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## Standardization of different potting media on physiological growth, yield and vase life of *Dendrobium* orchid CV. Sonia 17 under shade net conditions in high altitude tribal zone of Andhra Pradesh

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**Abstract**

The present investigation entitled “Standardization of different potting media on physiological growth and yield of *Dendrobium* orchid cv. sonia 17 under shade net conditions in high altitude tribal zone of Andhra Pradesh” was carried out at Horticulture Research station, Chintapalli, Visakhapatnam district of Andhra Pradesh during two consecutive years of 2016-17 and 2017-18. The experiment was laid out in a completely randomized design with 10 treatments and each treatment replicated thrice. The data recorded on various parameters viz., physiological growth, yield, vase life and were statistically analyzed. Significant differences were observed among different potting media on various parameters in *Dendrobium* orchids cv. Sonia 17. Among all the treatments, Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1) showed significantly the best results with respect to dry weight of plant (10.75 g), root length (17.54 cm), number of roots (32.51), chlorophyll content (1.05 mg/g), yield of spikes per plant per year (3.58), vase life (15.86 days) and longevity of spike on plant (41.23 days).

**Keywords:** *Dendrobium*, potting media, physiological growth, yield

**Introduction**

Orchids are the most beautiful flowers in God’s creation and have conquered the cut flower industry all over the world during the last few decades. Orchid cut flowers have emerged as leader in the International market and have immensely contributed to the economy of several developed and developing countries. They are valued for cut flower production and as potted plant in commercial floriculture owing to the wide range of colours, shapes, sizes and fragrance they display. Orchids are excellent for garden and can be grown in beds, pots, baskets, split hollows of bamboo pieces etc. They are marketed globally as cut flowers for making corsages, floral arrangements and boquets. They are also suitable for interior decoration and remain fresh for many days. They comprise the largest family (Orchidaceae) of flowering plants with 25,000 to 35,000 species belonging to 600-800 genera (Chowdhery, 2001) [3].

*Dendrobium* is the second largest orchid genera consisting of more than 16,000 species (Puchooa, 2004) [14]. Countries including Thailand, Taiwan, China, Phillipines, Germany, United States, Japan and India are major producers of *Dendrobium* orchids. Most *Dendrobium* species are epiphytic, sympodial orchids and are from subtropical and tropical regions and is a popular genus for cut flower production. Many growers in the states of Karnataka, Kerela, Tamilnadu and Andhra Pradesh are cultivating *Dendrobium* on a commercial scale. The flower spikes of *Dendrobium* are extremely beautiful, medium sized with flowers numbering between 5-20, in colours such as white, mauve, pink, red, blue, purple, yellow and are highly popular in the National and International market. Orchids are used in Indigenous system of medicine, particularly in Ayurveda.

At present cultivation of orchids, particularly *Dendrobium* hybrids is gaining momentum in India. It has got an excellent market potential in the floriculture industry. Despite the fact that India has diversified climate, low cost of labour and progressive farming technology, the orchid industry is still in an infant stage for commercial cultivation. *Dendrobium* being an epiphytic in nature spread their roots over the branches of trees exposing them fully, therefore, the type of media used for growing epiphytic orchids should provide a surface over which the plants can cling to. A good mixture of media is useful in terms of all vegetative and flowering

parameters. An ideal growing media facilitates proper aeration, adequate drainage and good anchorage to the plant and should provide healthy environment for roots. It should be inert, porous and resistant to organic decomposition. It should be cheap and easily available (Bose and Bhattacharjee, 1980) [2]. The vigorous and healthy root system in epiphytic orchids was first step towards ensuring maximum growth. Hence, selection of ideal rooting media provides a high degree of success for profuse root growth. In this concern, the present investigation was undertaken to standardize the potting media for *Dendrobium* Orchids cv. Sonia 17 for good physiological growth and yield.

### Material and Methods

The experimental site was located at the Horticulture Research Station, Chintapalli (Humid sub tropical zone), Visakhapatnam District, Andhra Pradesh and experiment was carried out during two consecutive years of 2016-17 and 2017-18. Eighteen months old tissue cultured plants which were originally imported from Thailand were used as planting material for conducting experiment. Sonia-17 is one of the popular hybrids of the genus. It is a cross between *Dendrobium caesar* × *Dendrobium tomiedrake*. The plant shows sympodial (upright) growth with club shaped pseudobulbs. Leaves are bright green, broad and acute. Flowers are white and purple coloured, sepals are creamy white with purple markings, petals purple in colour. Shade net house was used for growing orchid under partially controlled atmosphere and environment by reducing light intensity and heat radiation during day time. Plants were potted and placed on the benches of 40 m length, 18 cm width and 1 m height. Planting was taken up in plastic pots of size 16 cm diameter with 10 drainage holes each of 2 cm diameter (to drain the excess water and for free movement of air). Orchids require a

suitable potting medium for growth and development and it varies with type of orchid and the environmental conditions (Kang, 1972 and Fitch, 1981) [9, 7]. Growing medium for *Dendrobium* should be moist but never be soggy (Rajeevan *et al.*, 2008) [15]. After planting, the potting media were immediately irrigated thoroughly to maintain the optimum moisture condition. During vegetative phase N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O at the ratio of 3:1:1 and during blooming phase at the ratio of 1:2:2 (0.2% concentration) were provided weekly once. Nutrient combinations were made using ammonium nitrate, orthophosphoric acid and potassium nitrate. The commercially available water soluble fertilizers (19-19-19, 13-0-45) of different grades were also used as source for nutrients. Micronutrients were sprayed monthly once. Calcium nitrate and Magnesium sulphate @ 0.1% was given once in a month.

Completely randomized design was set with three replications having fifteen plants in each replication and each replication contains ten different treatments. The data recorded on various physiological parameters *viz.*, dry weight of plant, root length, number of roots per plant, chlorophyll content, yield of spikes per plant per year, longevity of spike on plant, vase life and were statistically analyzed.

### Results and Discussion

**Dry weight of plant (g):** The data pertaining to the effect of different potting media on dry weight of plant of *Dendrobium* orchid cv. Sonia 17 is presented in Table no. 1. Among all the treatments Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1) has recorded significantly the maximum dry weight of plant (10.75 g) while, Paddy husk + Brickpieces + Gravel (2:1:1) recorded significantly the minimum dry weight of plant (6.99 g).

**Table 1:** Effect of different potting media on dry weight of plant, number of roots and root length of *Dendrobium* orchids cv. Sonia 17.

Treatments	Dry weight of plant (g)	Number of roots	Root length (cm)
T <sub>1</sub> : Paddy husk + Brickpieces + Gravel (2:1:1)	6.99	23.90	12.86
T <sub>2</sub> : Paddy husk + Charcoal + Gravel (2:1:1)	7.85	26.54	13.78
T <sub>3</sub> : Paddy husk + Brickpieces + Charcoal + Gravel (2:1:1:1)	8.38	27.41	14.16
T <sub>4</sub> : Coconut husk chips + Brickpieces + Gravel (2:1:1)	10.40	31.63	16.70
T <sub>5</sub> : Coconut husk chips + Charcoal + Gravel (2:1:1)	10.06	30.74	16.10
T <sub>6</sub> : Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1)	10.75	32.51	17.54
T <sub>7</sub> : Cocopeat + Brickpieces + Gravel (2:1:1)	8.84	28.56	14.61
T <sub>8</sub> : Cocopeat + Charcoal + Gravel (2:1:1)	9.30	29.30	15.14
T <sub>9</sub> : Cocopeat + Brickpieces + Charcoal + Gravel (2:1:1:1)	9.65	30.05	15.74
T <sub>10</sub> : Coconut husk (Control)	7.43	25.33	13.27
Mean	8.96	28.59	14.99
SEm±	0.09	0.23	0.13
CD at 5%	0.27	0.67	0.40

**Table 2:** Effect of different potting media on chlorophyll content of *Dendrobium* orchids cv. Sonia 17.

Treatments	Chlorophyll content (mg/g)									Mean
	2MAT	4MAT	6MAT	8MAT	10MAT	12MAT	14MAT	16MAT	18MAT	
T <sub>1</sub>	0.24	0.27	0.36	0.46	0.49	0.54	0.72	0.73	0.80	0.51
T <sub>2</sub>	0.24	0.32	0.38	0.49	0.50	0.56	0.74	0.75	0.83	0.53
T <sub>3</sub>	0.23	0.32	0.43	0.54	0.55	0.60	0.75	0.78	0.84	0.56
T <sub>4</sub>	0.25	0.54	0.64	0.76	0.76	0.81	0.88	0.90	0.99	0.72
T <sub>5</sub>	0.26	0.55	0.64	0.73	0.76	0.82	0.89	0.90	0.98	0.72
T <sub>6</sub>	0.26	0.65	0.72	0.81	0.84	0.89	0.92	0.95	1.05	0.78
T <sub>7</sub>	0.25	0.48	0.54	0.63	0.66	0.71	0.82	0.83	0.85	0.64
T <sub>8</sub>	0.23	0.45	0.53	0.64	0.65	0.70	0.80	0.82	0.86	0.63
T <sub>9</sub>	0.22	0.45	0.56	0.66	0.68	0.73	0.85	0.87	0.86	0.65
T <sub>10</sub>	0.24	0.28	0.37	0.47	0.50	0.55	0.73	0.74	0.82	0.52
Mean	0.23	0.47	0.56	0.61	0.63	0.69	0.81	0.82	0.89	0.62
SEm±	0.01	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.05
CD at 5%	NS	0.15	0.15	0.15	0.15	0.15	0.18	0.18	0.18	0.15



**T<sub>6</sub>: Coconut husk chips + brick pieces + charcoal + gravel**



**T<sub>1</sub>: Paddy husk + Brick pieces + Gravel**

**Plate 1:** Effect of different potting media on number of roots per plant of *Dendrobium* orchids cv. Sonia 17

**Number of roots per plant:** The data pertaining to the effect of different potting media on number of roots per plant of *Dendrobium* orchid cv. Sonia 17 is presented in Table no. 1. Among all the treatments the maximum number of roots per plant was noted with Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1) (32.51). The minimum number of roots per plant was observed in Paddy husk + Brickpieces + Gravel (2:1:1) (23.90).

**Root length (cm):** The data pertaining to the effect of different potting media on root length of *Dendrobium* Orchid cv. Sonia 17 is presented in Table no.1. Plant grown in a mixture of Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1) has recorded significantly the maximum root length (17.54 cm) while, plant grown in a mixture of Paddy husk + Brickpieces + Gravel (2:1:1) recorded significantly the minimum root length (12.86 cm).

The plants grown in the media containing Coconut husk chips + Brickpieces + Charcoal + Gravel in the ratio of 2:1:1:1 registered maximum dry weight of plant which might be due to improved photosynthetic efficiency and higher carbohydrate accumulation in plants.

For proper root growth, a media must serve four functions *viz.*, to provide water, to supply nutrients, to permit gas exchange and to provide support for the plants. Root production is important for the survival and growth of any plants and orchids have no exception from this fact. Being

epiphytic, velamen roots are not only important for anchoring plants to the substrate but also involved in the absorption of water and the uptake of nutrients. Sympodial orchids produce roots faster than monopodial orchids.

Maximum number of roots per plant with highest root length were produced in the growing media with Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1). This might be due to the fact that the media is not compact, provided good aeration and allowed free growth of roots which resulted in increase of length and number of roots. Similarly, Paul and Rajeevan (1992) [13] found that a combination of charcoal + gravel jelly + brick pieces and coconut husk gave the maximum number of roots and root length in *Dendrobium* orchid.

The minimum number of roots and root length was produced in (T<sub>1</sub>) Paddy husk + Brickpieces + Gravel (2:1:1) might be due to the fact that paddy husk contain low amounts of phosphorus which resulted in poor root growth.

**Total chlorophyll content (mg/g):** The data pertaining to the effect of different potting media on total chlorophyll content (mg/g) of *Dendrobium* orchid cv. Sonia 17 is presented in Table no. 2. The data was recorded at two months interval from the date of planting to end of experiment during two consecutive years of 2016-17 and 2017-18 and significant differences were observed with different potting media in *Dendrobium* orchid cv. Sonia 17.

The chlorophyll content was non significantly influenced by different potting media at 2 months after transplanting.

At 4 months after transplanting, among all the treatments Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1) has recorded significantly the maximum chlorophyll content (0.65 mg/g) which was on par with Coconut husk chips + charcoal + Gravel (0.55 mg/g) and Coconut husk chips + Brick pieces + Gravel (0.54 mg/g) while, (T<sub>1</sub>) Paddy husk + Brickpieces + Gravel (2:1:1) recorded significantly the minimum chlorophyll content (0.27 mg/g) which was on par with Coconut husk (0.28 mg/g), Paddy husk + Charcoal + Gravel (0.32 mg/g) and Paddy husk + Brick pieces + Charcoal + Gravel (0.32 mg/g).

At 6 months after transplanting, among all the treatments Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1) has recorded significantly the maximum chlorophyll content (0.72 mg/g) which was on par with Coconut husk chips + charcoal + Gravel (0.64 mg/g) and Coconut husk chips + Brick pieces + Gravel (0.64 mg/g) while, Paddy husk + Brickpieces + Gravel (2:1:1) recorded significantly the minimum chlorophyll content (0.36 mg/g) which was on par with Coconut husk (0.37 mg/g), Paddy husk + Charcoal + Gravel (0.38 mg/g) and Paddy husk + Brick pieces + Charcoal + Gravel (0.43 mg/g).

At 8 months after transplanting, among all the treatments Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1) has recorded significantly the maximum chlorophyll content (0.81 mg/g) which was on par with Coconut husk chips + charcoal + Gravel (0.73 mg/g) and Coconut husk chips + Brick pieces + Gravel (0.76 mg/g) while, Paddy husk + Brickpieces + Gravel (2:1:1) recorded significantly the minimum chlorophyll content (0.46 mg/g) which was on par with Coconut husk (0.47 mg/g) and Paddy husk + Charcoal + Gravel (0.49 mg/g).

At 10 months after transplanting, among all the treatments Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1) has recorded significantly the maximum chlorophyll content (0.84 mg/g) while, Paddy husk + Brickpieces +

Gravel (2:1:1) recorded significantly the minimum chlorophyll content (0.49 mg/g) which was on par with Coconut husk (0.50 mg/g) and Paddyhusk + Charcoal + Gravel (0.50 mg/g).

At 12 months after transplanting, among all the treatments Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1) has recorded significantly the maximum chlorophyll content (0.89 mg/g) while, Paddy husk + Brickpieces + Gravel (2:1:1) recorded significantly the minimum chlorophyll content (0.54 mg/g) which was on par with Coconut husk (0.55) and Paddy husk+ charcoal + Gravel (0.56 mg/g).

At 14 months after transplanting, among all the treatments Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1) has recorded significantly the maximum chlorophyll content (0.92 mg/g) which was on par with Coconut husk chips + charcoal + Gravel (0.89 mg/g) and Coconut husk chips + Brick pieces + Gravel (0.88 mg/g) while, Paddy husk + Brickpieces + Gravel (2:1:1) recorded significantly the minimum chlorophyll content (0.72) which was on par with Coconut husk (0.73 mg/g) and Paddy husk + Charcoal + Gravel (0.74 mg/g).

At 16 months after transplanting, among all the treatments Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1) has recorded significantly the maximum chlorophyll content (0.95 mg/g) which was on par with Coconut husk chips + charcoal + Gravel (0.90 mg/g) and Coconut husk chips + Brick pieces + Gravel (0.90 mg/g) while, Paddy husk + Brickpieces + Gravel (2:1:1) recorded significantly the minimum chlorophyll content (0.73 mg/g) which was on par with Coconut husk (0.74 mg/g) and Paddy husk + Charcoal + Gravel (2:1:1) (0.75 mg/g).

At 18 months after transplanting, among all the treatments Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1) has recorded significantly the maximum chlorophyll content (1.05 mg/g) which was on par with Coconut husk chips + charcoal + Gravel (0.98 mg/g) and Coconut husk chips + Brick pieces + Gravel (0.99 mg/g) while, Paddy husk + Brickpieces + Gravel (2:1:1) recorded significantly the minimum chlorophyll content (0.80 mg/g) which was on par with Coconut husk (0.82 mg/g) and Paddy husk + Charcoal + Gravel (0.83 mg/g), Paddy husk + Brickpieces + Charcoal + Gravel (2:1:1:1) (0.84 mg/g), Cocopeat + Brick pieces + Gravel (2:1:1) (0.85 mg/g), Cocopeat + Charcoal + Gravel (2:1:1) (0.86 mg/g), Cocopeat + Charcoal + Brick pieces + Gravel (2:1:1:1:1) (0.86 mg/g).

The chlorophyll is an essential component for photosynthesis and occur in chloroplasts as green pigment in plant tissues. In general, total chlorophyll content increased with crop growth (Saravanan, 2001 in *Dendrobium*). The combination of Coconut husk chips + Brickpieces + Charcoal + Gravel in the ratio of 2:1:1:1 recorded maximum chlorophyll content which might be due to, magnesium which is essential for chlorophyll synthesis is present in Coconut husk resulted in increase of chlorophyll content from 2MAT to 18 MAT.

**Yield of spikes per plant per year:** The data pertaining to the effect of different potting media on number of spikes per plant of *Dendrobium* orchid cv. Sonia 17 is presented in Table no. 3. Number of spikes per plant differed significantly for different potting media.

Treatments had marked influence on number of spikes per plant and among all the treatments Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1) has recorded significantly the maximum number of spikes per plant (3.58) while, Paddy husk + Brickpieces + Gravel (2:1:1) recorded significantly the minimum number of spikes per plant (1.81). Coconut husk has been reported to contain some amount of major, secondary and micronutrients (Savithri and Khan, 1994), free from any admixture of heavy metals and due to higher porosity, adequate nutrient availability and lower pH and EC in the media enhanced plant growth and flower yield. Both physical and chemical characteristics of the growing medium exert substantial effect on growth of plants. Among the physical characteristics, aeration and water holding capacity are probably the most important factors while, among the chemical characteristics nutritional status and salinity level have crucial role on plant development (Dewayne *et al.* 2003) [5]. Apparently, the coconut husk with charcoal had the most appropriate physico-chemical properties *viz.*, bulk density (0.05 g/cc), porosity (98.10 g/cc), pH (6.27), EC (1.22 dSm<sup>-1</sup>) and available nutrients (1.10, 0.52, 2.61 % NPK) (Sumathi, 2016) [19] and thus gave good vegetative growth which ultimately produced maximum number of spikes per plant.

The lowest number of spikes was recorded in (T<sub>1</sub>) Paddy husk + Brickpieces + Gravel (2:1:1) media might be due to the fact that paddy husk contains low nitrogen and phosphorus resulting in poor root and vegetative growth that ultimately affected the reproductive growth and thus produced lesser number of spikes per plant.

**Longevity of spike on plant (days):** The data pertaining to the effect of different potting media on longevity of spike on plant of *Dendrobium* orchid cv. Sonia 17 is presented in Table no.3. Significant differences were reported in longevity of spike on plant with different potting media in *Dendrobium* orchid cv. Sonia 17.

Among all the treatments Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1) has recorded significantly the maximum longevity of spike on plant (41.23) further, Paddy husk + Brickpieces + Gravel (2:1:1) noticed significantly the minimum longevity of spike on plant (30.93).

**Vase life (days):** The data pertaining to the effect of different potting media on vase life of *Dendrobium* orchid cv. Sonia 17 is presented in Table no.3. Significant differences were observed in vase life with different potting media in *Dendrobium* orchid cv. Sonia 17.

Tabulated data clearly indicated that significantly the maximum vase life was recorded when plants grown in potting media combination of Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1) (15.86 days) while, plants grown in potting media mixture of Paddy husk + Brickpieces + Gravel (2:1:1) recorded significantly the minimum vase life (12.90 days).

The combination of Coconut husk chips + Brickpieces + Charcoal + Gravel in the ratio of 2:1:1:1 recorded maximum vase life which might be due to the increase in internal carbohydrate content of the flowers which enhanced the vase life.

**Table 3:** Effect of different potting media on yield of spikes per plant per year, vase life and longevity of spikes on plant of *Dendrobium* orchids cv. Sonia 17.

	Treatments	Yield of spikes per plant per year	Vase life (days)	Longevity of spikes on plant (days)
T1:	Paddy husk + Brickpieces + Gravel (2:1:1)	1.81	12.90	30.93
T2:	Paddy husk + Charcoal + Gravel (2:1:1)	2.08	13.35	33.73
T3:	Paddy husk + Brickpieces + Charcoal + Gravel (2:1:1:1)	2.38	13.65	34.13
T4:	Coconut husk chips + Brickpieces + Gravel (2:1:1)	3.28	15.30	39.70
T5:	Coconut husk chips + Charcoal + Gravel (2:1:1)	3.08	14.78	38.13
T6:	Coconut husk chips + Brickpieces + Charcoal + Gravel (2:1:1:1)	3.58	15.86	41.23
T7:	Cocopeat + Brickpieces + Gravel (2:1:1)	2.59	13.86	35.07
T8:	Cocopeat + Charcoal + Gravel (2:1:1)	2.76	14.10	35.97
T9:	Cocopeat + Brickpieces + Charcoal + Gravel (2:1:1:1)	2.89	14.45	37.00
T10:	Coconut husk (Control)	2.01	13.10	32.53
	Mean	2.64	14.13	35.84
	SEm±	0.03	0.08	0.24
	CD at 5%	0.09	0.26	0.73

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