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Assessment of Bio-Treatments on Growth Performance of *Emblica officinalis* in Nursery

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Abstract

The experiments were conducted on "Assessment of Bio-treatments on Growth Performance of *Emblica officinalis* in Nursery". At Forest research center for Eco-Rehabilitation. *Emblica officinalis* were graded and uniform size was used for raising seedlings. The seedlings were raised in 13 × 26 cm. size polyethylene bags with a potting mixture of unsterilized sand: loam soil: farm yard manure (1:1:1). After germination in polyethylene bags 10 ml / g of broth / culture of 11 bio-treatments were inoculated in the polybags by making holes in the rhizosphere of seedlings. The treatments taken for the study were as following: T_1-Control, T_2-Phosphobacterium, T_3-Bio P Plus, T_4-Azotobacter, T_5-Bio-K-Plus, T_6-Bio-N-Plus, T_7- Jiva Amrit-liquid, T_8- Jiva Amrit-powder, T_9-Vermicompost, T_{10}-Azoline, T_{11}-Rhizogold, and T_{12}-FYM. The experiment was set up in a completely randomized block design with 12 treatments and three replications. Results revealed that the treatments T_4- Azotobacter, T_6 - Bio-N-Plus, T_7- Jiva Amrit-liquid, T_8-Jiva Amrit-powder, and T_9-Vermicompost remarkably showed very good increment in height and root length as compared to control with 11.53, 10.43, 10.97, 12.97 & 11.07 cm and 20.17, 21.27, 22.50, 20.63 & 22.27 cm respectively. Similarly, the survival was also recorded after 90 days of experimentation. It clear from the data that for most of the treatments, survival was 100 % but for control, it was only 80 %. Successful functioning of introduced microbial bio-inoculants influenced on soil health. Exhaustive efforts have been made to explore soil microbial diversity of indigenous community, their distribution and behavior in soil habitats. Use of organic manures alone or in combination with chemical fertilizers, helps in improving physico-chemical properties of the soil and also improves the efficient utilization of applied fertilizers.

Keyword: *Emblica officinalis, Jiva Amrit, Vermicompost, Azotobacter, Rhizogold, Bio-N-Plus.*

Introduction

Aonla (*Emblica officinalis*) is an economically important commercial fruit plants species belonging to family Euphorbiaceae. The plant is winter hardy and can be grown successfully in arid and semi-arid regions and in soils with high pH and on waste lands (Prasad and Banker, 1998). Indian Gooseberry or Aonla, *Emblica officinalis* (*Phyllanthus emblica*) is an important horticulture crop of India. It is a moderate sized deciduous tree. The fruit, bark and leaves are used in dyeing and tanning. It has aroused good deal of interest among the scientific workers because it is one of the richest natural sources of vitamin 'C'. The fruits are major constituent of 'Chyavanprash' and 'Trifla'. The other uses of fruits are in pickle, marmalade, jam and sauce preparation. The use of bio- fertilizers in enhancing plant growth and yield has gained momentum in recent years because of higher cost and hazardous effect of chemical fertilizers. Nitrogen fixing bacteria and arbuscular mycorrhizal fungi were found to enhance growth and production of

various fruit plants significantly (Khanizadeh *et al*., 1995; Dibut Alverz *et a*l., 1996; Ghazi, 2006), besides improving the microbiological activity in the rhizosphere (Camprubi *et al.,* 1995; Kohler *et al.*,2007).

Bio-fertilizers are the preparation containing living cells or spores, which can supply one or few plant food elements on inoculation. The farming community shows much interest in the use of bio-inoculants in a single packet as Biomix of *Azopus or Rhizopus, instead* of supplying it as individual organism. Several field studies on dual inoculation indicated the compatibility of N2 fixing and 'P' solubilizing microorganisms .Subbarao (1982) reported the positive response of combined inoculation of N_2 fixing and P solubilizing microorganisms. This shows the compatibility and synergistic action among the inoculants. Similarly, the compatibility of *Rhizobium* and *phosphobacteria* inoculants was reported earlier in cowpea. Hence, a preliminary attempt had been made to study the success of *Rhizopus* on nodulation of cowpea. The chemical fertilizer no doubt increased the production but also produce many harmful effects. Therefore in developing countries like India, the use of bio-fertilizer is both economical and environmental friendly.

In order to increase the growth and yield of the crops, the farmers throughout the world are applying heavy dose of chemical fertilizers like urea, potash, super phosphate etc. It may lead to environmental pollution when the ground is water logged or the crop is not able to use the fertilizers. These fertilizers may runoff to the surface water or leaching in to the ground water. Another impact of the chemical fertilizers is it can able to lower the pH of the soil (Reynder and Viassak, 1979). Inoculation of Paddy with *Azospirillum* and *Mycorrhiza* increased the plant height and biochemical content (Kapulnik *et al.,* 1981). The present work is planned to study effect of different bio-treatments on growth behavior as height, number of leaves, root length and survival of plants in nursery on *Emblica officinalis*. The present work was planned to study effect of different bio-treatments on growth behavior as height, root length and survival of plants in nursery on *Emblica officinalis*.

Materials and Methods

The seeds of *Emblica officinalis* were graded and uniform size was used for raising seedlings. Seedlings were raised in a mixture of sand: loam soil: Farm Yard Manure (1: 1: 1) in polythene bag. In order to find out suitable bio-inoculants and their combinations to achieve maximum overall growth and minimize the cost of seedling production, following treatments were given after germination. The experimental site consisted of sandy loam soil and was neutral in reaction. The water holding capacity of soil was good. The seedlings were raised in 13 × 26 cm. size polyethylene bags with a potting mixture of unsterilized sand: loam soil: farm yard manure (1:1:1). After germination in polyethylene bags 10 ml / g of broth / culture of 11 bio-treatments were inoculated in the polybags by making holes in the rhizosphere of seedlings. The treatments taken for the study were as following: T_1-Control, T_2-Phosphobacterium, T_3-Bio P Plus, T_4-Azotobacter, T_5-Bio-K-Plus, T_6-Bio-N-Plus, T_7-JivaAmrit-liquid, T_8- Jiva Amrit-powder, T_9-Vermicompost, T_{10}-Azoline, T_{11}-Rhizogold, and T_{12}-FYM. Nursery experiment was conducted at nursery to study the effect of bio-treatments on growth behavior of Eucalyptus hybrid seedlings. The experiment was set up in a completely randomized block design with 12 treatments and three replications. All the plants were kept under identical nursery conditions and data was recorded after 90 days of application.

Data recording

Increment in height: The plant height was measured from the base of plant to the terminal growing point of the main stem at 30, 60, 90 days

after transplanting. The average plant height was expressed in centimeters.

Survival of plants: After completion of experiment, 90 days, the survival percent was also recorded for plants under all treatments including control.

Root length: After 90 days of experiment at the end, plants were randomly uprooted and root length recorded for all treatments including control. The root length measured from collar region to the tip of primary root with the help of a scale and the mean root length was expressed in centimeters.

Results and Discussion

In general, all bio-treatments showed increased Plant height (cm), root length (cm) and survival (%) as compared to control. It is clear from Table 1 that treatments T_4- Azotobacter, T6 - Bio-N-Plus, T_7-Jiva Amrit-liquid, T_8-Jiva Amrit-powder, and T_9-Vermicompost remarkably showed very good increment in height and root length as compared to control with 11.53, 10.43, 10.97, 12.97 & 11.07 cm and 20.17, 21.27, 22.50, 20.63 & 22.27 cm respectively (Fig. 1 & 2). Similarly, the survival was also recorded after 90 days of experimentation (Table 1). It clear from the data that for most of the treatments, survival was 100 % but for control (C), it was only 80 %. For all the treatments, root length was very high as compared to control C. Soil microorganisms play an important role in soil biogeochemical processes which determine plant productivity. Successful functioning of introduced microbial bio-inoculants influenced on soil health. Exhaustive efforts have been made to explore soil microbial diversity of indigenous community, their distribution and behavior in soil habitats.

Bio-fertilizers more commonly known as microbial inoculants are artificially multiplied cultures of certain soil organisms that can improve Soil fertility and crop productivity. The beneficial effects of *Mycorrhiza, Azospirillum and Phosphobacterium* related not only to their ability to produce antibacterial and antifungal compounds and growth regulators (Panday and Kumar, 1989). Bio-fertilizers are environment friendly low cost agriculture input playing a significant role in improving nutrient availability to the crop plants when supplemented with chemical fertilizers. (Tilak and Singh, 1994) Field experiments carried out at different locations in India proved that the inoculation of bio-fertilizers showed better improvement in growth of the crops (SubbaRao *et al*., 1979).

The results clearly indicate that inoculation of Rhizobium, VAM and Rhizobium + VAM significantly improve growth parameters as well as the biomass (Mishra, 2004). Best effect of these inoculations was observed in *Acacia nilotica*. Almost similar results were reported by Sharma *et al.* (1990) in case of Acacia catechu. Mishra (1995) has also reported good performance of *Leucaena leucocephala* after suitable inoculations on mine spoil. Better growth in case of dual inoculation has also been reported in other legumes by Kaushal (1996), Kaushik and kaushik (1995). This increase can be attributed to better uptake of various nutrients from soil as suggested by Sharma *et al*. (1990). On the basis of present investigations and results obtained use of biofertilizers are highly recommended in agro forestry ecosystem. This is an eco-friendly and cost effective alternative to synthetic fertilizers. The effect of bioinoculants (Frankia, Azospirillum and Phosphobacterium) on growth performance of *Casuarina equisetifolia* seedlings after inoculation with Frankia or Azospirillum or Phosphobacterium or combination of all the three inoculants after six months showed that total biomass was highest in Frankia + Azospirillum + Phosphobacterium (T) inoculated seedlings (Saravanan,2012).

The production of economic yield in any crop generally depends upon the cumulative effects of interactions among several factors such as genetic makeup of crop variety, climatic

factors, mineral nutrition and cultural practices adopted. Various environmental factors such as temperature, light, rainfall and relative humidity that prevail during different plant growth stages and development exert considerable influence on vegetative growth, seed yield and seed quality, as well as the incidence of certain pests and diseases. Application of organic manures has been a noble and traditional practice of maintaining soil health and fertility. The importance of organic manures is, now-a-days realized because of high cost of fertilizers and their inherent capacity to supply most essential nutrients for a balanced nutrition to the crop growth. Organic nutrients generally facilitate crop rooting; improve water retention capacity and results in the even distribution of nutrients in soil profile.

Table 1: Effect of bio-treatments on height increment and root length after 90 days

S. No.	Treatment	Increment in height (in cm)	Root length of seedlings (in cm)	Survival (%)
1	T_1	3.83	11.67	80
2	T_2	6.90	13.50	90
3	T_3	4.53	12.23	90
4	T_4	11.53	20.17	100
5	T_5	7.93	15.63	80
6	T_6	10.43	21.27	90
7	T_7	10.97	22.50	90
8	T_8	12.97	20.63	80
9	T_9	11.07	22.27	100
10	T_{10}	10.30	15.33	100
11	T_{11}	10.13	18.47	80
12	T_{12}	5.03	15.43	80

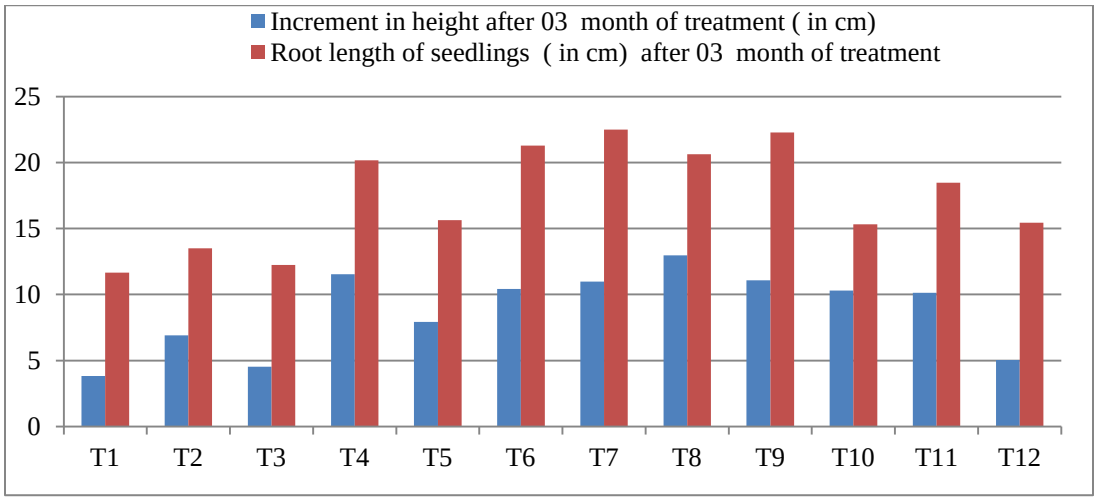

Fig. 1Effect of bio-treatments on height increment and root length after 90 days

Treatments :
T1►FYM T2►Phosphobacterium T3►Bio-P-Plus T4►Azotobacter T5►Bio-K-Plus T6►Bio-N-Plus T7►Jiva Amrit-liquid T8►Jiva Amrit-powder T9►Vermicompost T10►Azoline T11►Rhizogold 12►control

Emblicaofficinalis seedlings in the nursery at the initial stage of experimentation

Growth of seedlings of *Emblicaofficinalis* after 90 days of experimentation

$T_{1,\ 2\&\ 3}$

$T_{4,\ 5\ \&\ 6}$

T7, 8 & 9

T10, 11 & 12

Growth of seedlings of *Emblicaofficinalis* after 90 days of experimentation

Fig. 2

Conclusion

India has made spectacular breakthrough in production and consumption of fertilizers during the last four decades. But consumption of chemical fertilizers will be quite a limiting factor for increasing agriculture production in future. Because of escalating energy cost, chemical fertilizers are not available at affordable prices to farmers. Moreover, the unbalanced and continuous use of chemical fertilizers is leading to reduction in crop yields and in imbalance of nutrients in the soil which has adverse effect on soil health.

Although, chemical fertilizers are playing a crucial role to meet the nutrient requirement of the crop, persistent nutrient depletion is posing a greater threat to the sustainable agriculture. Therefore, there is an urgent need to reduce the usage of chemical fertilizers and in turn increase in the usage of organics which are needed to check the yield and quality levels. The aforesaid consequences have paved way to grow tomato using different organic manures and bio-fertilizer. Use of organic manures alone or in combination with chemical fertilizers, helps in improving physico-chemical properties of the soil and also improves the efficient utilization of applied fertilizers.

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