ISSN Print: 2664-844X
ISSN Online: 2664-8458
NAAS Rating (2026): 4.97
IJAFS 2026; 8(9): 170-172
www.agriculturaljournals.com
Received: 11-06-2026
Accepted: 13-07-2026

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Growth response of *Cordyline marginata* to various growth substrates

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DOI: https://www.doi.org/10.33545/2664844X.2026.v8.i9c.1868

Abstract
Growing substrates play a crucial role in the growth, development, and quality of ornamental foliage plants by influencing root aeration, water retention, nutrient availability, and microbial activity. *Cordyline marginata*, an important ornamental foliage plant valued for its attractive foliage and adaptability to indoor and outdoor landscapes, requires an appropriate growing medium for optimum growth and marketable quality. An experiment entitled "Growth response of Cordyline marginata to various growth substrates" ornamental foliage plant. This study aims to discover the optimal media combination for *Cordyline marginata* plant growth. The site of experiment is situated at 23^0N latitude and 89^0E longitudes at an elevation of 9.75 meters from mean sea level. The investigation involved 7 treatments (media combinations). T1: Soil + sand + FYM (2:1:1), T2: Soil + sand + vermicompost (2:1:1), T3: Soil + sand + FYM + vermicompost (2:1:1.0:0.5), T4: Cocopeat only, T5 Cocopeat + sand + FYM (2:1:1), T6: Cocopeat + sand + vermicompost (2:1:1) and T7: Cocopeat + sand + FYM + vermicompost (2:1:1.0:0.5). The results of the study revealed that the treatment T_1 Soil + Sand + FYM (2:1:1) significantly improved vegetative attributes of *Cordyline marginata.*

Keywords: *Cordyline marginata*, Pot culture, Media compositions, Growth parameters

Introduction
Cordyline marginata (Madagascar dragon tree) is a popular ornamental foliage plant widely cultivated for its attractive sword-shaped leaves, vibrant foliage color, and adaptability to both indoor and outdoor landscapes. The plant is highly valued in interior scaping, container gardening, and landscape design due to its architectural form, low maintenance requirements, and tolerance to a wide range of environmental conditions. The increasing demand for ornamental foliage plants in urban landscapes, offices, homes, and commercial establishments has created a need for efficient production techniques that enhance plant quality and growth. Growing substrate is one of the most critical factors influencing the growth, development, and quality of container-grown ornamental plants. A suitable substrate provides physical support, adequate moisture retention, aeration, drainage, and essential nutrients required for optimum plant growth. The physical and chemical properties of the growing medium directly affect root development, nutrient uptake, water availability, and overall plant performance. Therefore, the selection of an appropriate substrate is essential for producing healthy and marketable ornamental foliage plants. Traditionally, garden soil has been used as a major component of potting mixtures. However, soil-based media often possess limitations such as high bulk density, poor aeration, low water-holding capacity, and the presence of soil-borne pathogens. Consequently, there has been increasing interest in the use of soilless substrates and organic amendments such as cocopeat, vermicompost, perlite, vermiculite, rice husk, biochar, and farmyard manure. These materials improve the physical structure of the medium by enhancing porosity, moisture retention, drainage, and nutrient availability. Among the various substrate components, cocopeat has gained considerable importance because of its high water-holding capacity, low bulk density, excellent aeration, and eco-friendly nature. Vermicompost serves as a rich source of plant nutrients, beneficial microorganisms, and growth-promoting substances, while perlite and vermiculite improve aeration and moisture retention.

Research on ornamental foliage plants has demonstrated that combinations of these materials can significantly enhance plant growth, leaf production, root development, and overall plant quality compared to conventional soil-based media.

Several studies on ornamental foliage plants have reported superior growth performance in substrates containing cocopeat, vermicompost, and other organic amendments. Media with balanced proportions of soil, cocopeat, vermicompost, and sand have been found to improve plant height, leaf area, biomass accumulation, and root growth due to better physical and nutritional conditions. Similarly, lightweight soilless media characterized by high porosity and water-holding capacity have been recommended for the production of high-quality potted foliage plants.

Research conducted on ornamental foliage plants has consistently highlighted the benefits of combined substrate formulations. In a vertical gardening study involving several foliage ornamentals, including Cordyline, a medium consisting of soil, cocopeat, vermicompost, and sand in appropriate proportions produced superior growth compared with soil alone. Likewise, studies on Dracaena species reported that media containing cocopeat, sand, and vermicompost significantly enhanced plant height, leaf number, plant spread and overall plant performance under protected cultivation. Investigations on Aglaonema and other foliage plants have also demonstrated that soilless or partially soilless media enriched with organic amendments promote vigorous vegetative growth and improve market quality. Although considerable information is available on the influence of growing media on various ornamental crops, limited research has been conducted specifically on *Cordyline marginata*. Since the growth and aesthetic value of foliage plants largely depend on the quality of the root environment, it is essential to identify suitable substrate combinations that promote vigorous vegetative growth and improve plant quality under container cultivation.

Therefore, the present investigation was undertaken to evaluate the growth response of *Cordyline marginata* to different growing substrates and to identify an optimum potting medium for enhancing growth, foliage production, and overall plant performance.

Materials and Methods

The present study was conducted under shade net house installed at AICRP on Floriculture, Mohanpur, BCKV. The experiment was laid out in a Completely Randomized Design with seven treatments and three replications. Uniform irrigation was provided to all treatments as and when required. Weeding, removal of dried leaves, and plant protection measures were carried out regularly. Ten pots per treatments were raised and the following seven types of treatments (media) were used. T1: Soil + sand + FYM (2:1:1), T2: Soil + sand + vermicompost (2:1:1), T3: Soil + sand + FYM + vermicompost (2:1:1.0:0.5), T4: Cocopeat only, T5: Cocopeat + sand + FYM (2:1:1), T6: Cocopeat + sand + vermicompost (2:1:1) and T7: Cocopeat + sand + FYM + vermicompost (2:1:1.0:0.5). Observation of growth parameters after transplantation, the response of the foliage plant was studied for further analysis and evaluation was done on the basis of vegetative growth parameters such as plant height, Number of Leaves, Leaf length, Leaf width and Plant spread. The treatments consisted of different growing substrate combinations as follows:

Table 1: Treatments and composition of different media

S. No.	Treatments	Composition/details
1	T_1	Soil + sand + FYM (2:1:1)
2	T_2	Soil + sand + vermicompost (2:1:1)
3	T_3	Soil + sand + FYM + vermicompost (2:1:1.0:0.5)
4	T_4	Cocopeat only
5	T_5	Cocopeat + sand + FYM (2:1:1)
6	T_6	Cocopeat + sand + vermicompost (2:1:1)
7	T_7	Cocopeat + sand + FYM + vermicompost (2:1:1.0:0.5)

Results and Discussion

The experimental results revealed that the maximum plant height (86 cm) was recorded in the treatment containing Cocopeat + sand + FYM (2:1:1) and cocopeat. The observed differences in plant height may be attributed to the combined effect of cocopeat and FYM, which provide favorable physical and nutritional conditions for plant growth. Cocopeat improves aeration, water-holding capacity, and total porosity of the growing medium, while FYM enhances nutrient availability and organic matter content. The improved root-zone environment may have promoted better root development and efficient absorption of water and nutrients, ultimately resulting in increased plant height. These findings are in agreement with the reports of Muraleedharan *et al*. (2020) [4] in *Anthurium*, Gaikwad *et al.* (2020) [1] in tuberose, and Kavana *et al.* (2019a) in *Nephrolepis undulata*. These results are also in accordance with the findings of Treder (2008) [6], who reported maximum plant height in media containing cocopeat.

Leaves are the major site for photosynthesis in plants and higher leaf number is the index of plant health and vigor. Growing media must exhibit features that favor the growth of aerial parts particularly in perennial house plants. The number of leaves superior in (47) the media combination of Soil+ sand + vermicompost (2:1:1) whereas, the minimum number of leaves (16) was recorded in cocopeat + sand + vermicompost (2:1:1) (Table 2). Higher number of leaves might be due to ample aeration provided by sand and the nutrient status made available by both vermicompost and cocopeat. Similar results were reported by Moghadam *et al.*, (2012) [3] in Asiatic lilium hybrid "Navona". Leaf length (cm) exhibited significant variation among different growing media compositions. Maximum leaf length (36 cm) was observed in plants grown in media composition T_3 which is on par with media T_6 and T_5 and T_4 recording 33 cm and 32 cm and 31 cm respectively. The positive impacts of the growing medium components may be responsible for the plants increased vegetative development.

Table 2: Effect of various combinations of potting media on the plant height, Number of Leaves, Leaf length, Leaf width and Plant spread

S. No.	Treatment Name	Plant height (cm)	No. of leaves plant^{-1}	Leaf length (cm)	Leaf width (cm)	Plant spread (cm)
1	Soil + sand + FYM (2:1:1)	64	18	29.5	6	46x52
2	Soil + sand + vermicompost (2:1:1)	65	47	30	6.4	53x55
3	Soil + sand + FYM + vermicompost (2:1:1.0:0.5)	74	22	36	6.4	65x71
4	Cocopeat only	86	23	31	7	59x61
5	Cocopeat + sand + FYM (2:1:1)	86	20	32	7.5	71x65
6	Cocopeat + sand + vermicompost (2:1:1)	74	16	33	7.5	49x52
7	Cocopeat + sand + FYM + vermicompost (2:1:1.0:0.5)	55	21	22	5	51x42

Plant spread recorded in chlorophytum plants showed significant differences among different growing media compositions. The highest plant spread was observed in plants grown in media composition T_5 followed by media T_3. The enhanced vegetative growth observed in the plants may be attributed to the beneficial effects of the growing medium components. The medium consisted of cocopeat, vermicompost and FYM which improved the physical properties of the substrate by enhancing its texture and preventing compaction. Due to its highly porous nature, cocopeat increased the water-holding capacity of the medium, ensuring a continuous supply of moisture to the plants. Patel *et al*. (2020) [5] evaluated the effect of different potting media on three Dracaena species, including Dracaena marginata (syn. Cordyline marginata in ornamental trade). Among the media tested, the combination of cocopeat, sand, and vermicompost (1:1:1) produced the maximum plant height, plant spread, and rhizosphere development. The study demonstrated that substrates enriched with cocopeat and vermicompost significantly improved vegetative growth compared to other media combinations, highlighting the importance of balanced physical and nutritional properties in foliage plant production.

Conclusion

The observed variations in plant height, number of leaves, leaf length, leaf width, and plant spread can be attributed to the different potting media used. These differences may be due to the influence of the physical and physiological properties of the media, such as bulk density, porosity, water-holding capacity, and adequate aeration. The media also provide favorable growing conditions by preventing waterlogging and reducing the incidence of weeds, pests and diseases, thereby promoting better plant growth and development.

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