



***Anacardium occidentale*, the Cashew:
General Information & Planting Practices**

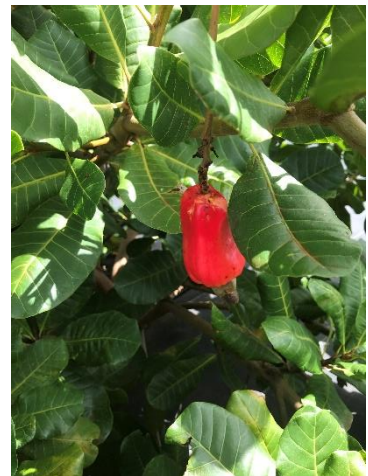
Introduction

About this information:

The information given in this presentation is gathered from various published sources, discussions with various Government Agencies Promoting modern practices among Cashew Plantations in India, and the Grant Administration's longtime involvement in various related projects. The information and suggestions given in this publication are based on industry practices as well as observed successes during the "Second Field Trial Introduction of Cashews as a New Crop for Hawaii" in which Cashew seedlings were grown. The results noted as industry standards and the successes experienced in Hawaii may differ on a case by case basis. We cannot be responsible for the outcomes associated with following the information put forth in this document.

Intro to the Field Trial

This guide is a result of work done in the Specialty Crop Block Grant Program's Fiscal Year 2015 Program in which in the "Second Field Trail Introduction of Cashews as a New Crop for Hawaii" it was determined whether cashews could successfully grow in the Hawaiian Islands as a potential and lucrative new crop. Specific high yielding varieties were imported and planted on the field trial participant's farm, located on the island of Oahu, and during this field study, the seedlings were cared for from the time of their import from Kerala, India in February of 2016 until this field trial ended in September of 2018. Unfortunately, the grafted portions of the seedlings did not survive but the root stock did, proving that the cashew is a hardy plant. In this time, it was determined that the growing conditions in Hawaii were indeed favorable for cashews.



Attributes of the Cashew and Cashew Tree

The scientific name for the Cashew is *Anacardium occidentale*, the word "ana" meaning "upwards" and "Cardium" meaning "heart." There are a few defining characteristics of the Cashew tree. While the tree is relatively small, it can be bushy and grows to about 32 ft in area. The flowers are small, starting out pale green later ranging from white to pink with a reddish interior. The fruit on the other hand is rather unique. Cashew trees have pseudocarp or "false fruit" and the false fruit is commonly referred to as a "Cashew Apple." Examples of other pseudocarps include strawberries, apples, and pineapples. The true fruit is actually a kidney shaped drupe that grows at the end of the apple where within the true fruit (*Raw Cashew nut - RCN*) contains a soft white kernel. The RCN is then covered by a double walled shell containing caustic phenolic resin.



Origins of the Cashew: Habitat, Growth, and History

The Cashew's origins are rooted in tropical/subtropical equatorial regions of South America. Their original habitats included Brazil's *Subtropical moist broadleaf forests* of the Northeast, *Savannas* of the Amazon Basin, and *Tropical grassland plains* of Columbia and Venezuela. While there are numerous varieties, very few are actually named with the exception of those specifically cultivated for high yield.

While Cashews may have originated in Brazil, they have found themselves at home throughout the "tropical" world. The Spanish are believed to be responsible for bringing Cashews northward to Central America while the Portuguese are credited with the large-scale introduction of the cashew throughout the world. Along with coffee and tea, the cashew was also one of the many agricultural commodities amongst cargo moved by the Portuguese to and from their colonies in Africa and Asia. Through this movement of goods, the Cashew was brought to India (Goa), Eastern Africa (first to Mozambique), and later to the Philippines and Indonesia. Cashews are believed to have arrived in Goa, India between 1560 – 1565 and were prized for their fruit and use in combating soil erosion. Testament to this concept comes in the shape and form of the world's largest cashew tree. Under the right conditions, cashew trees can thrive and are doing so in Brazil. In [Pirangi do Norte, Rio Grande do Norte](#), Brazil one single tree has managed to cover approximately 8,400 square meters. Yet, on the other hand, while cashews may have been spread throughout the world long ago, it was not until the 1930's that cashew production became a large-scale industry.

Movement of the Cashew through History



Why Hawaii?

Hawaii Checks All of the Boxes

Hawaii is one of only a handful of locations in the United States that are geographically and climatically conducive to growing cashews. While conducting research in Hawaii it was established that:

- Through our research, we determined that the participant's farm generally averaged about 79° F during the day and 66° F at night, ideal temperatures for Cashews. Geographically speaking, the Hawaiian Islands are in the tropics and hence conducive to growing cashews. However, while this particular site fell more or less within the ideal temperature range, it is still important for one to evaluate their own location in terms of favorability of temperature.
- Hawaii has a good number of Class C (Pasture Land) and Class D (Lands not suitable for agricultural use) sites that may potentially be suitable for growing.
- As cashews were long ago used to assist in soil erosion along coastal areas, perhaps they might fit in well on certain types of Class D coastal lands or even existing plantations. (Note: During the course of this field trial, this concept was not tested.)

Preferred Climate

The Cashew tree tends to do best at temperatures ranging between 68 - 86° F (20 - 30 ° C). While an exceptionally hardy plant which can withstand some cooler and hotter days, the temperature should not fall below 68°F (20°C) for prolonged periods or exceed 96°F (36°C) between flowering and fruiting periods which can result in adverse effects on the fruit setting and retention. As previously mentioned, the location of the field trial on the island of Oahu, fell well within this range. The Cashew trees planted even experienced a fair share of days that ranged outside the cooler side of the ideal temperature zone and still managed to thrive.

In an ideal scenario rainfall tends to be between 39–79 inches for optimum growing conditions in which Monsoons and prolonged generally dry seasons play an important role in contributing to strong yields. Even distributions of rain or too much rain throughout the year can be problematic and can result in fungal diseases or flower/fruit drop.

During the course of the field trial, measurements of rain were not collected, however based on local records, the area where the farm was located fell outside of the ideal rain totals, receiving approximately 27.72 inches of rain in 2017 but combined with intermittent watering by the farmer the seedlings thrived.

Preferred Soil Requirements

Cashews are relatively versatile in terms of soil requirements. They are adaptable to a wide variety of conditions without affecting productivity of the plant. They do very well in:

- Deep and well drained sandy loams without any hardpan.
- Pure sandy soils although mineral deficiencies in the soil may be likely.

However, they should not be grown in:

- Heavy clay soils with poor drainage.
- Areas with water stagnation or flooding. Soils with pH of higher than 8.0
- Highly alkaline or saline soils.

During the course of the field trial, it was determined through basic soil testing at the farm location for the field trial, it fell within the spectrum of being ideal for agriculture, this data for comparison of less suitable or fallow lands is not available.

Varieties



As previously mentioned, relatively few species are named and identified which may be a result of tendencies for cross pollination. Throughout India, there are at least 30 different varieties being cultivated on plantation wide basis. In the course of this project, Sulabha, Dharasree, and Madakkathara-2 varieties were chosen for import. While it was hoped that the grafted seedlings from India would survive, the grafted portions of the seedlings failed, leaving the root stock alive but thriving. As a result, at this time we are not able to determine the specific variety of Cashew. Perhaps in the future various propagation techniques can be used to help create high yielding varieties of Cashew based on the surviving rootstock.

Guidelines and Suggestions for Growing Cashews

Through the course of the field trial it was established that grafted Cashew seedlings appear to be particularly fragile and are not exceptionally suitable for long periods of transport. During the export of the seedlings from Kerala, India to Honolulu, Hawaii, the seedlings were in relatively good shape but showed signs of fatigue. During the shipping process we were able to determine that shipping tender recently grafted seedlings was not ideal, that the seedlings really benefitted from a damp but not waterlogged roots wrapped in plastic, and that shipping times of longer than one week could be harmful to the seedlings.

Planting Seeds and Seedlings/ Seedling Care

During the trial, there were many practices that allowed for significant growth of the seedlings. These included:



- Planting seedlings in spacious grow bags or pots allows for the fast-growing taproots to have ample room for growth. Significant growth was noted in seedlings planted in approximately 3 gallon grow bags.
- The cashew root system does not like to be waterlogged so ensuring balance through soil medium is ideal. Medium that promotes good drainage is ideal but on the contrast, using exceptionally porous medium may result in loss of moisture as well.
- Keeping the seedlings in an area with good air flow and partial shade is ideal. If keeping the seedlings in an enclosed greenhouse, it is essential to ensure that the seedlings aren't subject to overheating.



- Seasons for Planting are approximately June – July & September – October, however the seedlings in the field trial were planted in approximately February, indicating that this may not have a significant impact on the success of the seedlings once planted in their final location.
- Watering and fertilizing the seedlings can be somewhat of a learning curve. It was noted that while using fertilizers really helped the seedlings accelerate in growth both in and out of the greenhouse, they can and were also susceptible to fertilizer burn if fertilized too often or with higher concentrations. Watering was a similar situation in which while Cashews can handle regular water, they seem to do better when getting more periodic watering and will require a bit of attention to find an ideal balance.

Established Practices for Planting in Ground/Location

- When ready to plant in their final locations, these are the suggested methods for spacing to mitigate overcrowding:
 - 1.) Square
 - 2.) Triangle
 - 3.) *High Density Planting*
- Normal Density Spacing: Between 7m x 7m and 10m x 10m.
 - Will depend on soil fertility.
 - With fertile soil will want to space closer to 10m x 10m.
 - For less fertile soil, closer to 7m x 7m
- High Density Planting: 4m x 4m, 5m x 5m, or 8m x 4m.
 - Allows for more trees and higher yields
 - May lose some trees from competition in process over time and will need pruning regularly.
- The seedlings in the participating study were approximately planted in a row spaced in increments of 4 meters and showed no sign of overcrowding by the end of the field trial.

- Other industry based general suggestions for fertilizing and weeding include:
 - Weeding before use of fertilizers.
 - Manure is ideal, broadcast over entire tree basin (10cm deep) for young trees and in radial distance of 2 to 3 meters of watering area, leaving half a meter from the tree trunk.
 - Best to apply fertilizers during dry periods in between rains.
 - Once planted will want to maintain weeds which can be done through the use of Weed killers or by hand especially between August and September, coinciding with the monsoon season in India.

On the participant's land, one particularly effective practice to mitigate weeds was the use of large pieces of weed barrier. As fast growing grasses were a significant problem for not just the seedlings involved in this field trial but also all other crops being grown, large pieces of weed barrier were put down around the seedlings rendering weeding unnecessary.



Watering:

- Overall Cashews require little water and generally rely on rain water, but during the early stages might find it advantageous to irrigate as needed, especially if one chooses to keep them in an enclosed area like a green house or shade house.
- Adult trees can be irrigated with 200 liters of water per plant in 14 day intervals during flowering and fruiting.

Prospective Pests, Fungi, and Diseases:



The Tea Mosquito (Helopeltis antonni)

Some of the biggest risks to overall health of the tree and results in majority of economic losses stem from disease and insect damage. There are numerous pests that can prove harmful to the cashew tree. In India alone about 30 species of insects have been identified as insects that could pose a possible threat, while in Nigeria, 286 species have been found to cause some type of potential harm to the cashew. While there may be numerous potential pests, roughly **three** have been identified as particularly problematic if not controlled in the early stages: the Tea Mosquito (*Helopeltis antonni*), Stem and Root Borer (*Placaederus ferruginus* L.), and the Fruit & Nut Borer (*Thylocoptila panrosama* M.).

○ Pests Positively Identified in Hawaii and their Effects

While numerous flies, spiders, ants, and other insects were observed on and around the Cashews throughout the course of the field trial, it appears that there were really two specific pests that seemed to have a profound effect on the health and well being of the trees.

The first was the Sri Lanka Weevil (*Myllocerus Undatus*) and was first observed a few months after the seedlings were planted in their final location.

Larvae feed on the roots while the adults primarily consumed the leaves of the trees and moved from one location to another over time, which allowed most of the trees to regrow



1 Damage from Red Banded Thrips



2 The Sri Lanka Weevil (*Myllocerus Undatus*)

their leaves. Once the insects were identified it was determined that there were a number of ways to mitigate damage caused by the Sri Lanka Weevil.

The second significant pest was the Red Banded Thrip (*Selenothrips rubrocinctus*) and was a notable problem during the last 6 – 8 months of the field trial. Red Banded Thrips feed on the underside of the leaves and caused a significant amount of damage to the trees over time.

- **Fungi and Disease Based issues around the World:**

There seem to be two major fungal or disease based issues that are highlighted in cashew cultivations worldwide. The first is the Damping Off of Seedlings which is caused by ***Fusarium sp.*, *Pythium sp.*, *Phytophthora palmivora*, and *Cylindrocladium scoparium***. It affects seedlings, attacks the collar region or root zone of tender seedlings causing die off, and tends to occur mostly in nurseries or areas with poor drainage.

The second is, Die Back or Pink Disease which is a **Fungal Disease caused by *Corticium salmonicolor***. It affects the branches and leaves them with white/pinkish growth on bark. It goes deep to the tissue & causes gradual death of new shoots on the tree. In severe cases, the bark will split and peel off.

During the course of the field trial while we were able to successfully identify two of the most prolific pests affecting the Cashew Trees, we were unable to make any positive identifications of potential diseases or fungi.

Harvesting

In the cashew industry, high yielding varieties are critical to economic success.

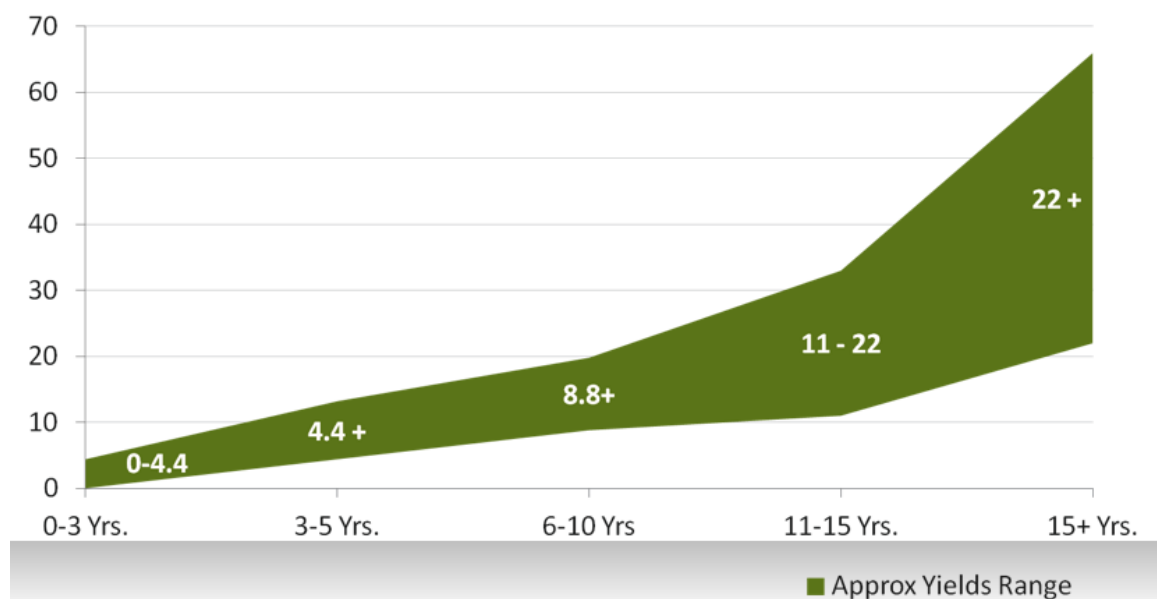
Cashews generally begin to produce on a commercial basis after roughly four years and will continue to produce for approximately 35 or more years. Flowering for the intended high yielding varieties brought in as part of the field trial starts in roughly December – February. This however varied slightly with the observance of flowers on the planted trees which flowered in February/March and bore fruit and seeds appearing by July and finishing up by September.

Throughout the world, harvesting the Cashew crop is traditionally done by simply collecting the nuts and fruit that have fallen to the ground and separating the RCN (Raw Cashew Kernel) from the fruit. It is believed that this process contributes to the best quality cashew nut. However, in an effort to make use of all portions of the harvest, many farmers elect to proactively harvest the fruit and nut so that they can utilize the fruit effectively.

Once the RCN has been harvested the next step is allowing the RCN to dry adequately. Doing so will help maintain the over all quality of the nut. During this portion of the harvesting process the fruit and nut have been separated and are allowed to sun/air dry for 2-3 days to ensure the moisture content falls from around 25% to approximately 9% and allows the flavor of the cashew to develop.

- **Yields Throughout World:**
 - Most trees generally yield 18–22 lbs. However, recently even higher yielding trees have been cultivated. (Approx. 44-55 lbs)

APPROXIMATE SINGLE TREE YEILD OVER TIME (LBS)



Trees reach production peak by 15 years and yield until approximately 35 years of age.

- Countries north of the equator, harvest from early in the calendar year to approx. mid-year while countries south of the equator, harvest from September or October to early on in the following year. In terms of the Hawaii crop, it seems to compare consistently with other regions north of the equator.

A Tough Nut to Crack: From Toxic to Tasty, How to Process Cashews

As mentioned before, the Cashew shell contains a caustic Phenolic Resin. In the wild this resin would allow for the cashew seed to remain uneaten and given the best possible chance at growing. This compound is also harmful to humans, but that doesn't mean that humans have shied away from Cashews. Over time a standardized practice has been established with first compromises the shell through heat in order to retrieve the kernel. Cracking cashews is a labor intensive process with multiple methods and varying end results.



3Cashew Nuts in Shell, Grown in Hawaii

- **Steaming:** The shell is heated via steam, resulting in it becoming soft and pliable.
 - Once the shell is heat treated through steam, oil, or fire, the shell becomes soft (with steam) or brittle.
 - Once the shell is weakened, the nut can be removed more efficiently.
- **Fire Roasting/Oil Roasting:** The most common and traditional method for processing. Nuts are either submerged in an oil bath and roasted **OR** roasted over fire (often times in a rotary drum.) It's a messy but effective process.
- With the traditional roasting method, each and every cashew is cracked by hand.
- **Mechanization: Steam or fire are first utilized to compromise the shell and release the resin inside.** Machines which are capable of cutting or scoring the shell are then used. However, the quality and yield are not ideal.

Other Harvest: Fruit and CNSL

If Cashew Apple harvest is sought after, the cashew apple must be collected before the fruit drops to the ground as the fruit is fragile and has a very high water content. Yeast and bacteria cause rot to set in within 24 hours. However, if kept at ideal temperature, the delicate fruit can remain in good condition for up to 5 weeks. Essentially, any long term preparations for the fruit as a product would require some relative measures of preservation. These can range from juices, to preserves, and even distilled spirits.



4Some of the first cashew apples from Feild Trial site.

Cashew nut shell liquid or CNSL, is the phenolic resin that is held inside the porous inner structure of the cashew shell and a large byproduct of processing and recovering cashew nut meat. It can be harvested from the shell and while it may be a byproduct of the production of cashews, it is incredibly useful in a multitude of applications such as:

- Incorporation into Brake Lining, paint for boats.
- Topically used as an antifungal and for healing cracked heels.
- Anacardic acid a component of CNSL is used in the Chemical industry for making Cardanol for resins.

A NEW NICHE FOR HAWAII

Nuts of all Kinds in High Demand

All nuts are in high demand world wide. The demand for cashews in particular is growing rapidly everywhere. In mature markets, consumers are increasingly drawn to nuts as a healthy snacking option. Furthermore, in emerging countries like China and India, middle classes with large disposable incomes are now driving consumption upwards and contributing to a climbing demand in cashews.

The ability for the state of Hawaii to be able to offer a specialty niche crop like Cashews with a limited supply could prove to be in high demand over time.

Naturally, due to the size of the Hawaiian Islands comparatively speaking to other engaged countries, there is no way for Hawaii to compete directly in terms of cost. However, one can argue that Hawaii can use the concept of scarcity of product to drive and establish a niche market for a Hawaiian grown cashew just as it has been done with the Macadamia and Pineapple. Cashews are already well established in the US consumer market. As consumers continue to become increasingly health conscious, cashew nuts have become a healthy snacking option. Not only do Cashews taste great, they are indeed good for you and are a:

- Great source of protein (approx. 5g / 1.05 oz.).
- Rich in unsaturated fatty acids.
- Low levels of saturated fats and soluble sugars.
- High levels of polyunsaturated fatty acids, which contribute to lowering cholesterol.
- High Levels of Oleic Acid, the same acid that makes Olive Oil so heart healthy.
- 25% of daily Magnesium (good for heart health.)
- Rich in copper

The Cashew Apple is an:

- Excellent source of Vitamin C, with 3-4 times more Vitamin C than in an orange or pineapple.
- Low calorie juice option (62 calories/200 ml.)
- Good source of antioxidants.
- Virtually unknown to the average American consumer.

In parts of India, Cashews Apples are processed into a liquor called “Fenni.” The state of Goa is particularly famous for the production of this liquor. It is also made in Brazil. Cashew Apples are often processed into various soft drinks and juices throughout cashew growing regions. Soft drinks are especially popular in Brazil and India. Cashew Apples are also processed into Jams, Syrups, Candies, and of course consumed raw and roasted.

Opportunity for Hawaii to Introduce Something New

Hawaii’s geographic location gives it an exceptional strategic advantage in that no state in the USA is as ideally situated to grow cashews successfully. Introducing a small batch crop of 100% Hawaiian/US Grown Cashews, could create a very unique product with a naturally high demand for small batch yield while Cashew Apples could present an opportunity to market a fruit virtually unknown to the average American consumer. As Americans become increasingly health conscious, low calorie healthy fruit or fruit beverages would prove intriguing and tempting to many. It has the potential to be positioned in a similar light to other “super fruits” like Goji Berries, Pomegranate, or Acai Berries with proper attention to marketing efforts.

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