RESEARCH ARTICLE

EFFECT OF GROWING MEDIA AND FIELD CONDITIONS ON NURSERY GROWTH PARAMETERS OF *ASPARAGUS RACEMOSUS* WILLD. UNDER MID HILL CONDITIONS

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Abstract: As a first step towards cultivation under mid hill conditions, seed germination study comparing different soil media under two field conditions especially to standardize nursery growth parameters was taken up.The study revealed Soil + Cocopeat + Vermicompost (1:1:1) mediaunder protected condition as the best media. As vermicompost production is quite costly than easily available FYM in the country, one can have the almost similar result by switching vermicompost with FYM in the media mixture. Maximum emergence percentage, shoot length and root length recorded was 27.83 %, 22.55 cmand 12.20 cm, respectively under mid hill conditions with 312.91%, 141.18% and 72.32% increase over control.

Keywords: *Asparagusracemosus*, Emergence percent, Root length, Shoot length

INTRODUCTION

*Asparagus racemosus*isa well known medicinal plant of tropical region with high volume trade (>100 MT/Year) (Anonymous, 2015a). It is commonly known as Shatavari, Satawar or Satmuli (Lawrence, 1960) and many more as per the different regions of the country.It is also one of the 32 prioritized medicinal plant for cultivation listed by NMPB (National Medicinal Plant Board). Root is the main economical part of the plant (Anonymous, 1948). Its demand is increasing approximately @15% annually (Anonymous, 2015b). The reasons for this increase are many from being a galatogauge, tonic, diuretic, aphrodisiac etc. to increasing awareness about its phytoestrogenic properties due to ill effect of synthetic oestrogen (Ashajyothi et al. 2009; Saxena et al. 2010; Kirtikar and Basu1918; Wani et al. 2011). In Ayurveda, it is regarded as rasayana(Goyal et al., 2003; Bopana and Saxena, 2007) and is also used for many Ayurvedic preparation likeShatawarighrita, Shatmulyadiloh, Shatawaripanak, Narayan tail, Vishnu tail, Muslipak, Shatavarikalpa, Phalaghrita, Brahma Rasayana etc. (Sharma, 1998; Kumar and Abbas, 2012)besides MENTAT which is given for nervous disorder (Anonymous, 2000).

To meet the annually increasing demand (approx. @ 15%) (Anonymous, 2015b) and to ease the pressure on areas already under cultivation e.g. Haryana, UP, MP, Rajasthan, Maharashtra etc., new areas having potential for cultivation should be considered with a view to bring more areas under its cultivation. Experience has showed that its plants also do well under sub temperate climatic regions prevalent in mid-hill Himalayas. Therefore mid hills of Himachal Pradesh are one such potential region where its cultivation can be taken up to meet the constant rising demand. So as a first step of cultivation, the present study was conducted to evaluate the effect of growing media and field conditions on nursery growth of *Asparagus racemosus*Willd. under mid hill conditions of Himachal Pradesh.

MATERIALS AND METHODS

For mid hill conditions, experimental farm of department of Forest Products, College of Forestry, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.) was selected as the area falls under mid hill zone of Himachal Pradesh. The experiment was conducted during four consecutive years to evaluate the comparative efficiency of seven soil media viz. Site Soil, Soil + FYM (2:1), Soil + Vermicompost (2:1), Soil + Cocopeat (2:1), Soil + Sand + FYM (1:1:1), Soil + Cocopeat + FYM (1:1:1) and Soil + Cocopeat + Vermicompost (1:1:1) in two field conditions (open and protected conditions). Observations were recorded on emergence percentage, root length (cm) and shoot length (cm).

RESULTS

Emergence percentage: Among different growing media maximum emergence percentage was recorded

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in Soil + Cocopeat + Vermicompost (1:1:1) in all four years i.e. 27.00%, 26.67 %, 28.00%, 29.67% respectively which is significantly higher except in 2nd year, the result of Soil + Cocopeat + Vermicompost (1:1:1) is at par with Soil + Cocopeat + FYM (1:1:1)i.e. 25% emergence percent (Table 1). Same trend as of 2nd year was also observed in pooled analysis i.e.maximum emergence percent in Soil + Cocopeat + Vermicompost (1:1:1) (27.83%) with at par with Soil + Cocopeat + FYM (1:1:1) (26.25%) with non significantinteraction. In protected conditions maximum emergence percent was observed i.e. 23.33% compared to the open conditions (14.57%) in all four years and same trend was observed in pooled analysis i.e. 23.02 % and 15.57 respectively.

Shoot length (cm): After emergence percent, same trend was observed in shoot length i.e. maximum shoot length was recorded inSoil + Cocopeat + Vermicompost (1:1:1) in all four years (17.98 cm, 18.73 cm, 19.55 cm, 19.20 cm, respectively) which is significantly higher than other growing medias except in the 3rd year where maximum shoot length was at par with the shoot length from the media consisting of Soil + Cocopeat + FYM (1:1:1) (19.27 cm) (Table 2).Maximum shoot length (17.21 cm, 16.98 cm, 19.12 cm, 18.02 cm, respectively) was observed in protected conditions in all the four years compared to the open condition (10.80 cm, 11.51 cm, 12.41 cm, 12.85 cm). Interaction was also significant showing maximum shoot length in Soil + Cocopeat + Vermicompost (1:1:1) media under protected condition which is at par in 1st (22.67 cm) and 4th (22.0 cm) year while significantly higher in 2nd year (22.57 cm). In 3rd year Soil + Cocopeat + FYM (1:1:1) media gave maximum value of shoot length (23.47 cm) but at par with the Soil + Cocopeat + Vermicompost (1:1:1) (22.978 cm) under protected condition concluding the same result. The Pooled analysis also represented the same trend i.e. maximum shoot length in Soil + Cocopeat + Vermicompost (1:1:1) (18.87 cm) under protected condition (17.83 cm) with significant interaction of these two (22.55 cm).

Root length (cm): In 1st year and 4th year, maximum root length (10.22 cm and 11.60 cm, respectively) with significant difference was observed in Soil + Cocopeat + Vermicompost (1:1:1) media, however, in 2ndand3rdyear same media gave the maximum root length (10.33 cm and 11.23 cm, respectively) but was at par with Soil + Cocopeat + FYM (1:1:1) media (10.13 cm, 11.12 cm, respectively) (Table 3). In interaction effect maximum root length (11.50 cm) was observed in Soil + Cocopeat + Vermicompost (1:1:1) under protected condition which was statistically at par with Soil + Cocopeat + FYM (1:1:1) under protected condition(11.10 cm). Same trend was observed in 2nd and 3rd year with non significant interaction in 4th year.In pooled analysis, maximum root length (10.84 cm) was observed in Soil + Cocopeat + Vermicompost (1:1:1) which was statistically at par with Soil + Cocopeat + FYM (1:1:1) (10.50 cm) among different growing media and among two field conditions, maximum root length (10.46 cm) was observed in protected conditionthan open condition (8.17 cm). In interaction effect maximum root length (12.20 cm) was observed in Soil + Cocopeat + Vermicompost (1:1:1) under protected conditionwhich was statistically at par with Soil + Cocopeat + FYM (1:1:1) under protected condition(11.83 cm).

DISCUSSION

Seed germination is first step towards the cultivation. Media plays a very important role in seed germination as well as growth of the plant. A perfect media should have all the nutrients especially the essential one in available form and in adequate amount. Besides nutrients, physical properties or condition viz. soil structure, porosity, drainage etc. of the media should be good. As most soils lack these qualities, therefore different kind of organic matters (especially in case of medicinal plants)viz. FYM, vermicompost, cocopeat etc. are added to the soil to make it perfect as near as possible to provide the best growth and development condition to the plant. Plant grown in organic conditions does not have residual accumulation of harmful chemical pesticides/ insecticides which is mandatory or necessary in case of medicinal plants. These additions helps in boosting yield resulting in commercial success of any cultivation.But it should be cheap and locally available.

In the present studies, it was observed that Soil + Cocopeat + Vermicompost (1:1:1) gave maximum emergence (31.67), shoot length (22.55 cm) and root length (12.20 cm) under protected condition. There is 312.91%, 141.18% and 72.32% increase over control in emergence percent, shoot length and root length.This may be due to the fact that vermicompost has many available plant nutrients, growth enhancing substances and number of beneficial micro-organisms like nitrogen fixing, phosphorus solubilizing and cellulose decomposing organisms (Sultan, 1997). In addition to this, cocopeat has high water holding capacity, thus making sure the availability of enough moisture which favoursbetter seed germination.Vermicompost and cocopeat also adds lots of organic matter to the soil or media. Due to innumerable properties of these two, they improve the soil properties leading to better germination and growth. Present study also reveals that the results of Soil + Cocopeat + Vermicompost (1:1:1) are at par with the Soil + Cocopeat + FYM (1:1:1), so one can have almost similar result or output by switching vermicompost with FYM in the media mixture as vermicompost is quite expensive than the easily available FYM in the country, making it cost effective. The higher values of the germination and

growth parameters under protected conditions may be due to the fact that controlled conditions are provided in protected conditions which enhance the effect of moisture and light intensity and facilitates early seed germination and growth. Another reason can be due to the fact that it is a plant of tropical region and under mid hill conditions, protected conditions provide near to the similar environment to that of tropical region. It also protects them from low temperature, frost and other extreme conditions. Present findings are in line with those of Nautiyal and Chauhan (2007) in *Nardostachysjatamansi* where they have reported poor seed germination under field conditions compared to that under polyhouse conditions. Similar results were also reported by Nautiyalet al. (2001) in *Picrorhizakurrooa*and Vashisthaet al. (2009) in *Angelica archangelica.*

Table 1. Effect of different growing media and field conditions on emergence percentage of *A. racemosus*

Emergence percentage															
Field conditions	**1st year**			**2nd year**			**3rd year**			**4th year**			**Pooled**		
Growing Media	**Protected**	**Open**	**Mean**	**Protected**	**Open**	**Mean**	**Protected**	**Open**	**Mean**	**Protected**	**Open**	**Mean**	**Protected**	**Open**	**Mean**
Site Soil	15.33 (23.04)	6.00 (14.18)	10.67 (18.61)	12.00 (20.27)	6.00 (14.18)	9.00 (17.22)	15.33 (23.04)	9.33 (17.77)	12.33 (20.40)	13.33 (21.37)	9.33 (17.77)	11.33 (19.57)	14.00 (21.93)	7.67 (15.97)	10.83 (18.95)
Soil+FYM (2:1)	20.67 (27.03)	12.00 (20.27)	16.33 (23.65)	16.67 (24.09)	10.00 (18.43)	13.33 (21.26)	20.00 (26.57)	13.33 (21.40)	16.67 (23.98)	22.67 (28.36)	14.67 (22.51)	18.67 (25.43)	20.00 (26.51)	12.50 (20.65)	16.25 (23.58)
Soil+Vermicompost (2:1)	23.33 (28.88)	14.67 (22.51)	19.00 (25.69)	20.67 (27.03)	13.33 (21.40)	17.00 (24.22)	23.33 (28.87)	16.67 (24.09)	20.00 (26.48)	23.33 (28.78)	15.33 (23.04)	19.33 (25.91)	22.67 (28.39)	15.00 (22.76)	18.83 (25.58)
Soil+Cocopeat (2:1)	18.00 (25.10)	9.33 (17.77)	13.67 (21.44)	12.67 (20.84)	6.67 (14.93)	9.67 (17.88)	16.67 (24.09)	10.00 (18.38)	13.33 (21.23)	18.00 (25.04)	10.00 (18.43)	14.00 (21.74)	16.33 (23.77)	9.00 (17.38)	12.67 (20.57)
Soil+Sand+FYM (1:1:1)	26.00 (30.66)	17.33 (24.60)	21.67 (27.63)	24.00 (29.32)	17.33 (24.57)	20.67 (26.95)	26.67 (31.09)	20.00 (26.57)	23.33 (28.83)	28.00 (31.89)	20.00 (26.51)	24.00 (29.20)	26.17 (30.74)	18.67 (25.56)	22.42 (28.15)
Soil+Cocopeat+FYM (1:1:1)	28.67 (32.37)	20.00 (26.57)	24.33 (29.47)	29.33 (32.78)	20.67 (27.00)	25.00 (29.89)	30.67 (33.62)	23.33 (28.85)	27.00 (31.23)	32.67 (34.84)	24.67 (29.72)	28.67 (32.28)	30.33 (33.40)	22.17 (28.03)	26.25 (30.72)
Soil+Cocopeat+Vermicompost (1:1:1)	31.33 (34.04)	22.67 (28.37)	27.00 (31.20)	30.67 (33.62)	22.67 (28.37)	26.67 (30.99)	31.33 (34.04)	24.67 (29.72)	28.00 (31.88)	33.33 (35.25)	26.00 (30.61)	29.67 (32.93)	31.67 (34.23)	24.00 (29.27)	27.83 (31.75)
Mean	23.33 (28.73)	14.57 (22.04)	18.95 (25.38)	20.86 (26.85)	13.81 (21.27)	17.33 (24.06)	23.43 (28.76)	16.76 (23.83)	20.10 (26.69)	24.48 (29.36)	17.14 (24.09)	20.81 (26.72)	23.02 (28.43)	15.57 (22.80)	
		CD			CD			CD			CD			CD	
Field conditions		0.66			0.89			0.88			1.11			0.87	
Growing media		1.24			1.67			1.64			2.08			1.62	
Field conditions*Growing media		NS			NS			NS			2.48			NS	
Year														1.23	
Year*Field conditions														NS	
Year*Growing media														NS	
Year*Field conditions*Growing media														NS	

Table 2. Effect of different growing media and field conditions shoot length of *A. racemosus*

Shoot length (cm)															
Field Conditions	**1st year**			**2nd year**			**3rd year**			**4th year**			**Pooled**		
Growing Media	**Protected**	**Open**	**Mean**	**Protected**	**Open**	**Mean**	**Protected**	**Open**	**Mean**	**Protected**	**Open**	**Mean**	**Protected**	**Open**	**Mean**
Site Soil	12.13	9.07	10.60	11.30	9.17	10.23	13.60	9.00	11.30	14.13	10.17	12.15	12.79	9.35	11.07
Soil+FYM (2:1)	16.27	10.20	13.23	15.17	10.60	12.88	17.83	10.63	14.23	16.63	11.97	14.30	16.48	10.85	13.66
Soil+Vermicompost (2:1)	16.13	10.40	13.27	16.47	10.93	13.70	19.40	12.43	15.92	17.97	12.10	15.03	17.49	11.47	14.48
Soil+Cocopeat (2:1)	12.37	9.37	10.87	12.53	9.37	10.95	15.07	9.17	12.12	14.33	10.53	12.43	13.58	9.61	11.59
Soil+Sand+FYM (1:1:1)	19.33	11.03	15.18	19.77	12.20	15.98	21.53	14.47	18.00	19.87	13.53	16.70	20.13	12.81	16.47
Soil+Cocopeat+FYM (1:1:1)	21.57	12.27	16.92	21.07	13.43	17.25	23.47	15.07	19.27	21.23	15.23	18.23	21.83	14.00	17.92
Soil+Cocopeat+Vermicompost (1:1:1)	22.67	13.30	17.98	22.57	14.90	18.73	22.97	16.13	19.55	22.00	16.40	19.20	22.55	15.18	18.87
Mean	17.21	10.80	14.01	16.98	11.51	14.25	19.12	12.41	15.77	18.02	12.85	15.44	17.83	11.90	
		CD			CD			CD			CD			CD	
Field conditions		0.44			0.43			0.49			0.47			0.44	
Growing media		0.81			0.81			0.91			0.87			0.82	
Field conditions*Growing media		1.15			1.15			1.29			1.23			1.16	
Year														0.62	
Year*Field conditions														0.88	
Year*Growing media														NS	
Year*Field conditions*Growing media														NS	

Table 3. Effect of different growing media and field conditions on root length of *A. racemosus*

Root length (cm)															
Field conditions	**1st year**			**2nd year**			**3rd year**			**4th year**			**Pooled**		
Growing media	**Protected**	**Open**	**Mean**	**Protected**	**Open**	**Mean**	**Protected**	**Open**	**Mean**	**Protected**	**Open**	**Mean**	**Protected**	**Open**	**Mean**
Site Soil	8.03	7.00	7.52	7.73	7.13	7.43	9.43	7.70	8.57	9.63	6.50	8.07	8.71	7.08	7.90
Soil+FYM (2:1)	9.37	7.47	8.42	9.23	7.90	8.57	10.20	7.80	9.00	10.80	7.53	9.17	9.90	7.68	8.79
Soil+Vermicompost (2:1)	9.33	7.57	8.45	9.87	8.17	9.02	11.10	8.40	9.75	11.00	7.70	9.35	10.33	7.96	9.14
Soil+Cocopeat (2:1)	8.10	7.10	7.60	8.47	7.27	7.87	9.57	7.70	8.63	9.90	6.53	8.22	9.01	7.15	8.08
Soil+Sand+FYM (1:1:1)	10.40	8.10	9.25	10.57	8.93	9.75	12.13	8.97	10.55	11.80	8.53	10.17	11.23	8.63	9.93
Soil+Cocopeat+FYM (1:1:1)	11.10	8.50	9.80	11.00	9.27	10.13	12.60	9.63	11.12	12.63	9.27	10.95	11.83	9.17	10.50
Soil+Cocopeat+Vermicompost (1:1:1)	11.50	8.93	10.22	11.13	9.52	10.33	12.80	9.67	11.23	13.37	9.83	11.60	12.20	9.49	10.84
Mean	9.69	7.81	8.75	9.71	8.31	9.01	11.12	8.55	9.84	11.30	7.99	9.65	10.46	8.17	
			CD			CD			CD			CD			CD
Field conditions			0.16			0.17			0.21			0.28			0.20
Growing media			0.29			0.33			0.39			0.52			0.38
Field conditions*Growing media			0.42			0.46			0.55			NS			0.53
Year															0.28
Year*Field conditions															0.40
Year*Growing media															NS
Year*Field conditions*Growing media															NS

CONCLUSION

Seeds of *Asparagus racemosus*should be sown under protected conditions in Soil + Cocopeat + vermicompost (1:1:1) media for getting early and healthy seedlings.

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