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Diversity of Constituent Components of Rice Field Agroforestry in Sawahan Village

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ABSTRACT. The conversion of agricultural land into non-agricultural land in Sawahan Village is one of the factors hindering the progress of the economic sector and the welfare of farmers in Sawahan. The best use of the remaining minimal land will help support the progress of farmers in Sawahan, especially with the agroforestry system. This study aims to find out farmers' insights regarding the application of agroforestry systems and find out the agroforestry constituent plants in Sawahan Village. The research method used in obtaining data is through direct observation and interviews through the study of literature. The results of the data that have been obtained from research are the agroforestry system in Sawahan Village, Ngemplak Sub-District, Boyolali Regency is an intercropping alternately. Plants that are often planted by farmers there are woody plants and food plants including rice and crops. The diversity of agroforestry plants in Sawahan Village is composed by the Family of Solanaceae as much as 18.2%; Poaceae as much as 18.2%; Cucurbitaceae as much as 13.6%; Fabaceae with a percentage of 9.05%; As well as other families found as agroforestry-making plants in Sawahan are Family Zingiberaceae, Verbenaceae, Musaceae, Muntingiaceae, Moraceae, Malvaceae, Euphorbiaceae, Caricaceae, Anacardiaceae with each have a percentage of 4.55%. Based on these results, it can be concluded that the farmers implement an agroforestry system because it can improve the economy for farmers and there are 22 species of plants belonging to 13 families found as constituents of the agroforestry system in Sawahan Village.

Keywords: agroforestry, diversity, rice fields.

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1. Introduction

The economy in Indonesia is built by several important sectors, one of which is the agricultural sector. The agricultural sector is a strategic sector in improving the Indonesian economy even though it has a very small contribution but agriculture is a determinant of people's food welfare (Karin and Sutrisna, 2016). The development of the agricultural sector in Indonesia has received more attention from the government so that the agricultural sector in Indonesia can improve the welfare of farmers and become a reliable sector in increasing economic progress (Liana et al., 2022). The agricultural sector is still a mainstay in creating jobs. There are several roles of the agricultural sector in economic development in Indonesia, namely 1) As a food-producing sector 2) As a source of labor for other economic sectors 3) As one of the producers of foreign exchange sources for the country 4) Increase demand for industrial products and thus encourage the necessity of expanding the secondary and tertiary sectors. (Nadziroh, 2020).

In Indonesia, rice is the main crop in agriculture and is one of the most important cultivated plants because half of the world's population depends on this crop (Tamba et al., 2017; Main and Zulman, 2015). This is because rice is one of the main foodstuffs in Indonesia (Sahri et al., 2022). The main problem of the rice sector today is land conversion. Land conversion is the change of land use from a certain form of use to another use of paddy fields that have been converted to other uses (non-agricultural) very little chance of being transformed back into paddy fields (Aryawati and Budhi, 2018). The occurrence of land conversion results in a narrowing of agricultural land which is feared to have an impact on the economy in Indonesia. Minimal land use as much as possible such as using agroforestry systems is very necessary to help reduce the impact of land conversion.

Agroforestry generally refers to land use systems or agricultural systems in which trees or shrubs grow together with agricultural crops or pastures and in which ecological and economic interactions occur between trees and other components (Alao and Shuaibu, 2013). This research was conducted in order to determine the knowledge and views of farmers regarding agroforestry and the diversity of agroforestry constituent plants in Sawahan Village.

2. Materials and Methods

2.1 Research Procedure

The location of the study was conducted in Sawahan Village, Ngemplak District, Boyolali Regency, Central Java, Indonesia. Sawahan Village has a rice field area of 78.9708 Ha and a

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garden area of 11.5315 Ha. The study was conducted from May to July 2022.

Fig. 1 Location of research in Sawahan, Ngemplak, Boyolali.

Fig. 2 Farmland in Sawahan Village, Ngemplak, Boyolali.

This study was conducted by collecting primary and secondary data. Primary data were obtained through direct observation and interviews. Secondary data are obtained through the study of literature. Observations are carried out by direct observation in the field by identifying and documenting the types of plants found and compiling agroforestry components on agricultural land in Sawahan Village. Then, the interview was conducted directly with the farmers of Sawahan Village.

2.2 Data Analysis

Data analysis was carried out descriptively qualitatively. The results of the interviews obtained were described, and the plant data obtained were identified and analyzed using literature studies or other supporting sources. Plants are identified based on their habitus as well as the type of their life status. Plant identification is carried out using the website, namely plantamor.com and theplantist.org, after which it is analyzed by describing the types of plants that have been found.

3. Result and Discussion

3.1 Understanding of Agroforestry According to Sawahan Farmers

Agroforestry is an agricultural system by managing and planting a variety of trees with/without crops a year on a land simultaneously with agricultural crops and/or livestock in an optimal, sustainable, and sustainable manner. The application of the agroforestry system functions in overcoming the problem of agricultural land needs arising from land use change while maintaining the function of forests and the environment. Addressing problems arising from land use change in overcoming food problems. Rice is one of the main commodities in Sawahan Village with 78.9708 ha of paddy fields with an average production yield of 7.18 kw/ha (BPS Boyolali, 2021). In addition to rice as the main commodity in Sawahan Village, there are several other agricultural products such as chili, corn, long beans, bitter gourd, tomatoes, and eggplants and so on.

Based on the results of interviews with farmers in Sawahan Village, farmers view agroforestry as a way of using and utilizing land by combining several types of crops on a land or called mixed gardens. Farmers use mixed gardens or agroforestry because they adjust to their land ownership and want to grow more than one type of crop that is likely to improve the economy. However, there are still farmers in Sawahan Village who do not maximize agroforestry. This is because there are farmers who only cultivate their agricultural land more dominated by rice crops.

3.2 Intercropping Agroforestry in Sawahan

The type of agroforestry applied by farmers in Sawahan Village is simple or intercropping of agroforestry. Intercropping agroforestry is an agricultural system by intercropping trees by planting one or more annuals. Intercropping agroforestry in Sawahan Village is carried out in several ways, including planting trees managing agricultural land plots, randomly in a random mixture, growing naturally in land plots and managed by farmers, planting plants of several types in one plot and alternating, and planting in a row to form a passage / fence. The agroforestry random mixture pattern is where agricultural crops are planted irregularly with tree crops in the absence of planning for the preparation of planting patterns (Naharuddin, 2018).

Crops that are often grown by farmers there are woody crops and food crops including rice and palawija. Intercropping agroforestry that is planted interchangeably will produce alternating crops as well, usually consisting of several types of

crops. However, when farmers plant rice, farmers will plant crops around the rice field barrier which known as galengan or pematang around the plot of agricultural land.

3.3 The diversity of plants that make up agroforestry in Sawahan

The agroforestry constituent plants found in Sawahan Village consist of 22 species belonging to 13 families, including Anacardiaceae, Caricaceae, Cucurbitaceae, Euphorbiaceae, Fabaceae, Malvaceae, Moraceae, Muntingiaceae, Musaceae, Poaceae, Solanaceae, Verbenaceae, and Zingiberaceae.

Fig. 3 Agroforestry System in Sawahan Village.
Note: 1) *Musa paradisiaca 2) Solanum melongena 3) Capsicum frutescens L. 4) Vigna unguiculata.*

The diversity of plant species constituents of agroforestry in Sawahan, Ngemplak, Boyolali is dominated by the Solanaceae and Poaceae families as much as 18.2%, Solanaceae which is one of the families that can live in hot and temperate climates, especially this family is very important in meeting human needs (Krisnawati and Febrianti, 2019). Some examples of plants of the Solanaceae family that are commonly cultivated by the people of Indonesia as plantation plants include curly chilies, cayenne peppers, tomatoes, cherry tomatoes, purple eggplants, and peppers (Aristya *et al*., 2019). Poaceae is the most common rice species found in Sawahan Village because rice is one of the main commodities in Sawahan Village. In Indonesia itself Poaceae is one of the plant tribes that has a high diversity of plants (Wulandari *et al*., 2017). Because Indonesia itself is a tropical country and receives sufficient rainfall, it is very good for the growth of this tribe (Hayutiasti *et al*., 2019).

The Cucurbitaceae family found as agroforestry constituent plants in Sawahan, Ngemplak, Boyolali is 13.6% of all families found. Cucurbitaceae is one of the important plant groups that are used as a source of food and medicine for life (Sitorus *et al*., 2019). The Cucurbitaceae family has benefits for life as vegetables, edible seeds, oilseeds, animal feed, fiber, nutrients, biodiesel, and foodstuffs (Ajuru and Nmon, 2017). Then the family that was found as one of the constituent components of agroforestry in Sawahan was Fabaceae with a percentage of 9.05%. Fabaceae is one of the flowering plant tribes with high economic value (Irsyam and Priyanti, 2016). Many of these Fabaceae families are used as food crops, fruit producers, medicinal plants, land cover, wood producers, oils, gom, natural dyes, insecticides, erosion control, and soil reclamation (Quattrocchi, 2012). According to Suakeningsih *et al*. (2021), stated that the general characteristic of plants of the Fabaceae family is that the fruit is pod-type and some have the shape of a tree but also some are in the form of shrubs and herbs. Other families found as constituent plants of agroforestry in Sawahan are the families Zingiberaceae, Verbenaceae, Musaceae, Muntingiaceae, Moraceae, Malvaceae, Euphorbiaceae, Caricaceae, Anacardiaceae with a percentage of 4.55%.

The constituent plants of agroforestry in Sawahan Village are distinguished by their life cycles, namely annual and perennial. Annual Plant is a plant that can only live for one season, about three months, harvested when it reaches a maximum age of three months, and dies when the yield is harvested (Saripurna, 2018).

Table 1
List of record of agroforestry constituent species

Family	Name	Local Name	Habitus	Status
Anacardiaceae	*Mangifera indica*	Mangga	Tree	P (5)
Caricaceae	*Carica Papaya L.*	Pepaya	Tree (9)	P (2)
Cucurbitaceae	*Cucumis melo*	Melon	Vines	A (7)
	Momordica charantia	Pare	Vines	A
	Cucumis sativus	Timun	Vines	A
Euphorbiaceae	*Manihot esculenta*	Singkong	Shrubs (9)	A (5)
Fabaceae	*Vigna unguiculata*	Kacang Panjang	Shrubs	A (8)
	Parkia speciosa	Mlanding	Tree	A (8)
Malvaceae	*Ceiba pentandra*	Kapuk/Randu	Tree	P
Moraceae	*Artocarpus altilis*	Sukun	Tree (11)	P
Muntingiaceae	*Muntingia calabura*	Talok/Kersen	Tree (10)	P (5)
Musaceae	*Musa paradisiaca*	Pisang	Herba (10)	P (4)
Poaceae	*Bambusa sp.*	Bambu	Tree (10)	P (5)
	Zea mays	Jagung	Shrubs	A (1)
	Oryza sativa	Padi	Shrubs	A (3)
	Cymbopogon citratus	Sereh	Herba (9)	A
Solanaceae	*Capsicum frutescens L.*	Cabai Rawit	Shrubs	A (6)
	Capsicum annum	Cabai Hijau	Shrubs	A (5)
	Solanum lycopersicum	Tomat	Shrubs	A
	Solanum melongena	Terong	Shrubs	A
Verbenaceae	*Tectona grandis*	Jati	Tree (10)	P (5)
Zingiberaceae	*Curcuma longa Linn*	Kunyit	Herba (10)	A (5)

Note: A: Annual Plants, P: Perennial Plants; 1. Hani and Geraldine (2018), 2. Junaidin *et al*. (2017), 3. Pardani *et al*. (2013), 4. Hindersah and Suminar (2019), 5. Prayoga and Ismail (2022), 6. Nurwanto dan Sulistyaningsih (2017), 7. Nianggolan *et al*. (2019), 8. Zuhroh and Agustin (2017), 9. Mingga *et al*. (2019), 10. Septiasari *et al*. (2021), 11. Lantip *et al*. (2021).

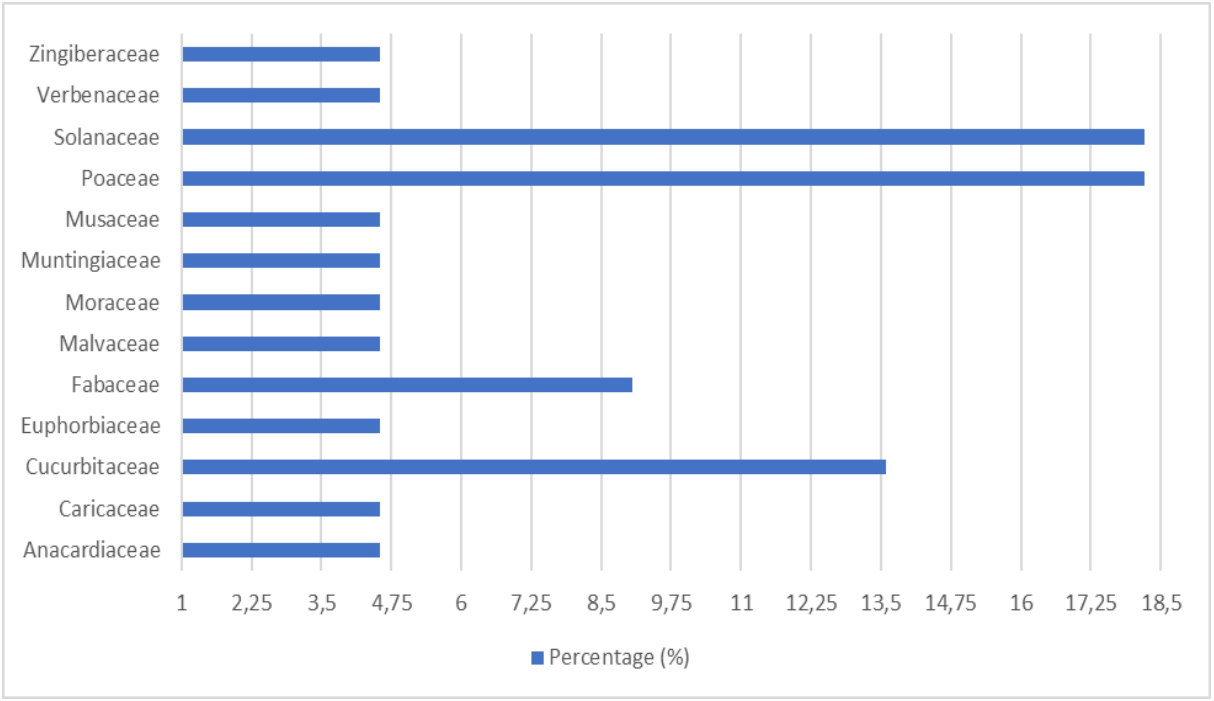

Fig. 4 Family of agroforestry constituent plants in Sawahan, Ngemplak, Boyolali.

There are 14 types of annual plants in Sawahan Village as agroforestry constituent plants. Perennial plants are plants that are able to grow for more than two years (Karyati, 2014). Perennial plants are generally more than one year old and the collection of the results is carried out more than once the harvest period for one crop (Ayu *et al*., 2015). Annual plants grown in Sawahan Village there are 8 types of plants including mango, banana, *Muntingia calabura*, breadfruit, kapok tree, bamboo, teak, and papaya. Perennial plants that are forestry in nature such as teak trees are planted as fences planted on the edge of agricultural land. The soil management carried out on these two types of plants is different. According to Kusumandari *et al*. (2015), soil management in annual plants requires more intensive management and maintenance than perennial plants. Soil management in annual plants is usually done by hoeing or stirring the soil which results in the destruction of soil aggregates and makes the soil easily eroded.

4. Conclusion

Farmers view agroforestry as a way of land use and utilization by combining several types of crops on a land or called mixed gardens. Therefore, farmers implement an agroforestry system because it can improve the economy for farmers. As well as plants grown as constituents of agroforestry in Sawahan Village, it consists of 22 species belonging to 13 families which are dominated by the Solanaceae and Poaceae families.

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