Int.J.Curr.Microbiol.App.Sci (2018) *7*(11): 289-298

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 7 Number 11 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.711.035

Effect of Growing Media and Seed Treatment on Seed Germination, Seedling Growth, Survival Percentage and Profitability of Seedling Production of Sarpagandha (*Rauvolfia serpentina* (L), Benth. ex kurz)

S.C. Swain* and D. Malik

All India Co-ordinated Research Project on Medicinal & Aromatic Plants and Betelvine, Biotechnology-cum-Tissue culture Centre, Baramunda, Odisha University of Agriculture & Technology, Bhubaneswar, Odisha-751003, India

**Corresponding author*

Keywords

Media, Seed treatments, Germination, Growth, Survival, Sarpagandha

Article Info

Accepted:
04 October 2018
Available Online:
10 November 2018

A B S T R A C T

A nursery experiment was carried out to study the effect of growing media, seed treatments on seed germination and seedling vigour of Sarpagandha. The experiment was conducted in a Factorial Completely Randomized Design with 18 treatment combinations and 3 replications. The treatment combinations consists of 2 types of growing media (M_1: Garden soil + FYM + Sand @2:1:1 and M_2: Coco peat + Vermiculite + Perlite @2:1:1) and 9 seed treatments (C_1: GA_3 50 ppm, C_2: GA_3 100 ppm, C_3: GA_3 150 ppm, C_4: NaCl 1%, C_5: NaCl 2%, C_6: Acid scarification by conc. sulphuric acid, C_7:Hot water treatment, C_8: Pre-soaking in tap water, C_9: Control(without treatment). The results revealed that the Sarpagandha seeds treated with GA_3 @ 150 ppm and sown in garden soil + FYM + sand @2:1:1 resulted maximum germination percentage(39.00 %), root diameter (2.82 mm), dry weight of shoot (2.11 g), dry weight of root (1.77 g) and survival percentage of seedlings(88.37). The seeds treated with GA_3 @ 150 ppm and sown in garden soil + FYM + sand @ 2:1:1 also realized maximum gross, net return with B: C. The minimum values in respect of the above parameters were obtained with seeds sown in coco peat + vermiculite + perlite without any treatment.

Introduction

Sarpagandha (*Rauvolfia serpentina* (L), Benth. ex kurz) belongs to the family-Apocynaceae is one of the most important native medicinal plants of India. There are approximately 85 species in the genus *Rauvolfia* found in tropical regions. Apart from *R. serpentina* there is another species, *R. tetraphylla* which is also cultivated on a commercial scale. Sarpagandha is an erect, evergreen perennial and under shrub. Fruits are drupe, single or generally didymous,7.5 mm in size, purple bluish to black in colour when ripe containing 1-2 stony seeds.

The roots of plants are the principal source of alkaloids mainly used for medicinal purposes. The root of Sarpagandha has been used for the treatment of hypertension and as a sedative or tranquillizing agent, snake-bite, insect stings, nervous disorders, mania and

epilepsy, intractable skin disorders such as psoriasis, excessive sweating and itching, gynecological ointments for menopause, toxic goiter and to promote uterine contraction in childbirth.

The Sarpagandha has enormous importance in the health care system. But after reports of its therapeutic properties, natural reserves of Sarpagandha have been declining due to over exploitation by the local and tribal people. This has led to listing of this species as "Endangered" by the International Union for Conservation of Nature and Natural Resources (IUCN) (Jain *et al.,* 2003). In India, Government of India has prohibited the collection of plants growing in wild in forests and its export since 1969. For the fulfilment of the present and future demand, this plant needs to be cultivated scientifically at a commercial scale.

Availability of good quality planting material is essential for commercial cultivation of Sarpagandha. Commercially, Sarpagandha is propagated by seeds. Irregular and low percentage of germination is the main obstacle in the seed propagation of Sarpagandha. The percentage of germination of seeds is quite variable, ranging from 10-60 per cent (Farooqui and Sreeramu, 2001). This is partly attributed to the adverse influence of the stony endocarp. Another serious factor is the absence of embryo, may be due to parthenocarpy or sterility. Irregular germination coupled with long germination period is also a major setback in seed propagation of Sarpagandha. To overcome the inhibitory effect of hard stony endocarp on dormancy, facilitate better germination and obtain higher quantity of quality planting materials, a nursery experiment has been conducted to study the effect of growing media and seed treatments on seed germination and seedling growth of Sarpagandha.

Materials and Methods

Experimental site

The experiment was carried out during 2017 and 2018 at All India Co-ordinated Research Project on Medicinal & Aromatic plants and Betelvine, Horticulture Research Station (HRS), Odisha University of Agriculture and Technology, Bhubaneswar.

The average annual rainfall of Bhubaneswar is 1552 mm (based on average of preceding 10 years). Most of the rainfall i.e. 85% is received from July to September. The average temperature varies from 14^0 C in winter to 40^0 C in summer and relative humidity varies between 49 or 90% from June to December.

Experimental details

The experiment was laid out in a Factorial Completely Randomized Design with 18 treatment combinations and 3 replications. The treatment combinations consists of 2 types of growing media (M_1: Garden soil + FYM + Sand @ 2:1:1 and M_2: Coco peat + Vermiculite + Perlite @2:1:1) and 9 seed treatments (C_1: GA_3 50 ppm, C_2: GA_3 100 ppm, C_3: GA_3 150 ppm, C_4: NaCl 1%, C_5: NaCl 2%, C_6: Acid scarification by conc. sulphuric acid, C_7:Hot water treatment, C_8: Pre-soaking in tap water, C_9: Control(without treatment).

Materials used

Collection of seeds

The ripened fruits of Sarpagandha were collected from mother block of AICRP on MAP and Betelvine, OUAT, Bhubaneswar. The fruits were pulped manually to extract the seeds. The extracted seeds were washed 2-3 times in clean water. The cleaned seeds are thoroughly dried and subjected to floating test

by immersing in water. The heavy seeds which sink in water were selected for the experiment.

Growing media

Two types of growing media such as garden soil + farm yard manure + sand @ 2:1:1 and coco peat + vermiculite + perlite @ 2:1:1 were prepared by mixing the individual components on volume basis as per the requirement. The mixture of growing media was filled with protray having 100 cavities. The protray filled with above growing media were kept inside the naturally ventilated poly house.

Preparation of plant bio-regulators and chemicals and methods of seed treatment

GA_3 50 ppm

In little amount of ethanol, 5 mg of GA_3 was dissolved. Then it was made upto 100 ml with distilled water. In this solution 600 seeds were soaked overnight (12 hour).

GA_3 100 ppm

Exactly 10 mg of GA_3 was dissolved in little amount of Ethanol and then it was made upto 100 ml with distilled water. In this solution 600 seeds were soaked overnight.

GA_3 150 ppm

In little amount of ethanol, 15 mg of GA_3 was dissolved and then it was made upto 100 ml with distilled water. In this solution 600 seeds were soaked overnight (12 hours).

Common salt (NaCl) 1%

The solution was prepared by dissolving 1 g of common salt in 100 ml of distilled water. In this solution, 600 seeds were soaked overnight.

Common salt (NaCl) 2%

This solution was made by dissolving 2 g of common salt in 100 ml of distilled water. In this solution, 600 seeds were soaked overnight.

Acid scarification in concentrated H_2SO_4

The seeds (600 numbers) were taken in a glass beaker. The concentrated H_2SO_4 of 36 N was poured in beaker till the entire surface area of seeds was touched by acid. Then it was slightly stirred with the help of glass rod. It was left as such for 1 minute. The seeds were subjected to 3-4 washes with fresh tap water immediately. Distilled water (100 ml) was poured into the beaker with scarified seeds and then allowed to soak overnight.

Hot water treatment

Exactly 600 numbers of seeds were taken in 250 ml glass beaker and sufficient amount of boiling water at 80 ºC was poured. The beaker with seed was left as such overnight.

Pre-soaking in tap water

The counted 600 seeds were taken in a beaker with sufficient amount of tap water and soaked it overnight.

Control

The seeds (600) were sown directly without subjecting to any treatments.

Seed sowing and after care

The seeds after treatment with different plant bio-regulators and chemicals were sown in protrays during May, 2017 and 2018 as per different treatment schedule. One portray has been used in each treatment accommodating 100 seed. Regular watering was done as per

the requirement. The prophylactic plant protection measures and weeding was taken during the course of investigation. Then, 20 seedlings of uniform growth were transplanted in the polythene bags of size 6"x4" filled with the aforementioned growing media after 50 days of sowing under each treatment in order to study the growth performance. The observation on germination was recorded from day of initiation up to 60 days of sowing. The data recorded on various characteristics of seed germination and seedling growth were subjected to Fisher's method of analysis of variance and interpretation of data was taken up as per Sukhatme and Amble (1995).

Results and Discussion

Seed germination

Seed propagation in Sarpagandha is commercially accepted by the farmers because of higher root yield with thick tap roots. But, seed dormancy and lack of viable embryo are the major obstacles in seed propagation of Sarpagandha. Dormancy is an endogenously controlled but environmentally imposed temporary suspension of growth independent of ambient environmental conditions. In Sarpagandha, seed dormancy may be imposed by hard seed coat and presence of high ABA level. There are several instances where different kinds of chemicals and growth regulators were applied exogenously to overcome these obstacles. In light of the available information, different treatments were tried to obtain improved seed germination.

The results presented in Table 1 revealed that germination was significantly influenced by the different seed treatments. The germination % was recorded from 15 DAS to 60 DAS and the maximum germination % at 60 DAS was observed with GA_3 @ 150 ppm (38.42 %) and the minimum (25.50 %) in control (without any treatment).The seed treated with GA_3 @ 150 ppm resulted 33.62% higher germination over control. The highest % of germination observed in GA_3 @ 150 ppm treatment might be due to efficient utilization of limited food reserve present in the seeds by early induction of α-amylase activity. Chetouani *et al.,* (2017) observed that *Thymus satureioides*. L seeds treated with 50 ppm GA_3 showed an increase of 27 % germination compared to the control (10%). *Lavendula dentate* seeds treated with gibberellic acid at 1000 ppm showed maximum germination of 67 % as compared to the control which did not exceed 1 percent. The present finding is in agreement with the results obtained by Bhuyar *et al.,* (2000), Ponkumar *et al.,* (2008), Hussain and Jha (2014), Anonymous (2017) and Phatak *et al.,* (2017) in Sarpagandha. The similar results were reported by Bhujbal (1975), Dhankhar and Kumar (1996) and Gholap *et al.,* (2000) in Aonla, Bhuse *et al.,* (2001) in Senna and Mithra and Ghosh (2004) in Ashwgandha. However, Paul, *et al.,* (2008) reported that none of the chemical or acid seed treatments improved germination % significantly in Sarpagandha.

The results of the studies revealed that germination was significantly influenced by the different growing media. The Sarpagandha seeds sown in garden soil + FYM + sand (2:1:1) recorded maximum germination (34.52 %) and the minimum (30.90 %) was noticed with coco peat + vermiculite + perlite (2:1:1). The interaction effect of growing media and seed treatments revealed that the maximum germination (39.00 %) was observed when seeds treated with GA_3 @ 150 ppm and sown in garden soil + FYM + sand (2:1:1) and the minimum (21.67 %) was noticed in seeds sown in coco peat + vermiculite + perlite (2:1:1) without any treatment. The higher germination of Sarpagandha seeds treated with GA_3 @ 150 ppm and sown in garden soil + FYM + sand @ 2:1:1 reflected the fact that

these combination might have provided favourable physical conditions needed for activating enzymatic and biochemical processes. The endogenous GA_3 present in the embryo might be at low concentration and therefore exogenous application of GA_3 through soaking of seeds in combination with garden soil + FYM + sand @ 2:1:1 might have enhanced the process of germination and given higher germination. Warakagoda and Subasinghe (2015) reported that dipping the seeds in 2250 mg/1 GA_3 solution for 24 hours reduce the time taken for germination by removing inhibitory chemicals, facilitating embryo growth and reducing inherent ABA/GA_3 ratio. The present finding agrees well to the results obtained by Bharti *et al.,* (2009), Bisla *et al.,* (1984) and Awasthi *et al.,* (1996) who reported higher and early germination in Aonla, Ber and Peach, respectively.

Seedling growth and survival percentage

The results showed that most of the vegetative growth parameters were significantly influenced by different seed treatment chemicals and growth regulators (Table 1 and 2). The treatment of seeds with GA_3 150 ppm has recorded maximum growth in respect of shoot length (17.08 cm), seedling diameter (2.73 cm) and root diameter (2.76 cm) among all the treatments.

The maximum values in respect of number of leaves/seedling (6.15), leaf length (8.62 cm) and leaf area (30.80 sq. cm) were obtained with seeds treated by GA_3 @ 150 ppm. The minimum value in respect of the above parameters was recorded in control (seeds without treatment). GA_3 at 150 ppm played a major role in plant growth. The external application of GA_3 at higher concentration might have boosted the growth by increasing cell multiplication and cell enlargement ultimately resulting into higher plant growth. The rapid and early germination might have also resulted in giving more periods for vegetative growth of plants. The seed germinated earlier might have produced vigorous growth during later period. The increase in shoot and root length by pre sowing treatment of GA_3 is due to uniform germination, intensify hydrolytic process, better uptake of nutrients and moisture. The beneficial effect of GA_3 on vegetative growth of seedling has been reported by Ponkumar *et al.,* (2008) in Sarpagandha. The reports of Bhujbal (1975) and Gholap *et al.,* (2000) as regards the seedling height, root growth and number of leaves in Aonla confirm the above findings. Palaniswamy and Ramamoorthy (1987) in Papaya and Yelure (1992) in custard apple reported increase in growth of seedlings due to application of GA_3 solution. Prakash *et al.,* (2017) reported higher seedling vigour by the application of GA_3 in Spinach. Wagh *et al.,* (1998) reported that seed treatment with GA_3 400 ppm solution prior to sowing was found helpful for increasing root growth in Aonla.

All the pre-sowing treatments of seeds with growth regulators and chemicals exhibited increased fresh and dry weight of shoot and root over the control. Seed treatment with GA_3 at 150 ppm recorded significantly higher fresh weight of shoot 9.71 g), fresh weight of root (4.36 g), dry weight of shoot (1.94 g) and dry weight of root (1.74 g) as compared to untreated seeds. In the present experiment, GA_3 at 150 ppm was playing a crucial role in increasing the physiological efficiency. The external application of GA_3 at higher concentration might have boosted the growth by increasing cell multiplication and cell enlargement ultimately resulting into higher plant growth and physiological efficiency. These results are in agreement with the observations made by Prakash *et al.,* (2017) in Spinach and Randhawa and Negi (1964) in Grapes.

Table.1 Effect of growing media and seed treatment on seed germination and Seedling growth of Sarpagandha

Treatment	Germination percentage (%) at 60 DAS	Seedling diameter (mm)	Root diameter (mm)	Number of leaves per seedling	Leaf length (cm)	Leaf width (cm)	Leaf area (cm^2)
Growing media							
M_1	34.52(35.94)	2.56	2.50	5.93	8.25	3.39	28.05
M_2	30.90(33.69)	2.54	2.48	4.93	7.06	2.94	21.17
SE(m)±	**0.271**	**0.006**	**0.006**	**0.089**	**0.122**	**0.063**	**0.462**
C.D. at 5%	**0.781**	**0.016**	**0.018**	**0.256**	**0.35**	**0.182**	**1.326**
Seed treatment							
C_1	33.67(35.43)	2.59	2.55	5.53	7.77	3.23	25.50
C_2	37.50(37.74)	2.67	2.59	5.95	8.35	3.40	28.77
C_3	38.42(38.28)	2.73	2.76	6.15	8.62	3.52	30.80
C_4	32.58(34.87)	2.52	2.46	5.43	7.62	3.12	24.07
C_5	36.17(36.93)	2.6	2.51	5.65	7.75	3.20	25.20
C_6	30.83(33.66)	2.5	2.43	5.2	7.33	3.01	22.27
C_7	30.67(33.58)	2.49	2.42	5.23	7.55	3.08	23.57
C_8	29.08(32.59)	2.44	2.35	4.93	7.01	2.98	21.00
C_9	25.50(30.24)	2.41	2.32	4.80	6.88	2.93	20.33
SE(m)±	**0.180**	**0.012**	**0.013**	**0.189**	**0.259**	**0.134**	**0.98**
C.D. at 5%	**0.520**	**0.035**	**0.038**	**0.543**	**0.743**	**NS**	**2.813**
Interaction (Growing media × Seed treatment)							
M_1C_1	36.17(36.95)	2.58	2.60	6.13	8.53	3.47	29.63
M_1C_2	37.50(37.74)	2.68	2.61	6.37	8.63	3.50	30.20
M_1C_3	39.00(38.63)	2.75	2.82	6.50	8.70	3.57	31.27
M_1C_4	35.17(36.35)	2.53	2.47	6.00	8.43	3.41	28.73
M_1C_5	35.67(36.62)	2.64	2.52	6.23	8.47	3.43	29.17
M_1C_6	34.50(35.94)	2.49	2.38	5.53	7.97	3.30	26.23
M_1C_7	31.50(34.11)	2.51	2.43	5.87	8.37	3.40	28.47
M_1C_8	31.83(34.33)	2.45	2.36	5.47	7.67	3.27	24.87
M_1C_9	29.33(32.77)	2.42	2.33	5.27	7.47	3.20	23.9
M_2C_1	31.17(33.92)	2.61	2.51	4.93	7.00	3.00	21.37
M_2C_2	37.50(37.74)	2.67	2.57	5.53	8.07	3.29	27.33
M_2C_3	37.83(37.94)	2.71	2.7	5.8	8.53	3.48	30.33
M_2C_4	30.00(33.40)	2.52	2.46	4.87	6.80	2.83	19.40
M_2C_5	36.67(37.24)	2.56	2.51	5.07	7.03	2.97	21.23
M_2C_6	27.17(31.38)	2.51	2.48	4.87	6.70	2.72	18.3
M_2C_7	29.83(33.06)	2.47	2.42	4.60	6.74	2.77	18.67
M_2C_8	26.33(30.85)	2.44	2.34	4.40	6.35	2.70	17.13
M_2C_9	21.67(27.71)	2.41	2.31	4.33	6.29	2.67	16.77
SE(m)±	**0.298**	**0.017**	**0.019**	**0.268**	**0.366**	**0.189**	**1.387**
C.D. at 5%	**0.863**	**NS**	**0.054**	**NS**	**NS**	**NS**	**NS**

(M_1: Garden soil + FYM + Sand, M_2: Cocopeat + Vermiculite + Perlite, C_1: GA_3 @ 50 ppm, C_2: GA_3 @ 100 ppm, C_3: GA_3 @ 150 ppm, C_4: NaCl @ 1%, C_5: NaCl @ 2%, C_6: Sulphuric acid scarification, C_7: Hot water treatment, C_8: Pre-soaking in tap water, C_9: Control (without treatment)

Table.2 Effect of growing media and seed treatment on shoot and root biomass production and survival percentage of Sarpagandha

Treatment	Fresh weight of shoot (g)	Dry weight of shoot (g)	Fresh weight of root (g)	Dry weight of root (g)	Survival percentage of seedling
Growing media					
M_1	8.83	1.77	3.62	1.45	82.89(65.70)
M_2	7.77	1.55	3.57	1.43	81.02(64.31)
SE(m)±	**0.004**	**0.001**	**0.004**	**0.001**	**0.123**
C.D. at 5%	**0.011**	**0.002**	**0.011**	**0.004**	**0.354**
Seed treatment					
C_1	8.86	1.77	3.91	1.56	84.29(66.66)
C_2	9.09	1.82	4.15	1.66	84.27(66.63)
C_3	9.71	1.94	4.36	1.74	87.32(69.15)
C_4	8.28	1.66	3.77	1.51	83.77(66.22)
C_5	8.52	1.71	3.80	1.52	85.09(67.28)
C_6	7.87	1.58	3.44	1.37	83.23(65.82)
C_7	8.05	1.61	3.24	1.29	82.27(65.09)
C_8	7.36	1.47	2.90	1.16	74.55(59.69)
C_9	6.94	1.39	2.82	1.13	72.75(58.53)
SE(m)±	**0.008**	**0.002**	**0.008**	**0.003**	**0.262**
C.D. at 5%	**0.024**	**0.005**	**0.023**	**0.009**	**0.751**
Interaction (Growing media × Seed treatment)					
M_1C_1	9.31	1.86	3.92	1.57	84.85(67.07)
M_1C_2	9.50	1.90	4.16	1.66	85.12(67.30)
M_1C_3	10.53	2.11	4.43	1.77	88.37(70.06)
M_1C_4	8.85	1.77	3.78	1.51	84.33(66.66)
M_1C_5	9.13	1.83	3.81	1.52	85.81(67.85)
M_1C_6	8.47	1.69	3.45	1.38	84.04(66.44)
M_1C_7	8.60	1.72	3.27	1.31	83.42(65.95)
M_1C_8	7.85	1.57	2.98	1.19	75.42(60.26)
M_1C_9	7.24	1.45	2.82	1.13	74.63(59.74)
M_2C_1	8.41	1.68	3.89	1.56	83.75(66.24)
M_2C_2	8.69	1.74	4.13	1.65	83.42(65.96)
M_2C_3	8.90	1.78	4.29	1.72	86.27(68.24)
M_2C_4	7.71	1.54	3.75	1.50	83.21(65.79)
M_2C_5	7.92	1.58	3.79	1.52	84.38(66.72)
M_2C_6	7.28	1.46	3.42	1.37	82.43(65.20)
M_2C_7	7.50	1.50	3.21	1.28	81.12(64.23)
M_2C_8	6.87	1.37	2.82	1.13	73.69(59.12)
M_2C_9	6.65	1.33	2.81	1.12	70.87(57.32)
SE(m)±	**0.012**	**0.002**	**0.011**	**0.004**	**0.370**
C.D. at 5%	**0.034**	**0.007**	**0.032**	**0.013**	**1.062**

(M_1: Garden soil + FYM + Sand, M_2: Cocopeat + Vermiculite + Perlite, C_1: GA_3 @ 50 ppm, C_2: GA_3 @ 100 ppm, C_3: GA_3 @ 150 ppm, C_4: NaCl @ 1%, C_5: NaCl @ 2%, C_6: Sulphuric acid scarification, C_7: Hot water treatment, C_8: Pre-soaking in tap water, C_9: Control (without treatment)

Table.3 Economics of production of Sarpagandha seedling under different combinations of growing media and seed treatments

Treatment	Treatment wise total seedlings produced	Cost of production of seedling (Rs)	Gross return (Rs)	Net return (Rs)	B: C ratio
M_1C_1	30.69	53	92.07	39.07	1.74
M_1C_2	31.92	54	95.76	41.76	1.77
M_1C_3	34.46	56	103.38	47.38	1.85
M_1C_4	29.66	50	88.98	38.98	1.78
M_1C_5	30.61	52	91.83	39.83	1.77
M_1C_6	28.99	50	86.97	36.97	1.74
M_1C_7	26.28	44	78.84	34.84	1.79
M_1C_8	24.01	42	72.03	30.03	1.72
M_1C_9	21.89	38	65.67	27.67	1.73
M_2C_1	26.10	63	78.30	15.30	1.24
M_2C_2	31.28	64	93.84	29.84	1.47
M_2C_3	32.64	66	97.92	31.92	1.48
M_2C_4	24.96	60	74.88	14.88	1.25
M_2C_5	30.94	62	92.82	30.82	1.50
M_2C_6	22.40	60	67.20	7.20	1.12
M_2C_7	24.20	54	72.60	18.60	1.34
M_2C_8	19.40	47	58.20	11.20	1.24
M_2C_9	15.36	43	46.08	3.08	1.07

Sale price: Rs. 3/- per seedling

(M_1: Garden soil + FYM + Sand, M_2: Cocopeat + Vermiculite + Perlite, C_1: GA_3 @ 50 ppm, C_2: GA_3 @ 100 ppm, C_3: GA_3 @ 150 ppm, C_4: NaCl @ 1%, C_5: NaCl @ 2%, C_6: Sulphuric acid scarification, C_7: Hot water treatment, C_8: Pre-soaking in tap water, C_9: Control (without treatment)

The survival percentage of Sarpagandha seedlings were significantly influenced by different seed treatments. The maximum survival percentage of seedlings was recorded with GA_3 @ 150 ppm (87.32) and the minimum (72.75) was noticed in control (without any treatment). This might be due to rapid and early germination which resulted in giving more periods for vegetative growth for better establishment of plants. Sharma *et al.*, (2000) reported that among the growth hormonal treatments, GA_3 100 ppm was found to be the best in terms of germination enhancement, seedling growth and survival % when compared to all other treatments. The results of the study indicated that vegetative growth of seedling, fresh and dry weight of shoot and root and survival % of seedlings were found significantly maximum in growing media garden soil + FYM + sand @ 2:1:1 as compared to coco peat + vermiculite + perlite (2:1:1). The fresh and dry weight of shoot and root and survival percentage of Sarpagandha seedlings was influenced by the interaction effect of media and seed treatments. The fresh and dry weight of shoot and root and % survival of seedlings were observed maximum when seeds treated with GA_3 @ 150 ppm and sown in garden soil + FYM + sand (2:1:1) and the minimum was noticed in seeds sown in coco peat + vermiculite + perlite (2:1:1) without any treatment. This might be due to the favourable effect of proper combination of media having suitable pH, nutritional status and physical

environment facilitate better growth and survival of Sarpagandha seedlings.

Parasana *et al.,* (2013) reported that the growing media soil + sand + FYM (2: 1: 1) was found to be the most effective for better growth of mango seedling and fresh and dry weight of seedlings as well as survival per cent of seedlings. Lopes *et al.,* (2007) reported that the rooting media soil + sand (1:1) has the best one for higher dry weight of roots and shoots compared to other treatments for all the observations.

Economics of raising seedlings

The economics of different treatment combinations were worked out taking into account the total seedlings produced, market price of inputs and sale price of seedlings (Table 3).

The seeds sown in coco peat + vermiculite + perlite @ 2:1:1 pre-treated with GA_3 @ 150 ppm showed the maximum cost of production (Rs.66/-). Whereas, the seeds sown in garden soil + FYM + sand @2:1:1 pre-treated with GA_3 @ 150 ppm exhibited maximum gross return (Rs.103.38), net return (Rs.47.38/-) with higher B: C of 1.85. This is due to the fact that the media garden soil + FYM + sand @2:1:1 is comparatively cheaper and production of higher successful seedlings.

The results of the study indicated that among the different seed treatments and media tested, Sarpagandha seeds treated with GA_3 @ 150 ppm and sown in garden soil + FYM + sand @2:1:1 resulted higher germination, higher seedling growth and survival % with highest net return and benefit cost ratio.

Acknowledgement

The authors are thankful to the Project Co-ordinator, AICRP on MAP and Betelvine and Director, DMAPR, Anand, Gujarat for providing fund, facilities and cooperation during the period of investigation.

References

Anonymous. 2017. Annual report, ICAR-Directorate of Medicinal and Aromatic Plants Research, Boriavi, Anand-387310, Gujurat, India, pp.73.

Awasthi, R.P., Godara, R. K. and Kaith, N.S. 1996. Interaction effect of VAM mycorrhizae and Azotobacter inoculation on Peach seedlings, *Indian J. of Hort.,* 53 (1): 813.

Bharti, M, Narayan, S. and Kumar, R. 2009. Effect of growing media on seed germination, rate of seed germination, transplanting success and seedling mortality in Aonla (*Embelica officinalis*, Garten.), *J. of Interacademicia*, 13 (4):408-411.

Bhujbal, B.G. 1975. Improvement in seed propagation of Aonla (*Phyllanthus emblica* L.), *Res. J. of Mahatma Phule Agri. Univ*., 6(1): 73-75.

Bhuyar, S. A., Wankhade, S. G., Paturde, J. T. and Khode, P.P. 2000. Seed germination studies in Sarpagandha (*Rauvolfia serpentina* Benth.), *Research on crops*, 1(2): 189-197.

Bisla, S.S., Singhro, R.S. and Chauhan, K.S.1984. Effect of growing media and urea application on seed germination and growth of Ber (*Zizyphyus mauritiana* Lamk.), *Haryana J. of Hort. Sci*., 13 (3):118-122.

Chetouani, M., Mzabri, I., Aamar, A., Boukroute, A., Kouddane, N. and Berrichi, A. 2017. Effect of gibberellic acid (GA_3) on the germination of seeds of *Thymus satureioides* L and *Lavandula dentate*, *J. Mater. Environ. Sci*., 8(3): 942-948.

Dhankhar, D.S. and Kumar, S.1996. Effect of bioregulators on seed germination and seedling growth in Aonla cv. Anand-2, *Recent Hort*., 3(l):45-48.

Farooqi, A.A. and Sreeramu, B.S.2001. Cultivation of medicinal and aromatic crops, *Universities press (India) Limited*: 234-241.

Gholap, S.V., Dod, V.N., Bhuyar, S.A. and Bharad, S.G.2000. Effect of plant growth regulators on seed germination and seedling growth in Aonla (*Phyllathus emblica* L.) under climatic condition of Akola, *Crop Res*., 20 (3): 546-548.

Hussain, A. and Jha, D.K. 2014. Seed germination improvement in two threatened medicinal plants, *Curr. Agric. Res. J*., 2(2): 131-136.

Jain, V., Singh, D. and Saraf, S. 2003. In-vitro micropropagation of *Rauvolfia serpentina* through multiple shoot generation, *Ancient Science of Life*, 23(1): 1-5.

Lopes, J.C., Bono, G.M., Alexandre, R.S. and Maia, V.M. 2007. Germination and vigour of passion fruit seeds in different stages of fruit maturation, substrate and presence of the aril, *Ciencia-e-Agrotcnologia*, 31 (5): 1347-1350.

Mithra, M. and Ghosh, P. 2004. Effect of chemicals and soaking duration on seed germination of Aswagandha (*Withania somnifera*). *Journal of Interacademicia*, 8(2): 302-304.

Palanisamy, V. and Ramamoorthy, K. 1987. Seed germination studies in Papaya, *Progressive Horticulture*, 19(3-4): 253-255.

Parasana, J.S., Leua, H.N. and Ray, N.R. 2013. Effect of different growing media mixture on germination and seedling growth of Mango cultivars under net house conditions, *The Bioscan*, 8 (3): 897-900.

Paul, D., Paul, N.K. and Basu, P.K. 2008. Seed germination response of *Rauvolfia serpentina* Benth. to certain physical and chemical treatments, *J. Bio-sci*., 16: 129-131.

Phatak R.S., Hegde, N.K., Gangadharappa and Hegde, L. 2017. Effect of seed treatment on germination in Sarpagandha (*Rouvolfia serpentina* Benth). *Int. J. Curr. Microbiol. App. Sci*., 6(12): 135-140.

Ponkumar, P., Padma, M., Kumar, M.R. and Madulety, T.Y. 2008. Effect of chemicals and plant growth substances on breaking of seed dormancy in Sarpagandha (*Rauvolfia serpentina* (Linn.) Benth. ex Kurz)., *Journal of Research ANGRAU*, 36:54-56.

Prakash, P., Singh, P., Singh, K.A.P., Singh, V., Singh, R., Vimal, S.C. and Sharma, K. 2017. Effect of plant growth regulators on partially aged seeds of Spinach (*Spinacea oleracea* L.) Genotypes, *Int. J. Microbial. App. Sci*., 6(11): 1327-1334.

Randhawa, G.S. and Negi, S.S.1964. Preliminary studies on seed germination and subsequent seedling growth in Grapes. *Indian J. Hort*., 21:184-196.

Sharma, S.N., Puri, S.C., Srivastava, G.H. and Kaul, B.L. 2000. Enhancement of seed germination in *Nothapodytes foetida*, *J. Med. Arom. Pl. Sci*., 22: 206-210.

Sukhatme, P.V. and Amble, V.N. 1995. Statistical methods for agricultural workers, ICAR, New Delhi.

Wagh, A.P., Choudhari, M.H., Kulwal, L. W., Jadhav, B.J. and Joshi, P.S. 1998. Effect of seed treatment on germination of seed and initial growth of Aonla seedling in polybag, *PKV Res. J.*, 22(2): 176-177.

Warakagoda, P.S. and Subasinghe, S. 2015. Studies on seed germination of *Coscinium fenestratum* (Menispernaceae): A threatened medicinal plant, *International Journal of Minor Fruits, Medicinal and Aromatic Plants*, 1(1): 37-46.

Yelure, V.G. 1992. Studies on seed germination and growth of some dry land fruits as influenced by seed treatments, *M. Sc. (Agri.) Thesis submitted to Dr. Punjabrao Deshmukh Krishi Vidyapeeth*, Akola.

How to cite this article:

Swain, S.C. and Malik, D. 2018. Effect of Growing Media and Seed Treatment on Seed Germination, Seedling Growth, Survival Percentage and Profitability of Seedling Production of Sarpagandha (*Rauvolfia serpentina* (L), Benth. ex kurz). *Int.J.Curr.Microbiol.App.Sci.* 7(11): 289-298. doi: https://doi.org/10.20546/ijcmas.2018.711.035