

## Effect of bio-fertilizers and growth regulators on seed germination and seedling vigor in amla

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**Abstract :** An experiment was conducted at Horticultural College and Research institute, Periyakulam during 1998-1999 to study the effect of bio-fertilizers, chemicals and growth regulators on the germination and seedling growth of amla. It was observed that Azospirillum + Phosphobacteria + 0.5% KNO<sub>3</sub> treatment with Azospirillum + Phosphobacteria + 200ppm of GA<sub>3</sub> treatment of old seeds were effective in causing initial germination. Fresh seed treated with Azospirillum + Phosphobacteria + 0.5% KNO<sub>3</sub> for 8 hours and one year old seeds treated with Azospirillum + Phosphobacteria + 200ppm of GA<sub>3</sub> for 8 hours recorded germination (95.08% and 49.17%) than the treatments. In fresh and one year old seeds, the same treatment was found to induce higher shoot length (8.61cm, 7.97cm), root length (2.99cm and 2.69cm), dry matter production (262g/10 seedlings, 248g/10 seedlings), and vigour index (2.77, 4.7, 278.40). in the case of time taken to reach buddable thickness, fresh seeds was treated with Azospirillum + Phosphobacteria + 0.5% KNO<sub>3</sub> for 8 hours taken lesser time taken to reach buddable thickness (111.83 days) and one year old seeds treated with Azospirillum + Phosphobacteria + 200ppm of GA<sub>3</sub> for 8 hours found to be lower days taken to reach buddable thickness of 113.27 days. Height of the plant at 90 days after sowing and 120 days after sowing for fresh seeds were found to be highest in Azospirillum + Phosphobacteria + 0.5% KNO<sub>3</sub> for 8 hours (14.89cm, 19.01) and one year old seeds, maximum height was found in Azospirillum + Phosphobacteria + 200ppm of GA<sub>3</sub> for 8 hours (14.72cm and 18.52cm). (*Key words* : Amla, *Emblia officinalis*, *Azospirillum*, *Phosphobacteria*, 0.5% KNO<sub>3</sub>, 200ppm of GA<sub>3</sub>, buddable thickness.)

Amla (*Emblia officinalis* G.) is an important tropical fruit crop widely grown under rainfed conditions. Amla is a hardy plant with tolerance to drought and salinity. It has the ability to withstand water stagnation too. The fruits are used as a constituent in most of the ayurvedic, medicinal preparations as it is rich in vitamin 'C' (650-720mg/100g). It adapts to wide range of soil reaction from a pH of 6.5 - 9.5 and tolerates salinity even up to 15dSm<sup>-1</sup>. It tolerates freezing temperature as well as a temperature as high as 46°C (Sankar, 1969). Therefore the present study was undertaken to improve the growth and vigour of amla seedling by using bio-fertilizers.

### Materials and Methods

The experiments were carried out at Horticultural College and Research Institute, Tamil Nadu Agricultural University, Periyakulam, during 1998 - 1999 in the factorial randomized block design (FRBD) with ten treatments and three replications. The treatments are as follows.

1. Azospirillum (200g kg<sup>-1</sup> of seeds) + cold water for 24 hours.
2. Phosphobacteria (200g kg<sup>-1</sup> of seeds) + cold water for 24 hours.
3. Azospirillum + Phosphobacteria (each 100g Kg of seeds) + cold water for 24 hours.

4. Azospirillum (200g kg<sup>-1</sup> of seeds) + 0.5% KNO<sub>3</sub> for 8 hours.
5. Phosphobacteria (200g kg<sup>-1</sup> of seeds) + 200ppm of GA<sub>3</sub> for 8 hours.
6. Azospirillum + Phosphobacteria (each 100g kg<sup>-1</sup> of seeds) + 0.5% KNO<sub>3</sub> for 8 hours.
7. Azospirillum (200g kg<sup>-1</sup> of seeds) + 200ppm GA<sub>3</sub> for 8 hours.
8. Phosphobacteria (200g kg<sup>-1</sup> of seeds) + 200ppm of GA<sub>3</sub> of 8 hours.
9. Azospirillum + Phosphobacteria (100g kg<sup>-1</sup> of seeds) + 200ppm of GA<sub>3</sub> for 8 hours.
10. Control (untreated seeds.)

Fresh and one year old seeds of amla were used for the study. The fresh seeds were collected from Horticultural College and Research Institute, Periyakulam and one year old seeds were collected from Agricultural Research Station, Bhavanisagar. Fresh and one year old seeds were soaked in cold water, chemicals and growth regulators and sown on sand medium. Fifty seeds were sown for each replication. Observation on earliness in germination, germination percentage, shoot length, root length, drymatter production, vigour index, time (days) taken to reach buddable thickness, height of the plant 90 and 120 and after sowing in poly bag were observed and were subjected to statistical scrutiny

as per the method suggested by Panse and Sukhatme (1985). The vigour index was determined using the method suggested by Abdul Baki and Anderson (1973).

Vigour index = Germination Percentage X mean length of the seedlings (cm).

### Results and Discussions

It is evident from study that seeds treated with Azospirillum + Phosphobacteria + 0.5% KNO<sub>3</sub> for 8 hours recorded highest germination percentage of fresh seeds (52.08%) and one year old seeds of amla (49.17%) treated with Azospirillum + Phosphobacteria + 200ppm of GA<sub>3</sub> for 8 hours showed higher germination which was significantly superior than all other treatments. The lowest germination percentage was obtained with untreated control with 18.25% and 16.19% for fresh one year old seeds respectively. In the case of earliness in germination, for fresh seeds and one year old seeds, the same treatment were found to be effective in causing early germination (6.50 days, 6.81 days). These two treatments were significantly superior than all other treatments. This might be due to the secretion of growth promoters by bio-fertilizers (Srinivas, 1987) which might have enhanced uptake of nitrogen (Manjunath *et al.*, 1984) Phosphorous (Delacruz *et al.*, 1988) and stimulated the growth and bio-mass. Seedling growth attributes viz., shoot length, root length, drymatter production, vigour index of fresh and one year old seeds of amla were treated with Azospirillum + Phosphobacteria + 0.5% KNO<sub>3</sub> for 8 hours recorded maximum shoot length, drymatter production and vigour index (8.61 cm, 2.99cm, 0.262g and

277.47) and one year old seeds (8.05cm, 2.71cm, 0.248g and 275.40) which was significantly higher than all other treatments. This might be due to potassium nitrate which has been reported to raise the ambient oxygen level by making less oxygen available for the citric acid cycle (Bowley and Black, 1982). Similar results due to KNO<sub>3</sub> treatment were also reported in loblolly pine (Biswas *et al.*, 1972) and Albizia lebeck (Roy, 1992).

In the case of time taken to reach buddable thickness, fresh seeds treated with Azospirillum + Phosphobacteria + 0.5% KNO<sub>3</sub> for 8 hours showed lower days taken (111.83 days), this was significantly superior than all other treatments. One year old seeds treated with Azospirillum + Phosphobacteria + 200ppm of GA<sub>3</sub> for 8 hours found to taken minimum days taken to reach buddable thickness (113.27 days) which was significantly higher than all other treatment. The same treatments recorded maximum were also in height in 90 days (14.89cm, 14.72cm) and 120 days (19.01cm, 18.52cm) or fresh and one year old seeds of amla. This may be due to uptake of nitrogen, phosphorous where stimulated the growth and biomass there by increased the survival rate of planted grafts and buddlings (Huang *et al.*, 1985). The effect of GA<sub>3</sub> in appropriate concentrations on increasing height of plants is also supported by Powell (1959).

**Table 1 :** Influence of seed Treatment on germination, Seedling vigour and seedling growth characteristics of amla

| Treatment       | Germination Percentage |                    | Earliness in Germination (days) |                    | Shoot length (cm) |                    | Root length (cm) |                    | Drymatter production (g/10 plants) |                    |
|-----------------|------------------------|--------------------|---------------------------------|--------------------|-------------------|--------------------|------------------|--------------------|------------------------------------|--------------------|
|                 | Fresh Seeds            | One year old seeds | Fresh Seeds                     | One year old seeds | Fresh Seeds       | One year old seeds | Fresh Seeds      | One year old seeds | Fresh Seeds                        | One year old seeds |
| T <sub>1</sub>  | 37.50                  | 32.03              | 7.28                            | 7.70               | 6.54              | 6.32               | 2.56             | 2.49               | 0.210                              | 0.200              |
| T <sub>2</sub>  | 38.38                  | 35.20              | 7.39                            | 7.82               | 7.31              | 6.60               | 2.51             | 2.40               | 0.224                              | 0.202              |
| T <sub>3</sub>  | 39.52                  | 36.19              | 7.45                            | 7.90               | 7.86              | 6.73               | 2.53             | 2.39               | 0.235                              | 0.207              |
| T <sub>4</sub>  | 45.50                  | 41.10              | 6.88                            | 7.10               | 7.96              | 7.28               | 2.49             | 2.41               | 0.246                              | 0.214              |
| T <sub>5</sub>  | 48.30                  | 43.20              | 6.92                            | 7.14               | 8.01              | 7.39               | 2.71             | 2.38               | 0.252                              | 0.257              |
| T <sub>6</sub>  | 52.08                  | 48.30              | 6.50                            | 6.90               | 8.61              | 7.79               | 2.99             | 2.69               | 0.262                              | 0.240              |
| T <sub>7</sub>  | 42.50                  | 42.50              | 7.10                            | 7.20               | 7.01              | 6.74               | 2.62             | 2.56               | 0.242                              | 0.237              |
| T <sub>8</sub>  | 43.29                  | 41.20              | 7.20                            | 7.34               | 6.70              | 7.39               | 2.58             | 2.53               | 0.244                              | 0.242              |
| T <sub>9</sub>  | 48.30                  | 49.17              | 6.80                            | 6.81               | 7.01              | 8.05               | 2.70             | 2.71               | 0.253                              | 248                |
| T <sub>10</sub> | 18.25                  | 16.19              | 9.80                            | 10.15              | 6.50              | 6.24               | 2.10             | 2.11               | 0.190                              | 0.184              |
| Mean            | 41.36                  | 37.51              | 7.33                            | 7.62               | 7.42              | 7.07               | 2.58             | 2.44               | 0.236                              | 0.220              |
|                 | N                      | N X T              | N                               | N X T              | N                 | N X T              | N                | N X T              | N                                  | N X T              |
| SEd             | 0.21                   | 0.11               | 0.002                           | 0.008              | 0.05              | 0.17               | 0.02             | 0.06               | 2.8x10 <sup>-7</sup>               | 0.001              |
| CD (P=0.05)     | 0.43                   | 0.22               | 0.005                           | 0.021              | 0.11              | 0.34               | 0.04             | 0.12               | 5.72X10 <sup>-7</sup>              | 0.002              |

N =Nature of Seeds N X T= Interaction

Table 1 contd.,

| Vigour Index |                    | Height of the plant at 90 days after sowing (cm) |                    | Height of the plant at 120 days after sowing (cm) |                    | Time to reach buddable thickness (days) |                    |       |
|--------------|--------------------|--|--------------------|---|--------------------|---|--------------------|-------|
| Fresh Seeds  | One year old seeds | Fresh Seeds                                      | One year old seeds | Fresh Seeds                                       | One year old seeds | Fresh Seeds                             | One year old seeds |       |
| 248.20       | 242.80             | 14.25  | 13.98              | 18.29   | 17.92              | 114.46                                  | 117.69             |       |
| 250.43       | 250.57             | 14.38  | 14.15              | 18.38   | 18.00              | 115.73                                  | 117.22             |       |
| 252.77       | 264.87             | 14.48  | 14.18              | 18.42   | 18.10              | 114.83                                  | 117.17             |       |
| 262.90       | 269.37             | 14.78  | 14.25              | 18.72   | 18.72              | 112.68                                  | 116.83             |       |
| 266.40       | 270.27             | 14.82  | 14.37              | 18.78   | 18.49              | 112.38                                  | 115.44             |       |
| 277.47       | 246.30             | 14.89  | 14.52              | 19.01   | 18.40              | 111.83                                  | 115.23             |       |
| 263.53       | 265.93             | 14.59  | 14.12              | 18.52   | 17.99              | 113.79                                  | 115.37             |       |
| 268.00       | 269.10             | 14.79  | 14.28              | 18.68   | 18.15              | 114.43                                  | 114.81             |       |
| 271.03       | 278.40             | 14.92  | 14.72              | 18.75   | 18.52              | 112.27                                  | 113.27             |       |
| 219.77       | 218.20             | 13.12  | 13.55              | 16.37   | 16.10              | 124.46                                  | 125.90             |       |
| 258.05       | 259.38             | 14.50  | 14.21              | 18.39   | 18.02              | 114.59                                  | 116.89             |       |
| N            | NXT                | N  | NXT                | N   | NXT                | N                                       | NXT                |       |
| Ed           | 2.34               | 5.76   | 0.08               | 0.26  | 0.01               | 0.03                                    | 0.00023            | 0.007 |
| D            | 4.74               | 11.65  | 0.16               | 0.52  | 0.02               | 0.06                                    | 0.00047            | 0.015 |

P=0.05)

N =Nature of Seeds    N X T= Interaction

## References

- Abdul-Baki, A. and Anderson, J.D. 1973, Vigour determination in soya-bean seed by multiple criteria. *Crop Sci.*, 13:630-633.
- Biswas, P.K., Bonamy, P.A. And Paul, K.B. 1972. Germination promotion of lobolly pine and bald cypress seeds by stratification of chemical treatments. *Physiol. J.*, 27:71-76.
- Bowley, J.D. and Black M. 1982. Physiology and biochemistry of seeds. Vol.II Vialibility, dormancy and environmental control. Springer - Verlag, Berlin, pp. 248-250.
- Delacruz, R.E., Manalo M.Q., Aggangan N.S. and Tambalo, J.D. 1988. Growth of three legume tree inoculated with VAM fungi and Rhizobium. *Pl. Soil*, 108: 111 - 115.
- Luang, R.S., Smith W.K. and Yost R.S. 1985. Influence of VAM on growth, water relation and lead orientations in subabul. *New Phytol.*, 97: 209-213.
- Manjunath, A., Bagyaraj D.F. and Gowda H.S.G. . 1984. Dual inoculation with VAM and Rhizobium in beneficial to leucaena. *Pl. soil*, 78: 448-454.
- Panse, V.G. and Sukhatme P.V. 1985. Statistical methods for Agricultural Workers. ICAR, New Delhi. Pp.125-148.
- Powell, L.B. 1959. Some response of apple and pear seedlings to gibberellins. *Proc. Amer. Soc. Hort. Sci.*, 74: 82-86.
- Roy, M.M. 1992. Effect of seed treatment with potassium nitrate and thiourea on germination of *Albizia lebbeck*. *Indian J. For.*, 15: 356-357.
- Sankar, G. 1969. Aonla for daily requirement vit 'c'. *Indian Hort.*, 13: 11, 35.
- Srinivas, K. 1987. Studies on the occurrences of VAM fungi and their interaction with some forest tree species. M.Sc. (Ag.) thesis, TNAU, Coimbatore.

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