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# SUSTAINABLE AGRICULTURE DEVELOPMENT THROUGH GREEN TECHNOLOGY: A CASE STUDY OF THE URUG INDIGENOUS COMMUNITY

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## Abstract

The study aims to discuss the development of sustainable agriculture through green technologies with a case study of the Urug Indigenous community. The objective is to examine the uptake and adaptation of these technologies by the Urug Indigenous population, the subsequent effects on agricultural output and the natural environment, and the challenges and opportunities emerging during this process. This research employs a qualitative methodology with an ethnographic approach. The research was conducted in Urug Village, Sukajaya District, Bogor, West Java, Indonesia. The data were collected through participatory surveys, interviews, literature research, and documentation on local wisdom on agriculture of the Urug Indigenous community. The result of this study is the Urug Indigenous rice farming system reduces negative environmental impacts and improves soil fertility through the use of green technologies, particularly annual rice cultivation, Leuit, and Terasiring methods. This green farming strategy is a model for achieving sustainable and environmentally friendly food security.

Keywords: Case study, Green technology, Sustainable agriculture, Urug Indigenous community.

## 1. Introduction

The topic relating to agriculture has become increasingly urgent in the context of global challenges such as climate change, land degradation, and increasing food demand [1-5]. This approach emphasizes practices that not only increase agricultural production but also maintain environmental sustainability and social welfare [6, 7]. This makes much research regarding agriculture from various aspects have been developed [8-14].

One innovative approach to sustainable agriculture is the utilization of green technologies [15-17]. Green technology encompasses a wide range of techniques and tools designed to reduce negative environmental impacts, improve resource efficiency, and support long-term economic sustainability [18]. The Urug Indigenous community in West Java, Indonesia, uses green technology to maintain their traditional agriculture practices. They integrate green technologies in line with their cultural and ecological values, demonstrating the potential of green technology in supporting sustainable agriculture [19, 20].

This study aims to examine the development of sustainable agriculture through the lens of green technologies, with a particular focus on the Urug Indigenous community. The focus of this study is on the adoption and adaptation of green technologies by the Urug Indigenous community, the resulting impacts on agricultural production and the environment, as well as the challenges and opportunities that arise in this process. The novelty of this research lies in its exploration of the local adaptation and innovation strategies developed by the Urug Indigenous community in implementing green technologies. It is thus hoped that this article will provide insights into the role of green technology in supporting sustainable agriculture and demonstrate how this approach can be implemented in a variety of other local contexts.

## 2. Theory

Sustainable agriculture is a holistic approach that balances ecological, social, and economic aspects to meet human needs while conserving natural resources [21]. It addresses challenges like climate change, soil erosion, and biodiversity depletion, promoting profitability, environmental health, and social equity for future generations [22].

Green technology is an innovative approach to environmental sustainability, focusing on conserving natural resources and minimizing negative impacts on the environment and human health [23]. It encompasses sectors like energy generation, agriculture, textiles, construction, and manufacturing [18].

Agriculture in Kampung Adat Urug, Bogor, is deeply rooted in traditional practices and indigenous knowledge. These traditional farming practices not only support food production but also highlight the importance of community cooperation and environmental sustainability in the region, contributing to the preservation of cultural heritage and biodiversity in Bogor, West Java, Indonesia [20]. The implementation of green technology in Urug Village has the potential to enhance food security, boost agricultural productivity, and facilitate environmental sustainability [24]. The sustainability benefits of green technology are described in Fig. 1.

## 3.Method

This research employed a qualitative methodology with an ethnographic approach. The research was conducted in Urug Village, Sukajaya District, Bogor, West Java,

Indonesia. The data were collected through participatory surveys, interviews, literature research, and documentation on local wisdom on agriculture of the Urug indigenous community. The research involved 10 respondents who were purposively selected based on their knowledge of the conditions of the Urug Indigenous community. The respondents were the Chairman, Chairperson, and Members of the Urug Indigenous Village Farmer Group.


**Fig. 1. Sustainability benefits of green technology.**

In the Urug Indigenous Village, local wisdom on agriculture was discovered and explained through descriptive analysis. To collect data, a range of methods were employed, including in-depth interviews, participatory observation, literature study, and documentation. Field observations and in-depth interviews yielded data on community activities, customary procedures, and customs of the Urug Indigenous community relating to rice farmland management. The results were then analysed and compared with a literature review on agriculture and green technology.

## 4. Results and Discussion

The Urug Indigenous people plant rice once a year in unison, following an order from the customary leader. The appearance of the constellation Kidang (or Orion) is an indicator for the Urug community to determine the time to plant rice in the fields. The Indigenous people of Kampong Urug carry out the process of planting rice simultaneously when the Kidang (Orion) constellation appears in the west. The position of the constellation Kidang (Orion) is in the western sky, indicating the onset of the rainy season.

The series of rice planting processes observed among the Urug Village Indigenous community are described as follows: ngabaladah, babad, ngangler, tandur, mupuk, ngonyos, dibuwat (harvest), lantayan, ngunjal. These processes bring rice to the leuit. The process of rice cultivation in the village of Urug is described in Fig. 2.

Annual rice cultivation improves rice quality, ecological environment, and agricultural development [25]. The once a year rice planting system increases seedling survival rates, ensures stable growth, and increases yield by selecting high quality seeds. It reduces irrigation and fertilizer requirements, improving efficiency

[26]. This system also optimizes seedling health, growth stability, and resource utilization, leading to higher yields and increased agricultural sustainability [27-29].


**Fig. 2. The series of rice planting processes of the Indigenous people of Urug village.**

The Indigenous people of Urug village store rice in the Leuit. The Leuit serves as a storage facility for rice harvested from the fields, preserving it for decades while maintaining its quality for consumption [30, 31]. Leuit structures are designed to regulate the environmental conditions of storage, which is crucial for maintaining the quality of paddy. Typically, Leuit structures are constructed from natural materials such as wood and bamboo, which facilitate good air circulation. The elevation position of the Leuit is usually built on poles or stilts, which makes it difficult for rats and other rodents to reach the paddy [32]. Vernacular architecture is a highly effective means of regulating the indoor environment, providing comfortable living conditions with local materials and construction methods, and demonstrating natural resource efficiency for sustainability [33]. Figure 3 illustrates the Leuit architecture found in the village of Urug.

Terracing is a green technology used for irrigation in Urug indigenous rice fields. It improves soil quality, water conservation, and productivity by retaining essential nutrients [34, 35]. This technique combats soil erosion and enhances water conservation, making nutrient retention crucial for optimal rice growth [36-38]. Table 1 outlines the specific nutrients that must be present in the soil for optimal rice growth and development.

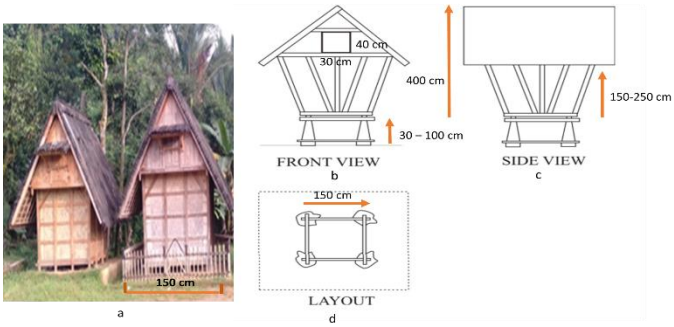


**Fig. 3. Leuit is where the Indigenous people of Urug store rice.**

**Table 1. Essential nutrients for optimal rice growth.**

| Nutrition | Benefits |
|---|---|
| Nitrogen (N) | Plants make chlorophyll, which is needed for photosynthesis, in their roots, stems, and leaves. |
| Fosfor (P) | Activates plant growth, and flower growth, accelerates fruit and plant ripening |
| Potassium (K) | Enhances resistance to drought and disease and plays a role in root development. |
| Sulfur (S) | Make plants stronger and crops better. |

Land terracing enhances agricultural practices, environmental conservation, and cultural preservation by protecting biodiversity, enhancing soil fertility, and conserving cultural heritage [39]. Integrating terraces with green technologies promotes sustainable soil conservation and environmentally friendly land management practices [40]. Figure 4 shows the implementation of terracing in the Urug traditional village.

**Fig. 4. Terracing system of the Indigenous Urug people.**

Indigenous communities use traditional rice farming systems, utilizing green technologies to address soil health, nutrient scarcity, and climate change, promoting sustainable and environmentally conscious food production [23]. This is important for reliable and flexible food systems, human health and a healthy, sustainable food system. Eco-agricultural strategies lead to optimal resource utilisation, a low risk of environmental degradation, and the mitigation of the effects of global warming.

## 5. Conclusion

The application of green technology in the context of sustainable agriculture in Urug Village has the potential to significantly enhance agricultural productivity while maintaining environmental balance. The use of green technology in the Urug community, specifically the practice of planting rice once a year and storing rice in the Leuit and Terasiring system, has been successful in reducing negative environmental impacts and increasing soil fertility. This research indicates this green farming model can be used as an example to be applied in other areas to achieve sustainable and environmentally friendly food security.

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