Evidence Based Decline in Coconut Productivity along the Coastline of Tanzania

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Abstract: *This paper attempts to find out and discuss the productivity status of coconuts along the coast belt of Tanzania. According to the current statistics, Tanzania is a major producer of coconut in Africa and ranks the eleventh in world. Between 1979 and 2004, there was a significant increase of coconut production in Tanzania due to implementation of the National Coconut Development Program (NCDP). However, since phasing out of NCDP in 2004, little is known and even less is documented on the status of coconut production and productivity in the country. This study was conducted along the coastal belt where more coconuts are produced with smallholder farmers who produce about 95% of the coconuts in Tanzania. Simple random and purposive sampling techniques were applied. The results showed a decline of area under coconut cultivation per household by twenty two percent between 2004 and 2014. Also there is a decline of productivity in nuts per Ha per household by eleven percent compared to during the NCDP period. The multiple problems facing the coconut productivity identified to be; low funding for extension services and research development, poor dissemination of improved technologies, absence of initiatives for coconut farm revival, planting and re-planting of new coconut seedlings. The way forward is for the Government and coconut stakeholders to strengthen extension services and allocate fund for coconut sub-sector development. Also the Government should consider the establishment of coconut board which will enforce the development of coconut along the value chain.*

INTRODUCTION

Coconut (*Cocos nucifera* L.) is an important oil crop that supports the livelihoods of the majority of the coastal people in the world and contributes to the sustainability of the environment (URT, 2013). The palm forms part of the daily diet of many people. It is also used in various industrial products (URT, 2013). Recent reports and studies indicate that there is a significant contribution of coconuts to the health and nutritional sectors as coconut juice is used as medical dextran and for a diuretic (Enig, 1996; Magat and Augtin, 1997). Coconut juice from young nuts is also now under trials in the treatment of kidney stones in a number of hospitals including the Metro Manila (Magat and Augtin, 1997). Moreover, there is scientific evidence showing that coconut oil is a source of good cholesterol in human body (Magat and Augtin, 1997). Additionally, coconut oil is

likely to prevent and serve as a treatment of coronary heart disease (Enig, 1996). Coconut oil is a valuable source of Lauric Acid; the medium chain saturated fatty acid is a precursor to the antimicrobial Lipid Monolaurin, which has important functional benefits to individuals with compromised immune system, in both growing children and the elderly (Enig, 1996).

Worldwide, the plant is grown in 93 countries that spread along the tropical belt of the world covering an area of 12.07 million Ha, with the annual production of 62.45 million tons of nuts per year (FAOSTAT, 2015). About 83% of the coconuts are produced in Asia with Indonesia being the largest producer with a production area of 3.0 million Ha that produce about 18.3 million tons of nuts, followed by the Philippines that has coconut production area of 3.5 million Ha that produce 15.35 million tons of nuts. India has the production area of 2.1 million ha that produce about 11.9 million tons of nuts (FAOSTAT, 2015).

Africa contributes 3.4% of the world nuts. The leading producing countries include Tanzania, Ghana, Nigeria, Mozambique, Kenya, Cote d'Ivoire, Madagascar, Guinea, Benin, and Togo (FAOSTAT, 2015). Tanzania also is ranked as eleventh biggest producer of coconut producing about 530 000 tons per year (FAOSTAT, 2015). The coconut production is mainly based along the coastal of the eastern part of Tanzania (NBS, 2012). About 95% of the coconuts in Tanzania are produced by small-scale farmers who own an average of one hectare. Medium and large-scale farmer producers accounts for only 5% of the coconut production in Tanzania (Pushpakumara *et al.*, 2013). According to NBS (2012), about 134,068 ha is an estimated area under coconut production in Tanzania; and this constitutes 1% of the total usable[1] land in Tanzania. According to NBS (2012), Coast region has the largest (36%) area under coconut production followed closely by Tanga (23%) and Lindi (20%). Other regions include; Morogoro (5%), Dar es Salaam (4%), and Mtwara (3.5%).

Between 1970 and 1980 the country faced a shortage of coconut production due to several factors such as low investment, pest and diseases, and drought (Kullaya, 1999). Therefore, the government decided to introduce the NCDP to reverse the downward production trend through research and development (R&D). Several improved technologies and agronomical practices such as coconut hybrids, spacing, weeding, replanting and processing were developed and introduced to farmers (Ashimogo *et al.*,

[1] Total usable land in Tanzania is 14,642,284 ha of which 99.1% allocated in mainland and 0.9% allocated in Zanzibar (NBS, 2012).

1996; URT, 2013). As a result, yields in coconut productivity increased by 50% from an annual average of 23% to 35% of nuts per palm. Similarly, the area under coconuts cultivation increased from 240 000 Ha before the project in 1979 to 265 000 Ha after the project in 2004. Moreover, sales of coconut and coconut-by products were almost doubled hence enabled an increase of income to coconut farmers (URT, 2013). After phasing out of NCDP in 2004, little now is known about the status of coconut production, productivity and status of improved agricultural technologies in the country. For example, the status of coconuts productivity per Ha or per tree, application of improved technologies at farm level and agronomical practices among smallholder farmers have not clear known and not documented. Therefore, it was important for this study to assess the coconut production, productivity and improved technologies at national and farm level. Information generated by this study would be shared among coconut actors such as the policy makers, extension officers, farmers, researchers and local government authorities. The study findings are meant to support the setting of strategies and plans for the betterment of coconut sub sector in Tanzania. Specifically, the study sought to assess the status of productivity of coconut and the technologies applied by farmers for coconut production in along the coast belt of Tanzania.

MATERIALS AND METHODS

The study area and sampling of villages

The study was conducted in coconut growing areas along the coastal belt of Tanzania Mainland and Zanzibar islands. According to URT (2013), the NCDP was implemented in almost 100 villages. The register of villages involved in the study at that time was collected at Mikocheni Agricultural Research Institute in 2012. Random sampling for sample villages was conducted from a population of villages with a support of Microsoft Excel software. The 6 randomly selected villages were Masaika (Pangani), Kwakibuyu (Muheza), Mdimuni (Mkuranga), Masaki (Kisarawe), Rwelu (Mtwara-Mikindani) and Jumbi (Central).

Data Collection

Information for this study was collected from different sources particularly at households/ village level and from government institutions. Both primary and secondary information was collected. Primary data were collected from household survey, which involved 150 coconut farmers (25 respondents from each of the visited village) and 30 key informants. The questionnaire and checklist were designed to capture both qualitative and

quantitative information. Secondary data involved a review of various documents and relevant web-sites research.

Data Analysis

Statistical Package for the Social Sciences version 16 (SPSS-ver16) was mainly applied for data entry and analysis.

RESULTS AND DISCUSSION

The status of coconut production in Tanzania

In Tanzania, the area under coconut production was 165 049 Ha in 2002 (NBS, 2002). The production had declined (by 18.7%) to 134 068 Ha in 2012 and population of coconut palms in Tanzania dropped by 1.2% from 25 300 000 in 2002 to 25 000 000 in 2012 (NBS, 2012). According to Muyengi *et al.* (2015), the decline of coconut production was associated with low production of coconuts at farm level and increase of human activities and settlements.

Coconut productivity in Tanzania

The results showed that nuts per tree in Tanzania observed to drop from 15 nuts in 2002 to 12 nuts/tree/year in 2012. The decline within ten years after NCDP was due to absence of interventions for coconut promotion in Tanzania (Muyengi *et al.*, 2015). New seedlings planted per Ha also observed to decrease by 75% between 1999 and 2014. During the NCDP, the planting rate was more higher compared to the current situation. For example, the coconut planting and replanting rate increased from 44% and 93% (mean of 81%) between 1996 and 1999 because of the presence and implementation of R&D interventions (URT, 2013).

Major crops cultivated along the coastal belt

Main perennial crops cultivated along the costal belt are coconut palms, citrus, cashewnuts, banana and cloves. Coconut palm is a major crop cultivated by 55.3% while other crops like citrus, cashewnuts, banana and cloves are cultivated by 44.7%. For annual crops, cassava is a major crop grown by most of the coconut farmers (57.3%) followed by maize (36.7%) and other crops including cowpeas, sweet potatoes, yams and beans (6%). These findings is also agreed with the observation by Muyengi *et al.* (2015).

During the NCDP period, coconut crop was grown by 95% of the farmers and only 5% of farmers grew other crops such as citrus, cashew nut, banana, mango and cloves. This means there was a decline of farmers' engaged in coconut production from 95% in 1999 to 55.3% in 2014. The reason for this decline could be many but among them are low returns

from coconut and an increase demand of other crops notably cassava crop which provides both food and cash to smallholder farmers. This shifts attention from coconut, therefore, some appropriate strategies are required in farm intensification with consideration of production of coconut and cassava crops along the coastal belt.

Area under coconut cultivation

The study result showed the declining trend of area under coconut cultivation at household level by 19% from 2.6 Ha in 2000 to 2.1 Ha in 2014(Table 1). At national level, the average of land under cultivation per household is 2 Ha (NBS, 2012). Despite the fact that area under coconut production in the study area is almost equal to the national average, the current decrease of 19% of area under coconut production after the NCDP period is a signal to coconut stakeholders on the need of revamping the sub-sector.

Table 1: Average area (ha) cultivation with coconut per household at different periods

Visited districts	Coconut cultivation (ha) NCDP period (2000)	Coconut cultivation (ha) in 2014
Zanzibar	1.4	1.3
Muheza	1.4	1.3
Pangani	3.6	2.9
Kisarawe	2.7	2.5
Mkuranga	4	2.8
Mtwara	2.9	2.1
Average	2.6	2.15

Coconut productivity

Results showed a decline of production and productivity of coconuts in a country as opposed to during NCDP period. In the study area (Table 2), the production of coconut was 2,818 nuts per household per year while the average yields was 1,342 nuts/ha per household. During the NCDP period, in particular, 1999 the recorded production was 3,150 nuts/year/household (Mwinjaka, 1999). This imply that there is a need of proper intervention and promotion of coconut production in conducive areas.

Table 2: Average productivity of coconuts at household level in the study areas

Study Areas	Ha/HH (1)	Total No Trees (2)	No. Bearing trees (3)	No. Nuts /tree(4)	*Nuts/year (3)x(4) = (5)	*Nuts/ha (5)/(1) = (6)	*Trees/ha(2)/(1) = (7)
Jumbi	1.3	85	47	39	1812	1394	65
K/kibuyu	1.3	47	36	76	2777	2136	36
Masaika	2.9	78	50	60	3014	1039	27
Masaki	2.5	77	41	75	3076	1230	31
Mdimuni	2.8	107	74	35	2599	928	38
Rwelu	2.1	73	43	59	2541	1210	35
Average	2.1	78	49	57	2818	1342	37

Technologies used for coconut production

The results show that traditional technology was mainly used for coconut production in the study area as opposed to improved technology except for farm cleaning or weeding (Fig. 1). Weeding was applied by 93% of the farmers while only 7% of farmers either did not clean their farms or used fire to clean their farms. During the NCDP period, about 76% of coconut farmers applied improved technologies which were improved coconut varieties, seedling re-placing, and spacing, pest control, weeding and processing (Ashimogo *et al*., 1996). This mean that since end of NCDP in 2004, the application of improved technologies has declined among farmers and this is due to low use of the improved technologies.

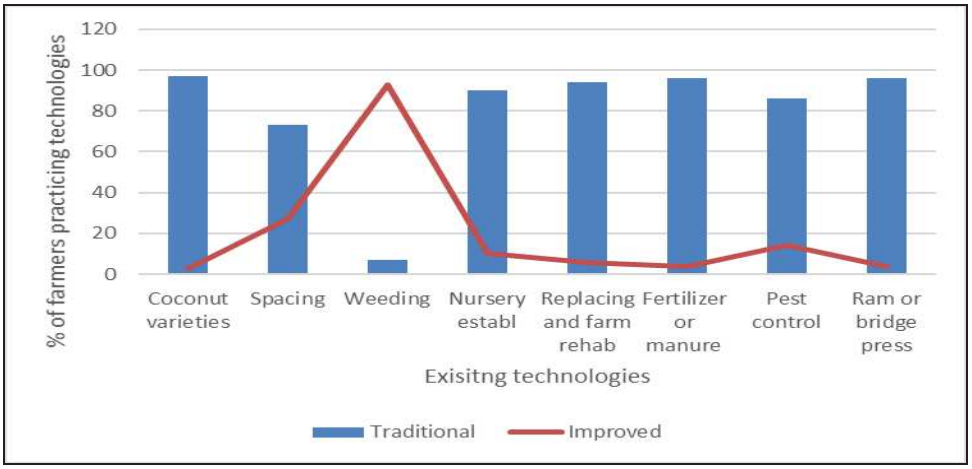

Figure 1: Types of technologies applied for coconut production in the study areas

FACTORS AFFECTING FARM PRODUCTIVITY IN THE STUDY AREA

Coconut trees per unit area

Number of coconut trees per Ha is identified as main factor among others that affects productivity of coconut in Tanzania. The coefficients for coconut trees per hectare was positive and also significant. This means that keeping other variables constant one coconut tree in a farm can change the harvest by 14 nuts per ha per year.

Extension Services

Provision of extension service for coconut farms and for farmers was identified as another main factor among others that affected productivity of coconut in Tanzania. The coefficients for provision of extension services was positive and also significant. According to the analysis, if there is an agricultural extension service in the village, the coconut harvest can change by 131 nuts per ha per year.

Table 3: Results of Multiple regression for the selected technology variables

Variable	Coefficient	Sign/exp	p-value (at 5% of level of signif)	Sign
Constant	136	-/+	0.5134	Yes
X_1: Pest control (controls applied/yr)	76	-/+	0.7063	No
X_2:farm labour (working household members/ha)	87	+/+	0.1300	No
X_3: Coconut trees/ha	14	+/+	<0.0001	Yes
X_4:Extension services offered to farmers (visits/yr)	131	+/+	0.4402	Yes
X_5: Weeding/yr	37	+/+	0.5170	No
X_6: Fertilizer application(kg/ha)	196	+/+	0.1305	No

Pests Management

The results showed that about 46.7% of the farmers experienced *rhinoceros* beetle (*Oryctes monoceros*) problem in their farms. About 8% of the farmers experienced both rhinoceros, keifer, coreid bug (*Pseudotheraptus* wayi*)* and coconut mites problems. Moreover, 4.7% of the farmers experienced problems with coconut mites (*Aceria guerreronis*) while 1.3% experienced problems with coreid bug. This implies that rhinoceros beetle was the most important damaging pest in the study area. Similar results were reported by Seguni (2010) who revealed Rhinoceros beetles to be the most threatening pests in all coconut growing areas causing 47% of tree infestation followed by coconut mites (5%) and Coreid bug (1.3 %).

Types of coconut palms

Three types of coconut palms were observed in the study area which includes; Local East African Tall (L-EAT), Improved East African Tall (I-EAT) and Pemba Red Dwarf (PRD). Most of the visited farms (92%) in the study area were planted with L-EAT, followed by a mixture of L-EAT, I-EAT, and PRD (5.2% of the farms). The farms with sole I-EAT and PRD were 2% and 0.6% respectively. During the NCDP period, about 76% of the farms in coconut based farming systems were planted with L-EAT followed by I-EAT and PRD by 21% and 2.3% respectively (URT, 2013). According to the farmers, the preference of planting L-EAT in the study area was attributed to its long harvesting cycle and resistance to drought and diseases.

Weeding Practices

The results showed that about 80.7% of the farmers practiced weeding in their farms as opposed to 19.3% of the farmers who did not weed their farms. Also, the results indicated that about 43.3% of the farmers practiced weeding at least twice per year as opposed to 34.1 and 3.3% who performed once and three times per year respectively. During the NCDP period, weeding was performed two or more times per year by 70% of the farmers in CBFS (URT, 2013). The NCDP manual, recommends that the weeding should be performed at least twice per year particularly, before and after the rainy season (NCDP, 1989).

Inputs status and application

The results indicated that most (96%) of the coconut farmers did not apply fertilizers. During the NCDP period particularly in 2000, about 30% of the coconut farmers applied fertilizer (URT, 2013). During focused group discussions with farmers, it was noted that the limited supply and price of fertilizer could be among the factors for not using fertilizers. Other factors given were low awareness and income.

Planting rate of coconut seedlings

Table 4 shows the planted seedlings in the visited areas before and after NCDP. The study results indicated that planting rate of seedling decreased by 64 % particularly from 39 seedling per Ha per year in 2000 to 14 seedlings per Ha per year in 2014. According to Muyengi *et al*. (2015), low planting rate of seedlings in the study area was associated with less efforts among farmers to engage in coconut production compared to other crops like cassava and also challenges of seedlings availability and less facilitation on planting and re-planting of new seedlings.

Table 4: Seedlings planted per year per household during and after NCDP

	Jumbi-Ungu ja	Masaki-Mkuranga	Rwelu-Mikindani	K/kibuyu-Muheza	Masaika-Pangani	Average
After NCDP(2014)	12	21	13	13	15	14
NCDP(2000)	51	47	18	42	37	39
Phsical changes-2000 to 2014	39	26	5	29	22	25
% changes	76	55	27	70	60	64

The funding in Coconut Sub-sector

Interview with management of Mikocheni Agricultural Research Institute[2] noted that there is a limited funding injected in coconut sub-sector development. The observation noted that for the last five years (2010-2015) there was no fund allocated by the government for coconut development in the country. According to Muyengi *et al*. (2015), if there is no intervention done by Government for promotion and development of coconut sub sector in the country there is a possibility of coconut harvested to continue to drop by 1% per year. Figure 2 is forecasting the coconut trees and number of nuts to be harvested by 2022.

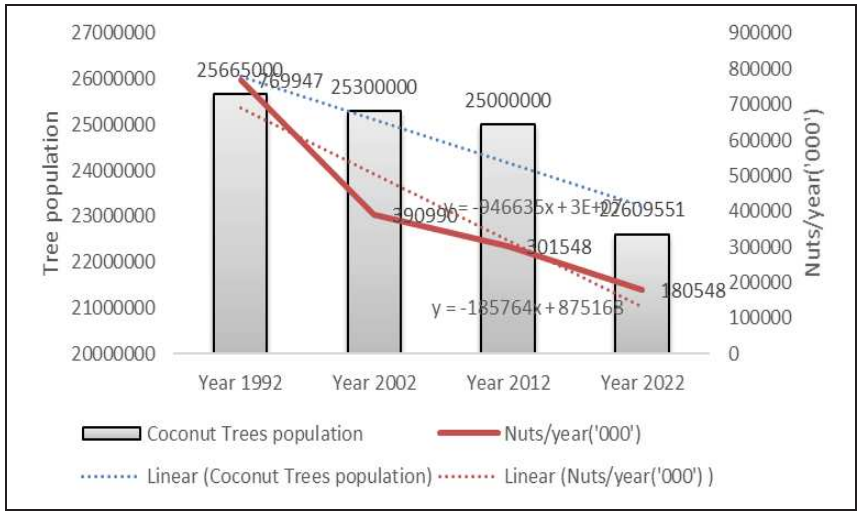

Figure 2: Coconut tree population and productivity of coconut palms in Tanzania by 2022

[2] The institute has a mandate for promoting and development of coconut sub-sector in Tanzania

As the projection indicates to decline of coconut in Tanzania by 2022, it is high time to lay down strategies and initiatives for promoting the sub-sector. The proposed strategy may include reviving of coconut farms, plant and re-planting of new seedlings and establishment of coconut board. Such initiatives were also taken to other countries e.g. in Kenya. Taking an example of Kenya, in 2013 the country through Coconut Development Authority (KCDA) has planted a total of 270,000 and in 2014 about 467,779 new seedlings were disseminated to farmers (KCDA, 2014). Such initiatives should be adopted in Tanzania too.

CONCLUSION AND THE WAY FORWARD

Conclusion

Based on this scientific research and analysis, it was concluded that, production and productivity of coconuts in Tanzania have been decreasing yearly. The area under coconut cultivation is also decreasing. Very few (22%) of coconut farmers in the study area applied improved technologies whilst most (78%) of coconut farmers still use traditional technologies. The future of the coconut crop is not promising as it projected that the drop rate is 1%., unless proper strategies are taken against this down ward trend. Reasons for low production, productivity and profitability are many but basically are attributed by less sustainability of the promoted activities during the NCDP and poor continuation of research and developmentactivities. Specifically, poor availability and low application of technologies, poor extension services, low level of planting, re-planting of coconut seedlings, production of seed and seedlings and low investments in research and coconut development.

The way forward

To promote and increase coconut productivity in Tanzania the following must be strategically done by coconut stakeholders and the government:

i) To invest in the sector by allocating the fund for research and coconut development.
ii) It's important for research institutions to disseminate improved technologies to farmers
iii) There is a need to establish a campaign for the rehabilitation of coconut farms and facilitate the establishment of new coconut plantations. Also, to facilitate planting and re-planting of new seedlings. This paper also recommends to have a special day for coconut planting at least once per year.
iv) The government should consider to establish a coconut board which will liaise, promote, coordinate and develop the coconut sub-sector.

Coconut board will enforce the development of coconut along the value chain.

References

Ashimogo, G. C., Lazaro, E. A. and Mwaseba, D. (1996). *Production and Utilization Effects of the National Coconut Development Programme in Tanzania*. A consultative Report for NCDP. Dar es Salaam, Tanzania. 65pp.

Enig, M. G. (1996). Health and Nutritional Benefits from Coconut Oil: an important functional food for the 21st century. Asean Vegetable oils (AVOCAS) Lauric Oils Symposium. Sept/96.Ho Chi Minh City, Vietnam.

FAOSTAT, (2015). Food and Agricultural Organization of the United Nations-Statistics. [http://faostat3.fao.org] site visited on 20/01/2015.

Kullaya, A. (1991). The state of coconut production in Tanzania. Country Report, presented at the First African Coconut Seminar, Arusha, Tanzania. 12pp.

Magat, S. S. and Agustin, Y. T. V. (1997). The Philippine Coconut Industry. Proceedings of the International Cashew and Coconut Conference, held at Kilimanjaro Hotel, Dar es Salaam, Tanzania from 17 to 21 February, 1997. pp 21-27.

Muyengi, Z., Msuya, E. and Lazaro, E. (2015). Coconut productivity and the status of improved agricultural technologies at small-scale level inMwinjaka, S. R. (1999). Optimal spacing and stand replacement models for smallholder farmers in Tanzanian coconut-based farming systems and their socio-economic assessment. PhD Dissertation, University of Zimbabwe. pp 60-80.

National Bureau of Statistics (2002). *National Census of Agriculture*. Small holder Agriculture, Volume II. Crop Sector National Report. 66. 214pp.

National Bureau of Statistics (2012). Sample Census of Agriculture for Smallholder Agriculture. Crop Sector Volume II. National Report-Dar es Salaam, Tanzania. 539pp.

Pushpakumara, J., Gunasema, H., Nayanie, S. and Nimal, P. (2013). Special Report on Development of the Coconut Industry. Dar es Salaam, Tanzania. 15pp.

Seguni, Z., Nyange, V., Materu, C., Mwingira, G. and Mruma, B. (2010). *Pest Control Research*. In Twenty-Five Years of Coconut Research for Development in Tanzania. pp. 78-96.

Tanzania: Country experience after National Coconut Development Program. *Journal of Economics and Sustainable Development*, 6 (18), 30-42.

United Republic of Tanzania-URT (2013). *Twenty-Five Years of Coconut Research for Development in Tanzania.* The handbook prepared by URT. Dar es Salaam, Tanzania. 260pp.

Vicent, C. S. (2014). Kenya Coconut Development Authority (KCDA). On-going Seedlings Distribution Programme.