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RESEARCH ARTICLE

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Exploration of porang plant population and productivity in different locations in the Buton island

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Abstract
The productivity of porang plants in Buton Island is influenced by varying environmental conditions across different locations, leading to inconsistent yields. The objective of this study was to explore the population and productivity of porang plants in distinct environments on Buton Island. This study used field surveys and secondary data collection to assess plant density to evaluate growth conditions. The collected data were analyzed using simple statistics and displayed on a population map. The results showed that there were 17 porang cultivation locations spread across five sub-districts with a population of 35.000-60.000. The conclusion emphasizes the importance of site-specific agricultural strategies for optimizing porang productivity. This research impacts sustainable agricultural practices, particularly in regions with varying environmental conditions.

KEYWORDS
Porang, plant, environmental, diversity, populations.

1. INTRODUCTION

Exploration of porang plant population has very important relevance for society, both economically and ecologically (Indriyani et al., 2011). Porang is a tuber plant that is increasingly popular due to its wide benefits in the food and medicine industries, as well as its high potential

economic value (Komariah et al., 2023). By exploring Porang plant population in various environments, we can identify the conditions that best support its growth, which in turn can increase the yield and quality of the tubers produced (Shenglin et al., 2020). This can also help farmers in choosing the most effective location and cultivation method, increasing their productivity and profits (Riptanti et al., 2022). In addition, understanding how Porang plants adapt to various environmental conditions can provide insights into how to manage land resources sustainably (Hosen et al., 2020). This is important to ensure the sustainability of production and maintain the balance of the ecosystem. Thus, exploration of Porang plant population not only supports the growth of the local agricultural sector but also contributes to economic stability and environmental conservation (Isnaini et al., 2023). Information obtained from this study can be used to develop better cultivation policies and practices, as well as reduce the risk of crop failure. Overall, this study can facilitate the development of more resilient and independent communities in facing agricultural challenges.

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Previous studies on the exploration of Porang plants in various parts of the world have contributed significantly to our understanding of the potential and challenges of cultivating this plant. Early studies focused on the morphology and taxonomy of Porang plants, such as that conducted by Hu et al. (2019), who identified several species and varieties within the genus Amorphophallus that have economic potential. In addition, research by Rambey et al. (2024) explored environmental factors that affect the growth of Porang plants, such as soil pH, moisture, and temperature, which showed that this plant grows optimally in soil with slightly acidic pH and high moisture. Another study conducted a study on the adaptation of Porang plants to various soil conditions in Southeast Asia, highlighting differences in growth in forest land compared to agricultural land (Soedarjo et al., 2020). In Japan, the economic potential of Porang plants, finding that Porang tubers have high market value and are widely used in food and medicinal products (Endang et al., 2022). In Indonesia, the success of Porang cultivation in various soil and weather types, as well as management strategies to increase yields (Hermudananto et al., 2019). The use of modern technology in Porang cultivation, such as the use of appropriate irrigation and fertilization systems to increase productivity (Muswanti & Rosmawati, 2023). The results of these studies provide important insights into how to optimize Porang cultivation conditions and management. These references describe the development of knowledge about Porang plants and the challenges they face in various environments and agricultural systems.

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Although study on Porang plants in various parts of the world has provided valuable insights, there are still several obstacles and gaps that have not been fully explored, especially in Indonesia. One major weakness is the lack of in-depth studies on the adaptation of Porang plants to various soil and climate conditions specific to Indonesia. Most previous studies, have focused more on the environment in Southeast Asia in general, without emphasizing significant regional differences in Indonesia, such as variations in microclimate and local soil characteristics (Salatnaya et al., 2020).

Other studies have shown that modern technologies applied in Porang cultivation in other countries, such as the use of the latest irrigation systems and fertilization techniques (Inonu et al., 2023), have not been widely applied or studied specifically in Indonesia. Furthermore, studies on the impact of climate change on the growth and health of Porang plants in Indonesia are still limited. Study the success of Porang cultivation in various soil conditions, but did not explore how extreme climate fluctuations, such as high temperatures or highly variable humidity, affect crop yields (Pieter et al., 2022). In addition, data on the effects of specific pests and diseases affecting Porang plants in Indonesia are also still minimal (Soedarjo, 2020). This lack of information hampers the development of effective management strategies to address these issues. This gap indicates an urgent need for more focused research on local conditions in Indonesia, including the development of varieties that are more resistant to extreme environmental conditions and cultivation approaches that are more in line with local practices.

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The aims of this study are to understand how Porang plants adapt and thrive in various environmental conditions on Buton Island. This study aims to identify environmental factors that influence the growth, health, and productivity of Porang plants in the area, which has unique soil and climate characteristics compared to other locations in Indonesia. By exploring Porang populations in various soil types and climate conditions in Buton, this research will provide insight into the optimal conditions for cultivating this plant, as well as the challenges that may be faced. The significance of this research is enormous for agricultural development in Buton and the surrounding area. The results of the study can help local farmers in choosing the most appropriate location and cultivation method, increasing their yields and income. Understanding the adaptation of Porang plants to the specific environmental conditions in Buton can help in better land resource management and agronomic planning. In addition, this research also has the potential to improve the sustainability of Porang production in areas that may not be widely explored, thereby contributing to economic diversification and strengthening local food security. Thus, this study not only serves to increase scientific knowledge but also to provide direct practical benefits to local communities and the agricultural sector.

By exploring Porang populations in various soil types and climate conditions in Buton, this research will provide insight into the optimal conditions for cultivating this plant, as well as the challenges that may be faced

2. MATERIALS AND METHODS

2.1 Study Locations

The study location was conducted in mainland Buton covering various types of environments such as forests, agricultural land, and cultivated gardens.

2.2 Research design

The research design for exploring the population of Porang plants in Buton was carried out by taking random samples at each predetermined location. This random sampling method aims to ensure an accurate representation of the Porang plant population in various environmental conditions in the Buton region. Each research location, which covers areas with different soil types, altitudes, and climate conditions, will be divided into several observation plots (Ma et al., 2021). These plots serve as units of analysis to measure important variables such as plant growth

(height, tuber diameter), health levels (pest attacks, diseases), and environmental factors (soil pH, humidity, temperature). The division into plots also allows direct comparison between different micro-environmental conditions in one location (Sekar et al., 2023). Each plot will be measured systematically to obtain consistent data, which will later be analyzed statistically to see the effect of environmental factors on the development of the Porang plant population.

2.3 Data analysis

Data analysis in this study was conducted using a statistical comparison method between different research locations. Data collected from various plots at each location were depicted in a map and analyzed using regional color differences to see significant differences in Porang plant growth (Becker-Reshef et al., 2023; Goodrich et al., 2023).

3. RESULTS AND DISCUSSION

3.1 Types of porang plant cultivation

Table 1 shows various locations of porang cultivation in the Buton and Baubau regions, Indonesia, along with the farmers who manage them. In Baubau City, especially in Sorawolio District, several porang farmers involved in seedling cultivation are La Samani in Kaisabu Baru Village, Ketut Musi in Ngkari-ngkari Village, and Hardiman in Tampuna Village. In Buton Regency, Siotapina District, other porang farmers include Safarudin in Karya Jaya Village, Ali Fandi in Sumber Sari Village, Samsudin in Gunung Jaya Village, and Mama Ade in Kuraa Village, all of whom also focus on seedling cultivation. In Kapontori District, several porang farmers who plant seedlings are Ismail in Bukit Asri Village, Parman in Wakangka Village, Haryanto in Tuangila Village, and La Mane in Lambusango Village. In Lasalimu District, porang farmers such as Mukiman, La Dusu, Kadis, La Subu, and Arsul in Togomangura Village, La Pamu in Sribatara Village, and Sigit Handoyo in Lasembangi Village also planted seedlings. Meanwhile, in South Buton Regency, Busoaa Village located in Batauga District and Gunung Sejuk Village in Sampolawa District are also seedling cultivation locations by farmers Jalia, Januar, and La Rade. However, in Todombulu Village, farmers Opo and La Ode Ritubu manage porang plants in the form of mature plants (plants), not seedlings. All of this data is supported by the Buton Food Crops, Horticulture, and Plantation Service, and the Central Statistics Agency (BPS).

Many porang farmers are interested in growing this plant because of its profitable prospects in various sectors, including the food and pharmaceutical industries. Porang plants are known to be easy to cultivate because they are tolerant to various types of soil and shade levels of up to 60%, so they can be planted under large trees or agroforestry systems. In addition, this plant can be processed into high-value products, such as konjac flour, which has a large demand in the global market for use as a food thickener and other industrial raw materials. Some farmers also use porang as an intercrop between annual crops, such as coffee or cloves, which increases their overall agricultural profits. Another advantage is the potential sustainability of porang cultivation in agroforestry systems, making it a long-term choice for many farmers (Achmad et al., 2022; Yuniati, 2022).

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Table 1. Types of porang plant cultivation.

Location	Porang farmer	Type (seedling / plant)	Data source	
			Department of Food Crops, Horticulture, and Plantations in Buton	Central Bureau of Statistics (BPS)
Baubau City (Sorawolio District)				
Kaisabu Baru Village	La Samani	Seedling	√	
Ngkari ngkari Village	Ketut Musi	Seedling	√	
Tampuna Village	Hardiman	Seedling	√	
Buton City (Siotapina District)				
Karya Jaya Village	Safarudin	Seedling	√	
Sumber Sari Village	Ali Fandi	Seedling	√	
Gunung Jaya Village	Samsudin	Seedling	√	
Kuraa Village	Mama Ade	Seedling		√
Buton City (Kapontori District)				
Bukit Asri Village	Ismail	Seedling	√	
Wakangka Village	Parman	Seedling	√	
Tuangila Village	Haryanto	Seedling	√	
Lambusango Village	La Mane	Seedling	√	
Buton City (Lasalimu District)				
Togomangura Village	Mukiman La Dusu Kadis La Subu Arsul	Seedling	√	
Sribatara Village	La Pamu	Seedling	√	
Lasembangi Village	Sigit Handoyo	Seedling	√	
Buton Selatan City (Batauga District & Sampolawa District)				
Busoaa Village	Jalia Januar	Seedling	√	
Gunung Sejuk Village	La Rade	Seedling	√	
Todombulu Village	Opo La Ode Ritubu	Plant		√

3.2 Porang plant population

Table 2 contains the population of porang plants in the mainland Buton region. In the Baubau City area, especially in Sorawolio District, there is porang cultivation in several villages, namely Kaisabu Baru Village with a population of 40,000 seedlings, Ngkari-ngkari Village with 35,000 seedlings, and Tampuna Village with 45,000 seedlings. In Buton Regency, Siotapina District also has several villages that are actively cultivating porang, such as Karya Jaya and Kuraa Villages which each have 40,000 seedlings, while Sumber Sari Village and Gunung Jaya Village each have 55,000 seedlings. Meanwhile, in Kapontori District, Bukit Asri Village, Wakangka, and Tuangila each have a porang population of 55,000 seedlings, while Lambusango Village has 40,000 seedlings. In Lasalimu District, Togomangura Village has 55,000 seedlings, Sribatara Village has 60,000 seedlings, and Lasembangi Village has 40,000 seedlings. Finally, in South Buton Regency, in Batauga and Sampolawa Districts, there are Busoaa and Gunung Sejuk Villages, each of which has a porang population of 55,000 seedlings, while Todombulu Village has 40,000 porang plants that are already mature plants.

The number of plant populations per hectare greatly affects the productivity of porang. The higher the plant population, the greater the potential production per unit area, because more plants can be harvested. However, increasing the population must also pay attention to the availability of nutrients and water so that plants do not compete excessively, which can reduce individual productivity. In a study on porang, it was revealed that managing plant density is very important to ensure optimal results, with recommendations for proper planting distance so that each plant gets enough nutrients and space to grow optimally. In addition, good agronomic practices, including fertilization and pest control, also play an important role in maximizing productivity per hectare (Azhar et al., 2023).

Table 2. Popolations of porang plant cultivation.

Location	Populations (ha)	Type (seedling / plant)
Baubau City (Sorawolio District)		
Kaisabu Baru Village	40.000	Seedling
Ngkari ngkari Village	35.000	Seedling
Tampuna Village	45.000	Seedling
Buton City (Siotapina District)		
Karya Jaya Village	40.000	Seedling
Sumber Sari Village	55.000	Seedling
Gunung Jaya Village	55.000	Seedling
Kuraa Village	40.000	Seedling
Buton City (Kapontori District)		
Bukit Asri Village	55.000	Seedling
Wakangka Village	55.000	Seedling
Tuangila Village	55.000	Seedling
Lambusango Village	40.000	Seedling
Buton City (Lasalimu District)		
Togomangura Village	55.000	Seedling
Sribatara Village	60.000	Seedling
Lasembangi Village	40.000	Seedling
Buton Selatan City (Batauga District & Sampolawa District)		
Busoaa Village	55.000	Seedling
Gunung Sejuk Village	55.000	Seedling
Todombulu Village	40.000	Plant

3.3 Map of porang distribution in Buton

The distribution map of porang plants in the mainland of Buton (Figure 1) shows the distribution of porang plants spread across various villages and sub-districts. There are several active, less active, and inactive cultivation locations. Areas that are active in porang cultivation are seen in the northern and southern parts of Buton, such as in the villages of Wakangka, Togomangura, and Kuraa. Meanwhile, less active areas are spread across the villages of Lambusango Timur and Sribatara. Several areas, such as in the villages of Gunung Sejuk and Todombulu in South Buton, are recorded as areas that are not active in porang cultivation. This map also shows district and village boundaries, which helps in visualizing the geographical distribution of porang plant cultivation in the Buton region.

Regional differences can determine the productivity of porang plants due to various environmental factors, such as soil type, climate, and rainfall patterns. Areas with fertile and nutrient-rich soil conditions tend to support optimal porang growth, which results in higher productivity levels. In addition, the availability of water and sufficient rainfall also greatly affects the quality and quantity of porang yields. Differences in temperature and sunlight intensity can also affect the photosynthesis process and plant growth. A study revealed that agricultural productivity, including porang, can be greatly influenced by regional variations in land use and natural resources.

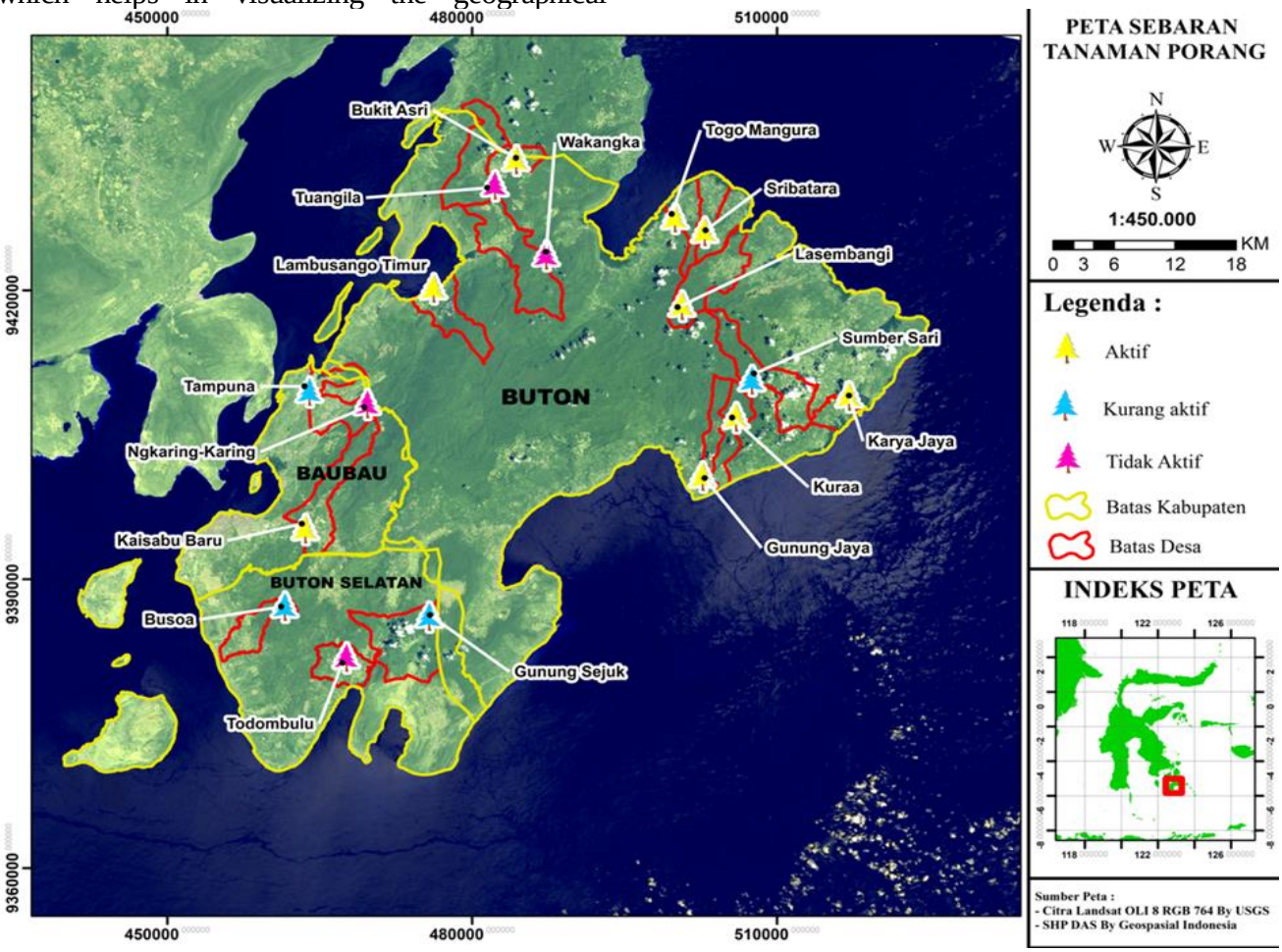

Figure 1. Map of the distribution of porang plants in the mainland Buton region.

3.4 Distribution of porang in various regions in Indonesia

Based on Table 3 which contains the distribution of porang plants in various regions in Indonesia, porang was found in several cities and districts with different numbers of locations. In Baubau City, porang was found in 3 locations, according to the current study. Meanwhile, in Buton City, porang was found in 11 locations, and in South Buton Regency there were 3 locations. In Malang City, the distribution of porang is wider with the discovery of this plant in 12 locations, based on research conducted by Alifianto et al. (2013). In Jember City, porang was found in 10 locations according to research by Sari et al. (2013). This information shows that porang plants are spread across various regions in Indonesia with varying numbers of locations depending on the region.

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Table 3. Distribution of Porang in various regions in Indonesia

Location	District	Locations	References
Baubau City	1	3	Present study
Buton City	3	11	
Buton Selatan City	2	3	
Malang City	8	12	(Alifianto et al., 2013)
Jember city	5	10	(Sari et al., 2013)

4. CONCLUSION

The objective of this study was to explore the population and productivity of porang plants in different locations on Buton Island. The findings showed that the density of porang plants varied significantly across locations, with higher densities leading to increased overall yield per hectare, though individual plant productivity decreased in areas with greater competition for resources. Environmental factors, such as soil quality and access to water, also played a critical role in influencing plant growth and yield. These results highlight the importance of location-specific agricultural practices to maximize porang productivity. Future research should investigate optimal planting densities and resource management practices to enhance yields while maintaining sustainable farming practices.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

Sri Yuniati: Writing original draft, Conceptualization, review, Dyah Roeswitawati: editing, Sarif Husein, Ali Ikhwan: Methodology, Supervision, Data curation. Chuzaimah Chuzaimah3, Susanti Diana, Henny Rosmawati, Nico Syahputra Sebayang, Neni Marlina, Juliano van Melis: Conceptualization, Methodology, Supervision

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CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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