

Economics of Silviculture: Insights from Coconut Seedling Production in Lagos State, Nigeria

Ekonomija uzgajanja šuma: uvid u proizvodnju sadnica kokosa u državi Lagos, Nigerija

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ABSTRACT

Nigeria has a record of producing about 250,000 tons of coconut annually, this production capacity is not enough in satisfying the demand of coconut in the country. Coconut demand exceed its supply currently in Nigeria. A semi-structured questionnaire was administered to 120 respondents selected purposively from the list of Lagos State Coconut Development Authority (LASCODA). Specifically, the study identified the variety of coconut seedling raised; examined the costs and returns of coconut seedling production; contribution of coconut seedling income to the total income of coconut seedling producers and identified the constraints on coconut seedling production. Descriptive statistics, budgetary analysis, and likert type scale were employed for analysis. The study revealed that, majority (64.17 percent) of the respondents raised the tall variety of coconut seedling. The budgetary analysis revealed that a typical coconut seedling producer makes a net profit ₦380,128.33/ha with a rate of return of 241.78 percent. Income from coconut seedling production contributed to the total income of the producers (66.3 percent) in the study area. Inadequate credit facilities, inadequate access to training among others were the constraints faced during production. Research recommends that prioritization of coconut seedling production to improve farmer's accessibility to credit and training programs should be organized for farmers so as to embrace innovation.

Key words: *Proizvodnja kokosa; Visoka sorta; proračunska analiza; Nigerija. Coconut Production; Tall variety; Budgetary Analysis; Nigeria.*

INTRODUCTION - Uvod

Coconut (*Cocos nucifera* L) is a palm plant of the Areca-
ceae family, which contains about 225 genera with over
2600 species along with oil palm and date palm culti-
vars, and it is the only accepted species in the genus Co-
cos (Debmandel & Mandel, 2011). Coconut is a mono-
cot large palm tree growing up to 30m tall with long
pinnate leaves that are 4-6m long and could be 8–25 in

number on a branch called palm fronds. The plant has
two natural groups, which are tall and dwarf trees, and
this serves as a base for identification, distinction, and
classification. The discovery of the fossilized nuts of co-
conut palm in New Zealand and India shows that the
coconut palm has existed for several million years, and
with its ability to float, the nut has spread by maritime
currents and more recently through human migration
(Nair et al., 2016). The plant probably originated in

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Southeast Asia and South America, but the theory supporting Southeast Asia is stronger because of several diseases and pests of coconut found in that part of the world (Washington University, St. Louis, 2011).

The coconut tree is highly valued as the “tree of life” for its critical role in the livelihoods of smallholders. It provides them with income, nutrition, and materials (Warner, Quirke & Longmore, 2007). Coconuts are unique fruits because they contain a significant amount of clear liquid, known as coconut water or coconut juice. Fully matured coconuts can be used as edible seeds or processed for oil, plant milk, charcoal, and coir. Coconut oil and milk are commonly used in cooking as well as in the manufacturing of cosmetics and soaps. The hard shells, fibrous husks, and long pinnate leaves can be used to make various products for decoration and furnishing (Gunn *et al.*, 2011). Even though coconut is not originally from Nigeria, the plant is grown in 22 states within the country, with Lagos State being the largest producer of coconut in Nigeria, thanks to the crop thriving well in coastal regions (Jekayinfa, Orisaleye, & Pecenka, 2020; Olorunfemi *et al.*, 2022).

Agriculture remains the foundation of Nigeria’s economy despite the presence of oil, serving as the primary source of livelihood for most Nigerians. According to the Nigeria Bureau of Statistics (2019), agriculture contributed 21.21%, 22.32%, and 22.86% to Nigeria’s GDP in 2016, 2017, and 2018, respectively. However, the agricultural sector in Nigeria faces numerous challenges, including insufficient infrastructure, soil infertility, seasonal fluctuations, pests and diseases, and other uncertainties (Izechukwu, 2011).

Nigeria has a population of around 180 million people and produces about 250,000 tons of coconut annually. However, this amount is insufficient to meet the demand for coconut in the country, let alone for exportation (Olorunfemi *et al.*, 2022). As a result, the country has become somewhat reliant on importing coconut from neighboring countries. Therefore, it is necessary to increase the cultivation and production of coconut in Nigeria to meet the growing demand, including for exportation. Currently, the only way to plant coconut is to use seedlings, which must be produced with great care by various organizations and individuals involved in the process. Thus, it is crucial to provide insight into the various factors that can enhance the production of coconut seedlings in Nigeria. Therefore, the main objective of this research is to perform an economic assessment of coconut seedling production, with specific goals of identifying the types of coconut seedlings being raised, estimating the costs and returns of coconut seedling production, evalu-

ating the contribution of coconut seedling income to the total income of producers, and identifying the constraints to coconut seedling production.

MATERIALS AND METHODS –

Materijal i metode

Study area - Studijsko područje

Lagos State, situated in the southwestern geopolitical zone of Nigeria, was established on May 27th, 1967. It shares borders with Ogun State to the north and east, the Bight of Benin to the south, and the Republic of Benin to the west. With a latitude of 6°35'N and a longitude of 3°45'E, Lagos State covers an area of 3,474 square kilometers, making it the smallest state in Nigeria. The estimated population of Lagos State, according to the National Bureau of Statistics (2012), is 17.5 million people. The state is divided into 20 local government areas. Lagos State is characterized by swamp and freshwater forests, as well as mangrove swamp forests. The state is influenced by a double rainfall pattern, making it a wetland region. The state experiences two climatic conditions, dry from November to March and wet from April to October. The drainage system of Lagos State is a maze of lagoons and waterways, with major water bodies like the Lagos and Lekki Lagoons, Yewa, Ogun, Oshun, and Kweme Rivers, as well as Ologe Lagoon, Kuramo Water, Badagry, Five Cowries, and Omu creeks. The climatic condition of Lagos State is favorable for the growth of several crops such as coconut, beans, plantain, banana, soybeans, maize, oil palm, cassava, cashew, sorghum, and sesame (Lagos State Government, 2019).

Sampling Techniques and Sample Size - Tehnike uzorkovanja i veličina uzorka

For this study, a simple random sampling technique was employed to select coconut seedling producers. The sample frame used was the record of the Lagos State Coconut Development Authority (LASCODA). The sample size was 50% of the sample frame, resulting in a total of 120 samples. The study relied on primary data gathered through a meticulously designed structured questionnaire. The questionnaire was specifically administered to coconut seedling producers operating within Lagos state, to collate comprehensive and relevant information for the study. The data collected was carefully analyzed to provide valuable insights and recommendations.

METHOD OF DATA ANALYSIS - Metoda analize podataka

Descriptive statistics – Deskriptivna statistika

The study employed descriptive statistics to provide a thorough understanding of the socio-economic characteristics of coconut seedling producers in the area. Furthermore, it analyzed the different varieties of coconut seedlings cultivated in the region and examined the extent to which the income generated from coconut seedlings contributed to the overall income of producers in the area. The analysis involved the use of frequency distributions and percentages, as well as measures of central tendency such as mean, median, and mode. Additionally, the coefficient of variation was utilized to determine the degree of variability in the data.

Budgetary analysis – Analiza budžeta

Budgetary analysis was used to estimate the cost and returns of coconut seedling production in the study area. This approach estimates the profitability of an enterprise. This model was adopted by (Akerele et al., 2018).

The formula is explicitly given as:

$$NI = TR - TC \dots\dots\dots Eq. (1)$$

$$GM = TR - TVC \dots\dots\dots Eq. (2)$$

$$PI = NI/TR \times 100\% \dots\dots\dots Eq. (3)$$

$$RRI = NI/TC \times 100\% \dots\dots\dots Eq. (4)$$

Where:

NI = Net farm income (USD)

TC = Total cost (USD); Total fixed cost + Total variable cost

TR = Total revenue; PQ (Price × quantity) in (USD)

GM = Gross margin (USD)

TVC = Total variable cost (USD)

PI = Profitability index

RRI = Rate of return on investment

Likert type scale – Likertova skala

The study used a four-point Likert scale to assess the frequency of constraints identified by the respondents. Each response was assigned a score ranging from very severe (4), severe (3), less severe (2), and not severe (1). The respondents were asked to rate their level of agreement with the identified constraints using an ordinal scale. This process was repeated for each constraint.

RESULTS AND DISCUSSION – Rezultati i diskusija

The socio-economic characteristics of the respondents - Socio-ekonomske karakteristike ispitanika

The socio-economic characteristics of the respondents identified were: sex, age, marital status, level of education, extension contact, and the source of finance. These are presented in Table 1–6 and explained below.

Table 1: Sex distribution of respondents

Tabela 1. Spolna distribucija ispitanika

Sex	Frequency	Percentage
Female	25	20.83
Male	95	79.17
Total	120	100

Source: Field Survey, 2019

Table 1 shows that 79.17% of the respondents involved in coconut seedling production are men, while only 20.83% are women. This implies that men are more active in this industry compared to women, which contradicts the findings of Gurbuz and Manaros (2019), who reported a higher percentage of women producers in the coconut industry.

Table 2: Age distribution of respondents

Tabela 2. Starosna distribucija ispitanika

Age	Frequency	Percentage
20 – 30	19	15.83
31 – 40	69	57.50
41 – 50	25	20.83
51 - 60	5	4.17
> 60	2	1.67
Total	120	100

Source: Field Survey, 2023

According to Table 2, most of the survey participants fall within the age bracket of 31–40 years, which is considered the active and productive age range for farmers who can engage in the physically demanding work of farming. This has significant implications for agricultural production since farming activities require physical strength and dynamism. This agrees with the findings of Gurbuz and Manaros (2019), who revealed that the age range of 30 to 40 years old has the highest percentage among coconut producers.

Table 3: Marital status distribution of respondents

Tabela 3. Distribucija ispitanika u bračnom statusu

Marital Status	Frequency	Percentage
Single	37	30.83
Married	83	69.17
Total	120	100

Source: Field Survey, 2023

Table 3, shows that most of the respondents (69.17%) were married. This is supported by the study of Gurbuz and Manaros (2019), whose study results indicate that the majority of coconut farmers (83.3%) were married, which suggests that married coconut farmers are heavily dependent on coconut farming for their families.

Table 4: Educational level distribution of respondents

Tabela 4. Distribucija ispitanika po stupnju obrazovanja

Educational Level	Frequency	Percentage
No Formal Education	9	7.50
Primary Education	47	39.17
Secondary Education	35	29.17
Tertiary Education	29	24.16
Total	120	100

Source: Field Survey, 2023

Based on Table 4, it appears that 7.5% of respondents did not receive any formal education, while 39.17% completed primary education, 29.17% completed secondary education, and 24.16% completed tertiary education. These results are in line with a study conducted by Yamuna (2016), which found that 42.4% of coconut seedling producers had completed at least secondary education, and 25.2% had completed undergraduate studies. In contrast, 24.4% had no formal education, 7.6% had completed post-secondary education, and a mere 0.4% had a career in agriculture.

Table 5: Contact with Extension Agents distribution of respondents

Tabela 5. Distribucija ispitanika u odnosu na kontakt sa agentima sa proširenje

Contact with Extension Agent	Frequency	Percentage
Yes	21	17.5
No	99	82.5
Total	120	100

Source: Field Survey, 2023

Table 5 shows that 17.5% of the respondents have contact with extension agents, while 82.5% of the respondents do not have contact with extension agents. This implies that the majority of the respondents do not have contact with extension officers. This is in contrast with the findings of Oyewole and Ojeleye (2015), who state that only 10.9% had no contact with extension agents while 89.1% had contact with extension agents.

Table 6: Sources of finance distribution of respondents

Tabela 6. Distribucija ispitanika u odnosu na izvor finansiranja

Sources of Finance	Frequency	Percentage
Owned	100	83.33
Borrowed	20	16.67
Total	120	100

Source: Field Survey, 2023

Table 6 shows that 83.33% of the respondents owned their finances, while 16.67% of the respondents borrowed their finances. This implies that many farmers in the study area have little or no access to credit from financial institutions. This agrees with the findings of Anigbogu, Agbasi, and Okoli (2015), who disclosed that the majority of farmers receive insufficient agricultural finance for output.

Table 7: The variety of Coconut seedlings raised

Tabela 7. Uzgajana sorta sadnica kokosa

Variety	Frequency	Percentage
Tall	77	64.17
Short	26	21.67
Hybrid	17	14.16
Total	120	100

Source: Field Survey, 2023

According to Table 7, the majority of the respondents (64.17%) raise tall coconut seedlings on their farms.

Table 8: Cost and returns of coconut seedling production

Tabela 8. Troškovi i povrati proizvodnje sadnica kokosa

Cost/Return	Average (USD)	Total Value (USD)	Percentage of Total
Total revenue(TR)	1707.59	204910.93	
Variable cost			
Seed nut cost	4.02	481.86	10.37
Labour cost	7.00	840.04	18.08
Fertilizer cost	9.97	1195.96	25.74
Pesticide cost	3.38	406.	8.74
Herbicide cost	2.25	268.47	5.78
Transportation cost	8.10	971.72	20.93
Other variable cost	4.01	481.51	10.36
Total variable cost(TVC)	38.73	4645.70	100
Fixed Cost			
Land cost	192.06	23047.22	79.27
Farm tools cost	17.44	2092.94	7.20
Other fixed cost	32.78	3933.60	13.53
Total fixed cost(TFC)	242.28	29073.75	100
Total cost (TC+TFC) 281.01 33719.45			
Average profit (ATR-ATC)		1426.60	
NET INCOME (NI) (TR-TC)		171191.48	
GROSS MARGIN (TR-TVC)		200265.23	
PROFITABILITY INDEX (NI÷TR×100)			83.54
RATE OF RETURN ON INVESTMENT			507.6

Source: Field Survey, 2023

21.67% grow short coconut seedlings, while 14.16% cultivate the hybrid variety. This implies that the tall variety is the most popular among the respondents. These findings align with the research conducted by Gurbuz and Manaros (2019), who found that 66.5% of coconut farmers planted the tall variety, which is the most common type of coconut tree and only 4.5% of farmers grew the dwarf type, while 10.5% planted coconut trees which were hybrid varieties.

The objective of the study was to assess the practicality of cultivating coconut seedlings by analyzing the costs and profits associated with the process. According to Table 8, the largest variable cost is the expense of fertilizer, which makes up 25.74% of the overall expenditure, followed by transportation costs at 20.93%. Additional variable costs include labor, seed nut, herbicide, and pesticide expenses, each contributing between 5.78% to 18.08%. Fixed costs, on the other hand, are dominated by land payment, which accounts for 79.27% of the total cost, while farm tools and implements are only 7.20%, and other fixed costs are

13.53%. A typical coconut seedling producer has a total cost of 281.01 USD/ha and makes a total revenue of 1707.59 USD/ha, resulting in a yearly profit of 1426.60 USD/ha. These findings demonstrate that coconut seedling production is a viable business with a favorable and significant profit margin. These findings disagree with the research conducted by Gurbuz and Manaros (2019), which revealed that the coconut farmers' yearly income from coconut output is quite little.

Table 9: Contribution of coconut seedling income to the producers' total income.

Tabela 9. Doprinos prihoda od sadnica kokosa ukupnom prihodu proizvođača

Source of Income	Amount (USD)	Percentage
Coconut Seedling	204910.93	70.22
Other activities	86905.44	29.78
Total	291816.37	100

Source: Field Survey, 2023

Table 9 shows that coconut seedling income contributes 70.22% to the total income of producers in the study area. This shows that coconut seedling production has a significant contribution to the farmers' total income. These findings agree with the study of Alouw and Wulandari (2020), which stated that approximately 6.6 million farmers depend on coconuts and items made from them as their primary source of income.

The survey conducted analyzed the factors that limited coconut seedling production among the participants using a 4-point Likert scale. According to Table 10, the constraints that had the most significant impact were inadequate credit facilities, lack of access to training, and limited extension services. On the other hand, the availability of seeds, fertilizers, labor, pests and diseases, and water supplies were less severe. The survey also found that land access was not a significant constraint. This follows the findings of Muyengi, Msuya, and Lazaro (2015) that the supply of inputs, poor agronomic methods, and extension services were some of the obstacles to coconut production.

CONCLUSION – Zaključak

The underlining impetus to this study is the Economics of silviculture with an insight from Coconut Seedling Production in Lagos State, Nigeria. The majority of the producers made an average profit of 1426.60 USD/ha in the production year. Fertilizer was a major item of cost in coconut seedling production. Findings from the study also showed that the majority of the farmers inherited their land and the land was relatively small in size which was between 1-2 hectares, with very poor access to credit and little or no special training on coconut seedling production. However, in light of these findings, it can

be concluded that coconut seedling production is profitable in the study area given the average profit realized per hectare.

RECOMMENDATIONS - Preporuke

The following recommendations are hereby made based on the major findings of the study:

1. The government should provide inputs like fertilizers, improved seed varieties, and farm machinery at subsidized rates to farmers.
2. Training programs should be organized for farmers so they can learn new things and improve on their old system of farming
3. Extension agents should get in touch with farmers more so they can be furnished with information which in turn can make them efficient
4. Farmers should maximize their returns from coconut seedling production by increasing their farm size, a larger farm size with good management practices should translate to improved output.

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Table 10: Constraints to coconut seedling production.

Tabela 10. Ograničenja za proizvodnju sadnica kokosa

Constraints	Very severe	Severe	Less Severe	Not Severe	Mean	Rank
Low extension extension services	26 (21.67)	63(52.5)	21(17.5)	10(8.3)	2.88	1 st
Inadequate credit facilities	18(15)	59(49.17)	34(28.33)	9(7.5)	2.72	2 nd
Access to training	18(15)	54(45)	40(33.3)	8(6.67)	2.68	3 rd
Water availability	11(9.17)	33(27.5)	69(57.5)	7(5.83)	2.4	4 th
Pest and diseases	6(5)	20(16.67)	74(61.67)	20(16.67)	2.10	5 th
Labor availability	8(6.67)	12(10)	75(62.5)	25(20.83)	2.03	6 th
Seeds availability	2(1.67)	13(10.83)	85(70.83)	20(16.67)	1.98	7 th
Fertilizer availability	0(0)	14(11.67)	84(70)	22(18.33)	1.93	8 th
Land access	11(9.17)	9(7.5)	19(15.83)	81(67.5)	1.58	9 th

Source: Field Survey, 2023

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SAŽETAK

Nigerija ima populaciju od oko 180 miliona ljudi i proizvodi oko 250.000 tona kokosa godišnje. Međutim, ova količina nije dovoljna da zadovolji potražnju za kokosom u zemlji, a kamoli za izvoz (Olorunfemi et al. 2022). Kao rezultat toga, zemlja se donekle oslanja na uvoz kokosa iz susjednih zemalja. Trenutno, jedini način za proizvodnju kokosa je korištenje sadnica, koje moraju s velikom pažnjom proizvoditi razne organizacije i pojedinci uključeni u proces. Ključno je pružiti uvid u različite faktore koji mogu poboljšati proizvodnju sadnica kokosa u Nigeriji. Stoga je osnovni cilj ovog istraživanja izvršiti ekonomsku procjenu proizvodnje sadnica kokosa, sa specifičnim ciljevima identifikacije vrsta sadnica kokosa koje se uzgajaju, procjenu troškova i prinosa proizvodnje sadnica kokosa, procjenu doprinosa prihoda od sadnica kokosa, ukupan prihod proizvođača, i utvrđivanje ograničenja za proizvodnju sadnica kokosa. Za ovu studiju korištena je jednostavna tehnika slučajnog uzorkovanja za odabir proizvođača sadnica kokosa. Korišteni okvir uzorka je zapis Državne uprave za razvoj kokosa u Lagosu (LASCODA). Veličina uzorka iznosila je 50% okvira uzorka, što je rezultiralo sa ukupno 120 uzoraka. Studija se oslanjala na primarne podatke prikupljene kroz pažljivo osmišljen strukturirani upitnik. Upitnik je posebno dat proizvođačima sadnica kokosa koji posluju u državi Lagos, kako bi se prikupile sveobuhvatne i relevantne informacije za studiju. Korištena je deskriptivna statistika kako bi se pružilo temeljno razumijevanje socio-ekonomskih karakteristika proizvođača sadnica kokosa u tom području. Nadalje, analizirane su različite sorte sadnica kokosa koje se uzgajaju u regiji i ispitano u kojoj mjeri prihod ostvaren od sadnica kokosa doprinosi ukupnom prihodu proizvođača u tom području. Studija je koristila Likertovu skalu od četiri tačke za procjenu učestalosti ograničenja koja su ispitanici identificirali. Svakom odgovoru je dodijeljen rezultat u rasponu od vrlo teškog (4), teškog (3), manje ozbiljnog (2) i neozbiljnog (1). Ispitanici su zamoljeni da ocijene svoj nivo slaganja sa identificiranim ograničenjima koristeći rednu skalu. Ovaj proces je ponovljen za svako ograničenje. Cilj studije bio je procijeniti praktičnost uzgoja sadnica kokosa analizom troškova i profita povezanih s procesom. Prema tabeli 8, najveći varijabilni trošak su troškovi đubriva, koji čine 25,74% ukupnih izdataka, a slijede troškovi transporta sa 20,93%. Dodatni varijabilni troškovi uključuju troškove rada, orašastih plodova, herbicida i pesticida, pri čemu svaki doprinosi između 5,78% i 18,08%. U fiksnim troškovima, s druge strane, dominira plaćanje zemljišta, koje čini 79,27% ukupnih troškova, dok poljoprivredni alati i alati čine samo 7,20%, a ostali fiksni troškovi 13,53%. Tipičan proizvođač sadnica kokosa ima ukupne troškove od 281,01 USD/ha i ostvaruje ukupan prihod od 1707,59 USD/ha, što rezultira godišnjim profitom od 1426,60 USD/ha. Ovi nalazi pokazuju da je proizvodnja sadnica kokosa održiv posao sa povoljnom i značajnom maržom profita. Tabela 9 pokazuje da prihodi od sadnica kokosa doprinose sa 70,22% u ukupnom prihodu proizvođača na istraživanom području. Ovo pokazuje da proizvodnja sadnica kokosa ima značajan doprinos u ukupnom prihodu poljoprivrednika. Ovi nalazi se slažu sa studijom Alouwa i Wulandarija (2020), u kojoj se navodi da otprilike 6,6 miliona farmera zavisi od kokosa i proizvoda napravljenih od njih kao primarnog izvora prihoda. U sprovedenom istraživanju analizirani su faktori koji su ograničili proizvodnju sadnica kokosa među učesnicima koristeći Likertovu skalu od 4 tačke. Prema tabeli 10, ograničenja koja su imala najznačajniji uticaj bili su neadekvatni kreditni kapaciteti, nedostatak pristupa obuci i ograničene savjetodavne usluge. S druge strane, dostupnost sjemena, đubriva, radne snage, štetočina i bolesti i zaliha vode bili su manje ozbiljni. Istraživanje je također pokazalo da pristup zemljištu nije značajno ograničenje. Ovo prati nalaze Muyengija, Msuye i Lazaroa (2015) da su nabavka inputa, loše agronomske metode i savjetodavne usluge bile neke od prepreka proizvodnji kokosa.

Na osnovu glavnih nalaza studije daju se sljedeće preporuke:

1. Vlada treba da obezbijedi inpute kao što su đubrivo, poboljšane sorte sjemena i poljoprivredne mašine po subvencionisanoj stopi za poljoprivrednike.
2. Trebalo bi organizirati programe obuke za poljoprivrednike kako bi mogli naučiti nove stvari i unaprijediti svoj stari sistem poljoprivrede.
3. Savjetodavni agenti bi trebali imati češći i neposredniji kontakt sa poljoprivrednicima kako bi mogli dobiti informacije koje ih zauzvrat mogu učiniti efikasnim.
4. Poljoprivrednici bi trebali maksimizirati svoje povrate od proizvodnje sadnica kokosa povećanjem proizvodne površine. Veća površina sa dobrim praksama upravljanja bi trebala dovesti do poboljšane proizvodnje.

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