

## Effect of rooting media on germination and seedling growth of nutmeg (*Myristica fragrans* Houtt.)

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### Abstract

Experiments conducted on germination of nutmeg (*Myristica fragrans*) seeds at Dapoli (Maharashtra) indicated that there were significant differences in germination of seeds sown in different media. The mean germination was significantly higher in seeds sown in rice bran (82.3%) which was on par with sand (82.0%) and sand + rice bran (81.7%). These media also recorded significantly lesser time for first emergence namely, 27.17 days (rice bran), 28.10 days (sand + rice bran) and 28.50 days (sand), respectively. The time taken for final emergence was also significantly lower in seeds sown in rice bran (80.83 days), sand + rice bran (81.60 days) and sand (82.17 days), respectively. The vegetative growth of seedlings namely, shoot length, shoot diameter, number of leaves and leaf area were also significantly higher in these media namely, rice bran, sand + rice bran and sand at 30, 90 and 180 days after germination.

**Keywords:** germination, *Myristica fragrans*, nutmeg, seedling growth.

### Introduction

Nutmeg (*Myristica fragrans* Houtt.) is usually propagated through seeds, and the germinated seedlings are also used for vegetative propagation methods like epicotyl grafting and softwood grafting. The seeds after extraction are sown either immediately or not later than 3–4 days (Flach 1966). However, germination of nutmeg seeds is reported to be low (40–50%) (Prabhu 1978). The present investigation was undertaken to study the effect of different media on seed germination and seedling growth of nutmeg under coastal hot humid conditions of Maharashtra.

### Materials and methods

The experiment was conducted for two consecutive years namely, 2002 and 2003 at Department of Horticulture, College of Agriculture, Dapoli (Maharashtra) in a randomized block design. The experiment consisted of 11 treatments (media) namely, T<sub>1</sub>-sand, T<sub>2</sub>-rice bran, T<sub>3</sub>-sphagnum moss, T<sub>4</sub>-saw dust, T<sub>5</sub>-coconut coir waste, T<sub>6</sub>-soil (control), T<sub>7</sub>-sand + rice bran (1:1, v/v), T<sub>8</sub>-sand + sphagnum moss (1:1, v/v), T<sub>9</sub>-sand + saw dust (1:1), T<sub>10</sub>-sand + coconut coir waste (1:1) and T<sub>11</sub>-sand + soil (1:1, v/v) which were replicated thrice. Tree-ripe harvested medium-sized nutmeg seeds weighing 10–12 g, collected from female

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nutmeg trees of 25–35 years age at College Farm were used for the experiment. Twenty seeds were sown on 15 July during 2002 and 2003 under each treatment in nursery beds of 0.80 m x 0.60 m x 0.20 m size. The sowing was done by keeping the seed in a vertical position about 1 inch deep in different media as per treatments. The beds were irrigated immediately after sowing, which was repeated every 2 days till final emergence. The sprouted seedlings (1 month old) were transplanted to polythene bags of 20 cm x 15 cm size containing potting mixture of soil + farm yard manure in 3:1 proportion. The seedlings were irrigated immediately after transplanting and thereafter irrigated at an interval of 4 days till last observation.

Observations on germination and time taken for initial and final emergence were recorded. The growth characters of seedlings like shoot length, shoot diameter and leaf area of five randomly selected seedlings were recorded at 30, 60, 120 and 180 days after emergence (DAE). Shoot length was measured from the base to the apex of seedlings. Shoot diameter was measured 1 cm from the base of the stem with the help of vernier calipers. The leaf area of seedlings was measured by using a leaf area meter. The root characters, namely, length and number of primary and secondary roots of five randomly selected seedlings were recorded at 180 DAE. The data recorded were statistically analysed as per standard procedures (Panse & Sukhatme 1995). The media used for germination were analysed for wa-

ter holding capacity, bulk density and major nutrient content as per standard analytical procedures (Chopra & Kanwar 1978) (Table 1).

### Results and discussion

There was a significant increase in germination percentage compared to control (soil) in both the years of experimentation (Table 2). The pooled analysis of data also indicated significant effect of media on germination percentage. The mean maximum germination percentage (82.3%) was significantly higher in seeds sown in rice bran which was on par with sand (82.0%) and sand + rice bran (81.7%) treatments. Minimum germination (38.3%) was recorded in control (soil). These findings are in accordance with the observations of Prabhu (1978) in nutmeg who observed maximum germination in sand (83.8%) followed by sand + soil medium (55.0%). The time required for first emergence was significantly lower (27.2 days) in seeds sown in rice bran which was on par with sand + rice bran (28.1 days) and sand (28.5 days) treatments.

The time required for final emergence was significantly lower (71.0 days) in seeds sown in sphagnum moss (Table 2). The probable reason for the same could be attributed to better aeration and good water holding capacity of sphagnum moss (Hartmann & Kester 1997).

The mean shoot length increased gradually during the period of growth at 30 to 180 DAE, irrespective of treatments (Table 3). The

**Table 1.** Water holding capacity, bulk density and nutrient content of media used for germination of nutmeg

Media	Water holding capacity (%)	Bulk density (g ml <sup>-1</sup> )	Major nutrient content (%)		
			N	P	K
T <sub>1</sub> -Sand	27.43	1.83	0.05	0.45	0.08
T <sub>2</sub> -Rice bran	274.19	1.64	0.57	0.85	0.25
T <sub>3</sub> -Sphagnum moss	1646.85	1.25	0.95	0.70	0.26
T <sub>4</sub> -Sawdust	476.00	0.60	0.14	0.95	0.20
T <sub>5</sub> -Coconut coir waste	2021.84	0.48	0.25	0.90	0.45
T <sub>6</sub> -Soil (Control)	40.22	1.52	0.25	1.40	0.34
T <sub>7</sub> -Sand + Rice bran	148.42	1.22	0.32	0.65	0.16
T <sub>8</sub> -Sand + Sphagnum moss	937.11	1.17	0.50	0.60	0.18
T <sub>9</sub> -Sand + Saw dust	274.15	1.24	0.93	0.68	0.21
T <sub>10</sub> -Sand + Coconut coir waste	1054.63	1.20	0.15	0.69	0.27
T <sub>11</sub> -Sand + Soil	32.83	1.66	0.12	0.93	0.21

Table 2. Effect of media on germination of nutmeg seeds

Treatment	Germination percentage			Time taken for first emergence (days)			Time taken for final emergence (days)		
	2002	2003	Pooled	2002	2003	Pooled	2002	2003	Pooled
T <sub>1</sub> -Sand	82.7(65.4)	81.3(64.4)	82.0(64.9)	29.0	28.0	28.5	82.0	82.3	82.2
T <sub>2</sub> -Rice bran	83.3(65.9)	81.3(64.5)	82.3(65.1)	26.0	28.3	27.8	81.3	80.3	80.8
T <sub>3</sub> -Sphagnum moss	69.3(58.4)	69.3(58.4)	69.3(58.4)	35.0	35.0	35.0	71.0	71.0	71.0
T <sub>4</sub> -Sawdust	62.0(52.0)	62.0(51.9)	62.0(51.9)	44.3	44.3	44.3	88.0	88.9	88.4
T <sub>5</sub> -Coconut coir waste	57.3(49.2)	58.0(48.8)	57.7(49.0)	48.7	48.0	48.3	85.9	85.0	85.4
T <sub>6</sub> -Soil (Control)	38.0(38.1)	38.8(38.5)	38.3(38.3)	50.7	51.0	50.8	112.0	112.9	112.4
T <sub>7</sub> -Sand + Rice bran	82.0(64.9)	81.3(64.4)	81.7(64.7)	27.3	28.7	28.1	82.3	80.9	81.6
T <sub>8</sub> -Sand + Sphagnum moss	73.3(58.9)	73.3(58.8)	73.3(58.9)	34.3	33.0	33.7	85.3	85.3	85.3
T <sub>9</sub> -Sand + Saw dust	69.3(58.4)	70.7(67.2)	70.0(62.8)	40.7	41.0	40.8	74.3	74.3	74.3
T <sub>10</sub> -Sand + Coconut coir waste	70.0(58.8)	68.7(56.4)	69.3(57.4)	42.0	42.0	42.0	79.0	78.3	78.7
T <sub>11</sub> -Sand + Soil	58.7(53.3)	58.7(50.4)	58.7(51.9)	42.3	43.0	42.7	83.0	81.9	82.4
Mean	56.7	56.7	62.1	38.2	38.4	38.3	84.0	83.7	83.8
SEm ±	1.1	0.7	1.2	0.6	0.5	0.7	0.9	0.3	0.7
CD (P=0.05)	3.3	1.9	3.4	1.9	1.5	1.9	2.6	0.9	2.1

\*Figures in parenthesis are transformed angular values

Table 3. Effect of media on shoot length of nutmeg seedlings

Treatment	30 DAE			90 DAE			180 DAE		
	2002	2003	Pooled	2002	2003	Pooled	2002	2003	Pooled
T <sub>1</sub> -Sand	8.17	9.37	8.77	10.17	10.70	10.44	23.57	25.57	24.57
T <sub>2</sub> -Rice bran	9.87	10.00	9.94	10.50	11.53	11.02	25.03	26.20	25.62
T <sub>3</sub> -Sphagnum moss	7.13	7.03	7.08	8.03	8.17	8.10	19.87	23.23	21.55
T <sub>4</sub> -Sawdust	7.20	6.93	7.07	7.82	8.13	7.98	19.47	22.20	20.84
T <sub>5</sub> -Coconut coir waste	7.17	6.73	6.95	7.93	8.00	7.97	20.40	23.23	21.82
T <sub>6</sub> -Soil (Control)	8.77	6.10	7.44	7.40	7.27	7.34	18.30	22.33	20.32
T <sub>7</sub> -Sand + Rice bran	10.00	10.36	10.18	10.70	12.27	11.49	25.50	26.87	26.19
T <sub>8</sub> -Sand + Sphagnum moss	9.97	7.83	8.90	8.70	9.17	8.94	19.27	23.60	21.44
T <sub>9</sub> -Sand + Saw dust	7.97	7.83	7.90	8.67	9.00	8.84	19.40	23.90	21.65
T <sub>10</sub> -Sand + Coconut coir waste	7.47	7.50	7.49	8.00	8.93	8.47	18.97	23.67	21.32
T <sub>11</sub> -Sand + Soil	7.17	7.20	7.19	7.93	8.53	8.23	19.27	23.30	21.29
Mean	8.26	7.90	8.08	8.71	9.25	8.98	20.82	24.01	22.42
SEm ±	0.10	0.32	0.55	10.17	10.70	10.44	0.29	0.30	0.63
CD (P=0.05)	0.29	1.26	1.73	10.50	11.53	11.02	0.84	0.89	1.98

DAE=Days after emergence; All values indicate cm.

mean shoot length was significantly higher (26.19 cm) in seeds sown in sand + rice bran at 180 DAE, which was on par with rice bran (25.62 cm) and sand (24.57 cm) treatments. Shoot diameter was also significantly influenced by different media at 30 to 180 DAE (Table 4). At 180 DAE, shoot diameter was significantly higher (0.67 cm) in seeds sown in sand + rice bran which was on par with

rice bran (0.66 cm), sand (0.65 cm), sand + sphagnum moss (0.62 cm) and sand + saw dust (0.62cm). Leaf area was also significantly influenced due to different media at 30 to 180 DAE (Table 5). At 180 DAE, leaf area was significantly higher (374.12 cm<sup>2</sup>) in seeds sown in sand + rice bran, which was at par with rice bran (367.95 cm<sup>2</sup>) and sand (364.08 cm<sup>2</sup>) treatments. Root growth was also signifi-

**Table 4.** Effect of media on shoot diameter of nutmeg seedlings

Treatment	30 DAE			90 DAE			180 DAE		
	2002	2003	Pooled	2002	2003	Pooled	2002	2003	Pooled
T <sub>1</sub> -Sand	0.26	0.27	0.27	0.38	0.39	0.39	0.60	0.70	0.65
T <sub>2</sub> -Rice bran	0.26	0.26	0.26	0.38	0.42	0.40	0.58	0.73	0.66
T <sub>3</sub> -Sphagnum moss	0.23	0.23	0.23	0.30	0.31	0.31	0.51	0.61	0.56
T <sub>4</sub> -Sawdust	0.23	0.23	0.23	0.30	0.32	0.31	0.48	0.60	0.54
T <sub>5</sub> -Coconut coir waste	0.23	0.23	0.23	0.29	0.31	0.30	0.49	0.62	0.56
T <sub>6</sub> -Soil (Control)	0.22	0.22	0.22	0.28	0.30	0.29	0.45	0.60	0.53
T <sub>7</sub> -Sand + Rice bran	0.29	0.29	0.29	0.39	0.41	0.40	0.61	0.72	0.67
T <sub>8</sub> -Sand + Sphagnum moss	0.22	0.23	0.23	0.30	0.35	0.33	0.62	0.62	0.62
T <sub>9</sub> -Sand + Saw dust	0.23	0.23	0.23	0.30	0.35	0.33	0.60	0.64	0.62
T <sub>10</sub> -Sand + Coconut coir waste	0.24	0.24	0.24	0.31	0.33	0.32	0.51	0.61	0.56
T <sub>11</sub> -Sand + Soil	0.23	0.23	0.23	0.30	0.35	0.33	0.49	0.60	0.55
Mean	0.24	0.24	0.24	0.32	0.35	0.34	0.54	0.64	0.59
SEm ±	0.04	0.01	0.01	0.01	0.30	0.01	0.01	0.01	0.02
CD (P=0.05)	0.12	0.03	0.02	0.03	0.88	0.02	0.03	0.03	0.07

DAE=Days after emergence; All values indicate cm.

**Table 5.** Effect of media on leaf area of nutmeg seedlings

Treatment	30 DAE			90 DAE			180 DAE		
	2002	2003	Pooled	2002	2003	Pooled	2002	2003	Pooled
T <sub>1</sub> -Sand	19.13	19.47	19.30	145.70	149.30	147.50	365.83	362.33	364.08
T <sub>2</sub> -Rice bran	22.45	20.47	21.46	151.13	153.27	152.20	365.17	370.73	367.95
T <sub>3</sub> -Sphagnum moss	13.90	13.53	13.72	143.47	143.50	143.49	357.73	347.10	352.42
T <sub>4</sub> -Sawdust	13.63	13.20	13.42	138.00	143.43	140.72	358.30	345.83	352.07
T <sub>5</sub> -Coconut coir waste	14.23	12.27	13.25	139.13	143.93	141.53	357.73	342.03	349.88
T <sub>6</sub> -Soil (Control)	13.40	14.17	13.79	138.00	140.80	139.40	337.70	340.13	338.92
T <sub>7</sub> -Sand + Rice bran	23.30	22.27	22.79	152.47	151.90	152.19	372.77	375.47	374.12
T <sub>8</sub> -Sand + Sphagnum moss	14.10	12.83	13.47	143.43	143.83	143.63	355.53	346.07	350.80
T <sub>9</sub> -Sand + Saw dust	15.30	15.83	15.57	143.93	145.47	144.70	354.20	350.03	352.12
T <sub>10</sub> -Sand + Coconut coir waste	16.63	17.20	16.92	143.47	143.77	143.62	362.70	342.03	352.37
T <sub>11</sub> -Sand + Soil	15.87	18.10	16.99	143.83	142.23	143.03	356.37	343.70	350.04
Mean	16.54	16.30	16.43	143.87	145.58	144.73	358.55	351.40	354.98
SEm ±	0.37	0.52	0.71	1.23	1.08	1.32	1.48	1.33	4.19
CD (P=0.05)	1.97	1.53	1.98	3.62	3.16	3.67	4.37	3.91	13.22

DAE=Days after emergence; All values indicate cm.

**Table 6.** Effect of media on root characters of nutmeg seedlings at 180 days after emergence

Treatment	Length of primary roots (cm)			Number of primary roots			Length of secondary roots (cm)			Number of secondary roots		
	2002	2003	Pooled	2002	2003	Pooled	2002	2003	Pooled	2002	2003	Pooled
T <sub>1</sub> -Sand	13.50	13.47	13.49	1.3	1.3	1.3	4.70	4.87	4.79	6.0	7.2	6.6
T <sub>2</sub> -Rice bran	14.17	13.73	13.95	1.3	1.4	1.3	5.17	5.08	5.13	5.6	7.3	6.5
T <sub>3</sub> -Sphagnum moss	9.63	9.17	9.40	2.4	2.5	2.5	4.18	4.18	4.18	4.5	5.2	4.9
T <sub>4</sub> -Sawdust	11.97	11.77	11.87	1.2	1.3	1.2	4.32	4.20	4.26	4.7	5.2	5.0
T <sub>5</sub> -Coconut coir waste	10.13	10.30	10.22	1.2	1.2	1.2	4.07	4.10	4.09	4.7	5.1	4.9
T <sub>6</sub> -Soil (Control)	10.70	9.47	10.09	1.1	1.1	1.1	3.10	3.40	3.25	3.9	4.2	4.5
T <sub>7</sub> -Sand + Rice bran	13.17	13.37	13.27	1.3	1.4	1.3	5.03	4.87	4.80	6.5	7.3	6.9
T <sub>8</sub> -Sand + Sphagnum moss	10.23	9.73	9.98	1.5	1.2	1.4	4.07	4.23	4.15	5.1	5.8	5.5
T <sub>9</sub> -Sand + Saw dust	12.60	12.83	12.72	1.2	1.3	1.3	4.42	4.43	4.43	5.3	5.2	5.2
T <sub>10</sub> -Sand + Coconut coir waste	12.00	11.63	11.82	1.2	1.2	1.2	4.50	4.27	4.39	5.3	5.8	5.6
T <sub>11</sub> -Sand + Soil	11.77	11.47	11.62	1.3	1.2	1.3	4.07	4.17	4.12	4.8	5.8	5.3
Mean	11.87	11.54	11.67	1.4	1.4	1.4	4.33	4.32	4.33	5.1	5.8	5.5
SEm ±	0.72	0.80	0.21	0.1	0.1	0.1	0.16	0.18	0.19	0.2	0.1	0.2
CD (P=0.05)	2.73	2.36	0.66	0.4	0.3	0.3	0.47	0.52	0.54	0.4	0.3	0.5

cantly influenced by different media at 180 DAE (Table 6). At 180 DAE, maximum length of primary roots (13.95 cm) was recorded in seeds sown in rice bran which was at par with sand (13.49 cm). Maximum number of primary roots (2.5) was recorded in sphagnum moss treatment. Maximum length of secondary roots (5.13 cm) was recorded in rice bran treatment, which was at par with sand + rice bran (4.80 cm) and sand (4.79 cm) treatments. Maximum number of secondary roots (6.9) was recorded in seeds sown in sand + rice bran treatment, which was at par with sand (6.6 cm) and rice bran (6.5 cm) treatments. Higher growth of nutmeg seedlings that germinated from rice bran, sand and sand + rice bran could be attributed to early germination in these media, which was responsible for quick establishment and better growth (Hartmann & Kester 1997).

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