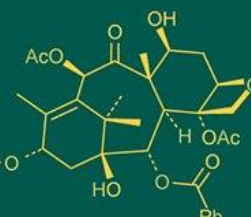
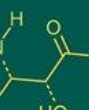
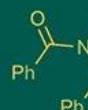


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Effect of different growing media and ga₃ on seed germination, seedlings growth and survival percentage of phalsa (*Grewia asiatica* L.) under shade net condition

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Abstract

The present study was carried out to investigate “Effect of Different Growing Media and GA₃ on Seed Germination, Seedlings Growth and Survival Percentage of Phalsa (*Grewia asiatica* L.) Under Shade Net Condition”. The study revealed that the treatments comprised combinations of Soil, FYM, Cocopeat and Vermicompost with seed soaked GA₃ 100ppm for 24hrs. The result indicated that T8 ((Soil + FYM+ Cocopeat +Vermicompost) + GA₃ @ 100ppm 1:1:1:1) is found to be the most effective for seed germination percentage, seedling growth and survival percentage viz, (days taken for initiation of germination (13.71days) and germination percentage (93.33) an increase in seedling growth viz, seedling height at 120DAS (32.44), number of leaves per seedling at 120 DAS (24.19), leaf area index (0.27), stem diameter (mm) at 120 DAS (3.36), fresh and dry weight of shoot (g) after 120 DAS (4.60 and 1.85), length of tap roots after 120 DAS (22.44), fresh and dry weight of roots (g) after 120 DAS (2.22 and 0.78), root shoot ratio (0.42), vigour index-I and II (3031.40 and 245.33) and survival percentage (93.33). Therefore, the combination of Soil + FYM+ Cocopeat +Vermicompost) 1:1:1:1 and GA₃ @ 100ppm was found most suitable for better seed germination, seedling growth and survival percentage of phalsa seedling.

Keywords: Growing media, ga₃, germination, seedlings growth, survival percentage and phalsa

Introduction

The Phalsa (*Grewia subinaequalis* DC) also known as star apple, it is a sub-tropical fruit native to India, belongs to the family Tiliaceae with chromosome no. 2n=36. This family has about 41 genera and 400 species, which are mostly distributed in the tropical and sub-tropical region of the world. Its fruit is known as berry Sukhjit (2020). The genus *Grewia* comprises about 140 species, mostly native to tropical and subtropical region of the world. Among them the most important species are *Grewia glabra*, *Grewia micrococas*, *Grewia optiva*, *Grewia tilifolia*, *Grewia belosa* etc. It was introduction from Philippines before 1914 and naturalized in Australia. Phalsa is also known by different vernacular names in different Indian languages such as Dhamani in Bengali, Phalsa in Punjab, Shukri in Hindi, Mirg Chara and Phrasakoli in Oriya, Tadasala in Kannada etc. In India, traditionally Phalsa is cultivated for subsistence farming and hence it is mostly consumed as fresh fruit and juice during summer months, ripen fruits are also used for the preparation of refreshing cool beverages (Saroli *et al*, 2019). It is commonly cultivated in several states, including Punjab, Haryana, Uttar Pradesh, Madhya Pradesh, Maharashtra, Gujarat, Andhra Pradesh, Bihar and West Bengal. Phalsa is a summer fruit, typically harvested from March to April in southern parts of India and from May to June in the northern regions. Phalsa is a small tree or large scraggly shrub to 4.5m (if unpruned). It has long, slender, drooping branches, the young branchlets densely coated with hairs. Phalsa is commercially propagated by seed. The mucilage in seeds make them difficult to germinate. The seedling plants of Phalsa are genetically stable i.e. similar to mother plant, where germination and seedlings growth is the major problem. Soil growing media soil is essential for plant growth, providing nutrients, water retention, and physical support to roots. Its porous structure ensures proper aeration, vital for root respiration and

Nutrient uptake. Soil hosts beneficial microbes, regulates pH levels, and promotes environmental sustainability, forming the foundation for thriving ecosystems. FYM: Farmyard manure (FYM) is vital in growing media as it enriches soil with organic matter, nutrients, and beneficial microbes. FYM enhances soil structure, water retention, and nutrient availability, fostering healthy plant growth. Its sustainable use reduces chemical dependency and promotes soil health, contributing to resilient and sustainable agriculture. Vermicompost: Vermicompost enriches growing media by enhancing microbial activity, expanding nutrient availability, and strengthening soil structure. Its organic composition enhances plant growth, reduces the need for synthetic fertilizers, and fosters sustainable agriculture practices. Vermicompost contributes to healthy soils, robust plant growth, and environmental sustainability. Cocopeat: It is a versatile growing medium, offers excellent water retention and aeration properties, fostering optimal root development and nutrient uptake. Its high organic content enhances soil structure and microbial activity, promoting healthy plant growth. Cocopeat is sustainable, renewable, and reduces the need for traditional soil, making it ideal for eco-friendly agriculture Rai *et al.* (2024) [36, 37]. Gibberellic Acid (GA) is a plant growth regulator with diverse roles in influencing plant development: Stem Elongation: GA stimulates cell division and elongation in the internodes, leading to increased stem length and overall plant height. Seed Germination: GA breaks seed dormancy and promotes germination by activating enzymes that degrade stored nutrients, facilitating embryo growth. Flowering Induction: GA interacts with other hormones and environmental cues to influence flowering. It's widely used in horticulture to trigger flowering in certain plants Akhil *et al.* (2023) [2]

Materials and methods

The research titled "Effect of different growing media and GA₃ on seed germination, seedlings growth and survival percentage of phalsa (*Grewia asiatica* L.) Under shade net condition" was carried out at the research farm within the Horticulture Research Farm, Faculty of Agricultural Sciences and Allied Industries, Rama University, Kanpur (U.P.) in 2025. The experiment was laid out in completely Randomized Design (CRD). All treatments were replicated thrice. For this experiment seed of phalsa were procured from Local market of Kanpur. For this study, a total of 270 seeds of phalsa were sown. The treatments, soaking GA₃ at 24 hrs were diluted in deionized water to makeup required quantity suitable for seed treatment. Sowing were done just after the compilation of seed treatments. The experiment was carried out by sowing seeds in media filled polythene bags. The perforated polythene bags of 4 x 6 cm size (150 gauges thickness) were used for sowing. The bags were filled with a mixture of Soil, FYM, Cocopeat and Vermicompost in the ratio of 1:1, 1:1:1, 1:2:1 and 1: 1: 1: 1. Before sowing the seeds in the polythene bags, soil were treated with fungicide, i.e. copper oxychloride @ 2%. Two seeds were sown in each polythene bags. Regular watering with water-cane was done gently in morning and evening. For improve the drainage, holes were made in polythene bags and filled with potting mixture which was prepared by Soil, FYM, Cocopeat and Vermicompost. The polythene bags were placed in flat beds with proper space. Phalsa seeds were soaked in 100 ppm GA₃ solution for 24 hrs

which were prepared by dissolving 100 ppm GA₃ (GA₃ was completely dissolved by addition of small quantity of NaOH pellets) in 1 liter of water. Seeds were sown 1 cm deep in the poly bag of size 4 x 6 cm size (150 gauges thickness) filled with prepared medium on 6TH August, 2025 at Horticulture Research Farm, Faculty of Agricultural Sciences and Allied Industries, Rama University, Kanpur (U.P.). All the poly bags were kept under net house condition. The Number of days required for initiation of germination, Germination Percentage (%) and seedling growth parameters of the seedling were recorded at 30, 60, 90 and 120 DAS of research period. The recorded data for all the observations were analyzed statistically by using techniques described by Panse and Sukhatme (1985).

Results and discussion

The present study, titled "Effect of different growing media and GA₃ on seed germination, seedlings growth and survival percentage of phalsa (*Grewia asiatica* L.) under shade net condition" the study was carried out during year 2025 aimed at analyzing seed germination parameters and seedling growth and survival percentage of phalsa. Data pertaining to germination parameters and growth seedling parameters influenced by various treatment has been given in Table 1 to 3. According to table 1 to 3, the various germination parameters and seedling growth parameters such as number of days required for initiation of germination, germination (%), seedling height (cm), number of leaves per seedling, leaf area index after 120 DAS, stem diameter (cm), fresh and dry weight of shoot (g), length of tap roots after 120 DAS, fresh and dry weight of roots (g), root shoot ratio, vigour index-I, vigour index-II and survival percentage were found significant among different treatments. The data are presented in the table 1. It is clear from the result the result that different growing media and seed soaked in 100 ppm GA₃ solution for 24hrs have a substantial impact on the number of days required for initiation of germination and germination (%). Highly significant lowest Days taken for initiation of germination and germination (%) (13.71 days and 93.33%) recorded due to the treatment T9 ((Soil + FYM+ Cocopeat +Vermicompost) + GA₃ @ 100ppm 1:1:1:1) which was statistically similar to the treatment T5 ((Soil + FYM + Vermicompost) + GA₃ @ 100ppm 1: 2: 1) (15.47 days and 80.00%). However, the highest number of days required for initiation of germination and germination was found in T0 (Control (Soil)) i.e., (25.67 Days and 50.00%). The results are conformity with the findings reported by Anburani and Shakila (2010) [4], Deb *et al.* (2010) [16], Barche *et al.* (2010) [8, 9], Pratibha *et al.* (2015) [34], Padma *et al.* (2013), Murlidhara *et al.* (2017), Chandra and Govind (1990) [14], Suryakanth *et al.* (2005) [46], Wilson *et al.* (2001), Arancon *et al.* (2004), Mishra *et al.* (2017) [27], Bhardwaj *et al.* (2014) [10], Lepakshi *et al.* (2021) [22], Rai *et al.* (2024) [36, 37], Kalyani *et al.* (2014) [21], Vasantha *et al.* (2014) [48] and Nimbalkar *et al.* (2012) [30]. Highly significant highest seedling height at 30, 60, 90 and DAS (4.20, 15.27, 25.00 and 32.44) recorded due to the treatment T9 ((Soil + FYM+ Cocopeat +Vermicompost) + GA₃ @ 100ppm 1:1:1:1) which was statistically similar to the treatment T5 ((Soil + FYM + Vermicompost) + GA₃ @ 100ppm 1: 2: 1) (4.09, 14.15, 23.79 and 29.40). However, the lowest seedling height (cm) was found in T0 (Control (Soil)) i.e., 2.38, 6.54, 12.66 and 15.33. Highly significant highest number of leaves per seedling at 30, 60, 90 and DAS

(4.09, 13.87, 17.62 and 24.19) recorded due to the treatment T9 ((Soil + FYM+ Cocopeat +Vermicompost) + GA₃ @ 100ppm 1:1:1:1) which was statistically similar to the treatment T5 ((Soil + FYM + Vermicompost) + GA₃ @ 100ppm 1: 2: 1) (4.00, 12.50, 17.02 and 22.69). However, the lowest number of leaves per seedling height (cm) was found in T0 (Control (Soil)) i.e. 2.22, 5.93, 7.50 and 12.58. These results are in conformity with Barche *et al.* (2010)^[8, 9], Babu *et al.* (2010)^[7], Pratibha *et al.* (2015)^[34], Nelson *et al.* (2008)^[29], Mishra *et al.* (2017)^[27], Bhardwaj *et al.* (2014)^[10], Thakur and Shylla (2018)^[47] and Dilip *et al.* (2017)^[19]. Highly significant highest number of leaves per seedling at 30, 60, 90 and DAS (4.09, 13.87, 17.62 and 24.19) recorded due to the treatment T9 ((Soil + FYM+ Cocopeat +Vermicompost) + GA₃ @ 100ppm 1:1:1:1) which was statistically similar to the treatment T5 ((Soil + FYM + Vermicompost) + GA₃ @ 100ppm 1: 2: 1) (4.00, 12.50, 17.02 and 22.69). However, the lowest number of leaves per seedling height (cm) was found in T0 (Control (Soil)) i.e. 2.22, 5.93, 7.50 and 12.58. These results are in conformity with Barche *et al.* (2010)^[8, 9], Babu *et al.* (2010)^[7], Pratibha *et al.* (2015)^[34], Borah *et al.* (2008), Anjanawe *et al.* (2013)^[5], Parasana *et al.* (2014)^[32], Mishra *et al.* (2017)^[27], Parasana *et al.* (2013), Thakur and Shylla (2018)^[47], Sharma (2016)^[43], Dilip *et al.* (2017)^[19] and Meena and Jain (2005). According to table 2, the various germination parameters and seedling growth parameters such as leaf area index after 120 DAS, stem diameter (cm), fresh and dry weight of shoot (g) and length of tap roots after 120 DAS were found significant among different treatments. Highly significant highest leaf area index (0.27) recorded due to the treatment T9 ((Soil + FYM+ Cocopeat +Vermicompost) + GA₃ @ 100ppm 1:1:1:1) which was statistically similar to the treatment T5 ((Soil + FYM + Vermicompost) + GA₃ @ 100ppm 1: 2: 1) (0.24). However, the lowest leaf area index was found in T0 (Control (Soil)) i.e. 0.08. These results are in conformity with Barche *et al.* (2010)^[8, 9], Babu *et al.* (2010)^[7], Pratibha *et al.* (2015)^[34], Mahadev *et al.* (2021)^[23], Sharma *et al.* (2016)^[43], Sadashiv *et al.* (2017)^[40], Borah *et al.* (2008), Anjanawe *et al.* (2013)^[5], Parasana *et al.* (2014)^[32], Mishra *et al.* (2017)^[27], Arvind *et al.* (2015)^[6], Ramteke *et al.* (2015)^[39], Rakibuzzaman *et al.* (2015) and Nandini and Singh (2021)^[44]. Highly significant highest stem diameter (mm) at 60, 90 and 120 DAS (1.71, 2.68 and 3.36) recorded due to the treatment T9 ((Soil + FYM+ Cocopeat +Vermicompost) + GA₃ @ 100ppm 1:1:1:1) which was statistically similar to the treatment T5 ((Soil + FYM + Vermicompost) + GA₃ @ 100ppm 1: 2: 1) (1.66, 2.59 and 3.33). However, the lowest stem diameter (mm) was found in T0 (Control (Soil)) i.e. 0.92, 1.21 and 2.03. These results are in conformity with Barche *et al.* (2010)^[1, 8, 9], Babu *et al.* (2010)^[7], Pratibha *et al.* (2015)^[34], Borah *et al.* (2008), Anjanawe *et al.* (2013)^[5], Parasana *et al.* (2014)^[32], Mishra *et al.* (2017)^[27], Bhardwaj *et al.* (2014)^[10], Parasana *et al.* (2013), Meena *et al.* (2017)^[25], Sen *et al.* (1990)^[42], Singh and Kaur (2020)^[45] and Bhavya *et al.* (2017)^[12]. Highly significant highest fresh and dry weight of shoot (g) after 120 DAS (4.60 and 1.85) recorded due to the treatment T9 ((Soil + FYM+ Cocopeat +Vermicompost) + GA₃ @ 100ppm 1:1:1:1) which was statistically similar to the treatment T5 ((Soil + FYM + Vermicompost) + GA₃ @ 100ppm 1: 2: 1) (4.46 and 1.74). However, the lowest fresh and dry weight of shoot (g) after 120 DAS was found in T0 (Control (Soil)) i.e. (3.02 and 1.07). These results are in

conformity with Barche *et al.* (2010)^[8, 9], Babu *et al.* (2010)^[7], Pratibha *et al.* (2015)^[34], Yadav *et al.* (2012)^[49], Dhakar *et al.* (2016)^[18], Dilip *et al.* (2017)^[19], Homeshvari *et al.* (2022)^[20], Mahadev *et al.* (2021)^[23], Bachman and Metzger, (2008), Zaller, (2007), Campos Mota *et al.* (2009)^[13] and Abirami *et al.* (20110)^[11]. Highly significant highest length of tap roots after 120 DAS (22.44) recorded due to the treatment T9 ((Soil + FYM+ Cocopeat +Vermicompost) + GA₃ @ 100ppm 1:1:1:1) which was statistically similar to the treatment T5 ((Soil + FYM + Vermicompost) + GA₃ @ 100ppm 1: 2: 1) (20.96). However, the lowest length of tap roots after 120 DAS was found in T0 (Control (Soil)) i.e. (13.02). These results are in conformity with Barche *et al.* (2010)^[8, 9], Babu *et al.* (2010)^[7], Pratibha *et al.* (2015)^[34], Alvarez and Grigera, 2005)^[3], Yadav *et al.* (2012)^[49], Bhardwaj *et al.* (2014)^[10], Mandal *et al.* (2022)^[24], Yadav *et al.* (2022), Homeshvari *et al.* (2022)^[20] and Mahadev *et al.* (2021)^[23]. According to table 3, the various germination parameters and seedling growth parameters such as fresh and dry weight of roots (g), root shoot ratio, vigour index-I, vigour index-II and survival percentage were found significant among different treatments. Highly significant highest fresh and dry weight of roots (g) after 120 DAS (2.22 and 0.78) recorded due to the treatment T9 ((Soil + FYM+ Cocopeat +Vermicompost) + GA₃ @ 100ppm 1:1:1:1) which was statistically similar to the treatment T5 ((Soil + FYM + Vermicompost) + GA₃ @ 100ppm 1: 2: 1) (2.07 and 0.66). However, the lowest fresh and dry weight of roots (g) after 120 DAS was found in T0 (Control (Soil)) i.e. (1.15 and 0.32). These results are in conformity with Barche *et al.* (2010)^[8, 9], Babu *et al.* (2010)^[7], Pratibha *et al.* (2015), Yadav *et al.* (2012)^[49], Dhakar *et al.* (2016)^[18], Dilip *et al.* (2017)^[19] and Yadav *et al.* (2018). Highly significant highest root shoot ratio (0.42) recorded due to the treatment T9 ((Soil + FYM+ Cocopeat +Vermicompost) + GA₃ @ 100ppm 1:1:1:1) which was statistically similar to the treatment T5 ((Soil + FYM + Vermicompost) + GA₃ @ 100ppm 1: 2: 1) (0.38). However, the lowest root shoot ratio was found in T0 (Control (Soil)) i.e. (0.30). These results are in conformity with Barche *et al.* (2010)^[8, 9], Babu *et al.* (2010)^[7], Pratibha *et al.* (2015)^[34], Bhardwaj *et al.* (2014), Desai *et al.* (2017)^[17]. Highly significant highest vigour index-I and II (3031.40 and 245.33) recorded due to the treatment T9 ((Soil + FYM+ Cocopeat +Vermicompost) + GA₃ @ 100ppm 1:1:1:1) which was statistically similar to the treatment T5 ((Soil + FYM + Vermicompost) + GA₃ @ 100ppm 1: 2: 1) (2348.40 and 192.43). However, the lowest vigour index-I and II was found in T0 (Control (Soil)) i.e. (768.83 and 69.30). These results are in conformity with Barche *et al.* (2010)^[8, 9], Babu *et al.* (2010)^[7], Pratibha *et al.* (2015)^[34], Ramateke *et al.* (2015), Prajapati *et al.* (2017)^[33] and Anjanawe *et al.* (2013). Highly significant highest survival percentage (93.33) recorded due to the treatment T9 ((Soil + FYM+ Cocopeat +Vermicompost) + GA₃ @ 100ppm 1:1:1:1) which was statistically similar to the treatment T5 ((Soil + FYM + Vermicompost) + GA₃ @ 100ppm 1: 2: 1) (90.00). However, the lowest survival percentage was found in T0 (Control (Soil)) i.e. (40.00). These results are in conformity with Parasana *et al.* (2013), Rai *et al.* (2024)^[36, 37], Barche *et al.* (2010)^[8, 9], Rahangdale, 2015)^[35] and Chawla and Mehta, (2015)^[15].

Conclusion

Based on present observation, it is possible to concluded that, treatment T8 (Soil + FYM+ Cocopeat +Vermicompost)

+ GA₃ @ 100ppm 1:1:1:1) noted to be highly effective for days taken for initiation of germination (13.71days) and germination percentage (93.33) an increase in seedling growth viz, seedling height at 120DAS (32.44), number of leaves per seedling at 120 DAS (24.19), leaf area index (0.27), stem diameter (mm) at 120 DAS (3.36), fresh and dry weight of shoot (g) after 120 DAS (4.60 and 1.85), length of tap roots after 120 DAS (22.44), fresh and dry

weight of roots (g) after 120 DAS (2.22 and 0.78), root shoot ratio (0.42), vigour index-I and II (3031.40 and 245.33) and survival percentage (93.33). Hence, both T8 ((Soil + FYM+ Cocopeat +Vermicompost) + GA₃ @ 100ppm 1:1:1:1) are suitable seed scarification treatments for improving seed germination and seedling growth of Phalsa seeds.

Table 1: Effect of different growing media and GA₃ on seed germination, seedlings growth and survival percentage of phalsa (*Grewia asiatica* L.) under shade net condition

Treatment Notation	Treatment combination	Germination Attributes		Seedling growth attributes							
		Number of days required for initiation of germination	Germination (%)	Seedling height (cm)				Number of leaves per seedling			
				30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS
T0	Control (Soil)	25.67	50.00	2.38	6.54	12.66	15.33	2.22	5.93	7.50	12.58
T1	(Soil + FYM) + GA ₃ @ 100ppm 1: 1	18.80	80.00	3.79	12.60	19.13	24.75	3.56	10.53	13.69	18.64
T2	(Soil + Cocopeat) + GA ₃ @ 100ppm 1: 1	21.67	66.67	3.54	9.30	18.52	23.03	3.40	8.54	13.09	15.97
T3	(Soil + Vermicompost)+ GA ₃ @ 100ppm 1: 1	16.65	76.67	3.86	13.71	21.27	27.39	3.81	11.38	15.80	21.18
T4	(Soil + FYM + Cocopeat) + GA ₃ @ 100ppm 1: 1: 1	19.54	56.67	3.64	10.68	17.34	20.56	3.21	8.29	15.15	16.53
T5	(Soil + FYM + Vermicompost) + GA ₃ @ 100ppm 1: 2: 1	15.47	80.00	4.09	14.15	23.79	29.40	4.00	12.50	17.02	22.69
T6	(Soil + FYM + Cocopeat) + GA ₃ @ 100ppm 1: 2: 1	21.41	53.33	3.44	11.02	20.26	25.30	3.13	9.37	12.65	15.26
T7	(Soil + Vermicompost + Cocopeat) + GA ₃ @ 100ppm 1:2:1	23.54	60.00	3.23	10.55	17.58	21.48	3.20	8.56	12.15	14.89
T8	(Soil + FYM+ Cocopeat +Vermicompost) + GA ₃ @ 100ppm 1:1:1:1	13.71	93.33	4.20	15.27	25.00	32.44	4.09	13.87	17.62	24.19
	F-Test	S	S	S	S	S	S	S	S	S	S
	C.D. at 0.5%	1.303	17.916	0.207	0.549	1.475	1.630	0.162	0.593	0.875	1.400
	SEm	0.435	5.984	0.069	0.184	0.493	0.544	0.054	0.198	0.292	0.468
	S.Ed(+)	0.615	8.462	0.098	0.260	0.697	0.770	0.076	0.280	0.413	0.661
	CV	3.843	15.125	3.343	2.756	4.374	3.862	2.752	3.469	3.655	4.502

Table 2: Effect of different growing media and GA₃ on seed germination, seedlings growth and survival percentage of phalsa (*Grewia asiatica* L.) under shade net condition

Treatment Notation	Treatment combination	Seedling growth attributes						Root attributes
		Leaf area index (cm)	Stem diameter (mm)			Fresh and dry weight of shoot (g)		Length of tap roots (cm)
			60 DAS	90 DAS	120 DAS	Fresh	Dry	
T0	Control (Soil)	0.08	0.92	1.21	2.03	3.02	1.07	13.02
T1	(Soil + FYM) + GA ₃ @ 100ppm 1: 1	0.19	1.50	2.42	3.22	4.13	1.57	18.92
T2	(Soil + Cocopeat) + GA ₃ @ 100ppm 1: 1	0.16	0.86	2.09	2.51	3.32	1.26	15.52
T3	(Soil + Vermicompost)+ GA ₃ @ 100ppm 1: 1	0.21	1.61	2.47	3.28	4.25	1.63	19.66
T4	(Soil + FYM + Cocopeat) + GA ₃ @ 100ppm 1: 1: 1	0.14	1.31	2.20	2.76	3.53	1.31	16.67
T5	(Soil + FYM + Vermicompost) + GA ₃ @ 100ppm 1: 2: 1	0.24	1.66	2.59	3.33	4.46	1.74	20.96
T6	(Soil + FYM + Cocopeat) + GA ₃ @ 100ppm 1: 2: 1	0.14	1.42	2.39	3.12	3.83	1.40	17.13
T7	(Soil + Vermicompost + Cocopeat) + GA ₃ @ 100ppm 1:2:1	0.12	1.36	2.32	3.19	4.03	1.51	18.00
T8	(Soil + FYM+ Cocopeat +Vermicompost) + GA ₃ @ 100ppm 1:1:1:1	0.27	1.71	2.68	3.36	4.60	1.85	22.44
	F-Test	S	S	S	S	S	S	S
	C.D. at 0.5%	0.021	0.075	0.091	0.104	0.117	0.064	0.899
	SEm	0.007	0.025	0.030	0.035	0.039	0.021	0.300
	S.Ed(+)	0.010	0.036	0.043	0.049	0.055	0.030	0.425
	CV	7.039	3.085	2.328	2.014	1.734	2.485	2.883

Table 3: Effect of different growing media and GA₃ on seed germination, seedlings growth and survival percentage of phalsa (*Grewia asiatica* L.) under shade net condition

Treatment Notation	Treatment combination	Root attributes		Vigour Index		Survival percentage
		Fresh and dry weight of root (g)		Root shoot ratio	I	II
		Fresh	Dry			
T0	Control (Soil)	1.15	0.32	0.30	768.83	69.30
T1	(Soil + FYM) + GA ₃ @ 100ppm 1: 1	1.85	0.49	0.31	1984.60	164.67
T2	(Soil + Cocopeat) + GA ₃ @ 100ppm 1: 1	1.60	0.44	0.35	1552.40	112.67
T3	(Soil + Vermicompost)+ GA ₃ @ 100ppm 1: 1	1.89	0.51	0.32	2099.84	163.90
T4	(Soil + FYM + Cocopeat) + GA ₃ @ 100ppm 1: 1: 1	1.63	0.45	0.34	1165.40	99.47
T5	(Soil + FYM + Vermicompost) + GA ₃ @ 100ppm 1: 2: 1	2.07	0.66	0.38	2348.40	192.43
T6	(Soil + FYM + Cocopeat) + GA ₃ @ 100ppm 1: 2: 1	1.70	0.48	0.34	1352.67	100.27
T7	(Soil + Vermicompost + Cocopeat) + GA ₃ @ 100ppm 1:2:1	1.73	0.50	0.33	1292.47	120.63
T8	(Soil + FYM+ Cocopeat +Vermicompost) + GA ₃ @ 100ppm 1:1:1:1	2.22	0.78	0.42	3031.40	245.33
	F-Test	S	S	S	S	S
	C.D. at 0.5%	0.037	0.028	0.022	493.959	34.980
	SEm	0.012	0.009	0.007	164.974	11.683
	S.Ed(±)	0.018	0.013	0.010	233.308	16.522
	CV	1.227	3.203	3.726	16.489	14.355

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