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Ethnobotany of cassava (*Manihot esculenta*) in the traditional peri-urban Sundanese community of Cireundeu Hamlet, Cimahi City, West Java, Indonesia

BUDI IRAWAN[1,♥], KARINA MAHESWARI SAFIRA[1], ANNISA[1], ENENG NUNUZ ROHMATULLAYALY[1], MUHAMMAD IHSAN[1], SURYANA[1], JOHAN ISKANDAR[1], BUDIAWATI S. ISKANDAR[2]

[1]Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Padjadjaran. Jl. Raya Bandung-Sumedang Km 21, Jatinangor, Sumedang 45363, West Java, Indonesia. Tel./fax.: +62-22-7797712, ♥email: budi.irawan@unpad.ac.id

[2]Department of Anthropology, Faculty of Social and Political Science, Universitas Padjadjaran. Jl. Raya Bandung-Sumedang Km 21, Jatinangor, Sumedang 45363, West Java, Indonesia

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Abstract. *Irawan B, Safira KM, Annisa, Rohmatullayaly EN, Ihsan M, Suryana, Iskandar J, Iskandar BS. 2024. Ethnobotany of cassava (*Manihot esculenta*) in the traditional peri-urban Sundanese community of Cireundeu Hamlet, Cimahi City, West Java, Indonesia. Biodiversitas 25: 116-128.* The community of Cireundeu Hamlet is one of the Sundanese traditional communities that still maintain wisdom in processing and using cassava (*Manihot esculenta* Crantz) as staple food (*rasi*) and foodstuff. Many landraces of cassava have the potential to develop into superior varieties, and research is necessary to make cassava a year-round food. The aim of this study is to elucidate the ethnobotanical knowledge of the rural Sundanese community on cassava, namely on various landraces and their folk classification, traditional farming management, and uses. Based on a case study of the traditional people in a peri-urban area of Cireundeu Hamlet, Cimahi City, West Java, Indonesia, mixed methods, i.e., qualitative and quantitative, were used in this study. There are seven landraces of cassava used as foodstuff that are traditionally managed by the Cireundeu people, including *sampeu apuy*, *sampeu bodas*, *sampeu gambir lembang*, *sampeu garnawis*, *sampeu hideung*, *sampeu karihkil*, and *sampeu mentega*. Based on Relative Frequency of Citation, the highest values are *sampeu bodas* (0.96) and *sampeu garnawis* (0.93). These cassava landraces can be distinguished by the Cireundeu people based on characteristics of petiole color, stem color, apical leaf color, leaf color, and taste of the tubers. Based on folk taxonomy, cassava is classified into five levels: level 0 (unique beginner), known as *tutuwuhan* and *pepelakan* (plants); level 1 (Life form) known as *beubeutian* (tubers); level 2 (generic) known as *sampeu karet* and *sampeu***,** a genus from *Manihot esculenta*; level 3 (species) known as *sampeu* (sweet-cassava, *Manihot esculenta* Crantz) and *sampeu karet* (bitter cassava, *M. carthagenensis* subsp. *glaziovii*); and level 4 (specific). The processing and use of cassava are carried out both in traditional and modern ways, including using apical leaves as *lalab* or boiled vegetables and using the roots as the basic ingredients for making *rasi* (*sangueun*), tapioca flour, and snacks.

Keywords: Cassava, folk taxonomy, foodstuff, local knowledge, staple food

INTRODUCTION

On the basis of ethnobiological perspective, it has been known that there is a strong relation between cultural diversity and biological diversity, which has formed the biocultural system jointly shaped by biocultural and cultural dynamics (Maffi and Dilts 2014; Seele et al. 2019; Franco 2022; Iskandar and Iskandar 2023a). Traditionally, some local communities in Indonesia used various distinctive local staple foods, such as sago, corn, cassava, and sweet potato (Nurfitriani and Hindersah 2021), but corn, cassava, sweet potato are native to South America, they are not local, but now naturalized. They adapted to local ecological conditions. Nowadays, however, rice is the main staple food for most households in Indonesia (Hafizah et al. 2020; Adiputra et al. 2021; Kartika and Fajri 2021; Maman et al. 2021; Mardiharini et al. 2023). Rice has been perceived by the rural people not only as an important main staple food, but also as a symbol of social status. In addition, the national food security program in Indonesia prioritizes increasing rice production rather than various other types of non-rice food. In the early 1970s, for example, the Indonesian government made efforts to modernize rice farming businesses through the Green Revolution (Iskandar et al. 2023a). The government has also been trying to increase rice production by creating new rice fields. As a result, nowadays, Eastern Indonesian people, including Maluku, Papua, and Eastern Nusa Tenggara, predominantly consume rice instead of local foods such as sago, cassava, and sweet potato (Nurfitriani and Hindersah 2021).

Like most of the Sundanese communities of West Java, the traditional communities living in Cireundeu Hamlet, Cimahi Peri-urban, West Java, have a tradition of consuming cassava rice instead of rice, called *rasi***,** which means *beras singkong* (cassava rice) (Kartika and Fajri 2021). For the Cireundeu people, planting and consuming cassava have been practiced for a long time, this has been done since 1924 for generations. This major dietary change occurred in 1918 when there was a rice field drought (Tramontane 2018). Since traditionally, cassava (*Manihot esculenta* Crantz) has been considered a main staple, it has been farmed and utilized (praxis) based on local knowledge

(corpus) and belief or cosmos (Iskandar et al. 2023b). Moreover, cassava has an important function not only as a main staple food, but also as a cultural identity of Cireundeu people (Laksono 2021; Ellen et al. 2012; Ellen and Soselisa 2012). Therefore, an ethnobotanical study on cassava among the rural people of Cireundeu is considered very important. Ethnobotany may be defined as the study of human interaction with plants, and it is relevant to many global concerns including food security, climate change, conservation biology, and human health (Ashebo 2019).

Although the cassava plant (*Manihot esculenta* Crantz) originally comes from the lowlands of South America (Ellen and Soselisa 2012), the plant was cultivated in western Java in the early 19th century (Mulyanto 2021). The indigenous people of Cireundeu Hamlet initially used cassava as a main staple food. Historically the reason for switching to cassava occurred when there was a shortage of food, especially rice, during the Dutch colonial period (Logayah et al. 2021). The cassava has been farmed and used by the Cireundeu people since 1924 with their local knowledge and beliefs (Iskandar et al. 2023a).

Studies on Cireundeu cassava have been carried out by various researchers, including on the tradition of eating cassava rice among the Cireundeu people (Nanda et al. 2019) the ethno-agricultural aspects of Cireundeu's traditional community (Primasongko and Raihandhany 2022) the geographical factors that influence the Cireundeu people to consume cassava as a main staple food (Maryani 2022) the cultural value of cassava food as an attraction for tourist visiting the Cireundeu Traditional Village (Kartika and Fajri 2021; Priyanto and Desmafianti 2023) the tradition of cassava consumption of the Cireundeu people and the food security of the village community (Logayah et al. 2021) and various factors that may determine why the Cireundeu people are consuming the cassava as a main staple food (Adiputra et al. 2021). Local knowledge of the community in utilizing cassava has been widely studied, but the study of folk taxonomy of cassava is currently not much studied, especially in Java. The indigenous people of Cireundeu have knowledge in characterizing, identifying, and classifying several variations of cassava types that exist in their environment. In addition, people use cassava as a staple food source known as *rasi* (rice from cassava). This makes the knowledge of the indigenous people of Cireundeu related to cassava has a unique and important to be studied.

The aim of this study is to elucidate the ethnobotanical knowledge of the rural Sundanese community on cassava (*M. esculenta*), based on a case study of the traditional people in a peri-urban area of Cireundeu Hamlet, Cimahi City, West Java, Indonesia.

MATERIALS AND METHODS

Study area

This study was conducted in Cireundeu Hamlet, Leuwigajah Village, Cimahi City, West Java Province, Indonesia. Geographically, it is located at 6°54'51.7" S, 107°31'22.2" E (Figure 1). The Cireundeu people are one of traditional Sundanese people of West Java occupying a hamlet of Cimahi Peri-urban. Based on the Profile of Cireundeu hamlet's statistical data (2022), the population of Cireundeu Hamlet was 114 at the time of the study, consisting of 17 children and 97 adults (54 men and 60 women), representing 56 households. The main employment of Cireundeu people is as farmers. They mainly farm cassava in dry fields (*kebon*). Some people of Cireundeu are involved in various off-farm jobs, including as freelance day laborers, private employees, entrepreneurs, teachers, students, traders, and civil servants. They have several types of agroecosystems, including homegardens, vegetable gardens, and mixed gardens. The rural people of Cireundeu also rear livestock, including cows, sheep, and local chickens.

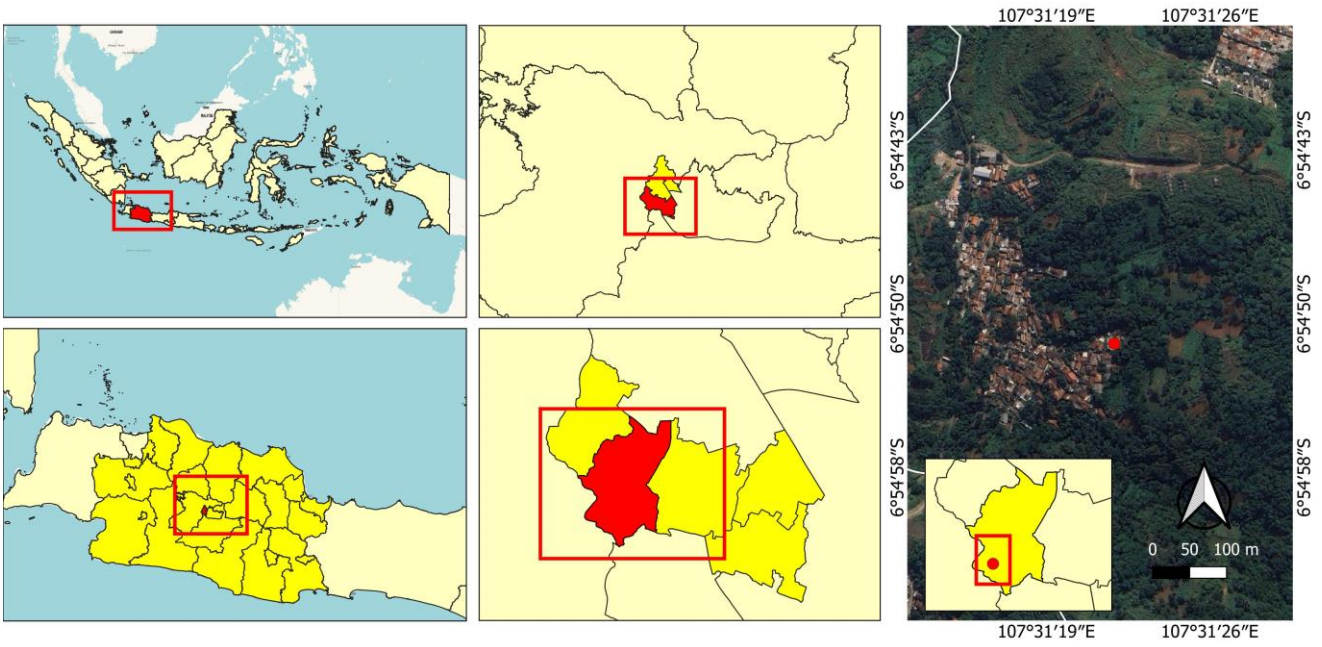

Figure 1. Location of study site, Cireundeu Hamlet, Cimahi City, West Java, Indonesia

The Cireundeu people are dissimilar from other rural Sundanese people in that Cireundeu people have the tradition to consume cassava as a main staple food instead of rice. The Cireundeu people have tried to pass down their culture as inherited from one generation to another by adapting to the local environment and living in harmony with it (i.e., the dry land of upland areas around the Cireundeu Hamlet are restricted to rice cultivation without irrigation). The rural people of Cireundeu Hamlet live by guidelines reflective of the limitations of the local ecosystem. They have a custom that is expressed in proverbs, as follows (Primasongko and Raihandhany 2022):

"*Teu nyawah asal boga paré*

Do not get involved in rice farming field as long as you have rice

Teu boga paré asal boga béas

Do not have un-husked rice (*paré*) as long as you have processed rice (*béas*)

Teu boga béas asal bisa nyangu

Do not have processed rice as long as you can cook rice

Teu nyangu asal bisa dahar

Do not cook rice as long as you can eat it

Teu dahar asal kuat"

Do not eat as long as you are strong

Procedures

As is common in ethnobotanical research, the first approach for this research was by paying visits to establish a rapport with the community and seek its consent. Our method of rapport building was aimed at gaining the trust of the community members. Thus, it was important to visit all the households to introduce researcher members and ask informal permission for conducting research, to find competent informants, and to organize a general and informal meeting to explain the study and the processes of data collection. In addition, in terms of the formal permission of conducting the fieldwork, Padjadjaran University made an introduction letter that was submitted by the researcher to the formal hamlet leader as well as the village leader.

The research used mixed methods, qualitative and quantitative, with an ethnobotanical approach (Albuquerque et al. 2014; Iskandar 2018). Before undertaking the intensive fieldwork among the local community of Caraunda, the researchers conducted a general primary study to obtain the local ecological and socio-economic conditions of the local community. While, the intensive research activities, including general observations, participant observations, semi-structured interviews, and structured interviews, were employed. Observation was undertaken to learn about local conditions, including the organization of the hamlet, agroecosystem types, and the people's activities relating to cassava farming, and the processing and use of cassava. To enable participant observation, the researchers lived with informants and shared with them many aspects of their lives, particularly in relation to cassava, and were actively involved in some activities such as harvesting, processing, and use of cassava. Semi-structured interviews were carried out with 15 key informants that were selected based on their profound knowledge of cassava. The key informants were purposively selected based on information from both the local informal and informal leaders. They were considered as local experts who have local knowledge on cassava. During the semi-structured interviews, informants gave extensive responses to a series of general questions, some of which were prepared in advance as an interview schedule and some of which arose naturally during the course of the conversation. The informants of this study were informal leaders, older male and female farmers, and local food makers who use processed cassava. Structured interviews were undertaken with other respondents by using questionnaires consisting of a series of specific, short questions asked verbally. Each question was asked in the same way of each respondent. The structured interviews aimed to obtain various answers from the respondents based on the questionnaire submitted to each respondent so that the percentage of respondents' answers to the total respondents as representative of the community can be calculated (Creswell 2014). The total number of respondents was 56 individuals. There were 31 men and 25 women with an age range of 20-40 years, as many as six people; ages 41-60, as many as 28 people; and ages 61-80, as many as 22 people, consisting of all heads of household from the Cireundeu Hamlet.

Data analysis

Qualitative data were analyzed in several stages, namely cross-checking, summarizing, and synthesizing, and were then made into a narrative account (Iskandar 2018). Cross-checking was carried out to validate data by means of triangulation, cross-checking data obtained from the key informants, and cross-checking data from the key informants with data from observations (Newing et al. 2011). Meanwhile, quantitative data were analyzed using statistics, such as calculating the frequency of respondents' answers to each question, using the following formula (Iskandar 2018):

$$P = \frac{f}{N} \, x \, 100\%$$

Where:

P : percentage of total respondents

f : frequency of respondent's answer

N : total respondents

Relative Frequency of Citation (RFC) is a value that describes the local knowledge of the community in revealing a useful type of cassava variety (cassava landrace). The RFC values range from 0 to 1. A value of 0 is obtained if no respondent mentions a cassava landrace that is considered useful, and a value of 1 is retrieved if all respondents mentioned and agreed on a cassava landrace that is considered useful. The formula used is as follows (Syahputra et al. 2021):

$$RFC = \frac{FC}{N}$$

Where:

FC : the number of respondents who mentioned a useful cassava landrace

N : number of respondents

RESULTS AND DISCUSSION

Folk taxonomy and cassava landraces

The Cireundeu people have knowledge of plant classification in four levels, namely level 0 (unique beginner), level 1 (life form), level 3 (generic), and level 4 (varietal) (Table 1).

Table 1 shows that the Cireundeu people use *tutuwuhan* and *sasatoan* as 'Unique Beginners' for plants and animals, respectively. They use the term *tutuwuhan* as unique beginner for plants in biological sense. This term is derived from partial reduplication of the first syllable of the word *tuwuh* attached with the suffix -an. As etymon, *tuwuh* itself means 'growth from the ground,' so that *tutuwuhan* can be defined as 'all that growth from the ground,' which refer to plant. There are four terms that are representing four life forms under *tutuwuhan* category, namely *tatangkalan* (trees) and *rungkun* (shrubs), *aareuyan* (lianas), *jujukutan* (grases), and *beubeutian* (tubers). *Beubeutian* is derived from the word *beuti* (Sundanese), which in Indonesian means tubers (Muzzammil 2021). *Beubeutian* consist of *sampeu* (*Manihot esculenta*), *boléd* or *huwi* (*Ipomea batatas*), and *taleus* (*Colocasia esculenta*). Based on the interviews with key informants, a total of seven cassava landraces were identified and still exist in Cireundeu hamlet (Table 2). We use the word 'landrace' (Ellen et al. 2012; Iskandar and Iskandar 2021) to distinguish local cassava variations based on the knowledge of the Cireundeu people, adding a Western botanical sense. The landrace is different from the botanical taxon in that it is based on a category for subdivision of ancestral plant varieties in the Western taxonomic sense. Based on scientific botanical knowledge, the cassava belongs to the Euphorbiaceae family. The cassava plant itself is divided into three subspecies, including *Manihot esculenta* subsp. *peruviana*, *M. esculenta* subsp. *flabellifolia*, and *M. esculenta* subsp. *esculenta*. In this study, all landraces of cassava in Cireundeu belong to *M. esculenta* subsp. *esculenta.*

Table 1. Folk Taxonomy of cassava plant according to the Cireundeu people (emic) and botanical scientific (ethic)

Level	Class based on botanical scientific (ethic view)	Class based on local terms of Cireundeu people (emic view)	Rank of botanical scientific*)
0	Plant/crop	*Tutuwuhan/Pepelakan*	Unique beginner
1	Tuber	*Beubeutian*	Life form
2	Kind of cassava	*Sampeu karet* *Sampeu*	Generic
3	Cassava	*Sampeu*	Species
4	Cassava landraces	*Sampeu Apuy* *Sampeu Bodas* *Sampeu Gambir Lembang* *Sampeu Garnawis* *Sampeu Hideung* *Sampeu Karihkil* *Sampeu Mentega*	Specific/ varietal

Note: *) (Iskandar 2018)

Table 2. Various cassava landraces according to the Cireundeu people, Cimahi City, West Java, Indonesia

Landraces	Meaning	Folk taxonomy				
		Apical buds color	Leaf color	Petiole color	Stem color	Tuber's taste
Sampeu apuy	*Apuy: api*, fire, ancient language, derived from *parupuyan*, meaning fireplace. Tuber is good for grilling (*dibakar*) and is tender	Red	Green	Red	Red	Sweet
Sampeu bodas	*Bodas*: white, the tuber color is white (*bodas*)	White	White	White	White	Sweet
Sampeu gambir lembang	*Gambir*: name of plant, species of *Uncaria gambir*, the leaves are usually used for betel chewing, mixed with betle leaves, which have a brownish color. *Lembang*: Location name in sub-urban area of Bandung, West Java. Stem color is reddish brown, from Lembang, West Java.	Red	Green	Red	Reddish brown	Sweet
Sampeu garnawis	*Garnawis*: individual people who introduced cassava variety (cassava landraces)	Light green	Light green	Reddish green	Pseudo brown	Sweet
Sampeu hideung	*Hideung*: black, apical bud, leaf, petiole, and stem have black color	Blackish red	Blackish green	Red black	Blackish red	Sweet
Sampeu karihkil	*Karikil* or *karihkil*: small stone with dark blackish color. Apical, bud, and stem have blackish color	Black	Dark green blackish	Black	Black	Bitter
Sampeu mantega	*Mentega*: butter, the tuber is smooth and has color like butter (*mentega*)	Green	Green white	Yellow	Yellow	Sweet
*Sampeu karet**	*Karet:* Rubber, the tuber is bitter and has color like butter	-	-	-	-	-

Note: *In the past this species was recorded; nowadays, however, it has rarely been planted in the community and is considered locally extirpated

Based on Table 1, at level 2, kind of cassava, two landrace groups, *sampeu karet* (*Manihot carthagenensis* subsp. *glaziovii*) and regular *sampeu* (*M. esculenta*) with various landraces are identified by Cireundeu people. *Sampeu karet* is the kind that grows without cultivation in the Cireundeu Hamlet area. It can produce yams weighing almost four times as much as cultivated varieties but is not consumed by the community because it is toxic. According to Hapsari and Pramashinta (2013), *sampeu karet* is comprised of cassava landraces that contain cyanide acid (HCN), so it is not traded or used by the Cireundeu people.

At level 4, Cireundeu people classify folk varieties (landraces) of cassava. *Sampeu bodas* and *sampeu garnawis* are most often used to make tapioca flour (*aci*). Based on historical ecology or environmental ecology, in the past, the best used cassava landrace was of *sampeu karihkil* because it produced more tapioca flour than *sampeu bodas* and *sampeu garnawis*. In addition, the tuber of *sampeu karihkil* had never been serious attacked by pests, including wild pigs and monkeys. Nowadays, however, *sampeu karihkil* is considered bitter or toxic. Moreover, in 2005, most of the *sampeu karihkil* in Cireundeu Hamlet died due to an outbreak of rot. This plague has no cause known to the Cieundeu people, who replaced *sampeu karihkil* with *sampeu bodas* and *sampeu garnawis* to be used as constellations and tapioca flour. The cassava landraces of *sampeu apuy* and *sampeu mentega***,** less well-known and rarely used by the Cireundeu people, are not found in their fields. Based on the local people's knowledge and perception (emic's views) from interviews with local people, it is known that the seven landraces of cassava of the Cireundeu people were obtained by the local community based on hereditary knowledge from both parents and elders. In other words, the local knowledge of the Cireundeu people on cassava landraces has been obtained based on the result of inheritance from one generation to another by being transmitted orally using the mother tongue, the Sundanese language. Thus, the local people of Cireundeu, like those in other communities, have botanical knowledge of various landraces of cassava beyond what they use (Iskandar and Iskandar 2018). Based on the Sundanese local language, cassava is traditionally called as *sampeu* or *singkong* in Indonesian language. Moreover, various cassava landraces (varieties) can be dived into seven landraces, including *sampeu apuy***,** *sampeu bodas*, *sampeu gambir lembang* (see Tables 1 and 2). Unlike the local knowledge, the cassava (*sampeu),* based on biological taxonomy, as analog with genus, consisting of varieties or may be categorized as species or subspecies (Table 1). This is based on vernacular names of cassava that are predominated as semantic and morphosyntactic binomial. Thus, as can be seen from Table 2, seven cassava landraces are distinguished and labeled according to morphological and culinary factors. The morphological factors are marked by the various colors of apical bud, leaf, petiole, and stem. Based on culinary factors, seven cassava landraces can be divided in two categories, namely sweet and bitter cassava.

The total of seven cassava landraces recorded in Cireundeu is lower than what is recorded by the Baduy traditional community of Kanekes Village, Lebak District, Banten Province (Hidayati et al. 2017). According to the Sundanese traditional people of Baduy, cassava is traditionally called *dangdeur*. There are nine documented landraces in the Baduy community, namely *dangdeur apu, dangdeur cangkudu, dangdeur karet, dangdeur ketan, dangdeur koneng, dangdeur lampeneng, dangdeur mantega, dangdeur nangka*, and *dangdeur roti* (Hidayati et al. 2017). Among them, there are two landraces that have the same name: *dangdeur mentega* and *dangdeur karet***.** The two cassava landraces in Baduy are commonly referred to by Cireundeu people as *sampeu mentega* and *sampeu karet* (Iskandar et al. 2023b).

Unlike both Cireundeu and Baduy, the cassava landraces in rural areas of Eastern Indonesia, such as Nuaulu on the island of Seram and Debut in the Kei Archipelago and Buano, West Seram, were recorded to have a very high diversity. For example, at least 17 cassava landraces were documented in Nuaulu of Seram. Based on the folk taxonomy of Nuaulu, cassava may be classified based on the following characteristics: Leaf size and shape; color and texture of petiole and stem; appearance of root parenchyma, periderm, and cortex; toxicity; taste of both raw root and leaf; the softness or hardness of the root; productivity; maturation time; storability; and cooking time (Ellen and Soselisa 2012). According to Nuaulu people in Ellen and Soselisa (2012), cassava landraces of *Manihot carthagenensis* subsp. *glaziovii* and landraces of *Manihot esculenta* are traditionally called *kasipii somber* and *kasipii***,** respectively. Moreover, *kasipii* may be divided into two groups, namely *kasipii putie* and the *posteli group*. The *Kasipii putie* group consists of nine landraces, namely *k. wanate, k. wasaena, k. kanapua, k. kasitena, k. unuhutu, k. sinsinte, k. buna, k. hatametene,* and *k. msinae***.** The *posteli* group, on the other hand, comprises *p. upone* and *p. putie***.** In the past, the eastern parts of Indonesia, including Maluku and Papua, consumed their staple food, including cassava. Thus, these cassava landraces have been predominantly found in the eastern part of Indonesia. Because the cassava is easily grown, even in marginal lands, including dry land and non-fertile land, easy grow and no need intensive farming inputs. As a result, it has built a biocultural system that has been jointly shaped by biological and cultural dynamics, which has a strong relationship between culture, linguistics and biodiversity (Ellen et al. 2012; Ellen and Soselisa 2012; Maffi and Dith 2014; Iskandar and Iskandar 2023a).

Characteristics based on emic views (emic character)

In general, the Cireundeu people distinguish each landrace of cassava by looking at its morphological characteristics. Based on the results of the questionnaire, respondents stated that they could distinguish cassava from the color of the stem (22.4%), the color of the petiole (45.8%), the color of the leaves (13.1%), the color of the leaf tips (14.0%), and the taste of tubers (4.7%). The details of the classification of the characteristics of the types of cassava based on the knowledge of the Cireundeu Indigenous people are provided in Table 2. Based on the ethical view, five of the seven varieties of cassava found in

Cireundeu show diversity in the characters of apical buds (leaf tops), leaves, petioles, and stems. Research conducted by Santos et al. (2020) in Pernambuco, Northeast Brazil, describes how farmers have shown a tendency to classify or separate their varieties of cassava by combining a set of seven different and easily understood morphological characters that are not related to use, instead to the color of the roots, stems and leaves. Similarly, according to Wooding and Payahua (2022), one of the characteristic features of cassava is its phenotypic variation. Although generally grown for starch production, cassava has a high number of varieties when viewed from the color and shape of the leaves, stem morphology, and other characteristics. Wide variations are also found in the tuber, resulting in varying starch productivity. This diversity is an asset for both traditional farmers, who can select cultivars that suit local environmental conditions, and industrial farms, which can manipulate certain traits to produce new cultivars. These results lead us to understand that among farmers, the knowledge of cassava diversity is linked to the knowledge of morphological characteristics.

Apical buds (leaf tops)

Based on observations, the leaves of *sampeu bodas* have a light green color, *sampeu gambir lembang* has a dark green color, *sampeu garnawis* has a greenish-purple color, and *sampeu hideung* and *sampeu karihkil* have a purple color (Figure 2). According to Fukuda et al. (2010), there are four color variations of cassava apical buds, including light green, dark green, greenish purple, and purple. These variations of cassava are supported by similar findings in eastern Indonesia by Ellen and Soselisa (2012).

Leaf

Based on observations, there are differences in leaf color, including *sampeu bodas, sampeu garnawis,* and *sampeu karihkil* have a light green color. while *sampeu gambir lembang* and *sampeu hideung* are dark green (Figure 3). According to Fukuda et al. (2010), there are four color variations of cassava plant leaves, including light green, dark green, purple green, and purple. Based on the shape of the middle lobe of the leaf, *sampeu bodas, garnawis,* and *karihkil* have an elliptical lanceolate shape. meanwhile, *sampeu gambir lembang* and *hideung* are lancet-shaped. There are 10 variations of the shape of the middle lobe of cassava leaves, including ovoid, elliptic-lanceolate, obovate-lanceolate, oblong-lanceolate, lanceolate, straight or linear, pandurate, linear-pyramidal, linear-pandurate, and linear-hostatilobalate (Fukuda et al. 2010). Based on the edges of the lobes, cassava plants can be distinguished into smooth and curvy. *Sampeu bodas, garnawis, hideung,* and *karihkil* have smooth lobe edges, while *sampeu gambir lembang* has curvy types. The leaf veins of *sampeu bodas, garnawis,* and *karihkil* have green characteristics. Meanwhile, *sampeu gambir lembang* and *hideung* have a reddish green color on less than half of the lobes.

There are four variations of leaf vein color, including green, reddish green on less than half of the lobes, reddish green more than half of the lobes, and all red. Based on the description of Fukuda et al. (2010), variations in the number of cassava leaf lobes include 3, 5, 7, 9, and 11. The number of cassava leaf lobes depends on the age of the plant and variety. This description is similar to the outcome of research by Chiwona-Karltun et al. (2015) in southeastern Africa, and by Wooding and Payahua (2022) in the Peruvian Amazon.

Petiole

Cassava leaf stalks have a length of 5-30 cm. There are four variations in leaf stalk orientation, namely: tilted up, horizontal, slanted down, and irregular. Based on the orientation of the petiole, all types in this study are horizontal. Meanwhile, the color of the petioles can be distinguished, for example reddish green of *sampeu bodas*, red of *sampeu gambir lembang*, greenish red for both *sampeu garnawis* and *karihkil*, and purple of *sampeu hideung* (Figure 4). There are six variations in the color of the petiole, including yellowish green, green, reddish green, greenish red, red, and purple (Fukuda et al. 2010). According to Hartanti et al. (2020), variations in the character of cassava leaf stalks are found in the color of the upper stem stalks and the color of the lower stem petioles. Generally, the color of the upper petiole on the upper stem is different from the color of the petiole on the other parts. This is because the leaf stalks on the upper stem are immature, causing discoloration. The varying color of the petiole can be used as a differentiator between genotypes (Laila et al. 2015).

Stem

The outer stems of *sampeu bodas, gambir lembang,* and *hideung* have a silver color, while *sampeu garnawis* and *karihkil* are dark brown (Figure 5). There are seven color variations of the outer stem of the cassava plant, including orange, yellowish green, gold, light brown, silver, gray, and dark brown (Fukuda et al. 2010). This description is also the same as in the study by Chiwona-Karltun et al. (2015). Based on the spacing of leaf scars, *sampeu bodas, gambir lembang*, and *garnawis* are short (≤8 cm), while *sampeu hideung* and *karihkil* are medium in size (8-15 cm). According to descriptions of Fukuda et al. (2010), the spacing of cassava plant leaf scars can be short (≤8 cm), medium (8-15 cm), or long (≥15 cm). There are two growth forms of the stem, straight and zigzag. In this study, all varieties of cassava have straight stem growth, similar to a study conducted by Wooding and Payahua (2022) on tuber phenotypes, including mass, number, length, and cyanide content, along with crown width and stem diameter.

Cultivation, utilization, and processing of cassava

Cultivation

The management of cassava farming in the agroecosystem of Cireundeu comprises land preparation, propagation preparation, planting, care and maintenance, and harvest.

Figure 2. Cassava plants based on leaf tops, description A. *Sampeu bodas*, B. *Sampeu gambir lembang*, C. *Sampeu garnawis*, D. *Sampeu hideung*, and E. *Sampeu karihkil*

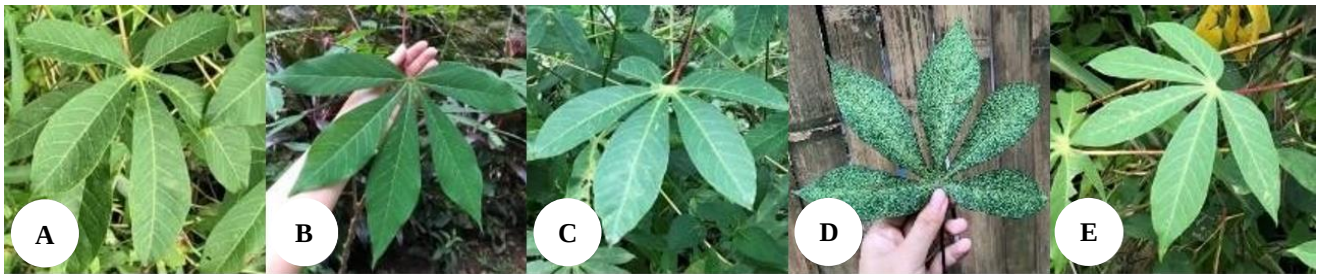

Figure 3. Cassava plants based on leaves, description: A. *Sampeu bodas*, B. *Sampeu gambir lembang*, C. *Sampeu garnawis*, D. *Sampeu hideung*, and E. *Sampeu karihkil*

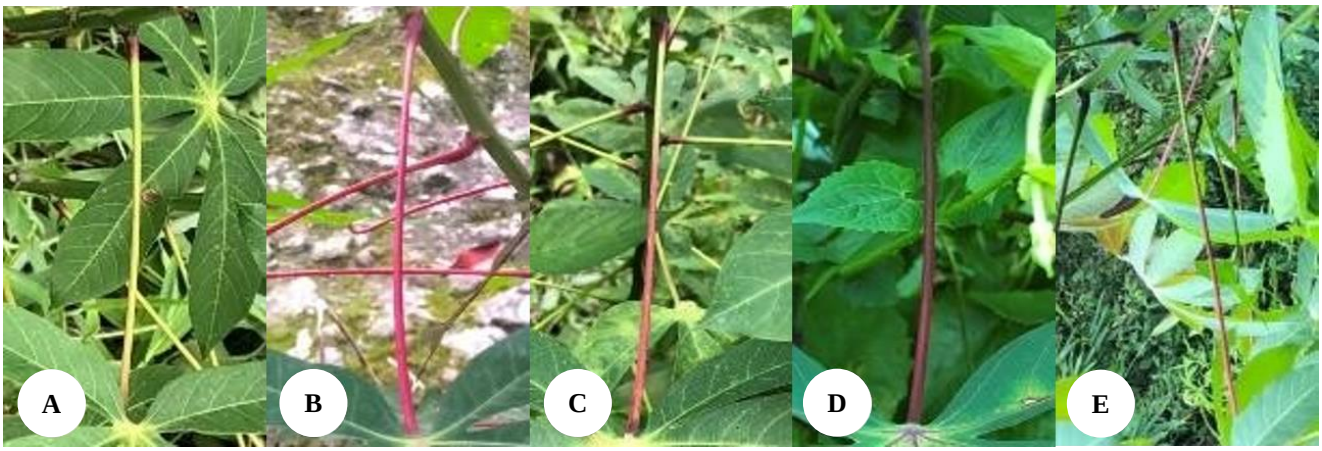

Figure 4. Cassava plants based on petiole, description: A. *Sampeu bodas*, B. *Sampeu gambir lembang*, C. *Sampeu garnawis*, D. *Sampeu hideung*, and E. *sampeu karihkil*

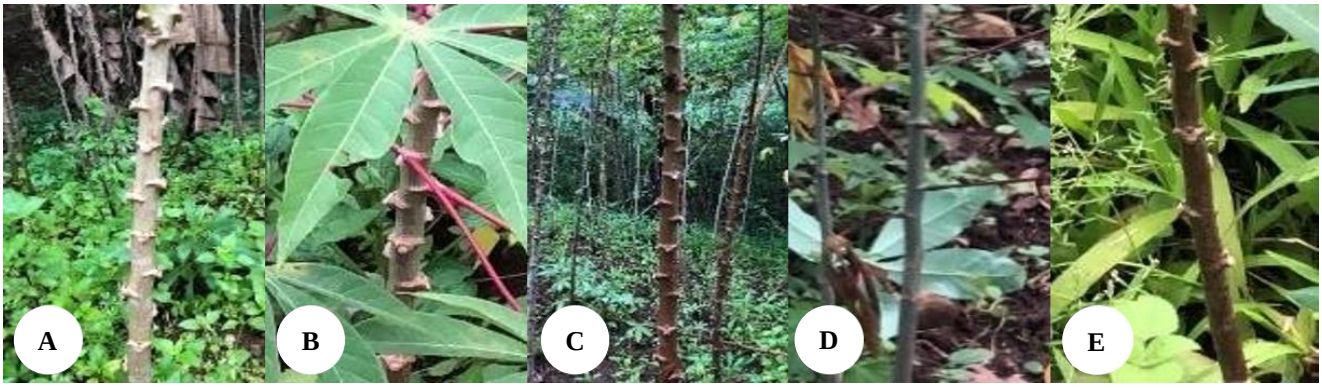

Figure 5. Cassava plants based on stem, description: A. *Sampeu bodas*, B. *Sampeu gambir lembang*, C. *Sampeu garnawis*, D. *Sampeu hideung*, and E. *Sampeu karihkil*

Land preparation

The land that will be planted with cassava in the Cireundeu Traditional Village is divided into two: land that has just been harvested with good results and land that has just been cleared (after fallow). The activity of clearing begins with *mitembeyan* (prayer before starting a job), then land preparation begins by loosening the soil with hoes, which can be done in two ways, by leaving it a few days before planting or by adding manure and planting after a few days.

Propagation preparation

Cassava is cultivated with stem cuttings from plants that are usually 10-12 months old. The cassava stem chosen for is the middle to the bottom stem, which is cut to a length of 20 cm with the lower end of the cutting tapered. Seedlings of cassava plant cuttings can be cut flat or obliquely. Oblique cuts have the advantage of a wider cross-section making it is possible for many roots to grow (Utama and Rukismono 2018). This method is the same as the one described by Santos et al. (2020).

Planting

In the Cireundeu Traditional Village, cassava can be planted at any time and there is no simultaneous planting season. Land preparation and planting are carried out in turns. Thus, cassava is always available every month, ready to be harvested and processed. Farmers usually rely on the weather during the cassava planting process. According to the key informants, cassava should be planted at the start of the rainy season because when it is 0-5 months old, cassava needs water and is vulnerable when the weather is dry (Utama and Rukismono 2018). The method of planting cassava is to bury the lower end of the cuttings in the soil to a depth of 10 cm or 1/3 of the length of the cuttings with the tops facing upwards so that the cassava does not grow upside down. The soil consists of latosol and red and yellow podzolic soil types. Coupled with the hilly topography around the village, the soil types are difficult for the cultivation of rice. Fortunately, some cassava cultivars can thrive on this type of land, such as *sampeu karihkil*. However, other sources mention that only *sampeu garnawis* is used as a source of stifle food (Primasongko and Raihandhany 2022).

Care and maintenance

Based on the results of the questionnaire, the people of Cireundeu know the care and maintenance of cassava plants to include getting rid of weeds (48.7%) and providing manure (38.3%) and urea fertilizer (13.0%). According to the key informants, after being planted and until harvesting, cassava is weeded (*ngored*) three times. If the soil is fertile, plants are usually provided manure and not any additional urea fertilizer.

Respondents to the questionnaire stated that cassava pests include *kuuk* (57.1%), rats (22.0%), porcupines (*Hystrix* sp.) (12.1%), and *rinjuh* (8.8%). *Uret* beetle pests (*Leucopholis rorida*) or *kuuk*, the larval phase of the beetle, is a seasonal pest. Cassava plants that are affected by *kuuk* will die at a young age because the roots, stems, and tubers are damaged (Subekti 2011). Field mice (*Rattus exulans*) and porcupines usually gnaw cassava tubers. While the newly planted seeds, termites (*Captotermes* sp.) will gnaw and eat the cuttings so that the growth of cassava plants is disrupted, and in some cases, the plant even dies. In controlling pests such as field rats, porcupines, and monkeys, people do not use exterminators but leave them alone. Except for *kuuk*, if the cassava plant grows abnormally, such as yellowing of the leaves, farmers usually remove the pest manually by digging the ground.

Harvest

The cassava harvesting process is done manually. Cassava plants can generally be harvested at the age of one year from the start of planting. Characteristics of cassava plants that are ready for harvest are leaves that look a little wilted due to falling out and cassava tubers that look big (Utama and Rukismono 2018). Cassava can be harvested several times a year. Therefore, there will not be a large harvest because the harvest time in each plantation does not occur at the same time. Due to the implementation of this crop rotation system, the Cireundeu Traditional Village can meet the basic needs of the villager per year (Primasongko and Raihandhany 2022).

Conservation

Cassava is traditionally cultivated by vegetative propagation. Therefore, during harvesting, some plants are separated and stored to plant next year. They are usually placed under perennial trees that have dense leaves so they do not dry out in the sun. In addition, they are kept near water so that they do not dry out.

Utilization and processing

Based on the interview results, all types of cassava can be processed into food. People usually use the organ parts of cassava leaf tops and tubers as food. The explanation is as follows:

Leaf tops

Cassava leaf tops are widely used by people in Indonesia as a food ingredient because they are delicious, cheap, easy to get, and healthy. Based on the results of the questionnaire, the Cireundeu Indigenous people use cassava leaves as a salad (41.2%), vegetable cakes (21.3%), ointment (19.1%), and *buntil* (18.4%).

Lalab is from the tops of cassava leaves, consumed by boiling or steaming it. The Cireundeu people are smilar to other rural Sundanese communities in general, including the Cijambu rural community of Cijambu Village and Tanjungsari Sub-district, Sumedang District, West Java. The cassava has traditionally made various distinctive Sundanese foodstuff, including boiled vegetable *(lalab), sayur/angeun daun sampeu, tumis/oseng daun sampeu*, and *urab daun sampeu* (Iskandar et al. 2023a) (Figure 6).

Sayur perkedel (vegetables cake) is prepared by washing the tops of the leaves, boiling them, and squeezing them to drain the water. They are then mixed with seasoning, salt, flavoring, and eggs. The dough is formed by hand until the surface is round, then fried using hot oil.

Coconut milk and cakes that have been fried before are added, along with stir-fried garlic, shallots, and red chilies.

Urap is made by washing cassava leaves and other fresh vegetables, boiling them, then roughly chopping them. Cayenne pepper, *kencur*, shallots, salt, and flavorings are mashed and added with grated coconut and a little water, then stirred. The top of cassava leaves and other fresh vegetables that have been roughly chopped are added to the spices, sautéed, and drained.

Buntil is processed by washing cassava leaves, boiling, and draining them. Red chilies, shallots, garlic, coriander, *kencur*, and brown sugar are mashed into the leaves. In a separate container, grated young coconut, pickled anchovies, ground spices, and other flavorings are mixed. The dough is placed on the cassava leaves, which have been widened, folded, formed into a round shape, and then tied. Coconut milk, additional ground spices and flavorings, and knotted *buntils* are then put into a pan and cooked until the water has reduced. *Buntil* is then removed and served.

Tubers

Rasi (cassava rice) or *Sangueun* (for cooking) is a food source to replace rice in Cireundeu (Figure 7). The cassava rice expiration period is six months after manufacturing. Based on the results of the questionnaire, people consume *rasi* twice a day (98.2%) or once a day (1.8%). According to the key informants, the advantage of consuming *rasi* is that it is filling, so that twice a day is sufficient for sustenance. *Rasi* is made by peeling cassava, washing it, then grinding (shredding) it using a machine. The grated cassava is squeezed using a *lawon* cloth and given water to secrete its essence. Grated cassava is squeezed with a ratio of 1 (grated cassava): 6 (clean water) five times. The cassava pulp that has been squeezed is placed in a sack so the excess water is squeezed down and the pulp becomes dry. To make it completely dry, the dregs are dried in the sun for two days and ground using a *jubleg* or a more modern sealer. Next, the constellations are sorted by removing the fiber or axis. Cassava rice can be steamed directly by mixing it with water gradually until the rice becomes a coarse grain. It is put into the intake and steamed using a boiler for 20 minutes.

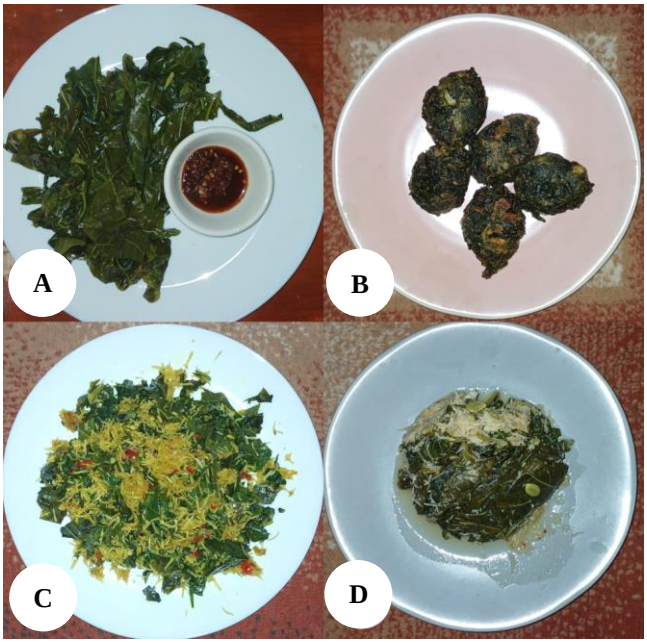

Figure 6. Various food from cassava leaves: A. Lalab, B. Sayur perkedel, C. Urab, D. Buntil

Figure 7. Production process of *rasi* (Cassava rice); A. Peeling and washing, B. Grating and squeezing, C. Drying, D. Shredding and sorting, E. Steaming, F. Ready to eat *rasi*

Tapioca flour (*aci*) is processed by peeling cassava, washing it, then grinding it using a machine. The milled results are then squeezed using a *lawon* cloth and given water to extract the starch. The cassava starch extract is then stored overnight. After settling, the water is removed, then the flour is removed, crushed into coarse lumps, and dried in the sun. Coarse lumps of flour that have been dried in the sun are then ground and sifted to obtain fine flour.

Cassava root is also used as a processed snack product. Based on the results of the questionnaire, processed cassava-based cake products include eggroll (12.7%), cheese sticks (12.7%), spice *opak* (12.0%), *dendeng* (10.9%), onion chips (9, 2%), *cireng* (7.9%), *awug* (7.1%), *peuyeum (tape)* (6.6%), *kcipir* (5.1%), macaroni (4.8%), *saroja* (4.8%), pastels (4.6), and *rangginging* (1.5%). Various products made of cassava, including ingredients and procesess can be seen in Table 3.

Cassava landraces RFC

Based on analysis of the Relative Frequency of Citation (RFC), that is a value that describes the local knowledge of the community in revealing a useful type of cassava variety (cassava landrace). It can be seen that the landrace of cassava that have the highest value are *sampeu bodas* (0.96) and *sampeu garnawis* (0.93) (Table 4).

This means that the two cassava landraces are very often used by the community to fulfill their daily needs, especially as food ingredients for congee and tapioca flour. Those with the lowest scores were *sampeu mentega* (0.25) and *sampeu hideung* (0.21). This means that both cassavas are rarely used and not widely known by the Cireundeu people.

Since the Cireundeu community mainly consumed cassava, particularly in the past, the cassava and the Cireundeu community have formed a biocultural system, that is a very close relationship between the cultural, linguistic and biodiversity of cassava (Bridgewater and Rotherham 2019; Sujarwo et al. 2019; Coe and Gaoue 2020; Axelsson and Franco 2023) . In addition, cassava has become a cultural keystone species in Cireundeu. Cassava has played a role as a source of staple food and high cultural value for the community. The Cireundeu people have been cultivating, conserving, and using cassava based on traditional ecological beliefs (Iskandar and Iskandar 2023). The traditional ecological knowledge of cassava has been transmitted among community members, and inherited from one generation to another. The consummation of the rice cassava (*rasi*) is mainly based traditional belief of the Original Sundanese Religion (*Sunda Wiwitan*). In other words, the behavior of the community in consuming *rasi* as a staple food is mainly determined by the belief. In addition, the sawah is not found in the Cirendeu hamlet. Nowadays, however, some young people have changed to be Muslim and obtained various jobs, including factory employees and working in the construction sector in the adjacent urban areas, including Cimahi and Bandung. In addition, the agricultural development program is emphasized on in enhancing the rice production. While, the non-rice staple foods, including casava has been neglected. At the same time, the various traditional agroforestry, including mixed gardens of the Citarum watershed, have been intensively converted to commercial gardens, including vegetables (Mulyanto 2021). Those factors may cause change the community tradition in consuming cassava. For example, currently, only some local community members, especially the older people of Cireundeu who have still maintain the *Sunda Wiwitan* of the Cireundeu community, usually still consumed cassava as their staple food. Meanwhile, many of the young people and have obtained various jobs are predominantly consumed rice instead of *rasi*. In addition, there are also cassava landraces, such as *sampeu karet,* which is rarely consumed and being locally extinct in Cireundeu. Therefore, based on the biocultural system, the loss of landrace cassava varieties is also a corresponding loss of cultural practices and linguistic elements associated with that species (Axelsson and Franco 2023). For example, currently since the *sampeu karet* has been locally extinct, many young people do not know about the *sampeu karet*. Undoubtedly, impact of loss of species and varieties of crops may also cause the loss of local knowledge or traditional ecological knowledge of those species, and vice versa.

Basically, traditional ecological knowledge (TEK) of community on the casava is not static. It may be changed due to many factors, including a change of the subsense of agriculture to off-farm jobs of the local community, and erosion of the mother language. The mother language is known as main function for transmitting the traditional ecological knowledge of the local community on cassava has been eroded by the intensive use of the national language. The Cireundeu people themselves, in various ways both spontaneously or introduced, have adapted to various ecological-socio-economic changes. For example, in order to attract the Cireundeu's younger generation and other non-Cireundeu people to love with consuming cassava. Nowadays, cassava is not only made of cassava rice (*rasi*) but also various types of modern cakes are also made. Therefore, by adopting innovation through individual agents, the Cireundeu people have tended to be able to control the rate direction of change in a way which has enable sustaining of an essentially traditional ways of life in consuming *rasi* both culturally and ecologically. To sum up, to conserve a variety of local food plants to diversify local food sources to maintain the food security of rural people in Indonesia, in climate change mitigation and adaptation, some efforts are not usual to only protect various local food plants, but it is also important to protect culture and linguistics of local communities (Axelsson and Franco 2023).

Based on the local knowledge of the Cireundeu people, there are seven landraces of cassava as a food ingredient that are traditionally managed by the community, namely *sampeu karihkil, sampeu bodas, sampeu garnawis, sampeu gambir lembang, sampeu apuy, sampeu hideung,* and *sampeu mantega.* The cultivation of cassava plants includes land preparation, propagation preparation, planting, care and maintenance, and harvesting. The use of cassava includes the tops of the leaves as fresh vegetables and the tuber as a basic ingredient for making *rasi* (*sangueun*), tapioca flour, and snacks. There are ways of processing cassava that are still traditional, as well as modern ones.

Table 3. Various foods made by Cireundeu people, including ingredients and the preparation process

Product name	Ingredients	Process
Eggrolls	Eggs, sugar, raisin flour, wheat flour, milk, and butter	Eggrolls are made by washing eggs first. Then, the eggs, sugar, and yeast are mixed, and the raisin flour, wheat flour, milk, and butter are added. Furthermore, it is made into dough, formed, baked, and packaged. Eggroll-making is not a local knowledge of the indigenous people of Cireundeu but the result of training held by the Padjadjaran University in the framework of community service.
Dendeng	Cassava skin, galangal, shallots, and garlic	*Dendeng* is made by washing cassava skin, boiling it, soaking it, and grinding it. The catfish is fileted and ground. Next, the galangal, shallots, and garlic are washed and blended. All ingredients are then cooked until well blended and cooked. After that the dough is formed, baked, then fried.
Macaroni	Eggs, raisin flour, wheat flour, salt, olive oil, and water	Macaroni is made by washing eggs first. Next, raisin flour, wheat flour, eggs, salt, olive oil, and water are mixed to form a dough and then steamed for 12 minutes and cooled. Furthermore, the dough is formed and then steamed back for 12 minutes until it becomes wet macaroni. After that, it is dried in an oven for 4 hours, and then finally it is packed.
Pastels	Eggs, cassava flour, *rasi* flour, wheat flour, butter, small shrimp, and salt	Pastels are made by washing eggs. Then, cassava flour, *rasi* flour, wheat flour, butter, eggs, and salt are mixed into a dough. The dough is printed, filled with small shrimp, and then fried.
Opak Bumbu	Cassava opaque, peanuts, red chili, garlic, cayenne pepper, sugar, salt, and flavoring	*Opak Bumbu* is made by frying the cassava opaque. Furthermore, peanuts (*suuk*), red chili, garlic, and cayenne pepper are fried and then blended and added sugar, salt, and flavoring. Finally, the opaque is mixed with spices.
Kcipir	Cassava flour, eggs, butter, salt, and flavoring	*Kcipir* is made by mixing cassava flour, eggs, butter, salt, and flavorings into a dough. After that, the dough is formed, fried, and packaged.
Saroja	Eggs, raisin flour, wheat flour, coconut milk, sugar, peanuts, scallions, salt, and water	*Saroja* is made with eggs washed first. Then eggs, raisin flour, wheat flour, coconut milk, sugar, peanuts, scallions, salt, and water are stirred into a dough. The dough is printed, fried, and packaged.
Cireng	*Aci* flour, sliced scallions, salt, flavoring pepper, and water	*Cireng* is made by kneading *aci* flour, sliced scallions, salt, flavoring, pepper, and hot water into a dough. The dough is formed, fried, and packaged.
Cheese sticks	Raisin flour, wheat flour, grated cheese, butter, eggs, and salt	Cheese sticks are made by mixing raisin flour, wheat flour, grated cheese, butter, eggs and salt into a dough. The dough is then formed and fried.
Onion chips	Raisin flour, wheat flour, butter, onion, celery, salt, and flavorings	Onion chips are made by mixing raisin flour, wheat flour, butter, sliced spring onions, celery, salt, and flavorings to mix (knead) to form a dough. The dough then is formed, fried, and packaged.
Ranggining	Cassava root, aci flour, garlic, salt, and flavorings	*Ranggining* is processed by grating cassava root and mixing it with cassava tapioca flour (*aci*), then drying it in the sun for 1 day. The dough is mixed with garlic, salt, and flavoring. After that, it is formed, steamed, and dried in the sun to dry. The dry *Ranggining* can then be fried.
Awug	Cassava tubers, rice flour, grated coconut, granulated sugar, and salt	*Awug* is made by peeling and grating cassava tubers, then mixing and stirring it with rice flour, grated coconut, granulated sugar, and salt in a bowl. The dough is then inserted and flattened into a banana leaf that has been pursed. The brown sugar that has been combed is put on top of the dough, covered with *awug* dough, and then the brown sugar is put back repeatedly until it is sufficient. The banana leaves are closed and glued together using a stick at the end so they do not come off. The wrapped dough is steamed until cooked for 30 minutes using medium heat. *Awug* is then served with grated coconut.
Peuyeum	Cassava and yeast	*Peuyeum* is processed by peeling the cassava and then washing it clean and steaming it until cooked. The cassava is then drained and then sprinkled with yeast tape evenly over the entire surface of the cassava. Cassava is then arranged in a closed container and left for 3-5 days. After three days, the tape is checked to see if it is ripe. If not, the tape is stored again until the 5th day. *Tape* that is ready to be consumed should be stored in the refrigerator.

Table 4. Cassava landraces and RFC values of cassava crops in Cireundeu Hamlet

Various cassava cassava	RFC
Sampeu Apuy	0.41
Sampeu Bodas	0.96
Sampeu Gambir Lembang	0.54
Sampeu Garnawis	0.93
Sampeu Hideung	0.21
Sampeu Karihkil	0.71
Sampeu Mentega	0.25

It can be concluded that the Cireundeu people, particularly for old generations, they have a distinctive cultural identity, particularly in consuming staple food, which is cassava rice (*beras singkong* or *rasi*) instead of consuming rice (*nasi*) like the Sundanese in general. Since the colonial period, Cireundeu people have been consuming the *rasi* due to lack of rice in the past. They have culturally adapted to local environment of the dry land, with lack of *sawah* and rice production. Nowadays, however, due to most development programs in Indonesia rely on intensification and extensification of wet-rice farming (*sawah*). Therefore, the sustainability of the cultural identity of Cireundeu tended to be difficult to maintain by the local community, particularly by the younger generations. One way to attract the younger generation is to modify *rasi* into modern food combined with various menu ingredients so that the younger generation is interested in consuming food modified with cassava as the basic ingredient.

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