# The importance of coconut seedling production in guyana

# La importancia de la producción de plántulas de coco en guyana

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## ABSTRACT

The demand for coconut water and coconut oil is increasing thus there is interest in expanding coconut cultivation. Coconut is primarily planted on approximately 28,500 acres by more than 1,400 farmers along the Guyana coastline with the Atlantic Ocean and in the Pomeroon Riverain area. Tall types (e.g. Jamaica Tall) are planted for oil while Dwarf types (e.g. Malaysian Dwarf Green, Suriname Brown) are planted primarily for water. At least 50% of the Tall type population is more than 50 years old and needs to be replanted to increase productivity. Farmers traditionally collect seedlings growing from dropped nuts at the base of trees without attention to prolificacy. Since a coconut tree productive life is more than 50 years, the economic impact of this practice can be significant. Via training programs, CARDI is encouraging the structured production of coconut seedlings to increase yields. This project aims to enhance the supply of quality seedlings using local seed nuts. Mother palms that display prolific bearing habits, resistance to pest and diseases plus vigorous growth habit were geotagged and recorded in a database. Seed nuts were purchased from farmers who own these trees and subsequently distributed (in batches of 400) to ten selected (age, gender, location) lead farmers to establish coconut seedling nurseries. Each lead farmer was assisted by 10 second ring farmers in the establishment of their nurseries under CARDI supervision. Results to date show that weed control and irrigation were important nursery activities. Some nurseries needed to be fenced to counter damage by animals (cows, sheep, goats). Average germination of seed nuts was approximately 50%. Available seedlings are being distributed to second ring farmers and lead farmers. CARDI will continue the national survey to identify outstanding mother palms. Measures to increase

average germination must also be implemented. Local coconut seedling nurseries should therefore be encouraged as their “success” will alleviate the pressure to import seed nuts thus avoiding the attendant risk of introducing exotic diseases (e.g. lethal yellowing disease) into Guyana. Further, given that a coconut palm will live 50 to 70 years, the importance of carefully selecting premium quality coconut seedlings as a bedrock to develop and grow the industry cannot be over emphasized.

**Keywords:** coconut seedlings, seed nuts, coconut nursery, coconut farmers.

**RESUMEN**

La demanda de agua y aceite de coco va en aumento, por lo que existe interés en ampliar el cultivo del coco. Más de 1.400 agricultores plantan principalmente cocos en unas 28.500 hectáreas a lo largo de la costa de Guyana con el Océano Atlántico y en la zona del río Pomeroon. Los tipos altos (por ejemplo, Jamaica Tall) se plantan para obtener aceite, mientras que los tipos enanos (por ejemplo, Malaysian Dwarf Green, Suriname Brown) se plantan principalmente para obtener agua. Al menos el 50% de la población de tipo alto tiene más de 50 años y necesita ser replantada para aumentar la productividad. Tradicionalmente, los agricultores recogen las plántulas que crecen de las nueces caídas en la base de los árboles sin prestar atención a la prolificidad. Dado que la vida productiva de un cocotero es de más de 50 años, el impacto económico de esta práctica puede ser importante. A través de programas de formación, CARDI está fomentando la producción estructurada de plántulas de coco para aumentar el rendimiento. Este proyecto pretende mejorar el suministro de plántulas de calidad utilizando semillas locales. Las palmeras madre que muestran hábitos de producción prolíficos, resistencia a plagas y enfermedades y un hábito de crecimiento vigoroso fueron geoetiquetadas y registradas en una base de datos. Se compraron nueces de siembra a los agricultores que poseían estos árboles y posteriormente se distribuyeron (en lotes de 400) a diez agricultores líderes seleccionados (por edad, género y ubicación) para establecer viveros de plántulas de coco. Cada agricultor líder fue asistido por 10 agricultores de segundo anillo en el establecimiento de sus viveros bajo la supervisión de CARDI. Los resultados obtenidos hasta la fecha muestran que el control de las malas hierbas y el riego fueron actividades importantes en los viveros. Algunos viveros tuvieron que ser cercados para contrarrestar los daños causados por los animales (vacas, ovejas, cabras). La germinación media de los frutos secos fue de aproximadamente el 50%. Las plántulas disponibles se están distribuyendo a los agricultores de segundo anillo y a los agricultores principales. CARDI continuará con la encuesta nacional para identificar las palmeras madre más destacadas. También deben aplicarse medidas para aumentar la germinación media. Por lo tanto, hay que fomentar los viveros locales de plántulas de coco, ya que su "éxito" aliviará la presión de importar nueces de siembra, evitando así el riesgo que conlleva la introducción de enfermedades exóticas (por ejemplo, la enfermedad letal del amarillamiento) en Guyana. Además, dado que una palmera de coco vive entre 50 y 70 años, nunca se insistirá lo suficiente en la importancia de seleccionar cuidadosamente plántulas de coco de primera calidad como base para el desarrollo y el crecimiento de la industria.

**Palabras clave:** plántulas de coco, nueces de semilla, vivero de cocoteros, cultivadores de coco.

## 1 INTRODUCTION

The coconut (*Cocos nucifera* L.: Arecaceae) industry is rapidly expanding in Guyana as a result of the growing usage of coconut water (coconut liquid endosperm) and the progressive benefits of coconut oil. Coconut farmers and companies have been investing in expansion of plantations and/or processing facilities. In this regard, the demand for coconut planting materials (seedlings) is increasing. The coconut industry is concentrated along Guyana’s coastline (Regions 1 to 6), along the Pomeroon River and Region

10. Coconut palms are largely cultivated by almost 1,400 large, medium and small scale farmers on approximately 28,500 acres (NAREI, 2018). Varieties primarily planted for water purpose are the Malayan Dwarf Green, Malayan Dwarf Yellow, Malayan Dwarf Orange and Surinamese Brown Dwarf whilst Panama Tall and Jamaica Tall are cultivated for coconut oil production. Alternatively, the 'Bastard' variety, a natural hybridization among the tall and dwarf types in the Pomeroon River, is cultivated for its dual purpose nature, both water and oil production.

The neglect of the industry contributes to the unproductivity of the sector by way of poor husbandry, old palms and palm population below recommendation. Harvesting of nuts occur at 5 to 6 weeks' intervals with a yield of 10 to 15 nuts per bunch for water production and 9 to 12 nuts per bunch for oil production (NAREI, 2018) whilst coconut palms during their peak productive stage yield between 20 to 25 nuts per bunch for water and 15 to 20 nuts per bunch for oil purpose and harvesting occurs at 4 weeks' intervals (Ramkhelawan & Paul, 2016). The productive life of a coconut tree ranges between 30 to 60 years according to variety (Paul & Ramkhelawan, 2016), whereas at least half of the cultivated coconut farms have surpass its prime productive stage in Guyana. Coconut farms established with high quality seedlings would allow the sector to regain optimal productivity. Further, dwarf varieties are gaining popularity for its water usage, these varieties tend to be intercropped with popular cash crops like tomato (*Solanum lycopersicum*), red peas (*Vigna unguiculata*) and plantain (*Musa spp.*) and fruit crop like soursop (*Annona muricata*). The Surinamese brown dwarf has been popular among homeowners resulting in demand exceeds supply. For these reasons, commercial scale production of quality coconut planting materials will satisfy the demand and allow for optimal return on investment.

Quality planting materials correlate with a successful establishment of a coconut plantation (Ramkhelawan & Paul, 2016). Coconut seedlings derived from seed nuts selected from desirable mother palms and grown in nurseries facilitate the ease of selection for superior traits. Selection of seed nuts from mother palms that display prolific bearing habits, resistant to pest and diseases, vigorous growth habit and selection for hybridization generally produce coconut planting materials of improved quality and vigour. Additionally, seedlings raised in a well-maintained nursery aids the selection of normal uniform seedlings (Santos et al., 1996; Baylon and Rivera, 2016). These seedlings can outperform random selected counterparts, eliminate the optimism for a high yielding palm and lead to improvements in the productivity of the industry. This project aims to enhance the supply of quality seedlings using local selected seed nuts.

## 2 METHODS

**Lead Farmer.** The selection of lead farmers to establish coconut nurseries followed the guidelines set out by the Coconut Industry Development for the Caribbean (CIDC) project, a jointly funded project between the European Union (EU) and African, Caribbean and Pacific (ACP) Group of States and

implemented by International Trade Centre (ITC) and Caribbean Agricultural Research and Development Institute (CARDI). In Guyana, the CIDC project selected Regions 2, 4, 5 and 10 as important segments of the coconut industry. Eleven lead farmers were select across four regions; representing an even composition of gender (emphasis on women and women's group), coconut farms at different stages (established verses recently planted) and youths. Lead farmers were chosen by the project to demonstrate the importance of coconut seedling production and to show that money can be made from such a venture. In addition, each lead farmer had ten second ring farmer to assist in the establishment of representative nursery. CARDI provided guidance and supervision at every stage of the execution of this project. The second ring farmers had been added to share and spread the training, knowledge and experience, as such, they would be inspired and motivated to venture out into their own nursery production system.

**Coconut Nursery Establishment.** The production of coconut planting materials/seedlings followed the seven steps outlined in figure 2. Coconut varieties listed in figure 1 were selected due to their relevance in the industry and percent collected against a target of 5,000 seed nuts. The procedure implemented for nurseries establishment incorporated traditional practices adopted by coconut farmers and guided by Paul and Ramkhelawan (2016) manual on Coconut Nursery Establishment and Maintenance. Figure 2 outlined the basic steps that fits the best model to produce uniform and quality seedlings within the Guyana's coconut industry context.

Figure 1: Important coconut varieties used for nursery establishment, economic usage and overall allocation of the 5,000 seed nuts distribution target.

| Type | Varieties | Purpose | % Allocation |
|---|---|---|---|
| **5 Years (Tall)** | Panama Tall | Oil | 24 |
| | Jamaica Tall | | 10 |
| **3 Years (Dwarf)** | Bastard | Dual (Oil & Water) | 10 |
| | Malayan Dwarf Green | Water | 23 |
| | Malayan Dwarf Yellow | | 20 |
| | Malayan Dwarf Orange | | 7 |
| **18 Months (Dwarf)** | Surinamese's Brown Dwarf | | 6 |

*Selection and marking of mother palms.* Coconut trees selected as mother palms were geotagged and recorded in a database created by CARDI, see figure 3. These mother palms were also painted with a band around the trunk for ease in further identification, a blue band signified water purpose (Dwarf varieties), a yellow band signified oil purpose (Tall varieties) and a blue and yellow band signified dual purpose (Bastard variety; natural hybrid). Mother palms who displayed prolific bearing habits on farms that did not provided favourable growing conditions and in areas free from pests (e.g. red palm mite, *Raoiella indica*) and diseases (e.g. Coconut bud rot) incidence were selected. Therefore, mother palms followed strict selection criteria as a regular bearer; i.e. produced a leaf and inflorescence at the axil

monthly and have a combination of twelve branches and twelve inflorescences at various developmental stages; palms made up of a straight stout trunk without no sign of growth deformity, leaf scars closely fitted with either a spherical or semi spherical shaped crown; leaf base widely encircled the trunk firmly with short and stout petiole; palms in their peak productive stage were identified (not exceeding 30 to 60 years based on variety); Further, palms selected produce above 100 nuts per year whereas varieties intended for water purpose had to consist of 20 to 25 nuts per Bunch (inflorescence) and measured up to 2 pints of water per nut and 15 to 20 nuts per bunch for oil purpose with a 150 g or above copra content.

Figure 2: A clockwise representation of the seven steps adopted in the establishment of coconut nurseries.

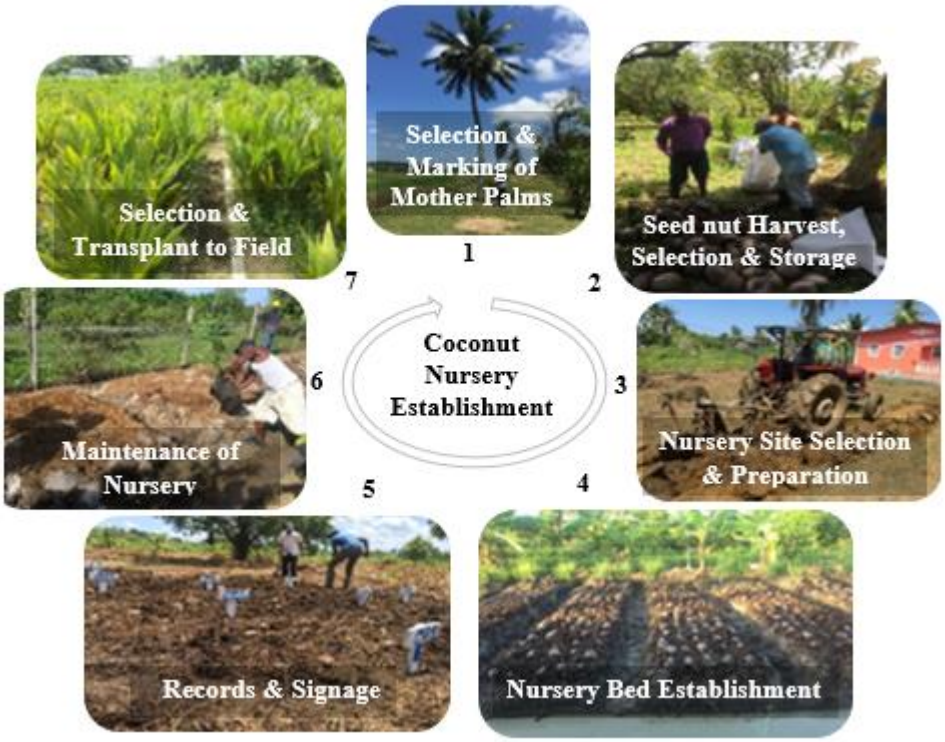


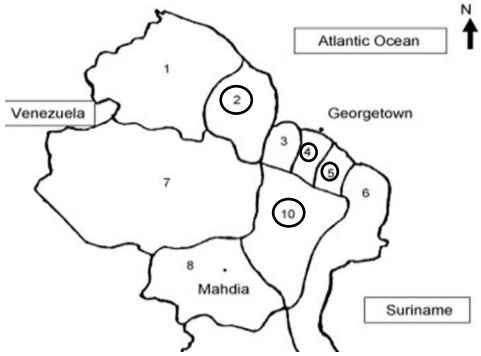

Figure 3: Summary of Mother palm databased in Guyana

| Regions | Location of Mother Palms | Mother Palms Identified |
|---|---|---|
| **2** | In Pomeroon river: Grant Nile, Marry Delight, Grant Newport Profit, Cozer Canal, Grant Collins, Grant Nashville, Maria's Delight, Grant Beach Profit, Grant Wide Garden and Grant Kahami.<br>Essequibo Coast: Maria Delight | 205 |
| **3** | Hauge Front | 10 |
| **4** | Mon Repos | 30 |
| **5** | Bygeval, Content, De Hoop | 75 |
| **10** | Nothinghamshire, West Watooka, R10 - Block C, West Wisroc | 28 |
| **Total** | | **365** |

*Seed nut Harvest, Selection and Storage.* Drop nuts around the base of mother palms were accumulate and a quick test of nut maturity by shacking and visual sign of deformity or pest damage were used to accept or reject suitable seed nuts. In some instance, seed nuts were harvest from bunches that already dried out or consisted of at least one dried nut. This stage followed 11-12 months for tall varieties and 10-11 months for dwarf varieties after emergence of inflorescence. Seed nuts from each mother palm were kept separate, assigned their unique batch/ID label (Fig. 5) and stored under a shed.

*Nursery Site Selection and Preparation.* Selection of nursery plots were facilitated by the eleven lead farmers, each lead farmer designated a suitable area on their farm as the nursery plot (Fig. 4). However, these plots had to established in an area not prone to flooding and freely drained, constituted of a light or loose-textured soil (where not possible plots were ploughed and organic matter added), plots situated in close proximity to irrigation source which was achieve either manually or a sprinkler irrigation system established, eased of access, isolated from potential source of pests and diseases and where necessary perimeter fence prevented livestock damage.

Figure 4: Table on right, list of lead farmers in respected regions and name of village. Map on left, top most part of Guyana map demarcating various regions.



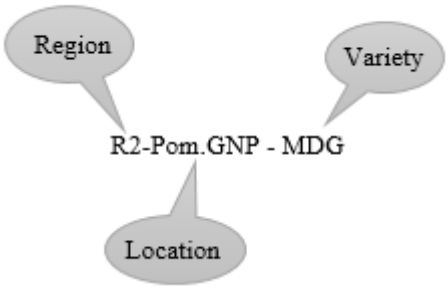

| Regions | Lead Farm's # | Nursery Location |
|---|---|---|
| 2 | LF 1 | Dartmouth, Essequibo Coast |
| | LF 2 | Grant Nashville, Pomeroon River |
| | LF 3 | Grant Enterprise, Pomeroon River |
| 4 | LF 4 | Victora, East Coast Demerara |
| | LF 5 | Friendship, East Coast Demerara |
| | LF 6 | Helena # 2, Mahaica |
| 5 | LF 7 | De Hoop, Mahaicony |
| | LF 8 | Bushy Park, Mahaicony |
| 10 | LF 9 | Block 22, Wismar, Linden |
| | LF 10 | Dalgin, Linden/Soesdyke Highway |
| | LF 11 | Hauraruni, Soesdyke/ Linden Highway |

*Nursery Bed Establishment.* Each variety was place in a separate bed, where a variety was source from multiple locations a 40 cm gap was left on the bed. The size of the beds varied according to the number of seed nuts per variety and beds were align side by side with a drain separating them apart. This simple layout was use for all eleven nurseries. Seed nuts were position in rows approximately 15 cm apart leaving one third of the nuts exposed and a gap of 20 cm was left to separate each row. The indigenous technique of floating a seed nut in water, allowing it to take a resting position them placed the nut in the same position in the row was adopted.

*Records and Signage.* Labels were place on each bed to demarcate the variety, region sourced and area/village of the mother palm (Fig. 5). Additionally, dates for establishment, seed nut harvest and receipt of seed nuts, total seed nuts sown and quantities per variety were documented. Germination data was

recorded fortnightly over the entire duration of the nursery. Labels differentiated when the same variety was source from multiple locations and placed on the same bed.

Figure 5: Format of label used to identify seed nut source.

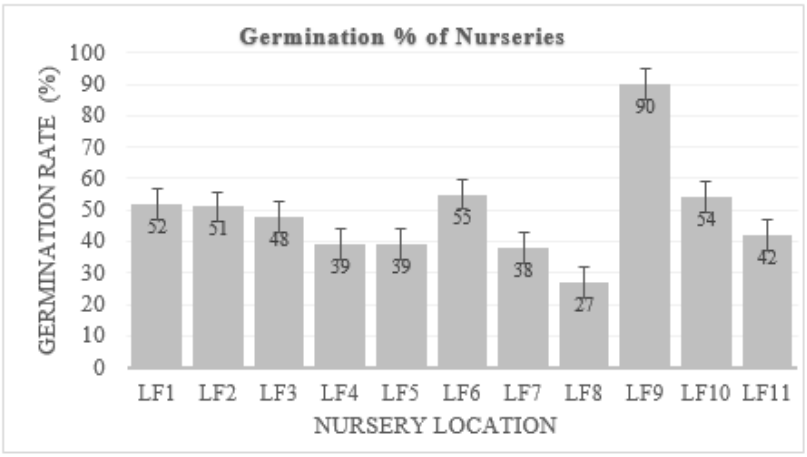



*Maintenance of Nursery.* Irrigation and weeds control were the key activities for nursery maintenance. Sprinkler or manual application of water on alternative days were applied until the soil was saturated whereas daily irrigation was required for the sandy soil (Region 10). Roughing of weeds was done as necessary and only lead farmer 8 at Bushy Park, Mahaicony had to apply Roundup, chemical weed control, for nut grass (*Cyperus rotundus*) at a rate of 10 ml per litre of water and applied twice. Mulch in the form of grass cuttings, coconut branches and wood shaving were used particularly for Region 10 nurseries. Pests and diseases monitoring was but no form of control was warranted.

*Selection and Transplant to Field.* Seedlings who attained maturity were select 4 – 5 months after emergence. The shoot of seedlings had a girth of 10 -12 cm at the collar, consisted up to six leaves with the youngest differentiated into leaflets, short and thick leaf stalks and appeared healthy and robust. Further, seedlings with a single, sturdy, straight sprout well seated into the husk were selected. Seedlings were evenly distributed among the lead farmer and the second ring farmers.

## 3 RESULTS AND DISCUSSION

Figure 6: Mean germination percentages with error bar of the eleven lead farm nurseries across Regions 2, 4, 5 and 10.



The germination rate bares a similar consistency among most of the nurseries (Fig. 6). Except for Lead farm 9 (LF 9) whose germination rate was way above average at 90 percent whilst Lead farm 8 (LF 8) was the lowest at 27 percent. These results represent an initial attempt to formalized production of coconut planting material under nursery conditions and whereas coconut seedlings required minimal care, experience is still required for optimal germination and selection rates. The semi-formal experience LF 9 had in seedling production translated to his nursery attaining the high germination rate. In the absence of locally available tissue culture technique and commercially viable vegetative prorogation, seed nuts taken from mother palms is the only possible means of seedling production.

Generally, coconut seedlings started to mature 4 to 5 months after sowing, germination commenced within 2 – 4 months for tall varieties and 1 – 3 months for dwarf varieties, this result follows the same trend reported by Coconut Research Institute of Sri Lanka (2006) and TNAU (2012). Seed nuts who germinated beyond 5 months after sowing were discard, as rate of germination is correlated to earliness of germination (Santos *et al.*, 1996). In the future, this translate to rapid formation of leaflets and improvement in yield. Given selection occurred at two stages, first at the selection of seed nuts and second prior to transplant, these seedlings are highly likely to outperform random selected seedlings and lead to increase farm productivity.

A nursery environment provides a structured approach to seedling production and facilitate ease in selection for uniformity and vigour characteristics (Santos *et al*., 1996; Ghose and Gopalakrishnam, 2013). Husbandry activities that were found to be important for proper maintenance are weeds control and irrigation. In this regard, the latter was evident during the last quarter of 2018 when Guyana was experiencing drought like conditions which coincide with the nursery establishment phase of this project. This scenario may have had an effect on the germination rate of seed nuts since adequate moisture is a necessity for seed nut germination and survival (Coconut Cultivation Board. 2011 & TNAU, 2012). It should also be noted that interest by neighbouring farmers is gradually creating orders for new seedlings as nursery owners are encouraged to continue seedling nursery activity towards impactful commercial sustainability. Analysis of achievements to date suggests that the potential to supply Tall type seed nuts is adequate but that Dwarf types will be challenging. Mother palms are vital to supply premium seed nuts; CARDI Guyana has recognized the importance of mother palms and have established a national mother palm database assessable to all stakeholders in the coconut sector.

## 4 CONCLUSION

Mother palms selection particular for the dwarf varieties are going to be a continuous activity for CARDI Guyana as it will provide nurseries with a source of seed nuts. However, nurseries are encouraged to establish their own genetic bank of mother palms which would guarantee their seed nut supply.

Measures to improve germination percentage of seed nuts have to be implemented. A structured approach to coconut seedling production can become a lucrative venture as farmers are beginning to understand the importance of planting quality seedlings and realized a profitable undertaken on a continuous nursery production cycle. The setting up of coconut seedling nurseries in Guyana would alter the culture of farm establishment and allow the industry to attain optimal productivity.

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