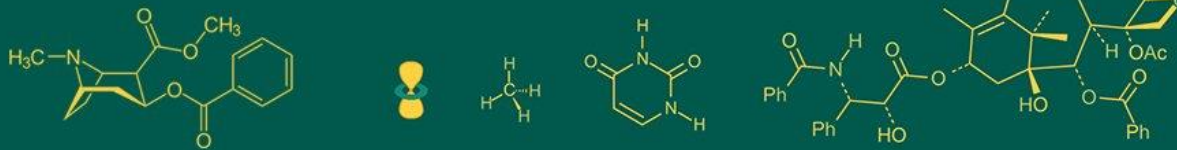


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Palm: Versatile group of plant material for landscape gardening

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Abstract

Decorative palms are one of the vital components of tropical, subtropical, or even heat temperate weather landscapes. In colder climates, they may be important interiorscape plants and are regularly a focal point in malls, organizations hubs, homes, road and other public areas. There are 181 genera with around 2,600 species are belonging to the circle of relatives Arecaceae (Palmae). The grate botanist Linnaeus, referred to as them "Princes of the vegetable country". in many historical cultures, fingers are image for such ideas as victory, peace and fertility. whilst, these days it represents image for tropics and vacation spots. The manufacturing of decorative palm is a quite small enterprise, yet pretty famous for people who produce on small acreage or ranchettes. decorative palms are widely used in landscaping for his or her wonderful look, making them maximum economically critical flowers inside the international. The clean cultivation of palms and their pleasant look lead them to first-rate favourites in the garden, enhance indoor air quality and used as reduce foliage in domestic or international marketplace too.

Keywords: Palm, landscape, gardening, tropical, arecaceae

Introduction

The palm tree is a beautiful, unbranched evergreen that is found across the world's tropical and warm climates. It's long, feathery, or fan-shaped leaves make an unmistakable profile at the top of the tree, and the trunk frequently displays old leaf scars that have weathered into a unique pattern that marks the passage of time. In the landscapes of tropical, subtropical, and even warm temperate regions, these ornamental palms are essential. They are not, however, exclusive to outdoor environments. These graceful trees become essential Interiorscape plants in cooler climates, where they beautify corporate headquarters, retail centers, skyscraper facades, busy streets, and other public areas, adding a hint of the exotic to our daily life.

A plethora of diversity unfolds inside the broad universe of palms. The Arecaceae (Palmae) family is a rich and intriguing botanical family with 181 genera and roughly 600 species. Even the renowned Swedish botanist Carl Linnaeus was enthralled by these plants, naming them the "Princes of the vegetable kingdom" due to their regal appearance and significance. The fascination of palms extends beyond their physical characteristics; throughout history, they have held significant cultural and symbolic value. Palm trees served as fertility, peace, and triumph symbols in a wide range of ancient cultures. These days, they are treasured as symbols of relaxation and travel, and they are representative of the tropics. A beach surrounded by palm trees and bathed in a golden sun has long been associated with paradise and leisure.

Palm trees have been around for a very long time. The first modern palm species, including *Nypa fruticans* and *Acrocomia aculeata*, appeared 94 million years ago, as proven by the discovery of fossil *Nypa* pollen from this time period. They have withstood the test of time, proving the resilience of nature's creations. While the manufacturing of ornamental palms is still a very minor industry, it is very popular among individuals who cultivate them on tiny plots of land or ranchettes. The distinctive appearance of decorative palms distinguishes them as one of the most economically important plants in the world of horticulture. Their ease of cultivation, combined with their aesthetic appeal, has made them popular among gardeners and horticulturists both.

They not only add an elegant touch to gardens, but they also function as air-purifying houseplants and contribute to the global market as sought-after cut foliage. The tropics are home to the vast majority of palm species, which thrive in a variety of ecosystems. Their diversity is most visible in lush, lowland tropical forests, which are frequently concentrated in ecological "hotspots" of biodiversity. In comparison to the Western and Eastern Ghats, two other regions with significant palm diversity, India's Andaman and Nicobar Islands have the highest palm species diversity. Madagascar, known for its diverse biodiversity, is home to more endemic palm species than the entire African continent. Colombia may also claim a distinction for having the greatest number of palm species in a single country. However, there is one notable exception to the tropical rule. It is estimated that only about 130 palm species naturally extend beyond the tropics, thriving primarily in subtropical regions. These hardy plants have found ways to adapt to climates outside of their natural range, demonstrating the palm family's remarkable adaptability.

Botany: Flowers are typically small and white, radially symmetric, and uni or bisexual. The sepals and petals are usually three in number and can be distinct or joined at the bottom. The stamens are typically six in number, with filaments that can be separate, connected to each other, or connected to the pistil at the bottom. Hands have large, evergreen leaves that are compound and spirally arranged on the top of the stem. The leaves can be palmately ('fan-leaved') or pinnately ('feather-leaved'). At maturity, the leaves have a tubular sheath at the base that splits open on one side. The inflorescence is a spadix or spike surrounded by one or more bracts or spathes that mature to be woody. The inflorescence is a spadix or spike surrounded by one or more bracts or spathes that mature to be woody. Flowers are typically small and white, radially symmetric, and can be unisexual or bisexual. The sepals and petals are usually three in number and may be joined at the base. Stamens are usually six in number, with filaments that can be separate, connected to each other, or connected to the pistil at the bottom. The fruit is typically a single-seeded drupe (occasionally berry-like), but some genera (for example, *Saraca*) may incorporate.



Fig 1: Morphology of palm regarding its fruits, leaves and bearing habit

Why palms are very popular?

It's having long, clean, round upright trunk with evergreen crown. Symmetrical growth, which makes avenue beautiful and discipline. They have wide range for selection: tall, intermediate, dwarf, sun lover, partial or shade loving, clumping or single stem. Palms are expensive initially, but in the long run enhance the prestige of properties immensely. Do not litter fall on ground and dry leaves remain attached. It requires small ground space for growth. Root system do not cover the large area and most suitable

for narrow space. It can transplant / relocated at any age. It requires very less care and attention.

Famous garden & society

Palm house, Indian Botanical Garden, Kolkata

This garden was founded in 1787 by Colonel Robert Kyd, an army officer of the East India Company. The Large Palm House containing rich collection of palms including *Lodoicea maldivica* (the double coconut palm); branching palm (*Hyphaene thebaica*) introduced from Egypt; The century Palm (*Corypha macropoda*).



Fig 2: Large palm house

Kamati Baug, Vadodara

Sayaji Baug is a garden located in Vadodara, Gujarat, India. It is also known as "Kamati Baug," built by H. H. Maharaja Sayaji Rao Gayakwad (who established it in 1879 over an area of 40 hectares.) - a great visionary ruler of Baroda. This place famous for the first collection of unique branching palm (*Hyphaene thebaica*).



Fig 3: Palm house, Royal Botanic Gardens, Kew

The building was completed in 1840 and it was designed by Charles Lanyon and constructed by iron-maker Richard Turner, who later build the Palm House at Kew. A list of palms growing now at Kew include about 125 species.



Nong Nooch Tropical Botanical Garden, Thailand

The garden opened to the public in 1980, Nowadays, the garden counts more than 8,000 species of palms.



Market value

The market value of palm trees varies greatly depending on several factors, including the tree's species, size, age, and overall health. Geographic location and local demand can also influence market value. Here are some important factors that influence the market value of palm trees.

- **Species:** The market value of various palm species varies. Some rare or exotic palm species may command

a higher price, whereas more common varieties are typically less costly.

- **Size:** The size of the palm tree has a significant impact on its market value. Larger, older trees are frequently more valuable than smaller, younger specimens.
- **Age:** Older palm trees, particularly those that are well-established and have a striking appearance, may be more valuable. It may take decades for these trees to reach their full size and appearance potential.
- **Health and Condition:** The palm tree's health and overall condition are critical factors. Trees that are healthy and well-maintained are more valuable than those that have diseases or damage.
- **Market Values Vary by Region:** Market values vary by region. Prices may be more competitive in areas where palm trees are commonly grown, whereas palm trees may be more valuable in areas where supply is limited.
- **Local Demand:** The demand for palm trees in a particular location can have an impact on their market value. Landscaped areas, tropical climates, or a preference for palm trees in urban and suburban settings may have higher demand and, as a result, higher market values.
- **Included Services:** If the sale of a palm tree includes services such as transplanting, delivery, or planting, the price may be higher to account for these extras.
- **Container vs. Field-Grown Palm Trees:** Palm trees can be grown in either containers or in the ground. Palm trees grown in the field are typically larger and more valuable. Container-grown palms are smaller and easier to transport, making them ideal for landscaping projects.
- **Unique Features:** Some palm trees may have unique features, such as rare coloration, unusual growth patterns, or historical significance, which can increase their market value.

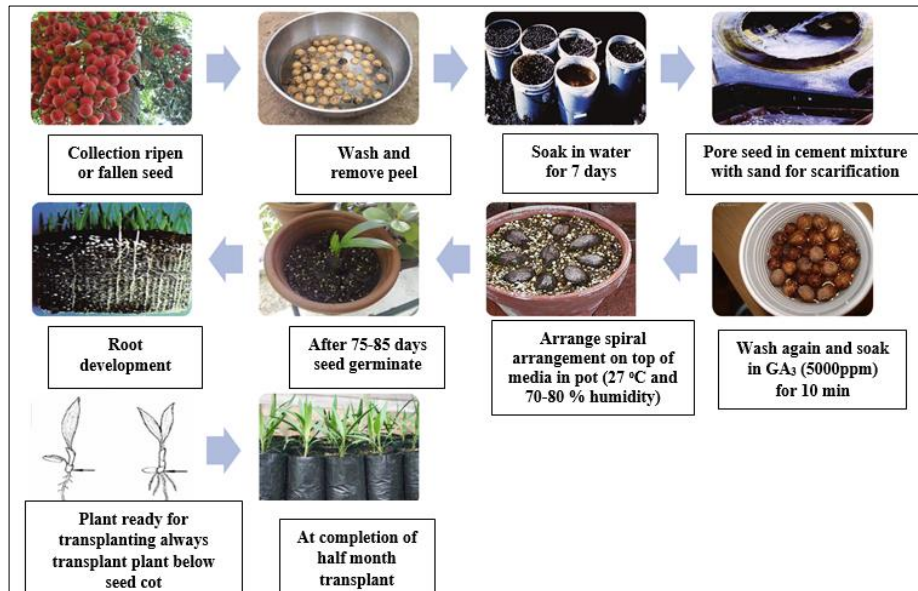
Climatic requirements: Palms have a wide range of climatic requirements due to the large number of palm species that are adapted to various environments. Palms are typically associated with warm and tropical climates. The majority of palm species thrive in temperatures ranging from 70°F (21°C) to 100°F (38 °C). They can withstand brief temperature fluctuations, but prolonged exposure to sub-zero temperatures can be harmful. Some palm species are more cold-hardy and can tolerate lower temperatures for brief periods of time.

Sunlight: Palms require a lot of sunlight to thrive. They prefer direct sunlight to partial shade. They frequently grow in open, sunny areas in tropical climates. They may benefit from some shade from the midday sun in subtropical areas.

Humidity: Palms thrive in high humidity environments, which is why they are so common in tropical areas. Indoors, they may require higher humidity levels to thrive, particularly in drier climates.

Propagation

Division of clump: In this procedure, a mature plant is divided into smaller sections, each of which has the potential to develop into a new plant.



Tissue culture

Tissue culture has been widely used for rapid multiplication of many types of plants. However, palms have generally been difficult to establish in tissue culture. All though techniques for tissue culture developed for commercially important food, oil and medicinal palms such as *B. gasipaes*, *C. nucifera*, *E. guineensis*, *E. edulis*, *P. dactylifera* and *Serenoa repens* used for clonal propagation of superior genotypes. All though tissue culture is not used commercially for propagation of ornamental palms.



Fig 4: Tissue culture

Soil

Palm can be grown in wide range of soil type (saline/alkane/acidic) of all the area of world but generally selection depend upon climate *i.e.*, warm or cool and also depend upon soil because wide range available in palm. Well aerated, good drainage capacity and water holding capacity. The preferable potting mix for palms should be good garden soil + coco peat + FYM + sand in 1:1:1 (For pot)

Fertilizer

For maintaining foliage as fresh and green, the plant needs to feed with liquid manure, oil cake and watering may be alternated with weak ammonium sulphate solution (15g/L of water) once in fifteen days. Top-dressing 8 g N₂O -2 g P₂ O₅-12g K₂O +4 Mg once in year during July-August.

Field production of palm

This method widely follows for the largescale palm production: Ornamental palm cultivation encompasses a wide range of soil types, although it's crucial for the soil to have proper drainage to ensure adequate aeration for root

development and ease of harvest, especially during periods of heavy rainfall. In instances where the soil has a high water-holding capacity and a high water table, planting beds can be elevated by up to 30 cm or more to enhance drainage and facilitate the digging process. However, this elevation may lead to reduced stability during strong winds. While deep soils are preferred, it is noteworthy that palms have been successfully grown in shallow soils as shallow as 45–60 cm.

The density at which palms are planted can vary significantly, typically ranging from 1,125 to 10,000 plants per hectare, contingent on the species being cultivated and the desired final size. For palms designated for mechanical harvesting, rows are typically spaced at 3.00–3.6m to accommodate machinery movement. Conversely, those intended for manual digging can be grown in rows with spacing as narrow as 2.4m apart. To maximize space utilization, palms may be planted in double rows with staggered plants, forming a diamond pattern.

In addition, monocultures of palms are common, but small, shade-tolerant species can be interplant beneath larger ones to optimize space use. Palms can also be interplant with non-palm trees or shrubs, provided that considerations are given to growth rate, spread, shade tolerance, and time to reach the market.

Liners introduced into field nurseries are typically cultivated in containers ranging from 11 to 19 liters. Although smaller container-grown palms are cost-effective, they may exhibit lower survival rates. It is important to note that while root-control bags (grow bags) have been advocated for branching in non-palm trees cultivated in field nurseries, the larger diameter of primary palm roots often leads to root wrapping rather than the development of a branched root system when grown in such bags.

Irrigation: The frequency of irrigation varies according to factors such as the soil's water-holding capacity, the water table's level, the specific species being cultivated, their age, and the amount of natural rainfall. The authors recommend that irrigation should be carried out for a duration that ensures the soil is adequately moistened to a depth of 0.6–0.9 meters. In the case of newly planted palm trees that do not receive significant rainfall, there may be a need for frequent irrigation, especially in sandy soils, during the

initial 6 months, with a subsequent reduction in the irrigation frequency.

Fertilization: Slow-release fertilizer specifically formulated for palm trees. A fertilizer with a ratio of approximately 19-19-19 (N-P-K) is suitable for many palm species in India. Palms often require higher potassium (13:00:45 K) levels for root development and overall health. Opt for slow-release fertilizers as they provide a consistent nutrient supply over an extended period, reducing the risk of over-fertilization and nutrient imbalances. This is especially beneficial in the Indian climate, where there can be extended growing seasons. In addition to the major N-P-K nutrients, palms in India may benefit from supplemental micronutrients like magnesium, manganese, iron, and zinc. Consider using a palm fertilizer that includes these micronutrients or apply them separately if needed. Palms should be fertilized during their active growing season, which generally occurs during the monsoon and post-monsoon periods. Avoid fertilizing during the dry season when palms are less active. Follow the manufacturer's recommendations for the specific palm fertilizer you choose. Typically, you'll apply fertilizer at a rate of 1 to 2 pounds of actual nitrogen per 100 square feet of the root zone area. Spread the fertilizer evenly over the root zone area beneath the palm's canopy, avoiding direct contact with the trunk. It's important to water the palms well after fertilization to help dissolve the nutrients and transport them to the root zone.

Transplanting and landscape management: The digging and transplanting of field-grown palms destined for landscape use is discussed in the section on Transplanting. Field-grown palms intended for interior usage should be dug with a root ball slightly smaller than the container in which they are to be placed. If they are to be transported out of state, they may need to have their root balls rinsed free of any native soil. The success or failure of transplanting depends on a number of factors, both above and below ground.

Root Ball Size

The most appropriate root ball length refers to the smallest root ball size that ensures a satisfactory survival rate. However, determining this optimal size has presented a bit of a challenge. In the case of most species, root balls typically do not need to exceed dimensions of 30 cm from the trunk or 30 cm in depth, as the highest concentration of vital root density is found within this specific volume. For other species that generate a significant number of new adventitious roots, in addition to lower root survival, it is advisable to consider a combination of roots originating from both sources in the calculation. It's important to note that because root balls have three-dimensional properties, the depth of the root ball should also be factored in when establishing the minimum root ball size.

Planting

Planting locations should possess adequate drainage, and in cases where there are hard pan layers obstructing drainage, it's advisable to drill through these layers to facilitate proper water drainage. Alternatively, palm trees can be planted on elevated mounds or berms to enhance drainage. Inadequate drainage and excessive irrigation can lead to unfavourable establishment rates and subsequent growth issues. The planting holes should have dimensions that are roughly

twice the diameter of the root ball, while maintaining a depth that matches the root ball's size. It's crucial to eliminate air pockets by compacting the soil below and around the root ball since it has been observed that palm roots tend not to develop into voids within the soil. For larger palm trees, deep planting has been employed to mitigate the need for additional support when transplanting palms and to create uniform-height plantings using palms of varying heights. However, it's important to note that over time, deeply planted palm trees often exhibit persistent micronutrient deficiencies, growth stunting, wilting, heightened insect pest pressure, and increased mortality.

Leaf Removal and Tying

As water stress remains the leading factor behind transplant failure in palm trees, it is customary to eliminate anywhere from one-third to two-thirds of the lower leaves. This reduction in leaf mass serves to minimize water loss through transpiration. In regions characterized by intense heat and arid conditions, this practice is deemed essential, even if the palms receive regular irrigation. Another method employed to curtail water loss through transpiration in newly transplanted palms involves tightly bundling their fronds. Initially, this bundling is primarily employed to prevent leaf damage during the transportation and handling of the palms. However, the practice of maintaining the leaves in a bundled state for up to six months post-transplantation has sparked some controversy.

Pruning

Pruning palm trees involves the removal of leaves, inflorescences, and sometimes even entire stems. In palms with a crown shaft, dead leaves naturally abscise, a process called self-cleaning, while in species lacking a crown shaft, these leaves may fall off naturally or remain firmly attached until the leaf base decays or is manually removed (non-self-cleaning). Some palm species have leaf bases or entire leaves that persist for decades after senescence. Though the large size of potassium-deficient older leaves may detract from the palm's aesthetics and are often removed during pruning, these older leaves serve as a supplementary potassium source in potassium-deficient palms, making their removal unnecessary. Over-pruning can reduce canopy size, impacting photosynthesis, and may temporarily increase leaf production. Over-pruning, reducing palms to just a few leaves, has been suggested to enhance hurricane survival by decreasing wind resistance. The number of leaves removed during pruning depends on potassium status, with only completely dead leaves needing removal. Pruning timing appears less critical, but regional factors may influence timing. In hurricane-prone areas, pruning before the storm season is ideal, while pruning in cold-prone areas should be avoided in winter, as a full canopy provides better insulation.

Harvesting Leaves for Cut Foliage: When palm trees are grown for their cut foliage, leaves are regularly collected over a long period of time. In order to guarantee quality, the oldest, unblemished leaves are preferred. This is because older leaves have longer vase lives than younger leaves because they have larger stores of carbohydrates. The type of palm tree and the intervals between harvests determine the precise quantity of leaves that can be harvested. To ensure the sustainable management of the palm's foliage resources, it is generally advised not to remove more than one-third of the canopy at a single harvest.

Interiorscape management

Palm selection for interiorscape use

- **Light:** Evaluate how much light is available in your room. Different palm species require different amounts of light. While some palms, like the Areca Palm (*Dypsis lutescens*), do well in bright, indirect light, others, like the Parlor Palm (*Chamaedorea elegans*), do better in low light. Light duration is also important. At least 8–12 h of light at or slightly above the LCP per day is recommended for plants in the interiorscape. If natural light is insufficient, supplemental lighting can boost light intensity up to 6.5 klux.
- **Space:** The palm's intended placement should be taken into account in terms of its size. Certain palms are small and ideal for cramped areas, but others—like the *Howea forsteriana*, or Kentia Palm—can grow to be fairly towering and are better suited for rooms that are bigger
- **Aesthetic Preferences:** There are many different ways that palms can look. While some have more robust, fan-shaped leaves, others have delicate, feathery fronds. Select a palm that goes well with your style and interior decor.

Relative humidity

Relative humidity levels in interiorscapes are generally low, usually below 50%, but they can drop to as low as 10–20%, especially during winter. Palms typically tolerate relative humidity down to 50% without damage, but at 10% leaf tip burn can occur.

Temperature

Temperatures in interiorscapes, which can range from 20 to 24 °C on workdays, are generally suitable for most palms. However, temperatures below 18 °C can reduce growth.

Soil or planting substrate

Maximum interiorscape plants are displayed in containers or in specialized planting beds in which the use of a soilless substrate (Peat moss, Leaf mold, Shredded bark 1:1:1) is beneficial.

Water

Excessive irrigation is a common problem in interiorscapes and can lead to root damage, disease, nutritional problems, and other disorders. The root ball, backfill, and surrounding soil of newly planted palms should be kept evenly moist, not saturated.

Fertilization

Because little or no growth occurs or is desired in interiorscapes, nutritional needs of palms are correspondingly low. Seek a fertilizer with an N-P-K (nitrogen-phosphorus-potassium) ratio that is balanced. For most indoor plants, use a balanced, all-purpose fertilizer such as 19-19-19 (200 ppm drench in pot at 3 month interval).

Effect of plant growth regulators

Plant growth regulators play a first-rate position to manipulate palm top, flowering, suckering and rooting. Seeds of several species of palms had been soaked in GA₃, the resulting seedlings exhibited excessively elongated or even twisted boom in the course of their first 12 months. In most species, leaves emerging treatment with gibberellic

acid (GA₃) assumed an extra juvenile form, with leaflets failing to break up usually. Boom retardant consisting of daminozide or chlormequat had no effect on length or form of leaves or on suckering in *Chamaedorea seifrizii*, *Caryota mitis* or *Dypsis lutescens*, however chlormequat darkened the inexperienced coloration of the leaves in all species and leaf size became reduced in all of those species through ethephon.

Indoor air quality improve by palm

In urbanized population, people spending 80-90% of their time indoors. Since many people spend much of their time indoors, long-term exposure to VOCs in the indoor environment can contribute to sick building syndrome. Concentrations of VOCs are higher in indoors than outdoors. Indoor plants are effective at removing VOCs.

Impact of pollution on growth of palm

Air pollution has a poor effect on boom of palms, frequently via interfering with bud accumulation. Airborne sulfur dioxide (SO₂) has been proven to cause red- orange necrosis parallel to the veins and leaflet margins in *Dypsis lutescens* leaves. Leaflet of hands uncovered to fluoride show necrotic lesions, sally arranged in parallel rows alongside the longitudinal axis.

Some research work done on palms

The survey of south Gujarat region on diversity of palm in Surat district and total 33 species of palm were recorded among them, five were cultivated and remains in wild and ornamental form [6]. Maximum seed germination (79.40%) and seed germination index (1.2190) of Queen Palm (*Syagrus romanzoffiana*) at 30 °C temperature in control environmental condition of Brazil [5]. Maximum plant height and stem diameter were observed through the foliar fertilizer application of NPK @ 8:9:9 compared to granular application of NPK @ 10:10:10 in lady palm seedling [4]. *Chamaedorea elegans* grown in greenhouse resulted maximum plant height (56.76 cm), number of leaves per plant (7.06), stem diameter (16.17 cm) as well as fresh weight (42.64 g) and dry weight (21.19 g) of shoots [1]. Transplanting of old pygmy date palms at the original depth or up to the top of the visible portion of the root initiation zone (0 cm to 15 cm) resulted optimum survival with good plant quality [2]. Bamboo palm (*Chamaedorea seifrizii*) removed highest amount of benzene (34,073 µg) and formaldehyde (76,707 µg) through maximum leaf surface area (10,325 cm²) from a sealed experimental chamber during 24 hr exposure period [8]. GA₃ (50 ppm) + BA (20 ppm) + 8- HQC (300 ppm) + CA (300 ppm) + Sugar (2%) significantly increased the vase life (84.00 days) and dry weight (1.63 g) of *Chamaedorea elegans* with higher general appearance score (4.0) [7]. Wax coating @ 0.5% of fishtail palm (*Caryota urens*) leaf had maximum useful vase life and total vase life [3].

Conclusion

From the foregoing dialogue, it is able to be concluded that palm is maximum flexible and thriving institution of plant and provide the highest esteem by using garden armature with wide variety of selection in special panorama viz. tropical, rainforest, barren region as well as sea shore vicinity. Better germination potential of palm seed can be performed at 30 °C temperature. Media in combination of compost + peat moss + perlite located promising for higher boom and improvement of pot plant. Green residence

circumstance could be very a whole lot suitable for commercial cultivation of pleasant cut foliage manufacturing. Foliar feeding via NPK @ 8:9:9 and NPK every @ 4 g/plant profound for higher growth of palm seedling and pot plant. Transplanting of old palm at the intensity from seen portion of the basis initiation area (zero cm to 15 cm) executed better survive charge. yearly drenching of Paclobutrazol @ 1.6 g a.i. observed effective for lessen the vertical boom in landscaping. positive palm species have the capacity to take away benzene, Formaldehyde and certain VOCs from the indoor air and purify it. Areca palm, Fish tail palm and Bamboo palm can also be cultivated commercially for cut foliage functions and vase life can be improved through GA3 (50 ppm) + BA (20 ppm) + eight- HQC (three hundred ppm) + CA (300 ppm) + Sugar (2%) or wax coating @ 0.5% remedy. moreover, waste of palm species mainly coir dirt, dry leaves and husk of end result can also utilize for soil moisture conservation.

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