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Production of Tubers as Local Food Crops: Overview of Types, Production, and Cultivation by Farmers

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Abstract
Tubers in the Waru District are one of the local foods that have great potential in supporting local food diversification. Based on Presidential Regulation No. 81 of 2024, which mandates the acceleration of food diversification based on the potential of local resources to meet diverse food needs. Tubers in the Waru District are one of the local food crop commodities that have the potential to be developed. This study aims to examine the description of tuber production in Waru District, Pamekasan Regency, including the types and distribution of tubers, production quantities, and cultivation patterns carried out by farmers. The study was conducted from July to September 2025 using a survey method with a qualitative descriptive approach. Data were collected through direct field observation, structured interviews with questionnaires, and Focus Group Discussions (FGDs). The results showed that there are twelve types of tubers in Waru District, consisting of eight types of tubers that are still cultivated and four types of tubers that only grow wild or are underutilized. Cassava, blue taro, and yams are the main commodities with the highest distribution and production rates, despite their relatively simple cultivation methods. This indicates that tubers have the potential to be developed as local foods to support food diversification.

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Keywords: Tubers, Production, Diversity, Local Food, Food Diversification

1. Introduction

Indonesia is an agrarian country with abundant natural resources, particularly agricultural resources, and a vast territory with the potential to meet food needs. Indonesian food consumption is still dominated by rice. According to data from the United States Department of Agriculture (USDA), Indonesian rice consumption reaches 35.7 million tons per year, ranking fourth in the world for rice consumption. This indicates that rice remains a primary food crop. The population's dependence on staple foods like rice can make the food system more vulnerable to climate risks. In such conditions, the presence of other food crops plays a crucial role, but unfortunately, their development and utilization often go unnoticed. Tubers are known to have good adaptability to environmental and climatic conditions, allowing them to grow in marginal areas where other crops cannot (Angely *et al*., 2024) [1]. Various types of tuber crops include cassava, sweet potato, potato, arrowroot, asiatic bitter yam, blue taro, wild taro, asiatic yam, indian shot, and others, which are generally alternative sources of carbohydrates (Wuryantoro and Afifin, 2017) [9]. Waru District, Pamekasan Regency, is an area with local tuber potential, with the majority of the population working as farmers. The land area in Waru District is 6,393 ha, with rice fields accounting for 17.84%, dry fields 81.09%, and yards 1.24% (BPP Waru District, 2024) [3]. However, to date, studies specifically discussing the description of tuber production in Waru District are still very limited. Information on the types of tubers cultivated, the resulting production levels, and how they are distributed has not been systematically documented. This limited data and information have resulted in the potential of tubers in the Waru District not being fully understood. Based on these conditions, research is needed that can provide clear and comprehensive information

or a picture of tuber production in Waru District. The information generated from this study is expected to form the basis for considerations regarding the development of the potential of the local agricultural and food sectors to support food diversification in the Waru District area. In this regard, this study aims to determine the picture of tuber production in Waru District, Pamekasan Regency.

2. Method

This study uses a qualitative descriptive method to describe the production of tubers as a local food crop. This approach was used to understand the types of tubers, their distribution, production volume, and cultivation patterns based on the experience and knowledge of local farmers. Data in this study were collected through direct field observation, structured interviews using a questionnaire, and focus group discussions (FGDs). The research location was determined purposively, with respondents determined using a snowball sampling technique. The study was conducted from July to September 2025 in Waru District, Pamekasan Regency. The research procedure was as follows:

2.1. Problem formulation

At this stage, researchers identified problems based on limited information regarding tuber production. The problem focused on how tuber production is described in terms of tuber type, distribution, production volume, and cultivation patterns used by farmers.

2.2. Literature search

The author gathered information and reviewed various literature, including scientific journals, academic books, institutional data, and government policies relevant to the research topic. The reviewed literature was used to develop the conceptual foundation of the research and support the analysis and discussion of the research results.

2.3. Data Collection

The author used both primary and secondary data. Primary data was obtained through field observations, structured interviews, and focus group discussions (FGDs). Secondary data was collected from various scientific publications, institutional data, and government policies that support tuber production information.

2.4. Data analysis and interpretation

Data analysis was conducted using qualitative descriptive analysis by grouping data based on tuber type, tuber distribution, production volume, and cultivation patterns. Data from interviews and observations were interpreted to describe tuber production as a whole. The analysis results are presented in descriptive form, supported by distribution maps and data tabulations to clarify the interpretation.

3. Results and Discussion

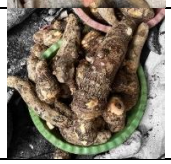
3.1. Results

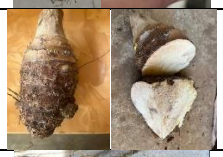
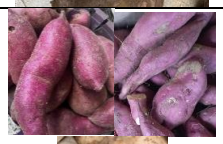
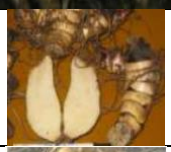
Based on field observations, various types of tubers are found in the Waru District, distributed throughout almost all villages. These tubers are one of the crops cultivated by farmers, in addition to their main crops, namely rice, corn, and tobacco. Most of these tubers are still actively cultivated by farmers, while four other tubers grow wild and are classified as underutilized. The types of tubers are shown in Table 1.

Table 1: Types of Tubers in Waru District

No	Common Name	Local Name	Family Name	Species Name
1	Cassava	Tenggeng	*Euphorbiaceae*	*Manihot esculenta Cratz*
2	Blue Taro	Talas Jombeng	*Araceae*	*Xanthosomasagittifolium (L.) Schott*
3	Black Wild Taro	Talas Kombeh Plotan	*Araceae*	*Colocasia esculenta (L.) Schott*
4	White Wild Taro	Talas Kombeh	*Araceae*	*Colocasia esculenta (L.) Schott*
5	Satoimo Taro	Talas Budu’	*Araceae*	*Colocasia esculenta var. antiquorum Schott*
6	White Yam	Obi’ Manis	*Dioscoreaceae*	*Dioscorea. rotundata*
7	Black Yam	Obi’ Item	*Dioscoreaceae*	*Dioscorea alata L.*
8	Sweet Potato	Longge/Sabeng	*Convolvulaceae*	*Ipomoea batatas (L.) Lam.*
9	Asiatic bitter yam	Gedhung	*Dioscoreaceae*	*Dioscorea hispida*
10	Arrowroot	Jerut/Larut	*Marantaceae*	*Maranta arundinacea L.*
11	Indian Shot	Genyong	*Cannaceae*	*Canna discolor Lindl.*
12	Asiatic Yam	Kaburan	*Dioscoreaceae*	*Dioscorea esculenta (Lour.) Burkill*

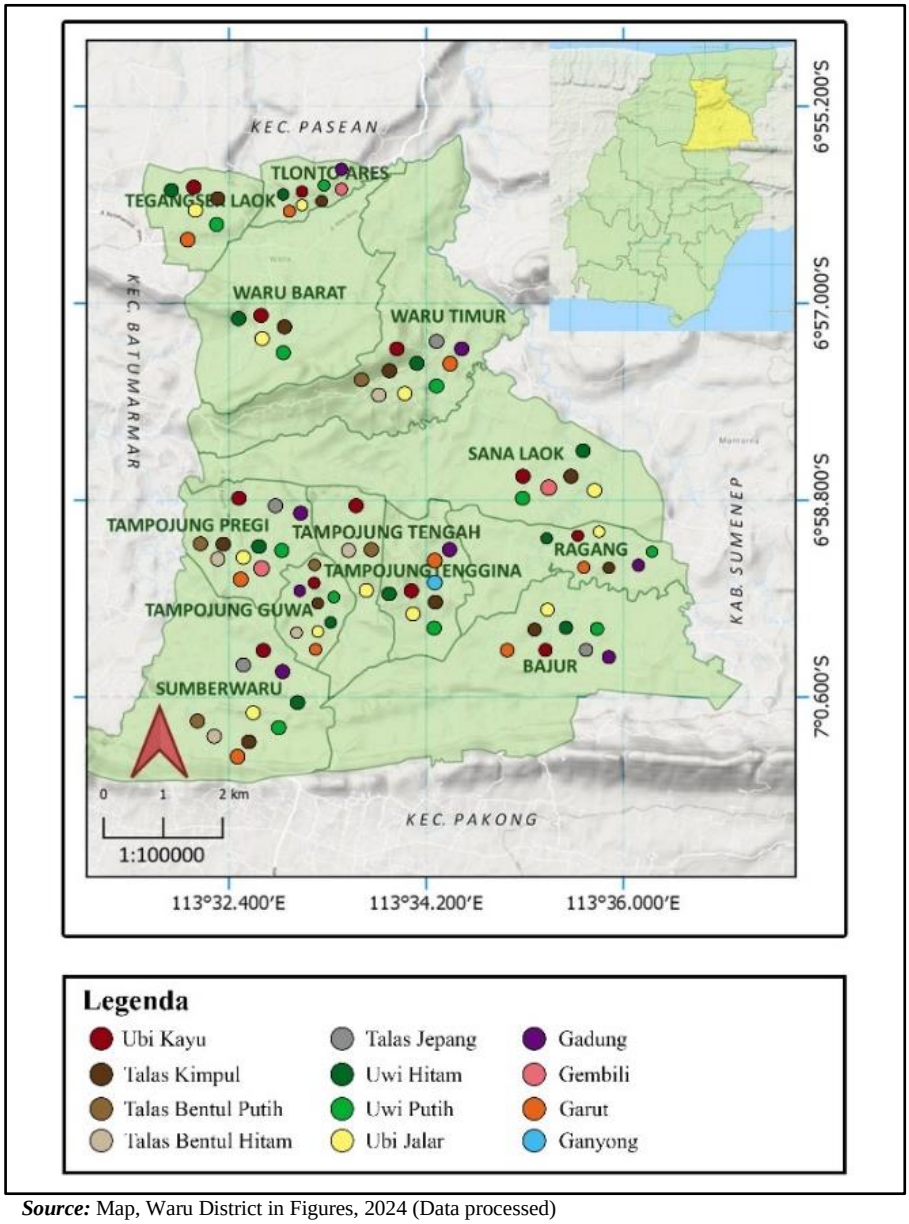
Table 2: Description of Tubers

No	Figure	Description
1		The shape of the cassava tuber is elongated and cylindrical, the outer skin is dark brown, and the skin is rough-textured with white tuber gelling.
2		The shape of the blue taro tuber is elongated and irregular, and the skin surface is rough and brown with white tuber flesh.

3		The shape of the cormus tuber is conical and is covered by root fibers with light brown cormus skin and yellowish white cormus flesh.
4		Taro tubers are oval in shape, have brown skin, and white flesh.
5		The size of the tuber is relatively smaller than that of other taro varieties and grows from the node axils with a round tuber shape, slightly tapered tip, rough brown skin, and white flesh.
6		The tubers are large and have an irregular, elongated shape. The surface of the tuber is relatively smooth with a brown outer skin and purplish white flesh.
7		The size of the tuber is relatively smaller than that of the black yam; the shape of the yam tends to be round to oval, the skin of the yam is rougher and thicker, dark brown in color, with white yam flesh.
8	 	The tubers are cylindrical to oval, with pointed or rounded tips. The skin and flesh color of the tubers vary, from purple skin with purple flesh, purple skin with white flesh, and white skin with white flesh.
9		The shape of the Asiatic bitter yam is irregular, tending to be round to oval, with a rough surface and brown outer skin with white tuber flesh.
10		The tubers are elongated, sometimes slightly curved, and vary in color from light brown to yellowish brown. The skin is somewhat scaly and has segments. The flesh is pure white.
11		The tubers are elongated, with light to dark brown skin and a slightly rough, scaly texture. The flesh is white to yellowish.
12		The tubers are round to oblong in shape, with a light brown outer skin and a slightly rough texture. The flesh is white to creamy and has a fairly firm texture.

Based on the twelve types of tubers, eight types of tubers that are actively cultivated by farmers are cassava (Manihot esculenta Cratz), blue taro (*Xanthosoma sagittifolium* (L.) Schott), wild taro (*Colocasia esculenta* (L.) Schott), black wild taro (*Colocasia esculenta* (L.) Schott), satoimo taro (*Colocasia esculenta* var. *antiquorum Schott*), white yam (Dioscorea rotundata), black yam (*Dioscorea alata* L.), and sweet potato (*Ipomoea batatas* (L.) Lam.). Meanwhile, four types of tubers that are classified as growing wild and underutilized are Asiatic bitter yam (Dioscorea hispida), Arrowroot (*Maranta arundinacea* L.), Indian shot (*Canna discolor Lindl.*), and Asiatic yam (*Dioscorea esculenta*

(Lour.) Burkill). Tubers are distributed throughout the villages in the Waru District. Cassava (Manihot esculenta Cratz), sweet potato (*Ipomoea batatas* (L.) Lam.), white yam (Dioscorea rotundata), black yam (*Dioscorea alata* L.), and blue taro (*Xanthosoma sagittifolium* (L.) Schott) have the widest distribution and are spread across 12 villages. Arroroot (*Maranta arundinacea* L.) is spread across 9 villages. Asiatic bitter yam (Dioscorea hispida) is spread across 8 villages. Wild taro (*Colocasia esculenta* (L.) Schott), both black and white types, are spread across only 5 villages. Satoimo taro (*Colocasia esculenta* var. *antiquorum Schott*) is spread across only 4 villages. Asiatic yam (*Dioscorea esculenta* (Lour.) Burkill) is found in only three villages, and Indian shot (*Canna discolor* Lindl.) is found in only one village, Tampojung Tenggina. The distribution of these tubers can be seen in Figure 1.



Source: Map, Waru District in Figures, 2024 (Data processed)

Fig 1: Distribution Map of Tubers

Tubers Production

Tuber production is the total yield of tubers harvested in a single growing season. This production is significantly influenced by climate change, land area, and cultivation patterns in the Waru District. Tuber production can be influenced by the number of plants planted in a single growing season. Planting volumes, production volumes, and cultivation patterns are shown in Tables 3, 4, and 5

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Table 3: Number of Tubers planted

Region	Number of Tubers Planted (Trees)									
Village	Cassava	Blue Taro	Wild Taro	Satoimo Taro	Yams	Sweet Potato	Asiatic bitter yam	Arrowroot	Indian Shot	Asiatic yam
Tegangser Laok	80	20	20	0	40	20	-	-	-	-
Tlonto Ares	100	200	40	0	300	600	-	-	-	-
Waru Barat	100	500	50	0	1500	50	-	-	-	-
Waru Timur	1400	800	400	300	650	700	-	-	-	-

Tampojung Pregi	80	54	30	36	50	80	-	-	-	-
Sana Laok	1000	50	20	0	30	40	-	-	-	-
Tampujung Tengah	200	0	50	40	20	20	-	-	-	-
Tampujung Guwa	150	100	200	20	40	30	-	-	-	-
Tampojung Tenggina	100	60	30	20	40	30	-	-	-	-
Sumber Waru	800	100	70	200	200	40	100	-	-	-
Ragang	500	100	20	0	20	120	-	-	-	-
Bajur	720	100	80	50	40	80		-	-	-
Total	5230	2084	1010	666	2930	1810	100	-	-	-

Table 4: Amount of Tubers Production

Region	**Production Number of Tubers (Quintals)**									
Village	**Cassava**	**Blue Taro**	**Wild Taro**	**Satoimo Taro**	**Yams**	**Sweet Potato**	**Asiatic bitter yam**	**Arrowroot**	**Indian Shot**	**Asiatic yam**
Tegangser Laok	3,2	1,0	0,20	0	2,40	0,20	-	-	-	-
Tlonto Ares	7,0	4,0	0,40	0	6,00	3,00	-	-	-	-
Waru Barat	4,0	8,0	0,25	0	22,50	0,50	-	-	-	-
Waru Timur	56,0	8,0	2,00	2,0	4,00	2,50	-	-	-	-
Tampojung Pregi	2,4	1,08	0,30	0,54	0,60	2,40	-	-	-	-
Sana Laok	63,0	2,0	0,10	0,40	0,30	0,40	-	-	-	-
Tampujung Tengah	6,0	0	0,50	0,40	0,10	0,20	-	-	-	-
Tampujung Guwa	7,5	2,0	1,00	0,24	0,20	0,10	-	-	-	-
Tampojung Tenggina	2,5	1,2	0,15	0,20	0,20	0,45	-	-	-	-
Sumber Waru	24,0	1,0	0,45	2,00	2,00	0,40	3,0	-	-	-
Ragang	25,0	2,0	0,10	0	0,20	1,20	-	-	-	-
Bajur	50,4	2,0	1,20	0,75	0,40	1,60	-	-	-	-
Total	251,0	32,28	6,65	6,53	38,90	11,95	3,0	-	-	-

Table 5: Cultivation by Farmers

Common Name	**Planting Time**	**Harvest Age**	**Cultivation**		**Explanation**
			M	**P**	
Cassava	October-November	8-12 months	+	+	Cultivated intensively, without crop rotation
Blue Taro	October-November	3-6 months	+	+	Cultivated intensively, without crop rotation
Wild Taro (Black and White)	October-November	4-6 months	+	+	Two types of tubers are cultivated intensively, without crop rotation.
Satoimo Taro	October-November	3-5 months	+	+	Cultivated intensively, without crop rotation
Yama (Black and White)	October-November	3-12 months	+	+	Two types of tubers are intensively cultivated together, without crop rotation.
Sweet Potato	May-July	3 months	-	+	Cultivated intensively, without crop rotation
Asiatic bitter yam	October-November	4-12 months	+	-	Not intensively cultivated
Arrowroot	-	-	-	-	-
Indian Shot	-	-	-	-	-
Asiatic yam	-	-	-	-	-

Note: M = Monoculture, P = Polyculture

3.2. Discussion

Based on tuber production data in Waru District, cassava is the commodity with the highest production, at 251.0 quintals, following the number of cassava plants, which is also the highest recorded in Waru District. The highest cassava production is in Sana Laok Village at 63.0 quintals, East Waru Village at 56.0 quintals, and Bajur Village at 50.4 quintals. This indicates a strong correlation between the number of plants and the size of cassava production in each village. Conversely, villages with a low number of cassava plants, such as Tegangser Laok Village and Tampojung Pregi Village, also show low production, each below 5 quintals. Other types of tubers show a more limited and uneven production pattern. The yam tuber yielded a total production of 38.90 quintals in one growing season, with the highest production in West Waru Village at 22.50 quintals. This corresponds to the majority of yam plants in the village. Blue taro yielded 32.28 quintals, with the largest production coming from West Waru and East Waru Villages. Meanwhile, sweet potatoes only produced 11.95 quintals. Wild taro, satoimo taro, and Asiatic bitter yam yielded relatively low yields, at 6.65 quintals, 6.53 quintals, and 3 quintals, respectively. This low tuber production was due to the limited number of plants. Furthermore, arrowroot, indian shot, and asiatic yam were not produced due to the lack of cultivation of these crops in the entire village. The varying production volumes were influenced by the weight of the harvest, which varied depending on the intensity of care by farmers and the environmental conditions in each village. Overall, this data confirms that the tubers in Waru District

with the highest production are the main types of tubers produced from cultivation, which is greatly influenced by the number of tubers planted.

There are eight types of tubers that are intensively cultivated by farmers. These types of tubers include cassava (Manihot esculenta Cratz), blue taro (*Xanthosoma sagittifolium* (L.) Schott), white wild taro (*Colocasia esculenta* (L.) Schott), Black wild taro (*Colocasia esculenta* (L.) Schott), white yam (Dioscorea rotundata), black yam (*Dioscorea alata* L.), satoimo taro (*Colocasia esculenta* var. *antiquorum Schott*), and sweet potato (*Ipomoea batatas* (L.) Lam.). These tubers are planted in monoculture and polyculture. Polyculture is an agricultural system that involves planting various types of plants in one field simultaneously (Harianti, 2025) [6]. Cassava is planted together with taro or yam, taro is planted together with yam, yam is planted together with taro or corn, and sweet potato is planted together with tobacco plants. Meanwhile, asiatic bitter yam (Dioscorea hispida) is planted in monoculture. Monoculture is a type of planting pattern that generally only plants one type of plant on one plot of land with the aim of being easier to maintain (Fikri *et al*., 2025) [5]. Asiatic bitter yam are planted in yards or dry fields using large trees as supports. Asiatic bitter yam will only be cared for if they are intended for processing and sale. Three other types of tubers, namely arrowroot (*Maranta arundinacea* L.), asiatic yam (*Dioscorea esculenta* (Lour.) Burkill), and indian shot (*Canna discolor* Lindl.) are not cultivated by farmers and only grow wild.

Tubers cultivated intensively receive routine care. These tubers generally begin cultivation between October and December, except for sweet potatoes, which begin cultivation between May and July. Cultivation from October to December is intended to await the arrival of the rainy season in each village area in Waru District. This is considered to reduce maintenance costs associated with water requirements for tuber crops. Tubers are cared for only by fertilizing without watering. Fertilization is carried out two to three times during one growing season, prioritizing the application of manure. Each tuber plant is given a dose of 250 grams of manure, 5 grams of urea fertilizer, and 5 grams of NPK fertilizer. Higher doses of manure can be given. Respondents stated that cultivating tubers with 10 kg of manure per plant can produce larger tubers, reaching 8 kg per tuber with a harvest period of 12 months, especially for yams and asiatic bitter yam. Applying a higher dose of manure will result in a higher yield of sweet potatoes, resulting in a higher yield. According to Suleman (2021) [8], manure application significantly impacts tuber weight per plant. A treatment with 4 tons of manure per hectare yielded tubers of 254.51 grams per plant and 14.54 tons per hectare. However, without manure application, tubers only weighed 96.31 grams per plant and 5.5 tons per hectare. Applying manure increases the availability of P, Ca, and CEC on marginal land, increasing the soil's water holding capacity, organic carbon content, infiltration, and improving aeration, allowing for more flexible tuber development.

The harvest time for each tuber varies depending on the farmer's needs. When farmers need tubers more quickly, they are harvested earlier, risking a smaller tuber weight. Cassava, yam, and asiatic bitter yam can be harvested as early as 3 months, and cassava, yam, and asiatic bitter yam can be harvested up to 12 months. Taro tubers cannot be harvested more than 6 months after they are harvested. If they are older than 6 months, the tubers in the soil will rot and cannot be harvested. Overall, tuber cultivation activities in each area in Waru District have similar and relatively simple cultivation patterns. This is due to the influence of climatic conditions that require waiting for the rainy season to begin cultivation. However, despite the simple and suboptimal cultivation patterns, farmers consistently cultivate tubers every season to provide a reserve food stock in addition to their main food, namely rice, and to process the harvest and sell it to the local market. Overall, this study shows that tuber production in Waru District is linked to local potential that has not been comprehensively documented. The existence of twelve types of tubers, with cassava, taro, and yams as the dominant commodities, shows that tubers still play an important role in local food needs even though they are cultivated using relatively simple patterns with minimal inputs, as can be seen from the distribution of production and cultivation patterns. Differences in production quantities between types and between regions indicate that tuber production is greatly influenced by the number of plants, planting patterns, and intensity of care. This diversity of tubers has the potential to be further developed as local foods and in supporting food diversification.

4. Conclusion

Tubers production in Waru District, Pamekasan Regency, shows significant potential for the availability of local food crops that can be utilized for local food diversification needs. There are twelve types of tubers with a relatively even distribution, although production levels and cultivation intensity vary. Cassava, blue taro, and yams are the main commodities most cultivated by farmers, especially cassava, with a total production of 251 quintals each season. The tuber cultivation pattern by farmers in Waru District is still simple and not optimal, but it has great potential to be developed as a source of local food crops and can support food diversification.

5. Recommendation

This study recommends the need for support from the local government, particularly the Pamekasan Regency Agriculture Office, in developing tuber cultivation, providing superior seeds, increasing farmer knowledge through education and counseling, expanding market access, and implementing agricultural technology. Furthermore, diversification of processed tuber food products needs to be developed to increase the added value of various types of local tubers and expand market opportunities, thereby improving the welfare of the local community. Regular mapping and documentation of tuber potential is also needed as a basis for formulating government policies regarding local food. Further research is recommended to examine several other aspects, such as economic aspects, nutritional content, and the effectiveness of tuber food diversification programs in the long term.

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