

Business Plan for Macadamia Clean Planting Material

MARKUP PROJECT MACADAMIA



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Business Plan for Clean Macadamia Planting Material

A Plan developed by KALRO to guide in the establishment and Operationalization of Macadamia Propagation Business units for Clean Planting Materials

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Figure 1: Macadamia seedlings Ready for field establishment

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ACRONYMS

AFA	Agriculture Food Authority
CA	Competent Authority
GNMP	Good nursery management practices
HCD	Horticulture Crops Directorate
KALRO	Kenya Agricultural & Livestock Research Organization
KES	Kenya Shilling
KEPHIS	Kenya Plant Health Inspectorate Service
МТ	Metric tons
NGO	None Governmental Organization
NIS	Nuts in Shell
NOCD	Nuts and Oil Crops Directorate
HCD	Horticultural Crops Directorate
INDF	International Nut and Dried Fruit

ACKNOWLEDGMENTS

This work was carried out as part of the European Union funded EAC-MARKUP Programme -Kenyan window - implemented by UNIDO, which aims at creating awareness and promoting the use of clean planting material of the marketable varieties of certain crops, like mangoes, passion fruit, macadamia and ground nuts. This was based on the need, as identified by farmers/growers, for clean planting mat4rial that would ensure better yield, compliant produce and marketability. This work was primarily carried out and written by experts from the Kenyan Agriculture Research and Livestock Organization (KALRO), namely: Grace Watani (Mango), Nasambu Okoko (Groundnuts), John Ndungu (Passion Fruit) and Antony Nyaga (macadamia). The KALRO experts work under the direct supervision of Lusike Wasilwa (PhD) who coordinated and documented all their activities. The work was sanctioned by UNDO-MARKUP expert Ali Abbas Qazilbash (PhD), International Expert QI & SPS Compliance and Stefano Sedola, Chief Technical Advisor-MARKUP and facilitated by Michael 'Maina' Karuiru, National Program Coordinator of the MARKUP-Kenya project. The guide and manuals developed by the KALRO experts was used as training material for the nursery staff and extension officers at county level. The experts then imparted this knowledge at the designated counties as identified under the MARKUP project.

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FOREWORD

Macadamia Nut Business Plan

The European Union (EU) in partnership with the East African Community (EAC) launched the Market Access Upgrade Programme (MARKUP) to support member countries improve market access of agro-food products to the EU and regional markets. The main purpose of this project is to contribute to the economic development of Kenya by increasing the value of both extra and intra-regional agricultural exports in selected horticulture sub-sectors; (snow peas and peas, mango, passion fruit, chilies, herbs and spices, and nuts [macadamia and groundnuts]). According to MARKUP, agriculture (crop and livestock production) contributes to an average of 27.3% of the national GDP and provides a source of livelihood to most Kenyans. It also contributes about 26% indirectly to GDP through linkages with other sectors such as agro-based manufacturing, transport, wholesale and retail trade. This programme (MARKUP) is structured around two intervention levels: the EAC Regional Window and the Partner States National Window with country specific projects. United Nations Industrial Development Organization (UNIDO) is the implementation partner for the Kenya-Partner States window.

The Kenyan macadamia value chain (VC) comprises producers (smallholders and macadamia nut processors' plantations), aggregators (traders and associations), processors (who also export), influencers and supporting organizations. Despite its economic importance, macadamia production has been on slow decline due to both biotic and abiotic constraints. The scope for increasing the production of crop exists, especially through increased acreage. However, despite the research undertaken on the crop over the years, good planting materials, pest and diseases and marketing are still a limiting factor. The main opportunity for yield improvement lies with supporting extension service providers (such as Kenya Agricultural & Livestock Research Organization [KALRO] and Agriculture Food Authority [AFA]) to increase their capacities and to multiply and disseminate high-yielding seedlings that are suited to the different macadamia growing regions of Kenya.

The importance of good quality planting material as an initial investment is a well realized factor for persons engaged in horticulture and tree nuts enterprises. However, good quality and assured planting materials at reasonable prices are not always available. There is therefore need to engage nursery managers and operators to enable them increase the number of available quality planting materials, at a reasonable price, while still operating the nurseries as a business.

This business plan has been developed by KALRO experts from a request by MARKUP. It entails to provide nursery managers and operators with the information necessary to run the nurseries and avail high quality seedlings at a reasonable price while operating them as businesses. The plan covers all the cost involved in the business, the estimated time lines, capital investments and recurrent costs, cash flow guidelines and tools for optimum price determination. The plan also gives a guideline on other business considerations to ensure customer satisfaction and assurance of a return visit.

The plan is meant to be used together with the procedural manual to ensure that both technical and business considerations are met during the production process. I am greatly indebted to the KALRO commodity experts who participated in the preparation of the Business Plan, which is expected to epitomize a new way of operating propagation units where in addition to the technical considerations, the business aspects are also incorporated to ensure sustainability.

Lusike Wasilwa, PhD

Director Crop Systems For Director General KALRO

EXECUTIVE SUMMARY

Macadamia nut farming offers an important source of income for producers worldwide and especially for smallholder farmers in Kenya. Kenya is currently the third top macadamia producer, with a global market share of 13% (7,750 tonnes on kernel basis). The role of macadamia as a cash crop for foreign exchange earnings has steadily increased in recent years (Quiroz *et al.*, 2020).

Global macadamia nut production more than doubled over the last decade, increasing from almost 28,000 tonnes (kernel basis) in 2007 to 59,300 tonnes in 2018. Today's global top producers are South Africa and Australia, accounting for over half of the world's macadamia production in 2018 with shares of 29% and 25%, respectively (Figure 2). Kenya is the third producer with a share of 13% (7,750 tonnes on kernel basis), followed by the U.S. at 9% and China at 8% (2019, INDF).



Figure 2. World macadamia production, 2008 to 2018 and 2018 breakdown (tonnes, kernel basis)

The Kenya macadamia nut value chain (VC) comprises producers (smallholders and macadamia processors' plantations), aggregators (traders and associations), processors (who also export), influencers and supporting organisations (Quiroz et al., 2020).

Despite its economic importance, macadamia nut production has been on slow decline in Kenya due to both biotic and abiotic constraints (Mbaka, 2011). The scope for increasing the production of the crop exists, especially through increased acreage. However, despite the research undertaken on the crop over the years, good planting materials, pest and diseases and marketing are still a limiting factor (Quiroz *et al.*, 2020). The main opportunity for yield improvement lies with supporting extension service providers (such as KALRO and AFA) to increase their capacities and to multiply and disseminate high-yielding macadamia seedlings that are suited to the different macadamia growing regions of Kenya (Quiroz *et al.*, 2020).

The importance of good quality planting material as an initial investment is a well realized factor for persons engaged in horticulture and tree nuts enterprises. However, good quality and assured planting materials at reasonable prices are not always available. There is therefore need to engage nursery managers and operators to enable them increase the number of available quality planting materials, at a reasonable price, while still ensuring the propagation units are economically viable.

This business plan endeavours to provide the said nursery managers and operators with the information and tools necessary to run the nurseries as business units and satisfy the needs of the producers competitively while assuring them that the planting materials acquired will benefit them in future and the industry at large, since the seedlings will be of the highest quality both physically and technically, and their phytosanitary status.

INTRODUCTION

Macadamia grows well at altitudes between 1,000 to 2000 metres above sea level, in the coffee tea zone, marginal and main coffee zones, and is grown in the central highlands, Machakos, Taita Taveta and most recently to the Rift Valley, Western and Nyanza regions. It is a small-scale farmer grown crop with only a few large-scale farmers having orchards with more than 1,000 trees.

Kenya exports more than 95% of its production amounting to about 5,000 MT dried kernels against a production of about 40,000 MT NIS (nuts in shell). The farm-gate prices for NIS has risen from KES 70 in 2013 to the current prices of KES 200 (2019). This has resulted to increased demand for seedlings for new plantings. The commercial varieties in Kenya are MRG-20, KMB-3, EMB-1 and KRG-15. These varieties are high yielding and differently suited to different ecological conditions. However, the cost of the seedlings remains high (KES 350 - 500 per seedling as at 2019). There is also limited number of certified nurseries most of which are located in the Mount Kenya region. The crop is estimated to support directly about 7,000 farmers and provides an opportunity to improve their livelihoods from the increased prices, as the world markets are largely undersupplied. Macadamia provides raw materials for processing facilities thereby providing additional employment. This nut is also known to contribute towards the increase of the forest/green cover to the 30% target set by the government.

The major nut producing counties in Kenya are Muranga, Meru, Embu, Kiambu, Kirinyaga, Trans-Nzoia; Nyeri, Tharaka Nithi, Machakos, Nyandarua, Baringo, and Taita Taveta (Nuts and Oil Crops Validated Statistical Report, 2022). In 2021, the area under macadamia nut was 7,180 ha producing raw nuts in shell (RNI) of 42,562 tons recorded in 2021 (NOCD, 2022). The average yield per tree is estimated at 39kg per tree per year much lower than the yield potential of 70-100 kg/tree per year.

To support the production of nuts, nursery operators both in in the private sector and public institutions, should be trained in good nursery management practices (GNMP). The production of high-quality seedlings emanating from training from this activity, is expected to bridge the gap of inadequate planting material and also reduce the distances that farmers have to travel to access high quality planting materials (Nyaga *et al.*, 2017)

County	Are	a (Ha)	Quantity	in tons	Value(KES) millions			
	2020	2021	2020	2021	2020	2021		
Muranga	1,892	1,893	10,823	11,546	693	774		
Meru	1,145	1,146	6,614	6,992	390	489		
Embu	1,139	736	6,801	4,487	343	292		
Kiambu	830	833	4,711	5,080	306	345		
Kirinyaga	702	705	3,912	4,300	215	279		
Nyeri	407	409	2,011 2,497		101	157		
Tharaka Nithi	242	244	1,390	1,487	74	97		
Machakos	136	139	821	850	48	51		
Nyandarua	132	133	722	810	35	41		
Baringo	83	83	481	509	22	31		
Busia	75	46	1.2	5.4	0.054	0.297		
Taita Taveta	73	74	446	454	24	30		
Trans-Nzoia	50	490	59	2,988	3	167		
Elgeyo Marakwet	44	44	41	68	2	4		
Makueni	41	43	45	65	2	4		
Uasin-Gishu	38	45	44	70	2	4		
Others	114	117	211	354	12	21		
Total	7,142	7,180	39,133	42,562	2,271	2,786		

Table	1. Area	under	macadamia	nuts.	production	and	the	value	2020-2021
IUNIC	II / AI CO	anaci	macaaama	iiacs,	production	and	CIIC.	Value	

Source: NOCD, 2022

ECONOMIC IMPORTANCE

Global macadamia nuts production is estimated at 211,000MT with Kenya producing approximately between 40,000-45,000MT annually. Kenya is the 3rd largest producer of macadamia nuts in the world after South Africa (54,000MT) and Australia (46,000MT). Production and earnings from Macadamia has increased tremendously over the years. Production increased from 1,839 MT in 1992 to about 45,000 MT in 2018. The earnings increased from KES 935,910 to about KES 6.052 billion during the same period. The number of local processing factories has also increased from 5 in 2008 to 26 currently having contracts with 133 registered marketing agents who supply them the produce (NOCD, 2019). The production area for macadamia has steadily grown from 633 Ha in 1992 to 44,883 ha in 2018. Currently, massive uptake of the nut crop in the non-traditional growing regions is taking place (Table 1).

Macadamia nut is considered by many to be a prime edible nut. The kernel can be eaten raw or roasted, or is used as a desert, and in the confectionery industry, making chocolates and biscuits. Macadamia nuts are 75% fat by weight, 80% of which is mono-saturated fatty acids. These fatty acids have a high percentage of palmitoleic acid that lowers blood cholesterol levels to reduce the cardiovascular disease risk factor. The oil extracted from macadamia nuts is similar in composition to olive oil. The high content of palmitoleic acid in the oil also makes a desirable ingredient in cosmetics especially skincare products. The seed cake that remains after oil extraction is used as a constituent of livestock feed.

OPPORTUNITIES IN THE MACADAMIA INDUSTRY

(i) Unsaturated global macadamia market

Macadamia (*Macadamia integrifolia*) is the world most popular nut due to its health benefits and its demand globally has been rising. The world market supply for the nut is about 20% undersupplied and therefore this creates a ready market for production in any corner of the globe.

(ii) Potential increase of macadamia growing regions

The potential for growth in the non-traditional areas of the Rift Valley, Western and Nyanza regions is high. This is evident by increased demand for the planting materials in the region. The regions have vast suitable land where macadamia production can be done on large scale.

(iii) Adequate processing capacity

Processing firms are currently operating below capacity. There are over 70 registered processors with an installed capacity of 150,000 MT against a production of approx. 50,000 MT. This presents an opportunity for processing even when the production increases as a result of increased plantings. There is need for a corresponding increase in number of trees planted to increase production to utilize the installed processing capacity.

2 MACADAMIA CLEAN PLANTING MATERIAL NURSERY AS A BUSINESS

DESCRIPTION OF THE BUSINESS

The importance of good quality planting material as an initial investment is a well realized factor for persons engaged in horticulture and tree nuts crops enterprises. However, assured good quality & planting materials at reasonable prices are not always available.

This business plan aims at giving a detailed is guideline to the existing nursery operators and any upcoming entrepreneur interested in starting a macadamia nursery as a business with assured quality clean planting materials as a product.

The plan covers all the production and business considerations and suggested ways of ensuring quality while at the same time keeping costs low so as to give the entrepreneur a business edge against the competition.

BUSINESS CASE CONSIDERATIONS

Before engaging in a business venture several factors need to be put in place to determine whether it is worth investing in the venture. The main factors rotate around:

(i) The Product

Define clearly what your product will be, seedlings...seeds'. scions...grafting services etc. One cannot produce what they have no idea what it is! The product description should also answer the question as to why the producer thinks the customer(s) need this product and why they will choose to buy from them and not the competition.

(ii) The Market

The questions here involve establishing weather there is a market for the product and at what price. Find out who are the competitors and what edge will you have against them so that the client can chose your product.

(iii) The Price

Are you offering product commensurate to its value? Consider your quality or positive attributes before determining your offer price. Keep in mind the competitors' price.

(iv) The Cost of Production

This will determine the minimum price at which you can be able to offer the product. Do you have avenues of cutting the production cost without affecting significantly the quality.

(v) Legal requirements

Ensure that you are not contravening any law or government guidelines in establishing the venture.

(vi) Raw Materials

Availability of supplies of production at acceptable prices

(vii) Risk Analysis

Conduct a risk analysis to determine all possible sources of "killer" factors that can affect the achievement of the targets

(viii) Cost Benefit Analysis

Conduct a cost benefit analysis of your operations versus the compotators offer price and establish whether the business venture is feasible

TECHNICAL CONSIDERATIONS FOR A MACADAMIA CLEAN PLANTING MATERIAL NURSERY ENTERPRISE

The establishment of a propagation unit involves several process that require competence in their implementation. These include the following;

(i) Mother Block Establishment

This will be the primary source of scion materials for the macadamia nursery enterprise. This must be located near the nursery to avoid long distance movement of scion materials after harvesting and also cost implications that would add to the production cost. One can also use established orchards from nearby locations that have known varieties that have been phenotypically identified (and tagged) and certified true to type by a competent person (from KALRO, AFA, HCD, or KEPHIS). **These trees must always have tags on them indicating the variety, preferably (tagged by) the Competent Authority.**

(ii) Nursery Site Selection

The location of the nursery considers various factors such as nearness to the required raw materials, most importantly ease of access by the customers, suitable topography for the establishment of structures and other amenities, source of clean irrigation water, secure from human and other physical and biological intrusions, low susceptibility to pests and diseases, among others.

History of the site must also be considered. Previous land use in the immediate past has an implication on the phytosanitary status of your seedling materials. Alternative use of land in the general area must also be considered since if the land is not self-owned, then leasing costs could be very high. General labour costs in the surrounding area also very important since has a direct implication on your cost of production

(iii) Nursey Structures

The nursery must be designed in such a way it allows easy delivery of raw materials without contaminating the final product. This is an important consideration for phytosanitary compliance. Work flow from raw materials to final product near the gate/ point of sale is paramount. The costing of the structure must be kept as low as possible while ensuring that the functionality is not lost. Beauty and appearance are important factors to remember as the image your client forms on first sight is important and forms part of the future decision making as to whether to return for another business opportunity or not.

(iv) Rootstocks

All rootstocks must be generated from the technically recommended seed nuts of KMB-3 and EMB-1 varieties. Avoid the use of Macadamia tetraphylla (sp) nuts as this will cause graft incompatibility in future.

Establishment of the rootstocks is preferably done in sand as a medium as this ensures no rotting or pest invasion. Once germinated, the rootstocks are transplanted at 3 hard leaf stage into potting bags, hardened under shade until new growth is seen. After that, they are put in the open for growth until attaining pencil thickness at the grafting point (approximately 15 cm above the soil pot level).

(v) Nursery Media

Ensure the correct media components are brought in the nursery before their actual time of use. For Macadamia, virgin forest soil is recommended as it avoids the

development of chlorosis in the rootstocks observed when soil is collected from other sources. Manure must be allowed to fully cure before use in the media. Both farmyard manure and compost are suitable as long as it is well cured and within the acceptable production protocol for the nursery. The ratio of soil to manure to sand to fine gravel should be maintained at 3:1:1:1. Soil analysis results may however recommend other ratios depending on quality and source of the media raw materials.

(vi) Grafting

Grafting method used depends on the skill of the grafter and size of rootstock. The normal grafting method is the top wedge, also called cleft method. Rootstocks are selected at pencil thickness stage and grafted with the desirable scion from the mother block. It is advisable to graft only one variety at a time to avoid mix-up of scions and hence nursery integrity. All grafted materials must be labelled. The materials are then placed in a tunnel and covered for 1- 3 months before removing for hardening under shade. Once the grafted materials are fully hardened, they are is ready for field establishment. The more careful and skilled a grafter gets, the higher the percentage takes that they achieve. For macadamia, takes of over 65% are considered reasonable.

(vii) General nursery Management

Operations such as watering, weed management, scouting for pests and diseases and their management, nutritional management and general structures upkeep are factors that contribute to the success of the enterprise and quality of the products. These operations must be timely, specific and monitorable. Once an issue needs attention, then this must be undertaken, checked, and if not fully addressed, alternative corrective action taken.

(viii) Record Keeping

All activities and occurrences at the nursery must be kept, dates, corrective action if applicable by who and when. All costs and materials and actions in kind must be recorded. This forms the basis of traceability and cost benefit analysis.

COMPETITIVE ANALYSIS

The current macadamia nurseries are faced with various challenges that new upcoming players need to address so as to be able to penetrate the market effectively. These include;

- High cost of seedlings therefore discouraging any new farmers/investors who want to plant new orchards, leading to others opting for not certified materials.
- Limited knowledge by nursery operators on GNMP particularly for Macadamia.
- Inadequate information on good agricultural practices (lack of information by both the farmers and the extension officers has led to poor agricultural practices especially in selection of the varieties). This leads to crop failure after establishment and therefore discouraging any new would be investor.
- Low regulatory capacity from the CA bodies.
- Hard-woodiness nature of the crop and poor callus formation leading to low graft takes and high mortality rates of grafts.
- Long propagation cycles (18 months).
- Low skills and knowledge on grafting techniques of macadamia by most nursery operators.
- Low adoption of released or introduced varieties by farmers.
- Non predictability of market demand especially for the export market which dictates the demand level for seedlings.
- High capital investment for nurseries (and long waiting periods before seedlings become ready).

PROPOSED INTERVENTION STRATEGY

- The current seedling prices range from roadside nurseries range from KES 250 500 although the quality is not assured. The strategy here is therefore to produce seedlings that are certified , true to type at a price between KES 200 300.
- Get all the nursery operators targeting to produce clean macadamia planting trained on GNMP for macadamia. Have the operators adapt this business plan for their planning and implementation.
- Train a nurseries support pool for extension service providers that will support the nursery operators.
- Involve the CA bodies where required by law and establish compliant and registered nurseries and have an edge of marketing the products as clean and certified.
- Adaption of the Procedural Manual for Macadamia Clean Planting Material so as to overcome the challenges of poor callus formation and low graft takes in macadamia nuts seedling production.
- Specifically, get grafters intensively trained on grafting techniques for macadamia using the procedural manual guidelines so as to be able to overcome the common mistakes that lead to graft union failure.
- Training of nursery operators on variety identification and maintenance of mother blocks for "True-to-Type-Ness".
- Establishment of nursery caucus groups in an area that support the operators together with the county governments to market their products in areas where demand is known within the country and beyond.
- The counties and their partners to support the nurseries to do the initial capital investment (infrastructure) even if it's on recovery basis after sales of the product.

MARKET ANALYSIS

The type of product will depend on what the clientele requires. This will also dictate what kind of a nursery (including infrastructure) one needs to invest in. If market/client analysis indicates that the clean planting materials demand will only service individual farmers, then there is no need to put up a structure for 100,000 seedlings. However, if the studies indicate a mix of both corporate and individual, numbers will dictate the size of investment.

The type of nurseries are classified in to four major categories

(i) Wholesale nurseries

- Targets large volumes of seedlings and usually accompanied by large extensive infrastructure.
- Due to the sales volumes anticipated per customer, the prices are much lower that retail nurseries
- The customers are usually institutions wishing to sell at retail prices for business, projects, county governments, NGO's and other similar organizations
- May sometime specialize in a single or few product types
- Usually owned by organizations or large investors

(ii) Retail Nurseries

- The target is usually individual customers usually buying materials for their own use or on behalf of someone else. These include individual farmers
- Characterized by small volume per individual buying
- May propagate the seedlings themselves or sometimes source from wholesale nurseries
- Prices are usually at retail level with few or no discounts

(iii) Export Nurseries

- Produces specifically for export and usually done on non-soil media
- Characterized by small operational areas although size may be large if market is available
- Access usually restricted with strict quarantine measures
- Close association the National Phytosanitary organization (KEPHIS)
- Must strictly adhere to export market requirements

(iv) Hybrid (of wholesale & Retail)

These kind of nurseries are usually associated with Government projects with an aim of meeting short term targets. It usually involves superimposing one type of nursery onto another to avoid capital investments that may become redundant on completion of the project.

OPERATIONAL PLAN/FINANCIAL OBLIGATIONS

For a functional nursery, the operator needs to understand the sequence of all activities in the nursery (Fig 3). This will enable the operator to plan for the cost requirements for each of the activities at each stage well in advance.

The planning should take into consideration that the capital investment will only be required at the beginning of the nursery operations other than for minimal maintenance costs. Therefore, for subsequent years, only operational (recurrent) costs are required.

Once the new nursery is operationalized, from seeding of the nuts to the first seedling being ready, it will take between 18 and 24 months. This therefore means that the business will only start repaying back the investment after that period. If it is a new macadamia only nursery, it means that the operator must find a way of supporting the costs associated with the enterprise for that period either from own sources or a financier. If the macadamia enterprise is being incorporated in a nursery that is operational with other products, then the financing of the macadamia activities can be supported by the other enterprises.

There is therefore need to develop a detailed cost plan guided by the activity plan that indicates what costs are expected at what time of the nursery cycle using the cost template in Annex 1. A cash flow analysis will also show what are the cumulative costs and what the cumulative balance sheet is looking like at any moment of the enterprise. The balance sheet will also indicate when the enterprise will attain a positive margin hence the point at which the operator will start making money after recouping all the costs at that moment.

MACADAMIA CLEAN PLANTING MA	١T	ERIAL																								
										١	NO	RKP	LA	N												
Capital Investments		Month 0	Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	2
Construction of sand Beds																										
Establishment of Shade Houses																										
Establishment of Grafting Tunnels																										
Costruction of Media mixing slab																										
Irrigation and water storage infrastructure																										
Procurement of Tools 7 equipments																										
Recurrent Activities																										
Acquisation of seed nuts																										
Acquisation of Forest Soil, Manure, Sand																										
Acquisation of Fertilizers																										
Acquisation of Pesticides																										
General Nursery Mangement																										
Grafting																										
Hardening																										
Sale of Seedlings																										

An example of the cost centers can be categorized as in Table 2

Figure 3: Activity outline for a macadamia clean planting material nursery

	MACADAMIA NURSERY BUDGET ESTIMATES 10,000 SEEDLINGS									
	EXPENDITURE	Qty	Unit Cost	Total						
	Actual Expenditure									
	CAPITAL INVESTMENT									
	INFRASTRUCTURE									
1	Mother Blocks establishment (1 Acre)									
	Cost of Seedligs	74	300	22,200						
	Planting Hole	74	40	2,960						
	Manure Costs (2 debes per hole)	148	50	7,400						
	Fertilizer Costs (17:17:17:, 300g/hole)	23	130	2,990						
	Planting Costs (MD)	2	600	1,200						
	Maintenance costs /yr in MD	60	600	36,000						
	Sub Total			72,750						
2	Nursery Beds									
	Sand Beds for Seeding (8x1.5M)	2	9,700	19,400						
	Sub Total			19,400						
3	Shade Houses			-						
	Hardening Shade 25 x 8 M (50%)	1	140,000	140,000						
	Grafting Shade Shade 25 x 8 M (90%)	1	120,000	120,000						
	Grafting Shade Shade 25 x 8 M (70%)	1	120,000	120,000						
	Grafting Tunnels (200 Capacity)	20	870	17,400						
	Additional Netting for drapings (Sq M)	200	220	44,000						
	Sub Total			441,400						
	Other infrastructure									
4	Media Mixing Slab /Transplanting area (10	1	89,000	89,000						
	x 15M									
				-						
5	Irrigation and water storage infrastructure	1	200,000	200,000						
	Sub Total 289									
	TOTAL CAPITAL INVESTMENTS			822,550						

 Table 2. Cost Centres for Macadamia Clean Planting Materials

6	Tools and equipments			-
	Wheel barrows	5	5,000	25,000
	Hose pipes	4	6,000	24,000
	PPE	2	5,000	10,000
	Knapsack Sprayers	2	7,500	15,000
	Jembes/pangas/hoes/rakes (Assorted)	1	10,000	10,000
	Grafting Kits	5	12,000	60,000
	Others (Shower heads, ropes, wires etc)	1	10,000	10,000
	Sub Total			154,000
В	RECURRENT COSTS			
1	Seed nuts (kgs) Target is 10000 seedlings,	800	200	160,000
	hence target 40,000 nuts assuming			
	germination of 50% min and 50% graft			
	takes			
2	Potting Bags (7x12")	50,000	2	75,000
3	Forest virgin soil (tons) incl transport	40	2,500	100,000
4	Well cured Manure/Compost	20	3,500	70,000
5	River Sand	20	3,000	60,000
6	Casual Labour for seeding (MD)	15	600	9,000
7	Casual labour for Media preparation and	50	600	30,000
	potting (MD)			
8	Casual labour for Transplanting	20	600	12,000
9	Pesticides (Assorted for 1 Year)	1	5,000	5,000
10	Foliar Feeds	1	10,000	10,000
11	Topdressing Fertilizer (CAN)	1	6,000	6,000
12	Casual labour - Gen Maintenance/yr	360	600	216,000
	Sub Total			753,000
	Grafting Costs			
1	Scion Costs	20,000	10	200,000
2	Grafters Costs	20,000	15	300,000
3	Grafting Tapes (Kgs)	10	500	5,000
4	Grafting wax (Kgs)	10	1,500	15,000
	Sub Total	1		520,000
	TOTAL RECURRENT & TOOLS COSTS			1,427,000

GRAND TOTAL

2,249,550

OTHER FACTORS TO CONSIDER

(i) Germination Percentages for Macadamia NIS

In general, macadamia nuts germinate very erratically and usually show low germination percentages of up to 50%. It is therefore important to factor this in when calculating the quantity of seed nuts to start with considering your target number of seedlings.

(ii) Nursery Losses

It is normal to lose some materials in the nursery during normal operations. In general, a mortality loss rate of up to 10% is acceptable.

(iii) Graft takes

Macadamia nut seedling propagation poses serious challenges to new grafters due to its hard wood nature. It is not unusual to get graft takes of 0 - 20% for beginners. The general average is about 50 - 60% takes. Experienced skilled grafters have however achieved graft takes of up to 90%. It is therefore important to factor this in as one plans for the target as omission of this consideration may result to collapse of the nursery at inception, decreased numbers of clean planting materials and inconvenience to the customers. There is need to train intensively the grafters and have them master the skill before actual commencement of mass grafting as per the targets set.

(iv) Timing of the seasons

The main market of the seedlings is usually during the rainy seasons or just before. It is therefore important to plan for the larger part of you clean planting material to be ready around this time. The major seasons are March – May and October – November of each year. In the highlands the main season is the March – May while in the lowlands, the main season is the October – November season. It is worth noting that the shorter the time the seedlings stay in the nursery when ready, the less the maintenance cost of the nursery and hence the better for the business.

(v) Client Support

When customers purchase the planting materials from the operator, they expect the nursery staff to advise them on the agronomic requirements of the crop and which varieties they should plant where. The client expects to be guided by a competent person hence the need for capacity building of any staff meeting/handling the customers in the nursery. Customer care should also be paramount as talking to customers in a courteous way and appreciating them and showing them how important to your business is paramount as they are the backbone of the business.

(vi) Financial prudence

Ensure that no incomes leak out of the formal system through proper record keeping and check systems, procurement from well researched sources to avoid resource wastage, offering best possible prices and proper stock management.



The ultimate result of the business venture will depend on how well the nursery operators manage the costs of operations, the management of the product quality and cleanliness, compliance to the legal and quality requirements and guidelines, customer care and support, and the competitive edge (price) compared to the equal footed competitors.



APPENDIX 1: TEMPLATE FOR COSTING MACADAMIA NUT SEEDLING PROPAGATION

Cost Details	g Target Number	= 1000 seed	dlings		
Cost Details					
	Unit Description	Quantity	Unit Cost	Total Cost	Derived Cost per seedling
Rootstocks Generation					
SUAL LABOUR					
gging & loading of soil	Mandays	4	650	2,600.00	2.60
rvestng of seed	Mandays	2	650	1,300.00	1.30
husking of nuts	Mandays	3	650	1,950.00	1.95
ed bed preparation	Mandays	4	650	2,600.00	2.60
il mixing	Mandays	3	650	1,950.00	1.95
ed sowing	Mandays	4	650	2,600.00	2.60
ansplanting	Mandays	4	650	2,600.00	2.60
itering	Mandays	8	650	5,200.00	5.20
raying	Mandays	2	650	1,300.00	1.30
eding	Mandays	4	650	2,600.00	2.60
ranging of Seedlings	Mandays	6	650	3,900.00	3.90
ardiing (Night& Weekends)	Mandays	3	650	1,950.00	1.95
	Sub-total			30,550.00	30.55
EDIA INPUTS					
ed nuts	kgs	20	200	4,000.00	4.00
rest soil	tons	2	300	600.00	0.60
rm yard manure	tons	0.7	1000	700.00	0.70
e ballast	Tons	0.3	450	135.00	0.14
ver Sand	tons	0.03	1000	30.00	0.03
	Sub-total			5,465.00	5.47
RTILIZERS					
۰.P	kgs	1	85	85	0.085
N	kgs	0	60	0	0
EA	kgs	1	60	60	0.06
liar feed	litres	1	6.5	6.5	0.0065
	Sub-total			151.5	0.15
STICIDES					
sorted Fungicides	Kgs/Lt	1	1200	1,200.00	1.20
sorted Insecticides	Kgs/Lt	1	1200	1,200.00	1.20
	Sub-total			2,400.00	2.4
TTING BAGS					
e 7*12	Pcs	3	2000	6,000.00	6
	Sub-total			6,000.00	6
ANSPORT OPERATION					
rest soil collection	kms	300	25	7,500.00	7.5
ed nut collection	kms	100	25	2,500.00	2.5
rchase of stores	kms	100	25	2,500.00	2.5
	Sub-total			12,500.00	12.50
A re r	NSPORT OPERATION est soil collection d nut collection chase of stores	Sub-total NSPORT OPERATION est soil collection d nut collection kms chase of stores kms Sub-total	Sub-total Sub-total INSPORT OPERATION Image: state stat	Sub-totalSub-totalINSPORT OPERATIONest soil collectionkmsd nut collectionkms10025chase of storeskmsSub-total	Sub-totalControlNSPORT OPERATIONImage: Controlest soil collectionkmsd nut collectionkmsd nut collectionkmsSub-totalImage: ControlSub-totalImage: Control

		Sub-total			4,000.00	4
	Seed nut collection	persons	2	1000	2,000.00	2
	Forest soil collection	persons	2	1000	2,000.00	2
1.7	TRAVELLING AND ACCOMODA	TION				

1.8	Cost of water for watering	Cubic mt	200	50	10,000.00	10			
		Sub-total			10,000.00	10			
	Total rootstock Costs				71,066.50	71.0665			
2	GRAFTING COSTS								
2.1	LABOUR								
	Grafting	Unit Cost	2000	15	30,000.00	30			
	watering	Mandays	24	650	15,600.00	15.6			
	spraying	Mandays	12	650	7,800.00	7.8			
	weeding	Mandays	12	650	7,800.00	7.8			
	scion /buds cutting	Mandays	6	650	3,900.00	3.9			
		Sub-total			65,100.00	65.1			
2.2	GRAFTING MATERIALS								
	Grafting tapes	rolls	1	1500	1,500.00	1.5			
	scions	nos	2000	5	10,000.00	10			
		Sub-total			11,500.00	11.5			
2.3	FARM INPUTS								
	CAN	kgs	10	60	600.00	0.6			
	UREA	kgs	10	60	600.00	0.6			
	Foliar feed	litres	10	100	1,000.00	1			
		Sub-total			2,200.00	2.2			
2.4	PESTICIDES								
	Fungicides	grams	10	60	600.00	0.6			
	Insecticides	litres	10	60	600.00	0.6			
		Sub-total			1,200.00	1.2			
2.5	TRANSPORT OPERATION				-	0			
	Scion /buds colletion	kms	100	25	2,500.00	2.5			
	Forest Soil Collection	kms	400	25	10,000.00	10			
		Sub-total			12,500.00	12.5			
2.6	SUBSISTENCE COSTS								
	Scion /buds colletion	persons	4	1200	4,800.00	4.8			
		Sub-total			4,800.00	4.8			
3.7	Costs for Water (for watering)	Cubic mt	300	50	15,000.00	15			
	Sub total				15,000.00	15			
	Total cost of grafting one maca	adamia seedling			112,300.00	112.3			
	Total cost of grafted seedling (rootstock + graft	ing cost)		183,366.50	183.3665			
		-							
	Overhead Costs								
	Marketing and promotion cost	s at 0.5% of nurse	ery costs		916.83	0.92			
	Storage costs at 1% of nursery	costs			1,833.67	1.83			
	Administrative costs at 1.5% of	nursery costs			2,750.50	2.75			
	Seedling issues studies at 1.5%	of nursery costs			2,750.50	2.75			
	Building maintainance and oth	er renovations at	1.5% of nu	rsery cos	2,750.50	2.75			
	Staff wages at 10% of nursery	costs			18,336.65	18.34			
	Losses due to seedling mortalit	ty a t10% of the pr	roduction c	ost	18,336.65	18.34			
	Electricity bill PM =500; 24 mo	nths = 12000			12,000.00	12.00			
		Sub-total				29.34			
	Total unit Propagating cost of macadamia seedling (R/Stock, Grafting, Overheads)								
	Gross profit of seedling @ 41%	of Total unit cost	t			87.29			
	Selling price of the seedling					300.00			

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