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Characteristics of Smallholder Coconut Cultivation in North Aceh

Khaidir, Usnawiyah, Muhammad Yusuf Nurdin, Elvira Sari Dewi*), AnggaYuda Alfitra, Muhammad Luthfi Pohan, Raihan Zarwa Harahap

Department of Agroecotechnology, Faculty of Agriculture, UniversitasMalikussaleh, North Aceh, Indonesia
Corresponding author. Email: elvira@unimal.ac.id

ABSTRACT

Cocosnucifera L. farms in Indonesia are smallholder plantations, and the cultivation methods used have not been properly considered, leading to a low yield.The study aimed to identify the coconut cultivation method and evaluate the systems' suitability according to the recommendation on small-scale farmer plantations in the North Aceh regency. Within the North Aceh regency, we interviewed 135 coconut farmers in three different districts, i.e., Baktiya, Sawang, and Dewantara.The data collected and analysed using R-studio and the non-parametric chi-square test. Around 83% of the respondent in Sawang practice mixed culture in coconut farming, 53% in Baktiya, and 40% in Dewantara. The majority of the coconut variety planted is from the farmer's local garden.Coconuts are usually harvested manually by climbing, with harvesting occurring three to four times each year.Coconuts are picked and shipped immediately to collectors without prior sorting or storage.The annual production of coconuts varies significantly amongst the three districts. Baktiya produces approximately 4.87 tonnes of coconuts annually, while Sawang and Dewantara yield 1.34 tonnes and 0.80 tonnes, respectively.In general, respondents have not carried out the cultivation process in accordance with regional recommendations for planting coconuts.

Keywords: *Coconuts, Cocosnucifera, Aceh Utara, Smallholder.*

1. INTRODUCTION

Coconut (*Cocosnucifera* L.) is an annual plant of the Palmae family with numerous comparative and competitive advantages, including coconut milk, desiccated coconut, coconut sap, and husk. High yields required cultivation that fulfilled the requirements of coconut plants.

Climate change mitigation and its implications on annual crops such as coconut provide a feasible option for carbon sequestration through coconut intercropping. Coconut can grow in practically any soil type, including alluvial, latosol, and sandy soils.This plant will grow and produce properly when cultivated close to running water, such as riverbanks and seashores. According to research on the appropriateness of land for coconut plantations in different districts on the coast of North Aceh, the soil in the location belongs to the moderately suitable class of the five identified soil subgroups [1].However, soil with adequate nutrients will increase farmer yields and income [2].

The first step toward the success of a coconut plantation is selecting plant material based on location and nursery management, such as selection of planting material, storage, nursery location selection, production, and disease pests[3]. There are at least six certified superior coconut varieties from diverse locations in Indonesia. Another possibility is superior local coconut from the selection of the High Producing Block based on the Plantation Office's or related agencies' Decree.

Planting and management procedures must be done appropriately, starting with seed preparation, fertilization, land preparation, weed management, pest control, and disease treatment.The ideal time to produce a large percentage of seeds from coconut is 12 months. Ecological pest and disease control are also required to achieve a healthy environment that helps coconut growers [4].This study aims to determine the method of coconut cultivation and evaluate the application of correct and appropriate methods according to recommendations in smallholder plantations in North Aceh.

2. MATERIALS AND METHODS

The research was carried out in the administrative area of North Aceh District. Location selection is based on the district with the largest population of coconut plants. Data were obtained from B.P.S. (Central Statistics Agency) North Aceh Regency in 2016. The observation sites included Baktiya, Sawang, and Dewantara, each district consisting of 3 (three villages) (Figure 1).

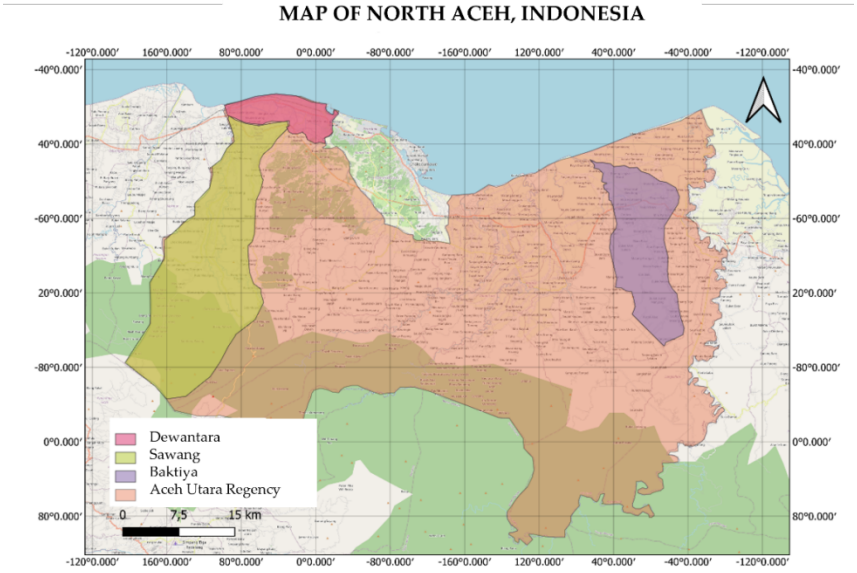

Figure 1. Location of the study area, North Aceh Regency, Aceh Province, Indonesia.Own illustration using QGIS.

The research was conducted using a survey method for plant cultivation in the North Aceh regency. Random sampling was carried out in stages between districts, villages, and farmers. Sampling was carried out in a stratified manner in three districts. Three villages were taken from each district, and ten farmers were taken from each village. Thus, there are 135 samples of farmers. Farmers were selected based on information from the village head on farmers with the highest number of coconut plants.The questionnaire consists of closed and open questions. Questions covered basic information, characteristics of coconut cultivation, cultivation management, harvest and post-harvest, and production of coconut planting practices in three districts in North Aceh. Data was collected and analyzed using R-studio version 4.03 software. Demographic data were processed using the non-parametric chi-square test. Radar diagrams describe the variables of cultivation measures applied by the respondent farmers.

3. RESULT AND DISCUSSION

3.1. Characteristics and Cultivation Practices

Respondents were categorized into three districts based on statistical data on coconut production in the North Aceh District[5].Table 1 depicts the characteristics of respondents, land, and coconut production in North Aceh's three districts. The coconut farmers interviewed in the three districts range from 39 to 54 years. Farmers in the Baktiya use 86% of the total land for coconut production, whereas farmers in Sawang and Dewantara use just about 60% each. Almost all farmers surveyed claimed that coconut production is used for domestic and commercial purposes.

Table 1. Comparison of the typical respondent characteristics, land use, and coconut output in districts of Baktiya, Dewantara, and Sawang, North Aceh, Indonesia.

Districts/ Characteristics	Age *(year)*	Family member *(number)*	Landholding *(ha)*	Land use *(ha)*
ktiya	54 a†	3	2.74 a	2.35 a
wantara	47 ab	3	1 b	0.67 b
vang	39 b	3	0.85 b	0.50 b

† Different letters in a different column indicate significant differences at the p>0.05 level using Tukey's adjustedmeans comparison test.

We know that age and number of the family are strongly related to work performance by smallholder farmers in managing their farms. The average of our respondent's age can be considered reproductive age, which contributed positively to agricultural output production [6].Most of the correspondents has not utilized all the land for coconut cultivation due to several reasons, such as financial constraint[7]. Our result shows that around 90% of respondent work as farmers and unskilled labor.

3.2. Management of Coconut Cultivation

The management of coconut cultivation studied includes thinning, weeding, hilling, fertilizing, irrigation, pesticides, and control of plant-disturbing organisms by the respondent farmers in each surveyed district, presented in Figure 2.

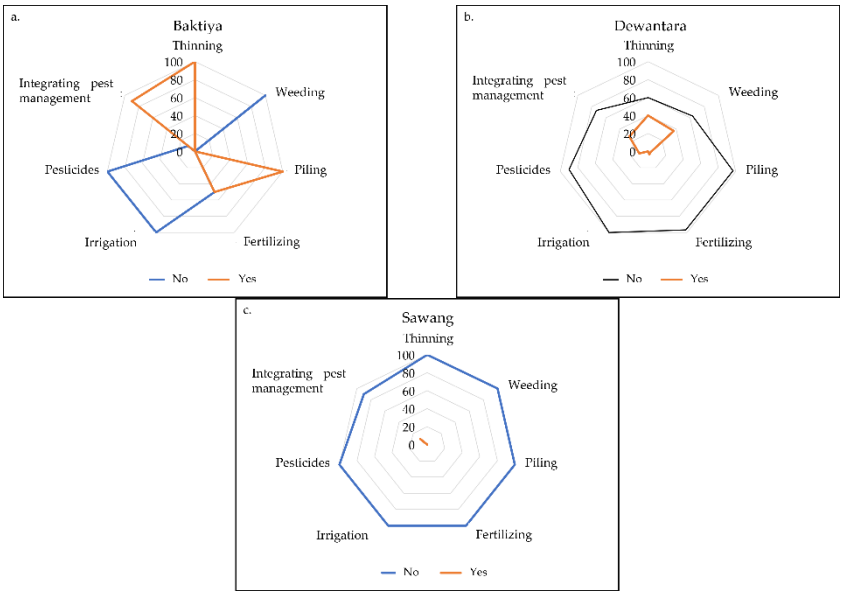

Figure 2. Coconut cultivation management practices by the farmers in three observeddistricts; (a) Baktiya; (b) Dewantara; and (c) Sawang in North Aceh Regency (% respondents).

All respondents in Baktiya did not practice weeding, irrigation, and applying pesticides to their planting land. So far, they have only implemented thinning and heaping activities. In contrast, only 50% provide fertilizer, and 90% control pests in coconut plantations. Meanwhile, in Dewantara, the efforts made were more diverse. Overall they also do not irrigate their coconut plantations. Only 40% thin the plants, 60% do weeding, 97% do heaping and fertilizing, 90% apply pesticides, and 73% of farmers apply integrated pest management.Most of the respondents in Sawang have not implemented cultivation activities such as thinning, weeding, hilling, fertilizing, irrigation, and pesticides, and only 10% controlled the pests.

Our respondent showed relatively limited agronomic management practices standard set bythe local agricultural agency(Aceh Agriculture and Plantation Agency). Inappropriate practices such as the poor selection of plant materials, insufficient fertilizer input, and other important farming activities contribute to the low yield, as experienced by the respondents [8, 9, 10].

3.3. Post-harvest and production of coconut

In the harvesting and post-harvest processes, the respondent farmers did not apply any particular technology where all harvesting was done manually or by climbing with a harvesting frequency of 3 to 4 times a year in the three sub-districts observed. After harvest, the coconuts are immediately transported without sorting or storage. Within a year, the number of coconuts produced varies significantly in the three districts. Baktiya produces around 4.87 tonnes per year, followed by Sawang with 1.34 tonnes, while Dewantara only produces 0.80 tonnes annually (Figure3).

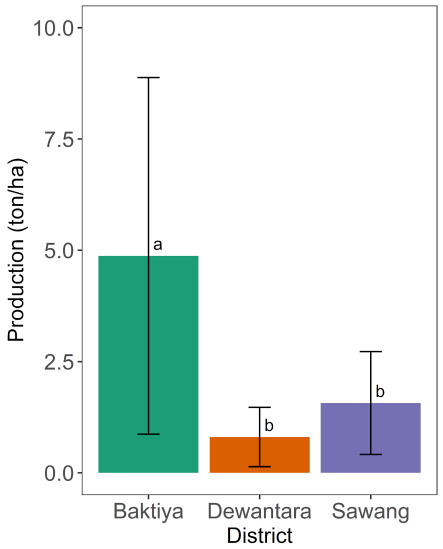

Figure 3. The average coconut production of respondent in three districts in North Aceh Regency in 2022.

The figure above shows that Baktiyahas the highest amount of coconut production compared to the other two districts, namely Sawang and Dewantara. The production of coconuts in Baktiya has excellent potential to be used as a food source to meet the needs of consumers' coconut consumption. In addition, the production of coconut fruit has the potential to be used as a source of biofuel, which can later be used as a substitute for fossil fuels, whose availability is increasingly depleting.One part of the coconut fruit that can be used as an alternative energy source is coconut dregs. Coconut dregs can be converted into biodiesel [11]. Using coconut dregs as a raw material source for biodiesel does not interfere with the availability of food from the coconut [12].

4. CONCLUSIONS

The seed sources used by all respondents are primarily from own produced and grown in a mixed cropping system. All respondents in the Baktiya and Sawang did not practice weeding, watering, and applying pesticides to the planting land. The coconuts produced are harvested manually using the services of a coconut climber, with a harvesting frequency of between 3-4 times per year in the three sub-districts observed. Baktiya produces around 4.87 tonnes of coconut annually, while Sawang and Dewantara produce 1.34 tonnes and 0.80 tonnes annually.

AUTHORS' CONTRIBUTIONS

All authors conceived the study and were involved in its design. Khaidir and E.S.D.; writing-original draft preparation, E.S.D., Usnawiyah., and M.Y.N.; writing-review and editing; E.S.D.: visualization; AYA, M.L, R.Z.H.: data collection; All authors have read and agreed to the published version of the manuscript.

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