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Influence of biofertilizers and growing media on growth parameters in aonla

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Abstract

Aonla is one of the highly remunerative crops usually found in dry deciduous forests of India. For raising the rootstock, it is mainly propagated by sexual methods. Findings regarding effect of biofertilizers and media on seed germination and seedling vigour is less hence the present experiment was conducted to study the effect of biofertilizers and media on seed germination and seedling vigour of aonla. Treatment combinations has showed the significant different. Among the different treatment combinations used media containing of soil + cocopeat + vermicompost enriched with the biofertilizer mixture of *Azotobacter* + PSB + KRB has recorded maximum number of leaves per seedling, stem diameter, seedling height, fresh and dry weight of shoot, survival per cent, and shoot: root ratio.

Keywords: biofertilizers, GA₃, growth parameters, vermicompost, FYM, aonla

Introduction

Aonla botanically *Embllica officinalis* L. bearing the chromosome number of 2n=28. In India it is also called as Indian gooseberry, fruit of 21st century, amritphal fruit, aonal, usuri which belongs to Euphorbiaceae family, native to tropical South-East Asia. It is the deep-rooted tree having the wide range of adoptability to grow in any types of soil (Lilabati and Sahoo, 2016) [4]. It is a rich source of ascorbic acid (vitamin C) next to barbados cherry and has high nutritional and medicinal properties (Vishen *et al.*, 2017) [13]. Dried fruits are used to treat diarrhoea, chronic dysentery, haemorrhage, diabetes, cough, jaundice *etc.* (Vishen *et al.*, 2017) [13]. Uttara Pradesh is the leading state in India in terms of both area and production of aonla (NHB anonymous 2019) [7]. Aonla can be propagated by both sexual and asexual methods. Asexually it is propagated by patch budding, shield budding, chip budding, forket budding and wedge grafting (Negi *et al.*, 2010) [6]. Seed propagation is essential to raise the rootstocks for asexual propagation. Growing media is the important factor for the plants that gives anchorage to the plants and provide essential nutrients required by the plants. The growing media enriched with biofertilizers possess the advantages like add nutrients through natural process like nitrogen fixing, phosphorus solubilizing and stimulate plant growth through the synthesis of growth promoting substances. They help to build up soil microflora and there by maintain soil health. Vermicompost application is one of the effective methods to improve the depleted soil fertility and enrich the nutrients availability, conserve more water and maintain soil quality (Makode, 2015) [5]. So, the present investigation was undertaken to study the effect of different growing media, biofertilizers and their interaction on seedling vigour of aonla.

Materials and Methods

The present investigation was carried out at College of Horticulture, Dr. Y.S.R Horticultural University, Venkataramannagudem, West Godavari District, Andhra Pradesh during the year 2020- 2021.

Experiment was laid out in the factorial randomized block design (FRBD) with 2 factors, biofertilizers (8 levels: B₀: Control, B₁: Nitrogen fixing bacteria (*Azotobacter* @ 2%), B₂: Phosphorous solubilizing bacteria (PSB @ 2%), B₃: Potassium releasing bacteria (KRB @ 2%), B₄: *Azotobacter* @ 2% + PSB @ 2%, B₅: *Azotobacter* @ 2% + KRB @ 2%, B₆: PSB @ 2% + KRB @ 2%, B₇: *Azotobacter* @ 2% + PSB @ 2% + KRB @ 2%) and media [2 levels: M₁: Soil + Cocopeat + FYM (1:1:1), M₂: Soil + Cocopeat+ Vermicompost (1:1:1)] with 16 treatment combinations replicated twice. For experimental purpose seeds were collected from the reliable source and treated with GA₃ @ 500 ppm for 24 hr to break the dormancy. Polybags of 20 × 15 cm pinched with 16 holes in each were filled with the media enriched with the different biofertilizers used in the experiment. Treatment combinations comprised of T₁: B₀M₁: Soil: Cocopeat: FYM (1:1:1), T₂: B₁M₁: *Azotobacter* @ 2% +Soil: Cocopeat: FYM

(1:1:1), T₃: B₂M₁: PSB @ 2% + Soil: Cocopeat: FYM (1:1:1), T₄: B₃M₁: KRB @ 2% + Soil: Cocopeat: FYM (1:1:1), T₅: B₄M₁: *Azotobacter* @ 2% + PSB @ 2% + Soil: Cocopeat: FYM (1:1:1), T₆: B₅M₁: *Azotobacter* @ 2% + KRB @ 2% + Soil: Cocopeat: FYM (1:1:1), T₇: B₆M₁: PSB @ 2% + KRB @ 2% + Soil: Cocopeat: FYM (1:1:1), T₈: B₇M₁: *Azotobacter* @ 2% + PSB @ 2% + KRB @ 2% + Soil: Cocopeat: FYM (1:1:1), T₉: B₀M₂: Soil: Cocopeat: Vermicompost (1:1:1), T₁₀: B₁M₂: *Azotobacter* @ 2% + Soil: Cocopeat: Vermicompost (1:1:1), T₁₁: B₂M₂: PSB @ 2% + Soil: Cocopeat: Vermicompost (1:1:1), T₁₂: B₃M₂: KRB @ 2% + Soil: Cocopeat: Vermicompost (1:1:1), T₁₃: B₄M₂: *Azotobacter* @ 2% + PSB @ 2% + Soil: Cocopeat: Vermicompost (1:1:1), T₁₄: B₅M₂: *Azotobacter* @ 2% + KRB @ 2% + Soil: Cocopeat: Vermicompost (1:1:1), T₁₅: B₆M₂: PSB @ 2% + KRB @ 2% + Soil: Cocopeat: Vermicompost (1:1:1), T₁₆: B₇M₂: *Azotobacter* @ 2% + PSB @ 2% + KRB @ 2% + Soil: Cocopeat: Vermicompost (1:1:1). During February 2- 3 seeds were sown in each polybag according to the treatment combinations. Watering was done regularly using rose can and different plant protection measures was taken at all the growth stages. From each replication representative 5 seedlings were taken to record the different germination and growth parameters at monthly interval.

Statistical analysis

The data on various characters studied during the course of investigation were analysed statistically by applying the procedures of analysis of variance as outlined by Panse and Sukhatme (1985) [8]. The critical difference among the treatment means was compared at 5 per cent level of significance.

Results and Discussion

Data recorded regarding growth parameters has showed the significant difference. Media containing soil + cocopeat + vermicompost with biofertilizers of *Azotobacter* + PSB + KRB recorded maximum number of leaves (6.25, 15.50 and 21.70 at 30, 60 and 90 DAS respectively), stem diameter (2.39, 6.52 and 7.75 mm at 30, 60 and 90 DAS respectively), seedling height (15.55, 37.44 and 51.27 cm at 30, 60 and 90 DAS respectively), fresh weight of shoot (16.82 g), dry weight of shoot (9.66 g), survival per cent (96.96%), shoot: root ratio (4.20) (Table 1).

The plants grown in media enriched with vermicompost shown better results regarding various growth characters like shoot length and root length (Khare *et al.*, 2018) [3]. Joolka *et al.* (2004) [2] observed maximum number of leaves per seedling, fresh and dry weight of shoot and shoot: root ratio of pecan seedlings grown in the media VAM + *Azotobacter* + GA₃ treatment. Quesni *et al.* (2013) [9] reported that highest plant height, stem diameter and number of leaves per plant of jatropha seedlings were obtained by applying algae, microbial and compost. Vishwakarma (2013) [14] reported that maximum survival percent of seedling (88.72%) can be achieved in acid lime var. Kagzi when the seeds are treated with soil + slurry + AZO + 150 ppm GA₃ followed by the treatment comprised of soil + slurry + AZO + PSB.

Biofertilizers helps in the synthesis of beneficial hormones and growth factors that will leads to the increased cell division and multiplication of cell also increases the assimilation and accumulation of food materials (Raman, 2012) [10] in apple that will helps in better growth of the seedlings. Similar results were observed in shea tree by Abdullahi *et al.*, 2012 [1], Verma *et al.*, 2019 [12] in dragon fruit and in sweet orange by Rana *et al.*, 2020 [11].

Table 1: Influence of biofertilizers and growing media on number of leaves per seedling, stem diameter, seedling height at 30, 60 and 90 DAS and fresh weight of shoot, dry weight of shoot, shoot: shoot ratio.

| Treatment | Number of leaves per seedling (No.) | | | Stem diameter (mm) | | | Seedling height (cm) | | | Fresh weight of shoot (g) | Dry weight of shoot (g) | Survival % | Shoot: root ratio |
|-------------------------------|-------------------------------------|--------|--------|--------------------|--------|--------|----------------------|--------|--------|---------------------------|-------------------------|------------|-------------------|
| | 30 DAS | 60 DAS | 90 DAS | 30 DAS | 60 DAS | 90 DAS | 30 DAS | 60 DAS | 90 DAS | 90 DAS | 90 DAS | 90 DAS | 90 DAS |
| B ₀ | 3.26 | 7.32 | 10.26 | 1.59 | 2.37 | 3.81 | 8.86 | 16.68 | 22.10 | 3.68 | 1.83 | 84.41 | 1.65 |
| B ₁ | 3.70 | 9.78 | 14.81 | 1.78 | 3.93 | 4.84 | 9.83 | 21.51 | 28.06 | 7.47 | 3.07 | 90.54 | 1.53 |
| B ₂ | 3.52 | 9.02 | 12.67 | 1.68 | 3.73 | 4.70 | 9.49 | 19.08 | 26.58 | 6.75 | 2.80 | 88.96 | 1.79 |
| B ₃ | 3.43 | 8.25 | 11.44 | 1.63 | 3.41 | 4.50 | 9.16 | 17.84 | 24.79 | 5.82 | 2.54 | 88.02 | 1.96 |
| B ₄ | 4.56 | 13.22 | 18.54 | 2.00 | 4.80 | 5.24 | 11.28 | 29.39 | 39.51 | 12.56 | 5.52 | 94.57 | 2.10 |
| B ₅ | 4.06 | 11.50 | 16.80 | 1.88 | 4.34 | 5.03 | 10.78 | 24.72 | 35.49 | 9.62 | 4.18 | 92.74 | 1.86 |
| B ₆ | 3.86 | 11.15 | 16.62 | 1.84 | 4.23 | 4.97 | 10.56 | 24.11 | 32.00 | 8.28 | 3.78 | 92.11 | 1.74 |
| B ₇ | 5.50 | 14.80 | 21.45 | 2.21 | 5.77 | 6.73 | 13.59 | 34.89 | 49.32 | 15.13 | 8.44 | 96.35 | 3.15 |
| SEm± | 0.05 | 0.15 | 0.10 | 0.02 | 0.04 | 0.02 | 0.23 | 0.36 | 0.33 | 0.30 | 0.22 | 0.58 | 0.08 |
| CD at 5% | 0.15 | 0.47 | 0.30 | 0.04 | 0.13 | 0.06 | 0.69 | 1.11 | 1.00 | 0.90 | 0.68 | 1.76 | 0.25 |
| Media | | | | | | | | | | | | | |
| M ₁ | 3.83 | 10.26 | 14.84 | 1.78 | 3.81 | 4.77 | 10.04 | 22.70 | 31.00 | 8.14 | 3.66 | 90.17 | 1.86 |
| M ₂ | 4.14 | 11.00 | 15.81 | 1.87 | 4.34 | 5.19 | 10.84 | 24.36 | 33.46 | 9.19 | 4.38 | 91.76 | 2.09 |
| SEm± | 0.02 | 0.08 | 0.05 | 0.01 | 0.02 | 0.01 | 0.11 | 0.18 | 0.16 | 0.15 | 0.11 | 0.29 | 0.04 |
| CD at 5% | 0.07 | 0.24 | 0.15 | 0.02 | 0.07 | 0.03 | 0.34 | 0.55 | 0.50 | 0.45 | 0.34 | 0.88 | 0.13 |
| Interaction | | | | | | | | | | | | | |
| B ₀ M ₁ | 3.10 | 6.84 | 9.95 | 1.58 | 1.74 | 3.54 | 8.69 | 16.56 | 20.58 | 3.63 | 1.72 | 81.22 | 1.60 |
| B ₁ M ₁ | 3.71 | 9.31 | 14.60 | 1.76 | 3.86 | 4.77 | 9.82 | 20.44 | 27.69 | 7.38 | 2.92 | 89.94 | 1.46 |
| B ₂ M ₁ | 3.49 | 8.86 | 11.65 | 1.67 | 3.64 | 4.64 | 9.35 | 18.97 | 26.23 | 6.45 | 2.79 | 88.82 | 2.07 |
| B ₃ M ₁ | 3.42 | 8.20 | 11.30 | 1.62 | 3.30 | 4.41 | 9.03 | 17.45 | 23.92 | 5.67 | 2.50 | 87.86 | 1.90 |
| B ₄ M ₁ | 4.52 | 12.55 | 18.00 | 1.99 | 4.65 | 5.18 | 11.14 | 27.97 | 39.32 | 12.04 | 4.87 | 93.55 | 2.30 |
| B ₅ M ₁ | 3.91 | 11.45 | 16.10 | 1.80 | 4.21 | 4.96 | 10.48 | 23.93 | 32.73 | 8.71 | 3.90 | 92.23 | 1.84 |
| B ₆ M ₁ | 3.73 | 10.80 | 15.94 | 1.79 | 4.10 | 4.94 | 10.20 | 23.92 | 30.16 | 7.82 | 3.38 | 91.98 | 1.64 |
| B ₇ M ₁ | 4.75 | 14.10 | 21.20 | 2.03 | 5.02 | 5.70 | 11.63 | 32.33 | 47.36 | 13.44 | 7.22 | 95.74 | 2.10 |
| B ₀ M ₂ | 3.41 | 7.80 | 10.57 | 1.60 | 3.00 | 4.08 | 9.03 | 16.81 | 23.61 | 3.74 | 1.94 | 87.61 | 1.70 |
| B ₁ M ₂ | 3.71 | 10.25 | 15.02 | 1.79 | 4.01 | 4.91 | 9.84 | 22.58 | 28.42 | 7.56 | 3.22 | 91.14 | 1.61 |
| B ₂ M ₂ | 3.54 | 9.19 | 13.70 | 1.68 | 3.82 | 4.75 | 9.62 | 19.18 | 26.94 | 7.05 | 2.81 | 89.09 | 1.52 |
| B ₃ M ₂ | 3.44 | 8.31 | 11.58 | 1.64 | 3.53 | 4.58 | 9.30 | 18.22 | 25.66 | 5.98 | 2.58 | 88.18 | 2.02 |

| | | | | | | | | | | | | | |
|-------------------------------|------|-------|-------|------|------|------|-------|-------|-------|-------|------|-------|------|
| B ₄ M ₂ | 4.61 | 13.90 | 19.10 | 2.02 | 4.94 | 5.31 | 11.43 | 30.81 | 39.69 | 13.08 | 6.17 | 95.59 | 1.91 |
| B ₅ M ₂ | 4.21 | 11.55 | 17.50 | 1.95 | 4.47 | 5.11 | 11.07 | 25.52 | 38.25 | 10.54 | 4.47 | 93.24 | 1.89 |
| B ₆ M ₂ | 4.00 | 11.51 | 17.30 | 1.90 | 4.40 | 5.00 | 10.91 | 24.30 | 33.83 | 8.73 | 4.17 | 92.24 | 1.85 |
| B ₇ M ₂ | 6.25 | 15.50 | 21.70 | 2.39 | 6.52 | 7.75 | 15.55 | 37.44 | 51.27 | 16.82 | 9.66 | 96.96 | 4.20 |
| SEm± | 0.07 | 0.22 | 0.14 | 0.02 | 0.06 | 0.30 | 0.32 | 0.52 | 0.46 | 0.42 | 0.31 | 0.82 | 0.12 |
| CD at 5% | 0.21 | 0.66 | 0.43 | 0.06 | 0.19 | 0.09 | 0.97 | 1.57 | 1.41 | 1.28 | 0.96 | 2.48 | 0.36 |

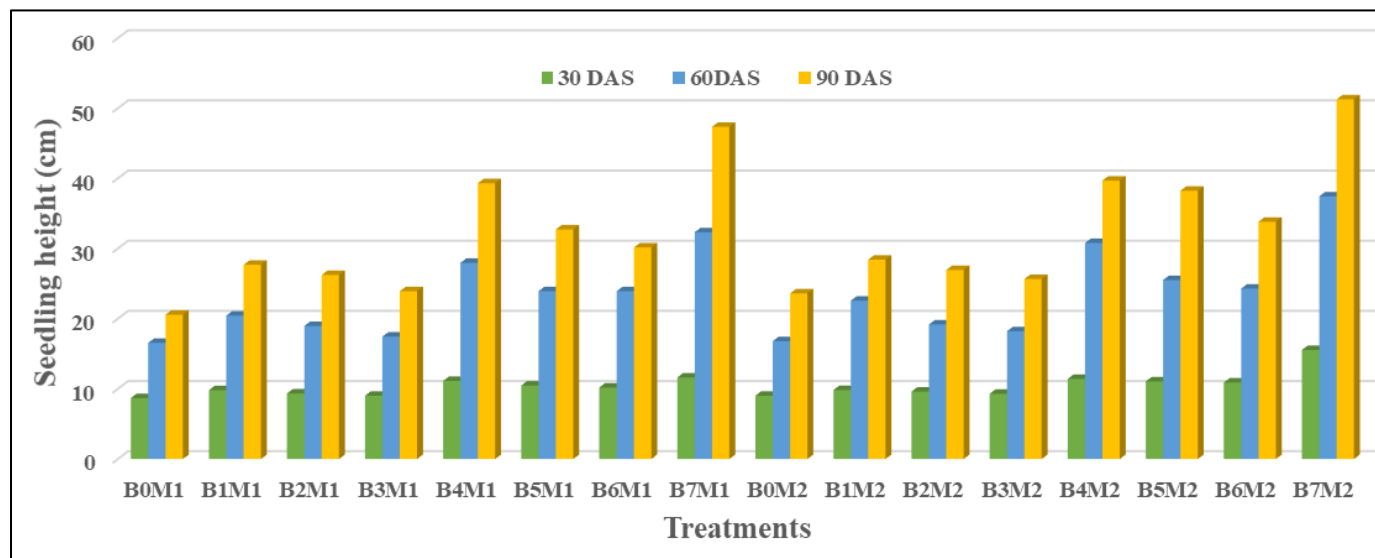


Fig 1: Influence of media and biofertilizers on seedling height (cm) in aonla

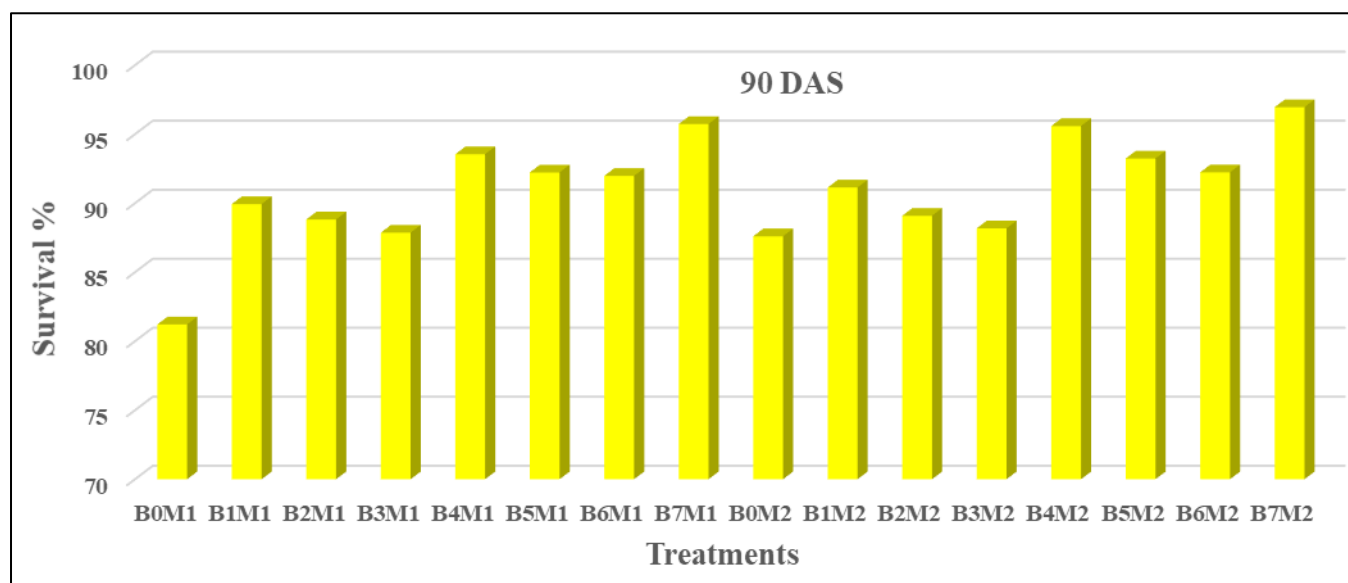


Fig 2: Influence of media and biofertilizers on survival % in aonla

Conclusion

Experiment revealed that the treatment T₁₆ containing media of soil + cocopeat + vermicompost with biofertilizers of *Azotobacter* + PSB + KRB recoded maximum number of leaves (6.25, 15.50 and 21.70 at 30, 60 and 90 DAS respectively), stem diameter (2.39, 6.52 and 7.75 mm at 30, 60 and 90 DAS respectively), seedling height (15.55, 37.44 and 51.27 cm at 30, 60 and 90 DAS respectively), fresh weight of shoot (16.82 g), dry weight of shoot (9.66 g), shoot: root ratio (4.20) and survival per cent (96.96%).

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