

***Artocarpus heterophyllus* Lam.**

**Monograph**

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# Table of contents

<b>Table of contents</b>	<b>1</b>
<b>INTRODUCTION</b>	<b>3</b>
<b>2.0 ECOLOGY</b>	<b>4</b>
2.1 DISTRIBUTIONAL CONTEXT	4
2.1.1 Affinities	4
2.1.2 Origin	4
2.1.3 Present distribution	4
2.2 ENVIRONMENTAL FACTORS IN DISTRIBUTION	5
2.2.1 Elevation	5
2.2.2 Climate	6
2.2.3 Geology, Toposequences and soils	6
<b>3.0 BIOLOGY</b>	<b>7</b>
3.1 LIFE CYCLE AND PHENOLOGY	7
3.1.1 Life cycle	7
3.1.2 Phenology	7
3.1.3 Flowering and fruiting	7
3.1.4 Fruiting	8
3.2 REPRODUCTIVE BIOLOGY	8
3.2.1 Sexuality	8
3.2.1 Pollen	9
3.2.2 Anthesis	9
3.2.3 Pollination and potential pollinators	9
3.3 Fruit development and seed set	10
3.3.1 Ovule development	10
3.3.2 Ovary wall development	10
3.4 ECOPHYSIOLOGY	10
<b>4.0 Propagation and management</b>	<b>11</b>
4.1 Natural regeneration	11
4.2 Nursery propagation	11
4.3 Planting	12
4.4 Flowering	12
4.5 Pest and disease control	12

<b>5.0 MARKETING AND ECONOMY</b>	<b>14</b>
5.1 Major Distributors	14
5.2 Products	14
EMERGING PRODUCTS, POTENTIAL MARKETS	14
Flavor	14
ITEMS BASED ON PULP, SKIN AND JUICE	15
Staple foods	15
Fruit	15
Nut/Seed	15
Leaf vegetable,	15
MEDICINAL AND TRADITIONAL, NON-WOOD USES	16
Medical Uses	16
CHARACTERISTICS	16
Description	16
Physical and strength characteristics	16
Uses	16
<b>Bibliography</b>	<b>18</b>

## INTRODUCTION

Jackfruit (*Artocarpus heterophyllus*) is a standout amongst the most critical trees in tropical homegardens and maybe the most across the board and valuable tree in the imperative sort artocarpus. It is a medium-measure evergreen tree regularly achieving 8– 25 m (26– 82 ft) in tallness that is effortlessly perceived by its natural product, the biggest among developed plants. The succulent, fragrant, and delightful natural product is eaten new or saved and hoarded in many different ways. The nutritious seeds are boiled or on the other hand cooked and eaten like chestnuts, added to flour for preparing, or on the other hand cooked in dishes. It is likewise known for its amazing, sturdy timber, which ages to an orange or red-dark colored shading. The leaves and natural product not used provide significant nutrition for cows, pigs, and goats. Numerous parts of the plant including the bark, roots, leaves, and natural product are credited with restorative properties. Wood chips yield a color used to give the well known orange-red shading to the robes of Buddhist clerics.

## 2.0 ECOLOGY

### 2.1 DISTRIBUTIONAL CONTEXT

#### 2.1.1 Affinities

The *Artocarpus Heterophyllus* or Jackfruit, is a member of the *Artocarpus* family. Its name is derived from greek: “Artos”, meaning bread, and “Karpos” fruit. This name dates to the time James Cook was realizing his second voyage in the 18<sup>th</sup> century, and ever since Johann Reinhold gave the name to the tree, it remained that way. Within the *Artocarpus* family, the most common species, besides the Jackfruit, is the Breadfruit or *Artocarpus altilis*, to which it holds a big resemblance both physically and nutritiously. Other examples are *A. mariannensis*, *A. camansi*, *A. integer*, *A. lakoocha*, *A. odoratissima*, and *A. lingnanensis*) From the latter, the Jackfruit is considered the most significant. (Elevitch and Manner 2006).

#### 2.1.2 Origin

Although pinpointing the exact origin of the Jackfruit is a hard task, researchers have found that this species of *Artocarpus* is likely to be native to the rainforests of Malaysia and Western Ghats of India. (Shapiro, Leo, 2011)

#### 2.1.3 Present distribution

Since the early contact and commerce between Europe and eastern civilizations, the Jackfruit has been spreading around the islands and lands near the Equator, all the way from Australia to South America and the Caribbean. (Campbell, R.J 2003) Although its presence in cultivation and

agriculture is not nearly as strong as other fruits and trees, it stills holds and represent an important crop for many East Asian cultures and economies. Some of these are: India, Burma, China, Sri Lanka, Malaysia, Indonesia, Thailand, and the Philippines (Table 1 below).

Table 1: Leading countries for Jackfruit production worldwide in 2015.

Rank	Country	Production (1000 tonnes)
1	India	1436
2	Bangladesh	926
3	Thailand	392
4	Indonesia	340
5	Nepal	18.97

## 2.2 ENVIRONMENTAL FACTORS IN DISTRIBUTION

### 2.2.1 Elevation

1–1600 m (3.3–5250 ft) is the usual elevation where the Jackfruit grows. It is mostly found in low forests up to 250, and it decreases in number as the elevation increases. In higher altitudes between 1000-1600m, the Jackfruit, although resistant to cold environments, is going to have a hard time growing and bearing fruits (Elevitch and Manner 2006).

### 2.2.2 Climate

The Jackfruit grows mostly between 30 latitudes from the Equator, thriving mostly at temperatures varying from hot to warm, and environments containing a high quantity of humidity. (Elevitch and Manner 2006)

### 2.2.3 Geology, Toposequences and soils

The Jackfruit grows best in lands or soils that are well drained and deep. The soil can vary between high fertility and moderate fertility, and it can survive a wide range of soils including: shallow limestone, sand, and rocky substrates. It would die or have a difficult time to bear fruits if the soil where it has its roots in has a poor drainage or if it touches stagnant water. It tolerates mildly acid soils, ranging from a pH of 5 - 7.5. (Elevitch and Manner 2006)

## 3.0 BIOLOGY

### 3.1 LIFE CYCLE AND PHENOLOGY

#### 3.1.1 Life cycle

The Jackfruit is a tree which has a perennial life cycle. Perennials plants, once they reach their maturity and maximum growth, in this case approximately 15 years, are going to last for a long, or apparently, even infinite time. During this “infinite” time, the tree is going to keep producing the fruit, considered as the largest of all cultivated fruits in the world. The tree is going to reach a diameter of 6.5m and a height of almost 25m. (Campbell, R.J 2003)

#### 3.1.2 Phenology

In regards to its year to year or even month to month behavior, the Jackfruit is not going to have a continuous and consistent behavior throughout the whole year. While the leaf and shoot production was continuous, fruit production did see a pattern of more production during certain months of the year depending on the location and weather discrepancies that may have disturb the fruit production cycle. (DP.Lina, 2015)

#### 3.1.3 Flowering and fruiting

Seedlings ordinarily take 4– 14 years before proving to be fruitful, despite the fact that the 'Singapore' (or 'Ceylon') cultivar starts proving to be fruitful 18– 30 months subsequent to transplanting (Morton 1987). Products of most cultivars achieve development in center to pre-fall. Morton (1987) reports that in Asia, contingent upon the climatic district, organic products mature for the most part from Spring to June, April to September, or June to August, with some offseason crops from September to December.



#### 3.1.4 Fruiting

Organic products are syncarps made out of the individual treated ovaries each forming into a fruitlet with delicate, yellow, plump perianths forming into mash and encompassing the seeds. The fruitlets, or genuine organic products, are at times called globules, cases or pips. Unfertilised female blooms form into intense, tie or string-like structures, called perigones, white mash or clothes. They involve spaces between fruitlets. While the perianths of prepared blooms shape consumable mash, the ovary divider does not end up plump and it forms into a pericarp.

### 3.2 REPRODUCTIVE BIOLOGY

#### 3.2.1 Sexuality

The Jackfruit is a monoecious plant, which implies that its androgynous (Shapiro, Leo). Monoecious alludes to a plant that produces male and female gametes on a similar individual; as opposed to dioecious, every individual being one sex just (Thomas Rost, Michael Barbour, C. Stocking, Terence Murphy 2006)

The Jackfruit is a **gynoecious** plant, which means it is a female species. This distinction between sexuality in plants refer to its ability to produce pollen, (if male) and produce seeds (when female). In the case of the Jackfruit, the seeds are cross pollinated, which means the pollen used by the seed to become fertilized does not come from the same species of plant. Therefore, variations between trees of Jackfruit may occur, and that's why grafting known varieties into the seeds is a common practice to ensure homogeneity between the products. (Elevitch and Manner 2006).

### 3.2.1 Pollen

Jackfruit blossoms are apparently pollinated by two, with a high rate of cross fertilization. (Little and Wadsworth 1964; Elevitch and Way 2006) By and large organic product set and natural product quality is improved by cross fertilization among cultivars.

### 3.2.2 Anthesis

Male inflorescences are borne on short shoots on principle and sidelong branches, while the female inflorescences are discovered just on the storage compartment and fundamental branches. The female inflorescences contrast from the guys in being bigger and having a thicker peduncle (Acedo 1992). Male inflorescences are created first and generally a bigger number of males create than females on the trees (Moncur 1985). At anthesis, the male blossoms produce a sweet fragrance of overripe organic product. The inflorescence in the long run decays before abscission (Moncur 1985).

After getting the seed under the appropriate circumstances, a seedling is going to develop very quickly, taking only 3 to 4 months to grow 10in. (Campbell, R.J 2003) After the second year, usually Jackfruit trees start growing at a rate of 1.5m each year, reaching at around However, for a seedling to be able to start producing fruits, a period of approximately 14 years is the usual. (Elevitch and Manner 2006) These fruits will take about 90-180 days to fully become mature.

### 3.2.3 Pollination and potential pollinators

The blooming male inflorescences have a sweet aroma of nectar and consumed sugar which pulls in little flies and bugs and different insects. Their action advances the arrival of dust grains from the projecting anthers. In any case, not very many creepy crawlies visit the female blooms and this lessens the odds of direct fertilization by bugs. The breeze and creepy crawly action together may go about as a fertilization instrument.

### 3.3 Fruit development and seed set

The jackfruit is regular with minor and real blooming and fruiting countenances. The shame of male blooms remains open for 5 days, while the female stays responsive for roughly 15 days.

The jackfruit has an extremely positive organic product set (90%) however a second rate seed for each syncarp (3% under open fertilization. (Valavi, Diminish and Thottappilly, 2011)

#### 3.3.1 Ovule development

Jackfruits are outbreeding plants, be that as it may they don't have the capacity to set organic product without fertilization thusly they are not apomictic. Hand fertilization is prompted with a specific end goal to accomplish better organic product sets. (Sherine El-Sawa, 1998)

#### 3.3.2 Ovary wall development

The perianths of prepared blooms frame palatable mash, the ovary divider does not wind up meaty and it forms into a pericarp. The seeds start from a meristematic tissue of the ovary divider called ovule primordium. A seed like structure covered with a white free covering begins to fill the dividers encompassing the ovary. (Ann Kh, 2015)

### 3.4 ECOPHYSIOLOGY

## 4.0 Propagation and Management

Engendering is for the most part by seeds; seeds require not be kept longer than a month prior to planting and germination takes 3 to two months. The seedlings ought to be moved when close to 4 leaves have showed up as further developed seedling, with its long and sensitive tap root is extremely hard to transplant effectively (Maundu P. furthermore, Bo Tengnas 2005).

### 4.1 Natural regeneration

Seedling life (communicated as far as seedling tallness, leaf region and dry weight) was additionally altogether influenced by seed mass and light administrations. Seedlings that rose up out of bigger seeds and developed under half light administration created the heaviest seedlings, while those subsequent from littler seeds and become under 3% light administration delivered the lightest seedlings. Resprouting limit of seedlings subsequent to cut-out was altogether influenced by seed mass and light administration. Seedlings rising up out of bigger seeds were fit for resprouting a few times progressively. Resprouting was more articulated under half and 25% light administrations when contrasted with 3% light. Achievement of *A. heterophyllus* recovery has all the earmarks of being controlled by an intelligent impact of seed mass (M.L. Khan 2003)

### 4.2 Nursery propagation

An in vitro culture strategy for clonal engendering of a horticulturally high yielding strain of jackfruit (*Artocarpus heterophyllus*) bearing natural products twice yearly has been accomplished. A couple of trees of jackfruit bearing organic products twice a year were chosen and in vitro culture was utilized for their clonal spread, utilizing shoot buds as explants (S.K. Roy, P.K. Roy 1996)

#### 4.3 Planting

The place decided for the planting ought to be first cleared from old tree stumps and old roots to maintain a strategic distance from termites and root malady. Whenever fundamental, the dirt ought to be furrowed initially, at that point lines are made to check the planting interims. More often than not, jackfruits are planted at a separation of 30 ft. x 30 ft. In a section of land, 48 trees can be planted. In another zone the planting interim can be lessened to 25 ft. x 25 ft., and 69 trees can be planted in a section of land (Rukayah Aman 1984)

#### 4.4 Flowering

The stamen has four anthers and produces a sweet fragrance (Purseglove, 1968). This parts to uncover a mass of sticky, circular, yellow, dust grains. A couple of between flower bracts are shed instantly after anthesis. The pinnacle of anthesis is between 2-3 pm (Samaddar and Yadav, 1982). Among the male blossoms, clean ones are additionally found. The clean male bloom has a strong unlobed perianth, while the fruitful male blossom is tubular and bi-lobed. The abscission of male spikes begins with an adjustment in shading from green to yellow, swinging to earthy yellow, lastly dark colored to dark. Spikes for the most part tumble off two to a month after development (Querijero, 1988). In any case, they may stay on the tree longer, before tumbling to the ground as a dark mass. Rich white marks of shame distend out of the surface of the spike when responsive, as a rule 4-6 days subsequent to opening of the spathes. Marks of shame have a tendency to be responsive for 28-36 hours (Sambamurthy and Ramalingam, 1954, Azad, 1989).

#### 4.5 Pest and disease control

Ailments and bugs are not a significant issue in jackfruit. IPGRI has issued a rundown of descriptors for characterisation and assessment of germplasm (IPGRI, 2000) and this rundown incorporates bugs and illnesses. In any case, Gunasena et al. (1996) detailed that the jackfruit is

generally free from genuine ailments. Soepadmo (1992) 60 expressed that yield security isn't a noteworthy worry for producers of jackfruit. All things considered, there are a few sicknesses and irritations, for example, natural product decay (*Rhizopus artocarp*i) and organic product borers (*Ochyromera artocarp*i, *Diaphania caesalis*) which ordinarily happen in jackfruit (Butani, 1978; IPGRI, 2000) and can lessen the cost for natural products.

## 5.0 MARKETING AND ECONOMY

### 5.1 Major Distributors

Jackfruit has been developed since ancient circumstances and has naturalized in numerous parts of the tropics, especially in Southeast Asia, where it is today an essential yield of India, Burma, China, Sri Lanka, Malaysia, Indonesia, Thailand, and the Philippines. It is additionally developed in parts of Africa, Brazil, Suriname, the Caribbean, Florida, and Australia. It has been acquainted with numerous Pacific islands since post-European contact and is of specific significance in Fiji, where there is a huge populace of Indian plummet.

### 5.2 Products

Jackfruit (*Artocarpus heterophyllus*) is an evergreen tree of the tropical locale. It has a place with the family Moraceae. The organic product give 2 MJ per kg/wet weight of ready perianth and contain abnormal amounts of sugars, protein, starch, calcium and vitamins. Jackfruit has assorted therapeutic uses, particularly as a hostile to oxidant, mitigating, against microbial, hostile to growth and against contagious specialist.

## EMERGING PRODUCTS, POTENTIAL MARKETS

### Flavor

Inside the thick yellowish outer wall, the fruit is filled up with pulp that can be considered acid to sweetish banana flavored. The seeds are also eaten after being treated/cooked, and they have a vague taste that reflects to the one in cashews. (Campbell, R.J 2003)

## ITEMS BASED ON PULP, SKIN AND JUICE

Over the world, in parts where the Jackfruit is a dominant player in the food culture, a wide range of uses have proven that the fruit can be as versatile as any other; harvested for its seed, fruit, leaves, and even to extract oils for medical uses:

### Staple foods

The pulp of the fruit is extracted and cooked as a starchy food resembling meat. It can also be canned in brine or curry to add flavor. (Elevitch and Manner 2006).

### Fruit

The fruit can be eaten fresh after opening the outer shell and extracting the pulp. This fruit, which is considered as one of the biggest, if not the biggest, can weigh almost 30 kg, from this almost 30% can be extracted into pulp that can be later consumed. (Elevitch and Manner 2006).

### Nut/Seed

Cooking the seeds inside the fruit is an extremely common thing people tend to do. There are two methods to cook these, either by boiling them or roasting them. Whether is boiled or roasted, both outcomes can be consumed on their own or accompanied by bread or curry. (Elevitch and Manner 2006).

### Leaf vegetable,

The leaves produced by the tree are also commonly used for consuming it as a vegetable. (Elevitch and Manner 2006).



## MEDICINAL AND TRADITIONAL, NON-WOOD USES

### Medical Uses

It is said that almost all the parts of the tree hold some type of medical use that can be exploited. Tonics can be made from the pulp and seeds, and can help overcome the alcohol inside someone's body (Fosberg, F, 1979). The seed starch is use to help with gastric distress, while the ash of the leaves can be used to treat ulcers. Not only is Jackfruit used in humans as medicine, it can also treat animals which can eat the pulp of the jackfruit (Elevitch and Manner 2006).

## CHARACTERISTICS

### Description

In terms of wood, two main types exist when classifying it: hardwood and softwood. The difference between both of these barely depends on the hardness of the wood, instead, it depends on what type of seed and leaves the tree produces (Diffen, 2017). In the case of the Jackfruit, the wood that can be found in its trunk is a type of hardwood classified as a medium hardwood (specific gravity 0.6-0.7) (Elevitch and Manner 2006). The wood it brownish, but after some time it can mature into a orange, almost red, color (Shapiro, Leo, 2011)

### Physical and strength characteristics

As it is often with hardwoods, the Jackfruit tree is made out of "highly durable, resisting termites and decay, seasons easily, resembles mahogany in appearance, and takes a beautiful polish" type of wood (Elevitch and Manner 2006). These properties of the wood can be attributed to the fact

that wood is a polymer which, mainly because of the way its molecular structure is made, has as one of its key properties being resistance to elastic tension and impact.

#### Uses

Because of the properties of the timber that is extracted from the Jacktree, today, several uses have been found for this type of wood. Because of its high durability and resistance to termites, timber extracted from the tree are most commonly used for two types of purposes: furniture inside homes, and as wood for construction. In addition, these two uses, Jackfruit wood is also intended for making musical instruments, oars, turnery, and in the past, widely used for masts in ships. (Lina and Protacio, 2015)

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