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Geethanjali
PG Student, Fruit Science,
College of Horticulture,
Venkataramannagudem,
West Godavari District,
Andhra Pradesh, India

P Vinaya Kumar Reddy
Assistant Professor (Horticulture),
College of Horticulture,
Venkataramannagudem,
West Godavari District,
Andhra Pradesh, India

A Harshavardhan
Assistant Professor (Horticulture),
College of Horticulture,
Venkataramannagudem,
West Godavari District,
Andhra Pradesh, India

Dr. Salomi Suneetha
Professor (Biochemistry),
College of Horticulture,
Venkataramannagudem,
West Godavari District,
Andhra Pradesh, India

Corresponding Author:
Geethanjali
PG student, Fruit Science,
College of Horticulture,
Venkataramannagudem,
West Godavari District,
Andhra Pradesh, India

Influence of biofertilizers and media on germination parameters and chlorophyll content in aonla

Geethanjali, P Vinaya Kumar Reddy, A Harshavardhan and Dr. Salomi Suneetha

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 germination parameters and chlorophyll content is less hence the present experiment was conducted to study the effect of biofertilizers and media on germination parameters and chlorophyll content of aonla. Treatment combinations has showed the significant difference. Among the different treatment combinations used media containing of soil + cocopeat + vermicompost enriched with the biofertilizer mixture of *Azatobacter* + PSB + KRB has recorded minimum days taken for initiation of seed germination, days taken to 50 per cent germination, maximum germination percent at 20 and 30 DAS and highest chlorophyll content.

Keywords: biofertilizers, GA_3, germination parameters, vermicompost, FYM, aonla

Introduction
Aonla botanically *Emblica 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 annonymus 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: B_0: Control, B_1: Nitrogen fixing bacteria (*Azatobactor* @ 2%), B_2: Phosphorous solubilizing bacteria (PSB @ 2%), B_3: Potassium releasing bacteria (KRB @ 2%), B_4: *Azatobactor* @ 2% + PSB @ 2%, B_5: *Azatobactor* @ 2% + KRB @ 2%, B_6: PSB @ 2 % + KRB @ 2%, B_7: *Azatobactor* @ 2% + PSB @ 2% + KRB @ 2%) and media [2 levels: M_1: Soil + Cocopeat + FYM (1:1:1), M_2: 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 GA_3 @ 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 T_1: B_0M_1: Soil: Cocopeat: FYM (1:1:1), T_2: B_1M_1: *Azatobactor* @ 2% +Soil: Cocopeat: FYM (1:1:1), T_3: B_2M_1: PSB @ 2% + Soil: Cocopeat: FYM (1:1:1), T_4: B_3M_1: KRB @ 2% + Soil: Cocopeat: FYM (1:1:1), T_5: B_4M_1: *Azatobactor* @ 2% + PSB @ 2% + Soil: Cocopeat: FYM (1:1:1), T_6: B_5M_1: *Azatobactor* @ 2% + KRB @ 2% + Soil: Cocopeat: FYM (1:1:1), T_7: B_6M_1: PSB @ 2%+ KRB @ 2% +Soil: Cocopeat: FYM (1:1:1), T_8: B_7M_1: *Azatobactor* @ 2% + PSB @ 2% + KRB @ 2% + Soil: Cocopeat: FYM (1:1:1), T_9: B_0M_2: Soil: Cocopeat: Vermicompost (1:1:1), T_{10}: B_1M_2: *Azatobactor* @ 2% +Soil: Cocopeat: Vermicompost (1:1:1), T_{11}: B_2M_2: PSB @ 2% + Soil: Cocopeat: Vermicompost (1:1:1), T_{12}: B_3M_2: KRB @ 2% + Soil: Cocopeat: Vermicompost (1:1:1), T_{13}: B_4M_2: *Azatobactor* @ 2% + PSB @ 2% + Soil: Cocopeat: Vermicompost (1:1:1), T_{14}: B_5M_2: *Azatobacto*r @ 2% + KRB @ 2% + Soil: Cocopeat: Vermicompost (1:1:1), T_{15}: B_6M_2: PSB @ 2% + KRB @ 2% +Soil: Cocopeat: Vermicompost (1:1:1), T_{16}: B_7M_2: *Azatobactor* @ 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 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

Less number of days taken for initiation of seed germination (8.50 days), days taken to 50 per cent germination (20.50 days), maximum germination percentage at 20 DAS (88.82%) and 30 DAS (97.38%) and total chlorophyll content (61.70) was recorded in the treatment T_{16} containing the media of soil + cocopeat + vermicompost inoculated with the biofertilizers of *Azatobacter* + PSB + KRB against lowest in the uninoculated seedlings (Table 1).

The plants grown in media enriched with vermicompost exhibit the positive effects on various germination parameters (Khare *et al*, 2018) [2]. Kumar *et al*. (2015) [3] showed that, media containing vermicompost showed highest seed germination of *Pinus gerardiana*. Media inoculated with biofertilizers like *Azospirillum*, *Azatobacter* and phosphobacteria showed earliness and highest seed germination of cardamom seeds showed by Paulraj and Raj in 2018 [9].

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) [12] 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 days taken to initiation of m seed germination, days to 50 % germination, germination % at 20 and 30 DAS and total chlorophyll content.

Treatment	Days taken to initiation of seed germination	Days taken to 50% germination	Germination % at 20 DAS	Germination % at 30 DAS	Total chlorophyll content (SPAD)
Biofertilizers					
B_0	17.25	30.50	43.43	45.80	40.44
B_1	12.75	24.75	67.72	68.25	46.93
B_2	13.50	25.25	63.99	64.94	45.94
B_3	14.00	26.75	56.63	56.74	44.66
B_4	9.50	23.25	85.72	87.84	52.30
B_5	11.25	23.75	76.77	80.10	50.88
B_6	11.50	24.00	74.45	78.09	49.81
B_7	8.50	21.00	87.66	93.96	57.74
SEm±	0.19	0.27	0.82	0.77	0.24
CD at 5%	0.58	0.83	2.48	2.34	0.74
Media					
M_1	12.69	25.38	67.17	69.32	47.46
M_2	11.88	24.44	71.92	74.61	49.71
SEm±	0.10	0.14	0.41	0.38	0.12
CD at 5%	0.29	0.42	1.24	1.17	0.37
Interaction					
B_0M_1	18.50	32.50	35.77	37.20	38.94
B_1M_1	13.00	25.00	65.93	67.01	46.27
B_2M_1	14.00	25.50	63.76	64.72	45.44
B_3M_1	14.00	27.00	55.83	55.83	44.39
B_4M_1	10.00	23.50	85.44	87.11	51.87
B_5M_1	11.50	24.00	72.58	76.51	50.37
B_6M_1	12.00	24.00	71.58	75.68	48.61
B_7M_1	8.50	21.50	86.50	90.55	53.78
B_0M_2	16.00	28.50	51.09	54.41	41.94
B_1M_2	12.50	24.50	69.50	69.50	47.59
B_2M_2	13.00	25.00	64.21	65.16	46.43
B_3M_2	14.00	26.50	57.44	57.66	44.92
B_4M_2	9.00	23.00	86.00	88.57	52.73

B_5M_2	11.00	23.50	80.96	83.70	51.38
B_6M_2	11.00	24.00	77.33	80.50	51.00
B_7M_2	8.50	20.50	88.82	97.38	61.70
SEm±	0.27	0.39	1.15	1.09	0.35
CD at 5%	0.83	1.17	3.51	3.31	1.05

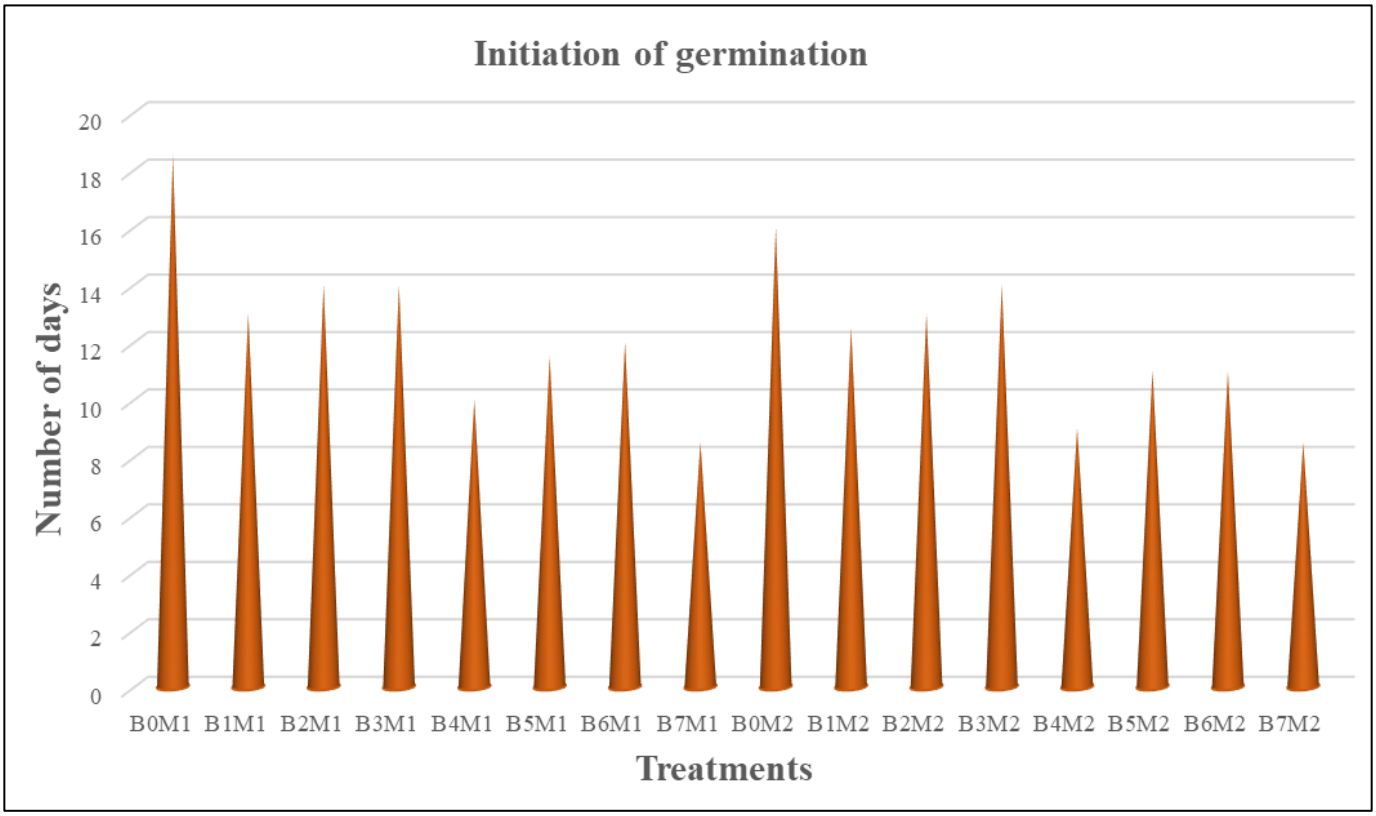

Fig 1: Influence of media and biofertilizers on initiation of seed germination in Aonla

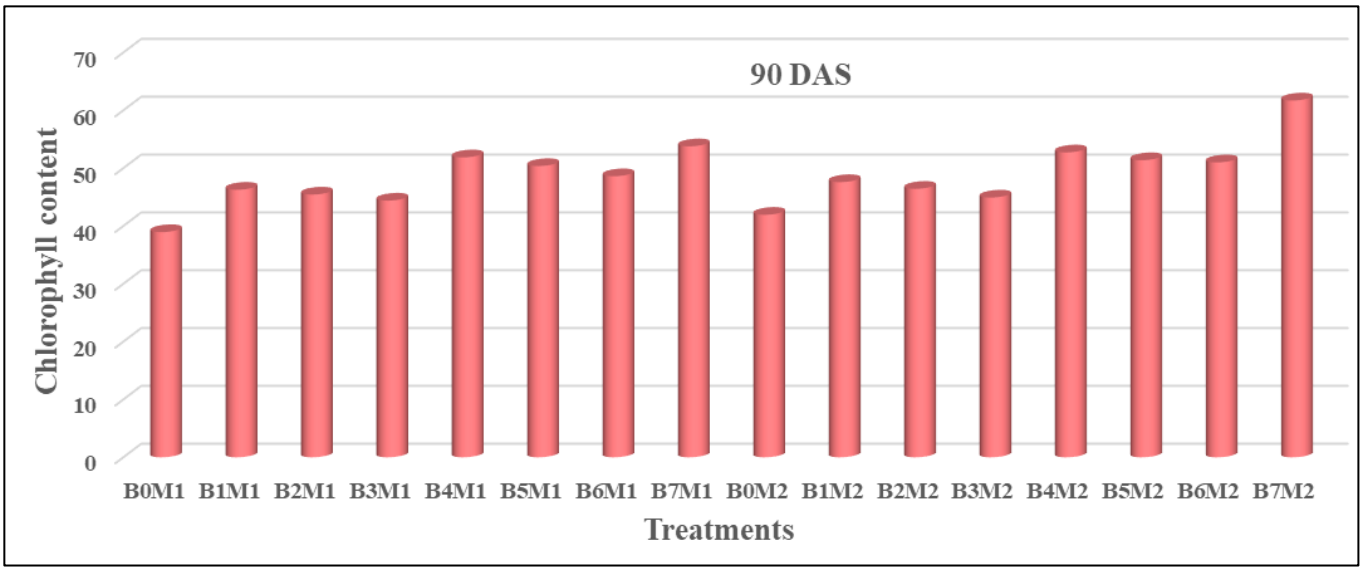

Fig 2: Influence of media and biofertilizers on chlorophyll content (SPAD) in aonla

Conclusion

Experiment revealed that the treatment T_{16} containing media of soil + cocopeat + vermicompost with biofertilizers of *Azatobacter* + PSB + KRB recoded less number of days taken for initiation of seed germination (8.50 days), days taken to 50 per cent germination (20.50 days), maximum germination percentage at 20 DAS (88.82%) and 30 DAS (97.38%) and total chlorophyll content (61.70).

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