



## Influence of testing media on seed germinability and seedling traits in seven medicinal plants

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**Abstract :** A lab experiment was conducted at the Seed Research and Technology centre of Acharya N.G. Ranga Agricultural University, Rajendra Nagar, Hyderabad during 2007-2008 to evaluate the influence of testing media on seed germinability and seedling traits in seven medicinal plants. The seeds of these crops were tested on four media to know their germination potential. The germination percentage varied with testing medias and genotypes. Top of paper method was very effective in recording higher germination for Isabgol(87.9%), Kalmegh(88.2%), Senna (94.4%) and Ashwagandha (74.7%). While, Podapatri gave maximum germination (53.7%) on between paper method. Sand (86.0%) and bp (85.0%) methods for Dulagandi and sand method (81.7%) for Tulsi were found very effective to obtain higher germination. Seedling vigour index on length basis differed with testing medias and genotypes. Top of paper method for Ashwagandha and Kalmegh, sand for Dulagandi, Podapatri and Tulasi, between paper for Isabgol and Senna were effective to obtain higher seedling vigour index on length basis. Soil was found very effective for obtaining higher seedling vigour index II for Ashwagandha, Dulagandi, Isabgol and Kalmegh, between paper for Podapatri and Senna. Sand for Tulasi gave maximum seedling vigour index on dry weight basis.

**Key Words :** Medicinal Plants, Testing media, Germination percentage, Seedling traits

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### INTRODUCTION

The World Health Organization (WHO) estimated that 80 per cent of the population of developing countries still relies on traditional medicines, mostly plant drugs, for their primary health care needs. Also, modern pharmacopoeia contains at least 25 per cent drugs derived from plants. Information is available on medicinal use of these plants and its constituents. However, Information regarding seed testing procedures in more number of medicinal plants is very meagre. Keeping this in view, the study has been taken up for standardization of suitable seed testing media and to evaluate its influence on seed germination and seedling traits in seven

medicinal plants viz., Ashwagandha (*Withania somnifera*), Dulagandi (*Mucuna pruriens*), Isabgol, (*Plantago ovata*), Kalmegh (*Andrographis paniculata*), Podapatri (*Gymnema sylvestre*), Senna (*Cassia angustifolia*) and Tulsi (*Ocimum sanctum*) at Department of Seed Science and Technology, College of Agriculture, Acharya N.G. Ranga Agricultural University during the year 2007-08. Supporting findings were made by Butola and Samant (2007); Rawat and Garg (2005).

### MATERIAL AND METHODS

Seeds of seven medicinal plants viz., Ashwagandha (*Withania somnifera*, Red variety Daunal), Dulagandi (*Mucuna*

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*pruriens*, White seed), Isabgol (*Plantago ovata* Forsk), Kalmegh (*Andrographis paniculata* Wall, Ex Nees), Tulsi (*Ocimum sanctum* Linn), Podapatri (*Gymnema sylvestre*), Senna (*Cassia angustifolia* Wahl) were collected from Herbal Garden, ANGRAU and from CIMAP, Boduppal, Hyderabad and they were subjected to various seed testing procedures as follows.

#### Germination tests (ISTA 1993 and ISTA 2006) :

##### Top of paper (TP) method :

For germination studies, seeds were germinated on top of two layers of blotter paper under controlled conditions of temperature ( $25 \pm 1^\circ\text{C}$ ) and relative humidity ( $90 \pm 2\%$ ) in four replications of hundred seeds each. Germination percentage was calculated by counting normal healthy seedlings with the following formula on the day of first count and final count:

$$\text{Germination (\%)} = \frac{\text{Number of normal seedlings}}{\text{Total number of seeds planted}} \times 100$$

Different reports on this species suggest that the germination percentage can be improved by the application of pre-sowing chemical treatments (Kattimani *et al.*, 1999; Vakeswaran and Krishnasamy, 2003; Mahdavi, 2013; Kumar *et al.*, 2011 and Snedecor and Cochran, 1967).

##### Between paper (BP) method (Standard germination test):

Seeds from each variety were subjected to germination test in four replications of hundred seeds each following between paper method in a seed germinator by maintaining an optimum temperature of  $25 \pm 1^\circ\text{C}$  and relative humidity of  $90 \pm 2$  per cent. The seeds were observed daily for radicle and plumule emergence and counts of such seeds were taken till maximum germination was attained *i.e.* on 14<sup>th</sup> and 18<sup>th</sup> day for Ashwagandha, 7<sup>th</sup> and 10<sup>th</sup> day for Dulagandi and Isabgol, 9<sup>th</sup> and 14<sup>th</sup> for Kalmegh, 13<sup>th</sup> and 16<sup>th</sup> for Podapatri, 7<sup>th</sup> and 11<sup>th</sup> for Senna and 5<sup>th</sup> and 11<sup>th</sup> for Tulsi, respectively. Germination percentage was calculated based on normal seedlings on the days of first and final count.

##### Sand media :

Each sample was sown in sterilized sand poured in plastic trays and seeds were sown at equidistance in four replications consisting of four hundred seeds in each replication. The sand was wetted up to 70 per cent water holding capacity and trays were kept in seed germinator at  $25 \pm 1^\circ\text{C}$  temperature and at  $90 \pm 2$  per cent relative humidity. Number of seedlings emerged on the day of final count were calculated and the germination per cent was computed.

##### Soil media :

Four hundred seeds were sown in four replications of hundred seeds each on red loamy soil with a spacing of 10cm between the rows. The number of seeds germinated in each row was counted on the day of final count and the total

germination percentage was calculated.

##### Seedling length (cm) and seedling dry weight (mg) :

Ten seedlings were collected at random from each sample on the day of final count from the seeds subjected to germination test using between paper method. The length of root and shoot of ten randomly selected seedlings were measured and the mean expressed in centimetre. The randomly selected ten seedlings used for growth measurement were initially sun dried and then in a hot air oven maintained at  $85 \pm 2^\circ\text{C}$  for 16 hrs /  $80 \pm 1^\circ\text{C}$  for 24 hrs. After cooling in a desiccator for 30 minutes and weight was recorded and expressed in milligram per 10 seedlings by following the method suggested by Hara Kumar *et al.* (1999).

##### Seedling vigour index :

Vigour index of the seedlings was calculated by adopting the formula given by (Abdul Baki and Anderson, 1973).

##### Seedling Vigour Index I :

Seed germination per cent  $\times$  Average seedling length (cm).

##### Seedling Vigour Index - II :

Seed germination per cent  $\times$  Average seedling dry weight (mg).

## RESULTS AND DISCUSSION

The germination percentage of Ashwagandha recorded maximum germination in top of paper method (74.7%) which was significantly superior to between paper method (56.7%), soil method (43.0%) and sand method (38.0%). The germination percentage of Dulagandi was higher in sand method (86.0%) followed by between paper method (85.0%) which were significantly superior to soil method (77.2%) and top of paper method (45.0%). Top of paper method was found most effective for recording maximum germination percentage (87.9%) in Isabgol followed by sand media (80.7%) which were significantly superior to between paper method (74.0%) and soil method (58.0%). Maximum and minimum germination percentage (88.2% and 62.6%) were recorded by top of paper and soil method, respectively in Kalmegh. The values of remaining methods recorded in between these two extremes. The germination percentage of Podapatri at initial itself recorded low germination, however, between paper method recorded significantly better germination (53.7%) than top of paper (47.3%), sand (32.0%) and soil method (16.5%). In Senna also germination potential significantly differed due to media. Among the four tested media, top of paper method recorded the highest germination (94.4%), which was significantly higher than between paper method (76.3%), soil (72.5%) and sand methods (71.6%). Germination was maximum (81.7%) in sand media which was superior to between paper method (66.0%) and top of paper method (63.3%). The germination

was very low by soil media (19.0%) in Tulsi. Irrespective of medicinal crops, the germination potentiality significantly differed due to germination media and medicinal crops. Among the four methods, top of paper was found very effective in recording maximum germination percentage for Senna (94.4%), Kalmegh (88.2%), Isabgol (87.9%), Ashwagandha (74.7%) where as between paper method was very effective in Dulagandi (85.0%) and Podapatri (53.7%) and sand method in Tulsi (81.7%) (Table 1).

Irrespective of medicinal crops, length of seedling significantly showed variation due to germination media in all medicinal crops (Table 2). Among the media, sand media (10.7 cm) and between Paper (8.05 cm) recorded highest seedling length as compared to soil method (6.5 cm) and top of paper

methods (5.3 cm). Irrespective of germination media, between paper method gave maximum seedling length in Ashwagandha (7.0cm), Isabgol (6.1cm), Senna (11.5 cm) which was superior to other methods. While sand media gave maximum seedling length in Dulagandi (32.0 cm) followed by Kalmegh (7.0 cm) and Podapatri (10.9 cm). Where as soil media was effective for recording highest seedling length in Tulsi (6.2cm) which were significantly superior over other methods. Seedling dry weight significantly differed due to testing media in all medicinal crops. Soil method in Ashwagandha (11.7 mg), Isabgol (17.6 mg), Kalmegh (47.1 mg), Podapatri (83.5 mg) and in Tulsi (8.1 mg) recorded maximum seedling dry weight, which was superior to other methods. Sand and soil methods recorded higher seedling dry weights in Dulagandi (1481.7 mg and 1362.8

**Table 1: Influence of tested medias on germination (%) in seven medicinal crops**

Tested medias	Germination percentages							Mean
	Ashwagandha	Dulagandi	Isabgol	Kalmegh	Podapatri	Senna	Tulsi	
TP method	74.7	45.0	87.9	88.2	47.3	94.4	63.3	71.59
BP method	56.7	85.0	74.0	78.7	53.7	76.3	66.0	70.08
Sand method	38.0	86.0	80.7	64.7	32.0	71.6	81.7	64.98
Soil method	43.0	77.2	58.0	62.6	16.5	72.5	19.0	49.84
Mean	53.2	73.31	75.18	73.60	37.39	78.74	57.52	67.10
S.E. ±	1.47	1.40	2.37	1.11	1.70	1.41	1.32	
C.D (P=0.05)	4.71	4.50	7.59	3.55	5.24	4.52	4.23	
C.V. (%)	5.50	5.00	6.31	3.04	3.88	3.60	4.59	

TP method- Top of paper method  
BP method- Between paper method

**Table 2 : Influence of tested media on seedling length (cm) in seven medicinal crops**

Tested media	Seedling length (cm)							Mean
	Ashwagandha	Dulagandi	Isabgol	Kalmegh	Podapatri	Senna	Tulsi	
TP method	5.5	5.6	4.0	6.4	4.6	8.4	3.0	5.39
BP method	7.0	17.0	6.1	6.6	4.9	11.5	2.9	8.05
Sand method	5.1	32.0	5.2	7.0	10.9	11.1	3.4	10.71
Soil method	3.7	14.6	4.4	4.1	5.0	7.6	6.2	6.57
Mean	5.39	17.34	4.97	6.09	6.40	9.68	3.89	7.58
S.E. ±	0.18	0.26	0.12	0.11	0.23	0.10	0.51	
C.D (P=0.05)	0.57	0.85	0.39	0.35	0.73	0.34	1.58	
C.V. (%)	6.68	3.09	5.00	3.64	7.21	2.22	3.39	

**Table 3: Influence of tested media on seedling dry weight (mg) in seven medicinal crops**

Tested media	Seedling length (cm)							Mean
	Ashwagandha	Dulagandi	Isabgol	Kalmegh	Podapatri	Senna	Tulsi	
TP method	6.67	332.3	5.7	7.7	64.4	109.3	3.1	75.62
BP method	7.25	728.8	7.4	9.2	68.3	187.2	3.0	144.46
Sand method	10.1	1481.7	6.1	11.9	81.7	119.3	3.4	244.90
Soil method	11.7	1362.8	17.6	47.1	83.5	149.5	8.1	240.06
Mean	8.94	976.42	9.24	18.98	74.50	141.34	4.42	176.20
S.E. ±	0.84	7.0	0.40	0.60	1.42	2.76	0.57	
C.D (P=0.05)	2.60	21.57	1.28	1.92	4.55	8.52	1.76	
C.V. (%)	4.01	2.51	8.70	6.32	3.82	2.71	3.81	

**Table 4: Influence of tested media on seedling vigour index I (SV I) in seven medicinal crops**

Tested media	Seedling vigour index I (SV I)							Mean
	Ashwagandha	Dulagandi	Isabgol	Kalmegh	Podapatri	Senna	Tulsi	
TP method	415.6	254.3	352.0	568.3	221.1	797.9	189.9	388.11
BP method	401.2	1450.1	455.9	526.8	263.9	879.4	191.4	594.41
Sand method	196.6	2752.0	423.9	459.1	350.2	792.6	282.8	727.68
Soil method	162.1	1131.8	260.4	260.7	83.8	552.3	118.4	371.60
Mean	293.74	1396.37	373.05	453.72	229.4	755.55	141.32	520.45
S.Em ±	3.97	37.30	17.19	14.88	7.03	15.40	4.95	
C.D (P=0.05)	12.25	119.6	55.0	47.62	22.5	49.30	15.86	
C.V. (%)	2.69	5.35	9.22	6.55	6.14	4.08	7.01	

**Table 5: Influence of tested media on seedling vigour index II (SV II) in seven medicinal crops**

Tested media	Seedling vigour index II (SV II)							Mean
	Ashwagandha	Dulagandi	Isabgol	Kalmegh	Podapatri	Senna	Tulsi	
TP method	498.5	14939.5	505.9	679.5	3050.8	7956.8	199.4	3975.35
BP method	410.3	61940.6	551.5	726.5	3688.7	14461.2	199.3	11708.32
Sand method	384.4	127426.2	500.4	769.4	2597.4	8549.0	279.5	20074.24
Soil method	505.6	105073.7	1021.6	2951.2	1378.3	10838.7	152.0	17417.58
Mean	450.51	77348.2	643.90	1281.68	2673.83	10451.4	207.55	13293.80
S.E. ±	5.98	68.49	6.01	33.15	125.73	25.83	3.73	
C.D (P=0.05)	18.43	211.02	18.54	106.05	402.22	79.59	11.50	
C.V. (%)	3.97	3.03	2.81	5.17	9.39	3.19	3.36	

mg, respectively). While in Senna Bp method (187.2 mg) followed by soil method (149.5 mg) gave maximum seedling dry weights which was superior to other methods. Irrespective of testing media, the seedling dry weight was highest in Dulagandi (976.4 mg) followed by Senna (141.3 mg) over other medicinal crops. Irrespective of medicinal crops, sand method (244.9 mg) and soil method (240.0 mg) were found very effective in recording higher seedling dry weight as against top of paper method (75.6 mg) and between paper method (144.4 mg) (Table 3). Irrespective of testing media, Dulagandi recorded maximum SVI (1396.3) followed by Senna (755.5) and lowest SVI was observed in Tulsi (141.3). Irrespective of crops, SVI was maximum in sand media (727.6) and lowest in soil method (371.6). Top of paper method gave maximum SVI in Ashwagandha (415.6) and Kalmegh (568.3) which was superior to other methods (Table 4). Isabgol (455.9) and Senna (879.4) recorded maximum SVI by between paper method as compared to other methods. While sand method was found very effective for recording SVI in Dulagandi (2752.0), Podapatri (350.2) and Tulsi (282.8) which was superior to other methods. Seedling vigor index II on dry weight basis significantly differed due to media. Irrespective of testing media, seedling vigor index II was maximum in Dulagandi (77348.2), followed by Senna (10451.4), which were superior to other medicinal crops. Irrespective of medicinal crops, sand method (20074.2) recorded highest seedling vigor index II and shown better performance over other methods (Table 5). Soil and Tp methods

for Ashwagandha; sand and soil for Dulagandi; soil and Bp methods for Isabgol; soil and sand for Kalmegh; Bp and Tp for Podapatri; Bp and soil for Senna; sand, Tp and Bp for Tulsi recorded maximum SV II than other methods.

From the above results, it is evident that the mean germination percentage was high in Senna (78.7 %) followed by Isabgol (75.1 %), which were significantly superior to Kalmegh (73.6 %), Dulagandi (73.3 %) Tulsi (57.5 %), Ashwagandha (53.2 %) and Podapatri (37.3%). Tp method for Ashwagandha, bp and sand methods for Dulagandi, tp and sand for Isabgol, tp and bp for Kalmegh, Podapatri and Senna, sand and bp for Tulsi were very effective for obtaining better germination over other methods. Similar trend was also observed for seedling length, seedling dry weight, and seedling vigour indexes I and II. Seedling length, seedling dry weight, seedling vigour index I and seedling vigour index II were maximum in Dulagandi followed by Senna as compared to other medicinal crop species.

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