf, root and shoot and dry weights of root and shoot of *L. acidissima* seedlings exposed to phosphobacterium could be ascribed to enhanced uptake of

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Table 1. Effect of biofertilizers on seedling growth performance of *Limonia acidissima* after 150 days

| Treatment | No. of leaves | Root length (cm) | Shoot length (cm) | Root/Shoot ratio | Fresh weight (g) | | | Dry weight (g) | | |
|---------------------|---------------|------------------|-------------------|------------------|------------------|-----------|-----------|----------------|-----------|-----------|
| | | | | | Leaf | Root | Shoot | Leaf | Root | Shoot |
| Control | 44.41±13.74 | 62.44±17.11 | 22.78±4.81 | 2.74 | 2.72±0.45 | 2.63±0.62 | 1.42±0.54 | 1.06±0.23 | 1.12±0.26 | 0.57±0.21 |
| <i>Rhizobium</i> | 43.06±8.00 | 64.08±13.92 | 22.88±4.27 | 2.80 | 2.89±1.05 | 2.28±0.84 | 1.31±0.38 | 0.96±0.35 | 0.95±0.33 | 0.53±0.16 |
| <i>Azospirillum</i> | 53.87±11.14 | 55.26±5.59 | 28.54±4.45 | 1.93 | 4.22±0.51 | 3.21±0.61 | 2.08±0.36 | 1.62±0.17 | 1.35±0.26 | 0.86±0.13 |
| VAM | 33.48±12.97 | 63.81±19.80 | 18.18±3.17 | 3.50 | 2.12±0.70 | 2.06±0.97 | 0.89±0.30 | 0.77±0.29 | 0.85±0.41 | 0.37±0.13 |
| Phosphobacterium | 45.48±5.42 | 49.12±26.32 | 33.96±5.59 | 1.44 | 4.93±0.88 | 3.56±0.58 | 2.52±0.65 | 1.30±0.60 | 1.67±0.20 | 1.08±0.28 |
| Mixture | 54.66±10.32 | 72.16±23.29 | 23.42±3.24 | 3.08 | 3.99±1.23 | 3.33±1.95 | 2.02±0.74 | 1.42±0.54 | 1.43±0.89 | 0.84±0.36 |
| CD at 5% level | 9.61 | 15.8 | NS | - | 4.3 | 1.61 | NS | 0.89 | 0.18 | 0.96 |

phosphorous brought about by phosphobacteria which mobilize the soil phosphorous as reported by Copper (1979). Phosphobacteria by virtue of its capacity to elaborate certain growth promoting substances like GA and IAA (Gaur and Ranna, 1990) might have induced the shoot length of *L. acidissima* seedlings. Among the bio-fertilizers used, combined inoculation of *Rhizobium*, *Azospirillum*, VAM and phosphobacterium (1:1:1:1) were found to increase the root length and production of leaves which is similar to the combined inoculation of *Rhizobium* and VAM on the growth of *Sesbania grandiflora* (Sengupta and Choudhuri, 1995). Seedlings treated with phosphobacterium showed highest fresh weight (Table I). *Azospirillum* inoculated seedlings exhibited higher leaf dry matter. The higher fresh weight may be due to the presence of high water content in phosphobacterium-inoculated seedlings. In all the treatments, it was found that the root length is always much greater than the shoot length. The increase root length shows the capability of the plant to adapt adverse climatic conditions as *L. acidissima* is mostly seen in dry plain areas. The present study reveals that phosphobacterium can be used as an effective biofertilizer to promote the growth of *L. acidissima* seedlings. This finding may be of immense importance in forest nursery practices. However, further work in this direction is required.

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