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Adoption of Tree Nursery Practices as Strategic Enterprise at Millenium Villages Project, Siaya County, Kenya

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Abstract

The Millenium Villages Project (MVP) in Siaya County (Kenya) was part of a clusters of villages in 10 countries in sub-Saharan Africa established to catalyse the achievement of the Millennium Development Goals (MDGs) with tree nursery enterprise as part of its key activities. This study was conducted to determine the level of adoption of tree nursery practices in the MVP Project. Exploratory survey involving purposive sampling of 31% households in the MVP and use of semi-structured questionnaires, interviews and focus group discussions was employed to collect data following validity and reliability tests. The resulting data were subjected to descriptive analysis using SPSS version 22 and differences between independent variables tested by Chi-square analysis (α =0.05). The most preferred tree species were Cupressus lusitanica (66.9%), Eucalyptus grandis (56.4%) and Grevillea robusta (43.1%). Farmers were not able to propagate some preferred trees due to unavailability of seeds (e.g. Grevillea robusta), lack of knowledge on vegetative propagation of the tree species (e.g. Casuarina equisetifolia), slow growth (e.g. Acacia nilotica), and seeds taking too long to germinate (e.g. Mangifera indica). Tree nursery operators in the region used locally-sourced seeds as a means of raising seedlings, without taking into consideration the genetic attributes of the germplasm used. Tree nursery enterprise at the millennium village has great potential as an economic venture, with a total net annual return of Ksh. 4, 976, 854.00 above total cost, translating into Ksh 27, 496.50 per capita at the village level. The most important challenges facing the adoption of tree nursery enterprise at the MVP are pests, scarcity of water and lack of adequate space for nurseries. This study recommends certification of tree nursery operators and development of tree germplasm tracking systems for quality assurance and marketing purposes as well as intensification of extension services and awareness campaigns for increased afforestation and attainment of at least 10% tree cover in Siaya County, and the rest of the Country.

Keywords: Tree Nursery, Strategic Enterprise, Tree Seed

INTRODUCTION

The Millennium Villages Projects (MVPs) were implemented across sub-Saharan African countries to catalyse the achievement of the Millennium Development Goals (MDGs) and act as a proof that the MDGs are achievable (Kimanthi & Hebinck, 2016). It was a project of the Earth Institute (at Culumbia University), the United Nations Development Programme, and Millennium Promise aimed at evaluating the integrated approach to rural development can be used to achieve the MDGs—eight globally endorsed targets that address the problems of poverty, health, gender equality, and

disease—by 2015 (The Earth Institute, 2015). The goal was to achieve effective method of global mobilization of a set of important social priorities worldwide (Sachs, 2012).

The Millennium Villages Project in Siaya County (Kenya) was based at Sauri, a cluster of 11 villages covering 132 km^2 and forming part of the original 14 clusters of villages in 10 countries in sub-Saharan Africa. The clusters were Sauri and Dertu (Kenya), Koraro (Ethiopia), Mbola (Tanzania), Ruhiira (Uganda), Mayange (Rwanda), Mwandama and Gumulira (Malawi), Pampaida and Ikaram (Nigeria), Potou (Senegal), Tiby and Toya (Mali) and Bonsaaso (Ghana) (The Earth Institute, 2007). According to Mutuo *et al*. (2006), the community structure and local leadership involvement in the MVP at Sauri (Siaya County) was sector-based, with the sectors being Agriculture, Health, Water and Sanitation, Energy, Roads and Communication, Education, Business, Environment, and Community Development. Under both the Environment and Business sectors of the MVP, 11 small-scale tree nurseries were established with an average of 200 seedlings, thus each of the villages in Sauri had a working tree nursery. Twenty six (26) members of the Environment committee were trained on small-scale commercial tree nursery establishment and management. This study was conducted to determine the level of adoption of tree nursery practices as strategic enterprise at the Millenium Villages Project, Siaya County, Kenya.

Specific objectives of the study were to determine: (i) the socio-economic determinants of the adoption of the tree nursery enterprise with respect to tree species selection and preference, tree seed quality and collection methods, and sources of tree germplasm propagated and commercialized at the MVP; (ii) the economic benefits of tree nursery enterprise; and (iii) challenges facing the adoption of the tree nursery enterprise and their possible mitigation strategies.

MATERIALS AND METHODS

Study Area

The study was conducted at the Millennium Villages located in Yala Division, Siaya County (Figure 1), which is one of the six counties in the Nyanza region. The land surface area of the County is 2,530km^2 and the water surface area is 1,005 km^2. Siaya Couty is bordered by Busia County to the North West, Vihiga and Kakamega counties to the North East, Kisumu County to the South East and Homa Bay County across the Winam Gulf to the South. The water surface area forms part of Lake Victoria (the third largest fresh water lake in the world). It approximately lies between latitude 0º 26´ South to 0º 18´ North and longitude 33º 58´ and 34º 33´ East (CGS, 2013). Siaya County is characterised by high poverty levels (47.56%) and food insecurity. Low adoption of agricultural technologies, low use of inputs, high cost of credit, and poor quality soils are some of the salient factors that exacerbate the impact of climate change and variability in the County (MoALF, 2016).

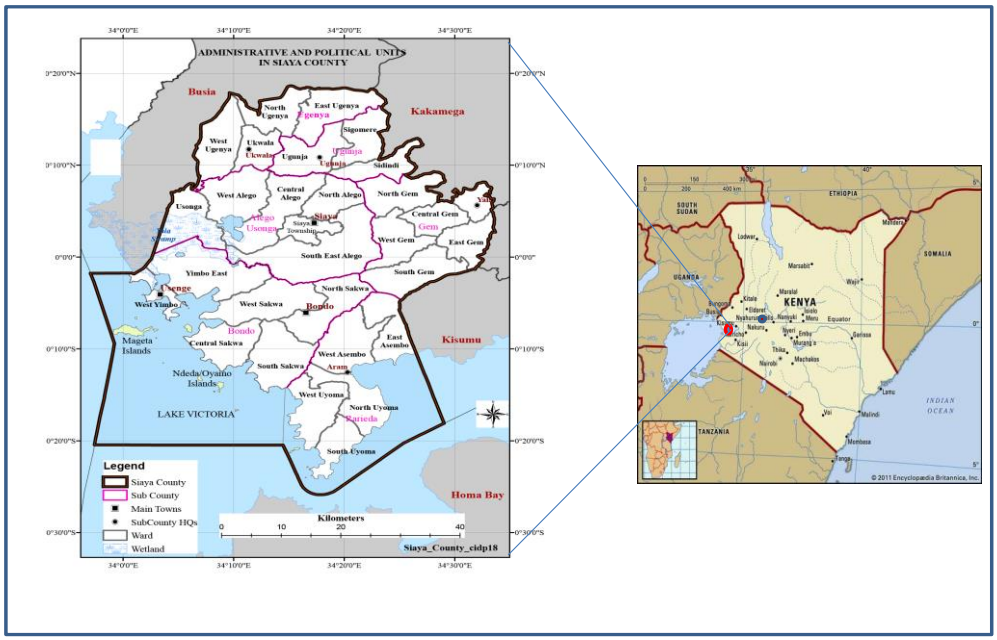

Figure 1: Location of the study area within Siaya County.

Research Design, Data Collection and Analysis

Exploratory survey research design was used to evaluate the adoption of tree nursery practices as strategic enterprise on livelihood improvement. Purposive sampling was done to focus on particular characteristics of a population that is of interest, to best enable the researcher answer research questions. The target population was 181 tree nursery farmer households enrolled at the Millennium Villages in 11 Sub-locations in Yala Division, Siaya County at a sampling intensity of 31%. Semi-structured questionnaires, interviews and focus group discussions were used to collect data following validity and reliability tests. The resulting data were subjected to descriptive analysis using SPSS version 22 and presented as charts and tables. Differences between independent were tested by $\chi 2$ analysis for significance at α =0.05 and means separated by LSD (Zar, 1984).

RESULTS AND DISCUSSION

Socioeconomic Profile of the Respondents

Socioeconomic profile of the respondents is presented in Table 1. Most of the respondents (60.2%) were aged 36-55 years and there was high gender disparity with higher number of males (65.2%) being more than females (34.8%) in the Millenium Villages. Most of the household heads were married (62.4%) followed by those were single (28.7%) while 7.2% of the people were widowed. Generally, most of farmers (58.0%) in the tree propagation business had secondary level of education and majority of the households (48%) had family size of 5-7 and a monthly income of Kshs 10,000-20,000 (42.0% household).

Table 1: Respondents' Socio-economic and Demographic Profile

Variable	Response category	Frequency (n = 181)	Percent (%)
	< 18	9	5.0
	18-35	45	24.9
Age (years)	36-55	109	60.2
	> 55	18	9.9
	Total	**181**	**100**
	Male	118	65.2
Gender	Female	63	34.8
	Total	**181**	**100**
	Married	113	62.4
	Single	52	28.7
Marital status	Widowed	13	7.2
	Divorced	3	1.7
	Total	**181**	**100**
	Primary	27	14.9
	Secondary	105	58.0
Level of education	University	17	9.4
	Informal	32	17.7
	Total	**181**	**100**
	< 5	59	32.6
	5-7	88	48.6
Household size	8-10	23	12.7
	>10	11	6.1
	Total	**181**	**100**
	< 5000	21	11.6
	5,000-10,000	73	40.3
Monthly income (Kshs)	10,001-20,000	76	42.0
	20,001-50,000	8	4.4
	>50,000	3	1.7
	Total	**181**	**100**

Noteworthy is the fact that majority of the small-scale tree nursery owners were above 36 years of age, indicating that very few youths are engaged in the tree nursery enterprise in the region. This could be due to the general perception that agriculture is a career of last resort, one of drudgery and low monetary benefits (GOK, 2017). However, results of studies conducted in Eldoret Municipality (Kenya) indicate that young people are beginning to venture into tree nursery enterprises, particularly in urban areas (Rutto & Odhiambo, 2017). These authors noted that a large proportion (86.1%) of tree nursery owners in Eldoret Municipality have been found to be young (between 18 and 43 years) and have attained post primary level of education (64%). The high family size is characteristic of household sizes in developing countries. Large average household sizes, of greater than five persons per household, have been observed across much of Africa and the Middle East (UN, 2017).

The Socio-Economic Determinants of the Adoption of the Tree Nursery Enterprise at the MVP in Siaya County

The basis on which the individual's farmers at the MVP decide on the tree species to raise is summarized in Table 2. Marketability (91.2%) of the tree species and demand for the planting stock (i.e. seedlings or cuttings) (79.6%) were the major determinants of tree preference among the farmer whereas the species identified by supporting agency (82.6%) and growth performance (quality) (82.2%) of the species influenced the choice of species promoted by MVP for adoption and commercialization in the millennium village. The ministry of agriculture however, promoted tree species mainly on the basis of growth performance (quality) (86.1%) and suitability of the planting site (81.2%).

Table 2: Basis on Deciding on the Tree Species to Raise among the Individual Farmers at the Millennium Village, Siaya County

Basis for choice of Tree Species	Frequency of making decision (%)		
	Individual	MVP	Ministry of Agriculture
Availability of germplasm	67.4	72.6	63.8
Demand of planting stocks	79.6	65.6	52.2
End use of the tree	84.0	62.8	44.0
Growth quality of the species	56.4	82.2	86.1
Suitability of the planting site	51.4	81.1	81.2
Identified by the supporting agency	45.9	82.6	82.1
Marketability of the tree	91.2	55.8	43.4

The most preferred tree species by the farmers at the millennium village were *Cupressus lusitanica* (66.9%), *Eucalyptus grandis* (56.4%) and *Grevillea robusta* (43.1%) as shown in Table 3. The farmers were not able to propagate and commercialize some tree species even though they would have wished to do so due to various reasons such as unavailability of seeds (e.g. *Grevillea robusta*), lack of knowledge on vegetative propagation of the tree species (e.g. *Casuarina equisetifolia*), slow growth of the species (e.g. *Acacia nilotica*), and seeds taking too long to germinate (e.g. *Mangifera indica*) (Table 4).

The uses of various tree species (e.g. whether for timber or biomass energy) and mean household farm size have been found elsewhere (Tanzania) to be some of the key factors that influence households' tree planting behaviour (Kulindwa, 2016). In North Korea, local knowledge of the multiple functions of Agroforestry species ensured that the tree selection criteria included the value of timber, fruit, fodder, oil, medicines, fuelwood, and erosion control (He *et al*., 2015). In Central Kenya, chances of farmers motivated to plant trees for environmental conservation were about 3.5 times higher to retain trees as compared to the group of farmers planting trees as a source of livelihood (Oeba *et al.,* 2012). In the millennium villages, it is likely that demand for timber and fuelwood (thus, marketability), species promoted by the non-governmental agencies, fast growth of tree species and farm size were the major factors that influenced tree species choice and the adoption of tree nursery enterprise at the millennium villages in Siaya County.

Table 3: The Most Preferred Tree Species by Farmers at the Millennium Village, Siaya County

Scientific name	Common name	Family	Fraction of nursery growing the species (%)	
			Frequency	Percent
Grevillea robusta	Grevillea	Proteaceae	78	43.1
Casuarina equisetifolia	Australian pine tree	Casuarinaceae	66	36.5
Eucalyptus grandis	Blue gum	Myrtaceae	102	56.4
Acacia nilotica	Acacia	Fabaceae	56	30.9
Caliandra calothyrsus	Caliandra	Fabaceae	44	24.3
Mangifera indica	Mango	Anacardiaceae	34	18.8
Spathodea nilotica	Nandi flame	Bignoniaceae	23	12.7
Cupressus lusitanica	Cypress	Cupressaceae	121	66.9
Dovyalis caffra	Kayapo/ Kei apple	Salicaceae	30	16.6
Cordia Africana	Cordia	Boraginaceae	25	13.8

Table 4: Preferred Tree Species though not raised by the Small-Scale Tree Nursery Operators and Reasons for not raising the Species

Preferred tree species though not raised in tree nurseries	**Reason for not raising the tree species**
Gevillea robusta	Unavailability of seeds
Casuarina equisetifolia	Lack of knowledge on vegetative propagation
Eucalyptus grandis	High cost of planting materials
Acacia nilotica	Takes long to grow and mature
Caliandra calothyrsus, Cordia africana	Lack of information on how to raise it
Dovyalis caffra, Mangifera indica	Seeds take long to germinate
Cupressus lusitanica, Spathodea nilotica	Takes long to grow and mature

The small-scale tree nursery owners mainly used germplasm from two types of sources, namely locally-sourced seeds and wildlings (Table 5). While the majority of them (64.1 %) preferred germplasm raised from locally-sourced seeds, others used wildlings (30.9 %) that were readily available and easy to collect, and seedlings (40.3 %) purchased from local sellers. Seeds of many timber species are tiny, making ground collection difficult. In addition, a general lack of information on the phenology of various indigenous tree species makes it difficult for the tree nursery owners to collect the seeds and produce seedlings of such species. Also, use of wildings is cost-effectiveness due to a shorter management period in the nursery. Where seeds are collected, the tree nursery operators rarely consider the quality of tree germplasm.

Table 5: Sources of Tree Germplasm Used by Farmers in the Millennium Village in Siaya County.

Sources of Germplasm Used	**Frequency**	**Relative Frequency (%)**
Locally-sourced seeds	116	64.1
Wildings	56	30.9
Seedlings from local sellers	73	40.3
Cutting	37	20.4

Lack of sufficient material and germplasm input and using seeds of low or unknown quality has been identified as some of the major constraints to tree nursery enterprise in Oromia region of Ethiopia (Dedefo *et al*., 2016) and this scenario is mirrored in many parts of developing counties including western Kenya. Farmers commonly plant trees on farms or community lands to grow products that satisfy household needs and

market demands. Non-government organizations (NGOs) often support farmers' tree-planting efforts. Tree seed, a key input that determines the success of any tree planting activity, is often in short supply. As a result, farmers and NGOs use whatever seed is available, regardless of its quality (Mulawarman *et al*., 2003). There is however, great need to be concerned about the genetic quality of locally-sourced seeds, as the case of millennium villages in Siaya County, Kenya.

The Economic Benefits of Tree Nursery Enterprise at the Millennium Villages in Siaya County

The nursery survey revealed that about 54% of the individual nurseries sell seedlings while only 13.6% of the communal nurseries accept seedling orders. This implies that individual nurseries are more profited oriented, which largely affect their operations. Collectively the millennium village had a net annual return of Ksh. 4,976,854.00 above total cost, translating into Ksh 27, 496.50 per capita. This shows there is great potential and benefits derived from the enterprise. Although, the economic benefit from the tree nursery enterprise is below the Kenyan GDP per capita of 1169.34 USD in 2017, it is a venture full of potential that only waits to be tapped given incentives to the local community. The GDP per capita in Kenya averaged 832.22 USD from 1960 until 2017, reaching an all time high of 1169.34 USD in 2017 and a record low of 481.38 USD in 1961 (TE, 2018).

The Challenges Facing the Adoption of Tree Nursery Enterprise at the Millennium Villages in Siaya County

Problem Faced by the Tree Nursery Owners at the MVP, Siaya County

The main challenges facing the adoption of tree nursery enterprise at the Millennium Villages in Siaya County were pests (rank 1), scarcity of water (rank 2) and lack of adequate space for nurseries (rank 3) based on cumulative weighted score (CWS) (χ^2 = 28.142; df = 9; p = 0.001). All other problems mentioned received CWS of less than 63. It is worthwhile to note that labour ranked consistently low throughout (Table 6). Overall results on major problems encountered by farmers show clearly that establishment and management of tree nurseries was feasible for majority of farming households, even with their limited resources and capacities.

Table 6: Cumulative Weighted Score of Problems in Tree Nurseries at the MVP, Siaya County

Problem faced by tree nursery owners	Cumulative weighted score	Problem rank
None	546	0
Pests on Seedlings	345	1
Scarcity of water	224	2
Lack of adequate nursery space	220	3
Damage by livestock	46	4
Lack of information	50	5
Limited tree seed	40	6
High labour demand	22	7
Transporting seedlings	10	8
Lack of markets for seedlings	4	19

Constraints to the Adoption of Tree Nursery Enterprise at the MVP, Siaya County

Lack of capital was identified as the most important constraint to the adoption of tree nursery enterprise at the millennium villages (87.0%; Relative frequency = 27.5%), followed by lack of technical skills (76.4%; Relative frequency = 24.2%) and lack of quality seeds (67.8%; Relative frequency = 21.5%) *(χ^2 = 18.231; df = 4; p = 0.002)*

(Fig. 2). In addition to lack of capital, investment in tree nursery enterprise is faced by uncertain future owing to the long-term nature of the tree crop, even at the seedling stage, in many countries at different levels of economic development. In Great Britain, for instance, studies have shown that lack of long-term market predictability brought about by the current configuration of forestry grants and regulations and, in particular, the administrative systems for processing grant applications is identified as a major impediment to having a sustainable and competitive supply of home-grown and currently adapted planting stock (Whittet *et al.*, 2016). This problem isn't unique to developing counties.

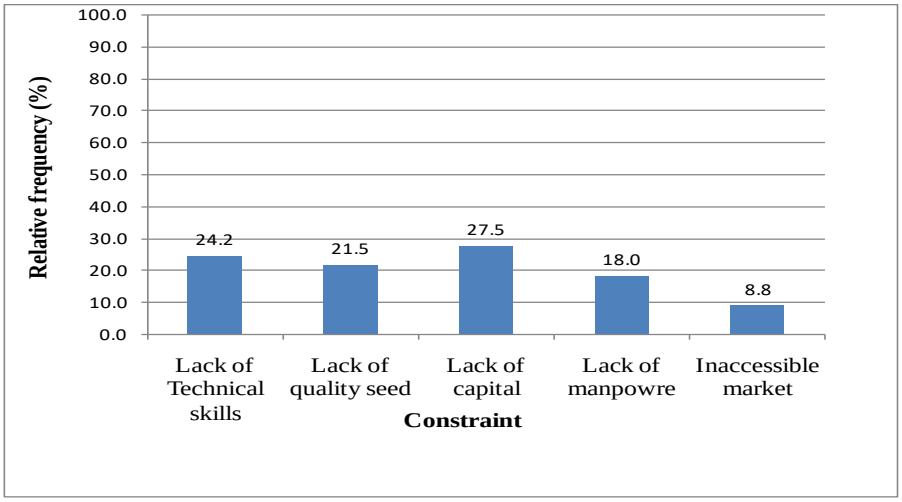

Figure 2: Constraints to the adoption of tree nursery enterprise at the MVP, Siaya County.

CONCLUSION

Marketability of a given tree species, growth performance (whether fast growing or not), species promoted by governmental and non-governmental organizations are the major factors influencing the adoption of tree nursery enterprises at the millennium villages in Siaya County. *Cupressus lusitanica* (66.9%), *Eucalyptus grandis* (56.4%) and *Grevillea robusta* (43.1%) were the most preffered tree species. Tree nursery operators in the region use locally-sourced seed as a means of raising seedlings, without taking into consideration the genetic attributes of the germplasm used. Tree nursery enterprise at the millennium village has great potential as an economic venture yielding a high per capita at the village level.

This study recommends certification of tree nursery operators and development of tree germplasm tracking systems for quality assurance and marketing purposes as well as intensification of extension services and awareness campaigns for increased afforestation and attainment of at least 10% tree cover in Siaya County, and the rest of the Country.

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