



UDC 633

## SYSTEM FOR SELECTING SUPERIOR RICE VARIETIES AND CONSUMPTION NEEDS OF TOURISM AREAS IN INDONESIA: A CASE STUDY OF BALI PROVINCE

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### ABSTRACT

The need for rice commodity food will continue to increase in line with the increasing population and the high level of rice consumption for the Indonesian population. In Bali, the need for rice is not only to meet the population, but also the needs of tourists. Efforts to increase rice production have been made by intensification, accompanied by the use of superior varieties of rice seeds. However, the use of superior varieties of rice seeds is still very low. Therefore, it is important to look at the availability and demand for rice and identify types of rice varieties that suit farmers' preferences in an effort to increase rice production. The research was conducted using a survey method in three districts in Bali Province involving 65 groups/subaks and eight key informants. Secondary data was analyzed descriptive and primary data was analyzed using the exponential comparison method (MPE) with Eckenrode weighting. The research results show that the demand for rice in Bali cannot be met from its own production. Efforts are needed to increase rice production and productivity to meet the needs of the population, as well as paying attention to farmers' preferences regarding the superior varieties being developed. The farmers' preferred preferences of the 18 types of varieties planted are the highest rice varieties: Ciherang, Inpari 32 HDB, Cigeulis, Inpari 43 Agritan GSR and IR 64. These preferences are very useful for breeders and seed producers in producing future rice seeds for the Province Bali.

### KEY WORDS

Preferences, rice varieties, consumption, seed, tourist areas.

Indonesia is a country with a large increase in population every year, which has an impact on the provision of food needs for all population. The population of Indonesia until mid-2024 is 281,603,800 people with an additional growth rate of 1.11% (BPS, 2024). The need for rice commodity food will continue to increase in line with the increasing population and the high level of consumption, especially rice for the Indonesian population, which is 93.78 kg/capita/year (BPS, 2020). The results of the study by (Arifin et al., 2021), stated that projections of rice production and domestic rice consumption levels show the potential for rice imports of 15 million tons by 2045, although on the other hand it is estimated that it will experience a rice surplus of 37.80 million tons. Likewise in Bali Province, from the simulation results of existing conditions, it is estimated that rice production in 2030 is 348,673 tons, rice consumption is 462,666 tons and rice stocks are -448,162 tons, so it can be said that existing conditions in the field cannot meet the target of surplus rice stocks in Bali Province in 2030 (Pradnyana et al., 2021)

Fulfilling the food needs of the community is the obligation of the government by increasing rice production every year through both extensification and intensification policies. Efforts to fulfill through intensification include through technological innovation in the use of new superior varieties of rice seeds. The success of increasing rice productivity and income is closely related to the use of quality seeds as production inputs (Sutaryo & Pramono, 2016; Syahri & Somantri, 2016; Setiani et al., 2021). Seeds are a determining factor in increasing



productivity in addition to the use of fertilizers, the environment and socio-economic factors of the local community (Otieno et al., 2017; Paudel et al., 2013). Furthermore, according to Mercado et al. (2023), seed is one of the most important single inputs in crop production, significantly affecting overall productivity.

However, not all seeds of superior rice varieties released can be used by farmers in Indonesia. The level of use of superior varieties of rice seeds in Indonesia in 2022 only reached 66.80% of the 274,666 tons of national seed requirements (Amaliah et al., 2023). According to Samrin et al. (2021), the cause is that not all superior seed varieties can be adopted and accepted by farmers or end users. Therefore, the attitude and characteristics of farmers towards rice seed varieties are very important in the position of farmers as consumers of rice seed products (Saleh & Dirgantara, 2023). An important factor in the selection and development of superior rice varieties in a region is the attitude and preference of farmers towards these superior seeds (Syamsiah et al., 2015). For this reason, it is necessary to identify rice varieties that are in accordance with the preferences of farmers, especially in Bali in an effort to fulfill community food security.

The need for rice as a staple food, not only to meet the needs of the population of Bali Province but also tourists visiting Bali. Bali as one of the world's tourist destinations, in 2023 recorded foreign tourists visiting as many as 5,273,258 people dominated by tourists from Australia, India, China, England, America, Singapore, South Korea, France, Malaysia, Germany and other countries (BPS Province Bali, 2024). Additional tourists from within the country (domestic tourists) were 9,877,911 people. On the other hand, the population of Bali Province in 2023 was recorded at only 4,404,300 people. Along with the increase in population and the number of tourists, especially archipelago tourists, it will lead to an increase in rice food consumption. Therefore, it is important to think about increasing rice production in Indonesia, especially in Bali Province, by utilizing technological innovations related to the use of new superior varieties of rice that have high production and according to the preferences of farmers in Bali. So that farmers use superior varieties in production, get a decent price and increase income. The choice of technological innovation in the form of using superior rice varieties that can increase rice productivity is very urgent (Slameto et al., 2021). The benefits for seed producers are knowing the types of rice varieties that must be produced, higher seed absorption, easier marketing and can increase profits.

## METHODS OF RESEARCH

This research was conducted in April-July 2023, by conducting a survey using questionnaire tools to 65 groups (with the name of the Subak) in three districts as rice production centers in Bali Province, namely Tabanan Regency, Badung Regency and Buleleng Regency. The key informants involved in this study were eight key informants which consists of elements of experts (rice researchers and breeders), practitioners (rice seed producers and organic rice farming actors) and regulators (Bali Province Agriculture and Food Security Office, seed supervisors of UPTD BPSBTPH Bali Province, Assessment Institute for Agricultural Technology Bali Province, and Agricultural extension officer).

Analysis of rice needs in Bali using the weighted moving average forecasting method. Preferences for rice varieties use the exponential comparison method (MPE) with Eckenrode method weighting, such as calculating the value (N), assessing the final weight of each criterion, and assessing the importance of the criteria weight. The formulation for calculating scores for each alternative in the exponential comparison method (Marimin & Slamet, 2010; Rangkuti, 2011):

$$\text{Total value (TNi)} = \sum_{j=1}^n (RK_{ij})TKK_j$$

Where: TNi = Total value of alternatives I; RKij = relative importance of criterion j in decision option I; TKKj = degree of importance of decision criterion j; TKKj>0; unanimous; n = number of decision options; m = number of decision criteria.



According to Fadhil et al. (2017), in weighting with the Eckenrode method, the assessment of each sub-criteria is calculated using the geometric mean formula from the results of the key informant assessment multiplied by the weighted weight of each sub-criteria. So that each criterion is calculated by summing up the results of all the values of the sub-criteria contained in each criterion.

## RESULTS AND DISCUSSION

Asian countries dominate global rice production with the highest level of rice consumption in the world. In Asian countries, rice is the main source of carbohydrates for nearly 2.4 billion people and is processed into food in various forms such as rice, flour, noodles, cakes, and other snacks (Sujianto et al., 2022). Including Indonesia, most of its population consumes rice as a staple food. Likewise, Thailand consumes rice-based products as the main food (Somsong et al., 2020) and most of the population in Asia.

Bali as one of the world's tourist destinations is part of Indonesia, with an area of 5,636.66 km<sup>2</sup>. It consists of eight regencies and one city as the center of government, namely Denpasar City. Every year, tourists visiting Bali exceed the population of Bali itself, except during the Covid-19 pandemic in 2020-2021. According to BPS data, in 2023 there were 9,877,911 tourists visiting Bali (domestic tourists) and 5,273,258 (foreign tourists). This increase in the number of tourists is followed by an increase in supply for rice consumption, especially for domestic tourists.

Next, using data from the last six years (2018-2023), forecasting was carried out until 2030 consisting of population growth, the number of domestic tourists and the amount of rice production in Bali (Figure 1). It can be seen that the trend in the number of residents and domestic tourists is increasing, but rice production is decreasing. Using the assumption that the per capita consumption level of the Balinese population is 89.04 kg/year, there will be a rice supply shortage of 28,291.18 tonnes in 2030.

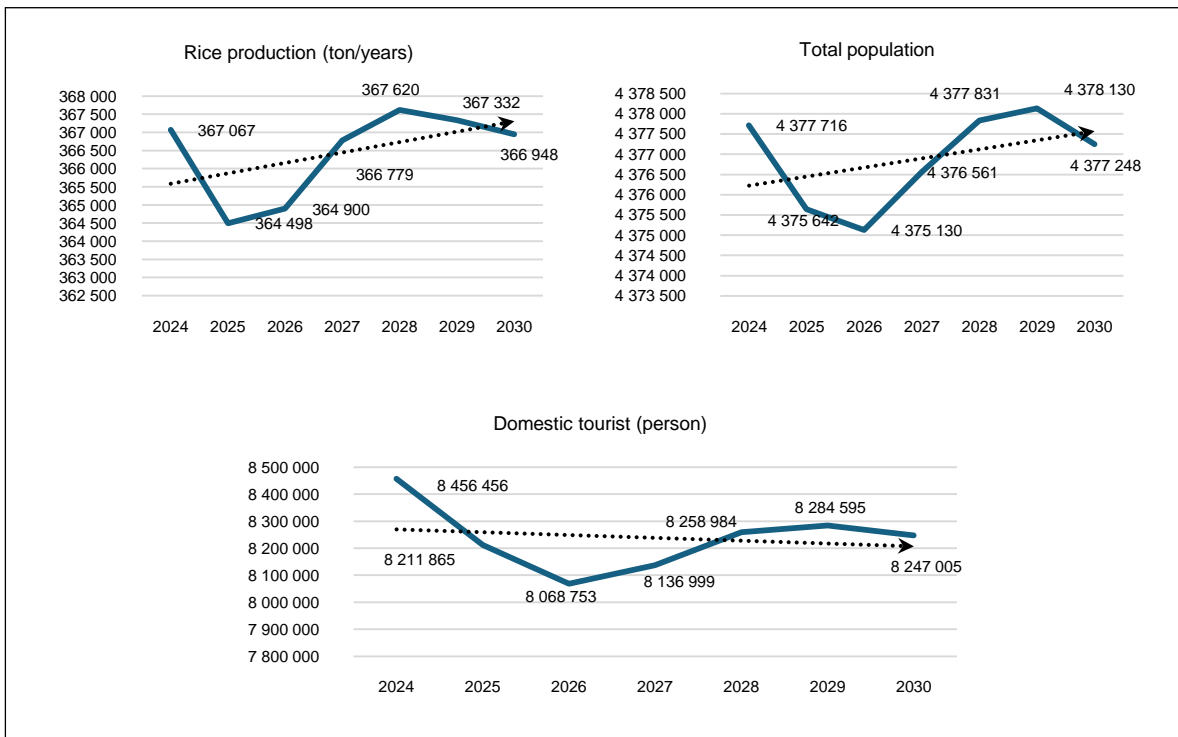


Figure 1 – Forecasting rice production, population and domestic tourists for 2024-2030

In the same year (2023), there were 4,404,300 people in Bali. The rice consumption level of the Balinese population per capita is 89.04 kg/year or equivalent to 0.247 kg/day.



The need for rice consumption is 392,158 tons / year, on the other hand, the production of rice produced by farmers is 379,870 tons / year (BPS, 2024), so the shortage of rice stock is 12,289 tons / year. Furthermore, if it is assumed that Indonesian tourists stay in Bali for three days, an additional rice stock of 7,329.41 tons is needed. So the rice deficit becomes 19,619 tons/year. The prediction results for the next six years until 2030 using the weighted moving average (WMA) method, show that domestic tourist arrivals and the total population of Bali follow an increasing trend, while the trend of rice production in the future is decreasing (Figure 1). The prediction results in 2030 the number of people in Bali is 4,377,248 people, the number of domestic tourists is 8,247,005 people. With the predicted rice production of 366,948, there will be a shortage of 28,921 tons of rice.

Current conditions, the average productivity of rice in the last ten years (2018-2023) has only reached 6.03 tons/ha with an average harvest area of 118,442 hectare (ha). Seeing these conditions, it is very important to think about increasing rice production to meet the needs of the community and tourists visiting Bali. With the condition of the harvest area that tends to decline, one way is to use superior varieties that have the potential to increase rice productivity. Increased productivity is expected to meet the needs of rice in Bali. There are many choices of rice varieties with high productivity. The Inpari 32 rice variety can produce up to 7.1 tons/ha and from the farming analysis provides an R/C value=3 (Arya et al., 2017). According to Syafruddin et al. (2023), the Inpari 30 variety also consistently provides high yields, reaching 7.5 tons/ha planted in Batui District, Banggai Regency, South Sulawesi, Indonesia. Furthermore, Haryati & Noviana, (2020), stated that the Inpari 43 variety in paddy fields in Majalengka Regency, Indonesia gave a production yield of 7.70 tons/ha.

In line with the development of tourism, the condition of rice fields in Bali in addition to functioning as a place to grow rice to produce rice, has also been utilized as a tourist attraction by utilizing the arrangement of the system of terraced rice fields. This tourism presents a view of rice terraces and has developed in the tourist village of Jatiluwih (Tabanan Regency). The rice terraces of Jatiluwih Tourism Village as part of the World Culture Heritage, are able to maintain an agrarian culture with traditional agricultural systems (Prasiasa & Widari, 2021). The scenery of rice terraces becomes more attractive if followed by the synchronous and compact growth of rice, especially for tourists who like outdoor activities. The use of new superior rice varieties allows rice plants to grow more synchronously, resistant to lodging with high yield potential.

Rice is a key strategic crop for food security and nutrition. The two rice species, *Oryza Sativa* (Asian Rice) and *Oryza Glaberrima* (African Rice) are known for their commercial value. However, *Oryza Glaberrima* is cultivated in a very limited area in Southern Africa. *Oryza Sativa*, the most important commercial rice species can be divided into three sub-species namely *Indica*, *Japonica* and *Javanica* based on their commercial development regions (Gadal et al., 2019). In China, the development of improved rice varieties increased the national average yield from 6.21 tons/ha in 1996 to 6.89 tons/ha in 2015 (Cheng, 2016). The yield potential of rice has been significantly improved through the development of super rice varieties in China (Wang & Peng, 2017). The proportion of hybrid rice among new varieties released each year continues to increase, reaching 92.49% in 2017, with the average yield of government-released rice varieties increasing from 6.57 tons/ha in 1991 to 9.49 tons/ha in 2017 (Wang et al., 2021).

Rice that is widely grown in Indonesia is the *Javanica* sub-species and has been developed into new superior varieties with all its advantages and disadvantages. Rice plants are grown in rice fields with different soil, climate and environmental conditions, so farmers are expected to consider all aspects of the criteria possessed by a rice variety. The resulting production potential is also very promising (> 7 tons/ha). Based on the results of the research, 18 types of VUB were identified that have been cultivated by farmers in Bali in the period 2017-2022 (Table1).

The selection of the dominant preferred VUB based on farmers' preferences was conducted using the exponential comparison method (MPE). Determination of criteria was based on feedback from the 65 groups, which was further justified by key informants into criteria that could represent the wishes of farmers based on previous literature references. In



general, the preferred rice varieties are those that have high yields, have high market value, and a short period of time, while rice millers prefer rice varieties that consider size and shape, color (Biswas et al., 2023). Farmers' preferences in selecting rice varieties depend on certain plant characteristics with production yield, flavor being the highest priority of farmers and other most important desired traits (Fatondji et al., 2020). Furthermore, according to Gondal et al. (2021), rice texture (hardness and chewiness) and rice fragrance are the most important sensory attributes in determining preference for rice varieties.

Table 1 – New varieties of inbred rice cultivated by farmers in Bali 2017-2022

Num	Name of Rice Variety	Num	Name of Rice Variety
1	IR 64	10	Inpari 48 Blas
2	Cigeulis	11	Mentik Susu
3	Ciherang	12	Cibogo
4	Inpari 16 Pasundan	13	Situbagendit
	Inpari 24	14	Inpari IR Nutri Zinc
6	Inpari 30 Ciherang Sub 1	15	Sertani
7	Inpari 32 HDB	16	Logawa
8	Inpari 33	17	Pamelen
9	Inpari 43 Agritan GSR	18	Pertiwi

Source: Primary data processed.

The criteria used in this study are: 1) production level, 2) age of rice, 3) height of rice plants, 4) price of harvested dry grain, 5) texture of rice, 6) Plant Disease Pest Infestation Level, and 7) ease of obtaining rice seeds. Furthermore, from each criterion, three measurement scales were categorized as decisions (Table 2). The value of choice as a description of the category is a reference to the results of previous research as well as reference standards from the government in the form of technical guidelines and government regulations. Only the value of choice on the criteria for ease of obtaining rice seeds is the justification of key informants/experts.

Table 2 – Criteria, categories and score options for rice varieties

Num	Criteria	Categories	Score options	Score
1	Production	High	> 6 ton/ha	5
		Medium	5-6 ton/ha	3
		Low	< 5 ton/ha	1
2	Age of rice plant	Early maturing	105–124 day after seeding	5
		Medium	125–150 day after seeding	3
		Longevity	> 151 day after seeding	1
3	Height of rice plant	Short	< 110 cm	5
		Medium	110-130 cm	3
		High	>130 cm	1
4	Selling price	High	> Rp 4200/Kg unhusked rice	5
		Medium	Rp 4200/Kg unhusked rice	3
		Low	< Rp 4200/Kg unhusked rice	1
5	Rice texture	Soft	amylose 2-19%	5
		Medium	amylose 20-25%	3
		slightly hard	amylose 25-33%	1
6	Plant disease pest infestation level	Mild	AP ≤ 11%	5
		Medium	>11 - 25 %	3
		Heavy	> 25 ≤ 85%	1
7	Ease of obtaining seeds	Easy	Available all the time	5
		Medium	Not always available	3
		Difficult	Not available	1

Source: Kodir et al. (2018); Kementrian Pertanian, (2007); BPS, (2023); Syamsir et al. (2014); (Kementrian Pertanian, (2018).

The selection of the dominant VUB preferred by the farming community in Bali was carried out using the exponential comparison method (MPE). This is done by determining the weight of each criterion to indicate the level of importance of a criterion. Weighting with the



Eckenrode method uses the opinions of key informants (Table 3). The highest perception of superior rice varieties is on the level of production, followed by disease resistance, ease of obtaining seeds, selling price, rice texture, plant age and finally plant height.

Table 3 – Criteria, values and weights of criteria for superior rice varieties in Bali

Criteria	Key Informant								Values	Weights
	R1	R2	R3	R4	R5	R6	R7	R8		
Production	5	4	5	5	4	4	5	5	129	0.175
Age of rice plant	4	4	2	3	4	3	2	2	94	0.127
Height of rice plant	3	2	2	3	2	3	2	1	69	0.093
Plant Disease Pest Infestation Level	5	4	4	3	5	4	5	5	119	0.161
Selling price	4	5	1	5	4	4	4	5	107	0.145
Rice Texture	5	5	1	4	4	3	3	3	107	0.145
Ease of obtaining seeds	4	5	3	4	5	3	4	4	114	0.154
Multiplier factors	7	6	5	4	3	2	1	0	739	1

Source: primary data processed.

Description: (R1-R4) regulators from Bali Province Agriculture and Food Security Office, seed supervisors of UPTD BPSBTPH Bali Province, Assessment Institute for Agricultural Technology Bali Province, and Agricultural extension officer; (R5-R6) experts from rice researchers and breeders; (R7-R8) practitioners from rice seed producers and organic rice farming actors.

Table 4 – Relative importance degree matrix (RK) of superior rice varieties

Num	Varieties	Criteria						
		A1	A2	A3	A4	A5	A6	A7
1	Ciherang	3.92	4.83	4.67	4.83	5.00	2.08	4.58
2	Cigeulis	4.18	4.53	4.29	3.71	4.18	2.29	3.47
3	IR 64	3.00	4.00	3.50	4.00	4.25	1.25	1.50
4	Inpari 16 Pasundan	3.50	3.25	3.00	1.25	2.25	2.50	1.50
5	Inpari 24	3.75	3.50	3.00	1.25	3.25	3.00	1.25
6	Inpari 30 Ciherang Sub 1	3.50	4.00	3.17	2.50	3.17	2.50	1.17
7	Inpari 32 HDB	4.63	4.38	4.00	3.25	4.25	4.38	3.38
8	Inpari 33	3.80	3.20	3.20	1.80	1.60	2.40	1.60
9	Inpari 43 Agritan GSR	4.17	4.00	3.33	1.33	3.50	3.83	1.50
10	Inpari 48 Blas	3.60	4.00	3.20	2.20	2.80	3.40	1.40
11	Mentik Susu	2.75	2.75	3.00	1.50	3.00	1.50	1.00
12	Cibogo	3.00	2.50	3.25	1.00	2.00	1.75	1.00
13	Situbagendit	2.75	2.75	3.00	1.00	2.00	1.25	1.00
14	Inpari IR Nutri Zinc	2.50	3.00	3.50	1.00	2.00	2.25	1.25
15	Sartani	2.25	3.00	3.50	1.00	1.00	1.25	1.00
16	Logawa	2.25	3.00	3.25	1.00	1.00	1.75	1.00
17	Pamelen	2.75	2.00	2.25	1.25	3.25	1.50	1.00
18	Pertiwi	2.25	2.50	3.00	1.00	1.00	1.25	1.00
	Weight Value	0.175	0.127	0.093	0.161	0.145	0.145	0.154

Source: Primary data processed.

Description: (A1) Production; (A2) Age of rice plant; (A3) Height of rice plant; (A4) Plant Disease Pest Infestation Level; (A5) Selling price; (A6) Rice Texture; (A7) Ease of obtaining seeds.

Determining the priority order of decisions is based on the total score or value of each alternative. The total value (TN) states that the greater the total value of the alternative, the higher the priority order.

The highest value is a priority to become a superior variety for rice farmers in Bali. Priority in the sense of most preferred takes into account production, age of rice plant, height of rice plant, plant disease pest infestation level, selling price, rice texture and ease of obtaining seeds. With this method, farmers can choose the type of rice based on their preferences. This practical approach is important to increase the level of acceptance and dissemination of new superior varieties in Indonesia.

Next, the results obtained are sorted as in Figure 2. From Figure 2, it can be seen that the superior rice variety ranked first is Ciherang, then Inpari 32 HDB, Cigeulis, Inpari 43 Agritan GSR and IR 64, up to the last is the Pertiwi rice variety. The Ciherang, Cigeulis and IR 64 varieties are varieties that have been released for quite a long time. The IR 64 rice



variety was even released in 1986, Ciherang (2000) and Cigeulis (2002). These three varieties both have delicious and fluffier rice taste. This is because the parental background of the ciherang and cigeulis varieties is the same, namely IR 64, which can be seen in the description of the two varieties. Description: Ciherang originates from a cross between IR 18349-53-1-3-1-3/IRI and 19661-131-3-1///IR 64///IR 64, and Cigeulis originates from a cross between Ciliwung/Cikapundung varieties //IR64 (Romdon et al., 2014).

Table 5 – Matrix of degree of importance (TKK) and terms of results of the criteria for superior rice varieties

No	Varieties	Criteria							TN	Rank
		A1	A2	A3	A4	A5	A6	A7		
1	Ciherang	1.27	1.22	1.15	1.29	1.26	1.11	1.26	8.57	1
2	Cigeulis	1.28	1.21	1.15	1.23	1.23	1.13	1.21	8.45	3
3	IR 64	1.21	1.19	1.12	1.25	1.23	1.03	1.06	8.11	5
4	Inpari 16 Pasundan	1.24	1.16	1.11	1.04	1.12	1.14	1.06	7.88	10
5	Inpari 24	1.26	1.17	1.11	1.04	1.19	1.17	1.04	7.97	8
6	Inpari 30 Ciherang Sub 1	1.24	1.19	1.11	1.16	1.18	1.14	1.02	8.06	7
7	Inpari 32 HDB	1.31	1.21	1.14	1.21	1.23	1.24	1.21	8.54	2
8	Inpari 33	1.26	1.16	1.11	1.10	1.07	1.14	1.08	7.92	9
9	Inpari 43 Agritan GSR	1.28	1.19	1.12	1.05	1.20	1.21	1.06	8.12	4
10	Inpari 48 Blas	1.25	1.19	1.11	1.14	1.16	1.19	1.05	8.10	6
11	Mentik Susu	1.19	1.14	1.11	1.07	1.17	1.06	1.00	7.74	11
12	Cibogo	1.21	1.12	1.12	1.00	1.11	1.08	1.00	7.64	14
13	Situbagendit	1.19	1.14	1.11	1.00	1.11	1.03	1.00	7.58	15
14	Inpari IR Nutri Zinc	1.17	1.15	1.12	1.00	1.11	1.12	1.04	7.71	12
15	Sertani	1.15	1.15	1.12	1.00	1.00	1.03	1.00	7.46	17
16	Logawa	1.15	1.15	1.12	1.00	1.00	1.08	1.00	7.50	16
17	Pamelen	1.19	1.09	1.08	1.04	1.19	1.06	1.00	7.65	13
18	Pertiwi	1.15	1.12	1.11	1.00	1.00	1.03	1.00	7.42	18

Source: Primary data processed.

However, it is not only high productivity and taste that influence the choice of rice varieties. The research results of Tenriawaru et al. (2023) in the Toraja area, shows that from the consumer side, local rice varieties are more popular than superior varieties, causing relatively high consumer demand. High demand results in higher sales prices. The high price causes farmers to prefer local varieties of rice, despite its other unique features such as its distinctive and sharp aroma. There are still many farmers cultivating local rice, because the cultivation of traditional rice varieties depends on the price received (Blakeney et al., 2020). The desirable and undesirable characteristics of rice varieties expressed by farmers must be the basis for selection by breeders in variety development (Loko et al., 2021). According to Britwum & Demont, (2021), it is important for rice seed breeders to consider culture and traits that combine agronomic benefits and consumer preferences.

The Ciherang, Cigeulis and IR 64 varieties are still rice varieties that are very popular with farmers even though they were released a long time ago. This is in line with research results by Putra et al. (2023), that there are still many farmers who plant superior varieties of lowland rice that have long been released, namely Cigeulis (31.61%), Ciherang (31.03%), Mekongga (27.01%), and IR64 (6.32%). According to Hossain et al. (2022), one of the main causes of poor variety replacement is the lack of dissemination of new varieties; so that old varieties continue to be cultivated on a larger scale.

A relatively new rice variety is the Inpari 32 HDB variety which was released in 2013. This variety is also related to the IR 64 variety, namely a cross from Ciherang/IRBB64. Next is the Inpari 43 Agritan GSR variety which was released in 2016, which is a cross of WuFengZhan/IRBB5/WuFengZhan (Kementerian Pertanian, 2023). These two varieties also have a smooth taste, so they are liked by many farmers in Bali. In general, the five rice varieties chosen by farmers are varieties that meet the criteria used in the research, namely: 1) high production, 2) soft taste, 3) fairly early maturity, 4) resistant to plant pests, 5) appropriate price, 6) medium plant height, 7) ease of obtaining seeds. So even though this variety has been released for quite some time, it is still sought after by farmers in Bali. So



that the dominant rice varieties cultivated are taken into consideration by seed producers in planning the types of varieties to be produced in the future, so as to increase the use of superior varieties of rice seeds.

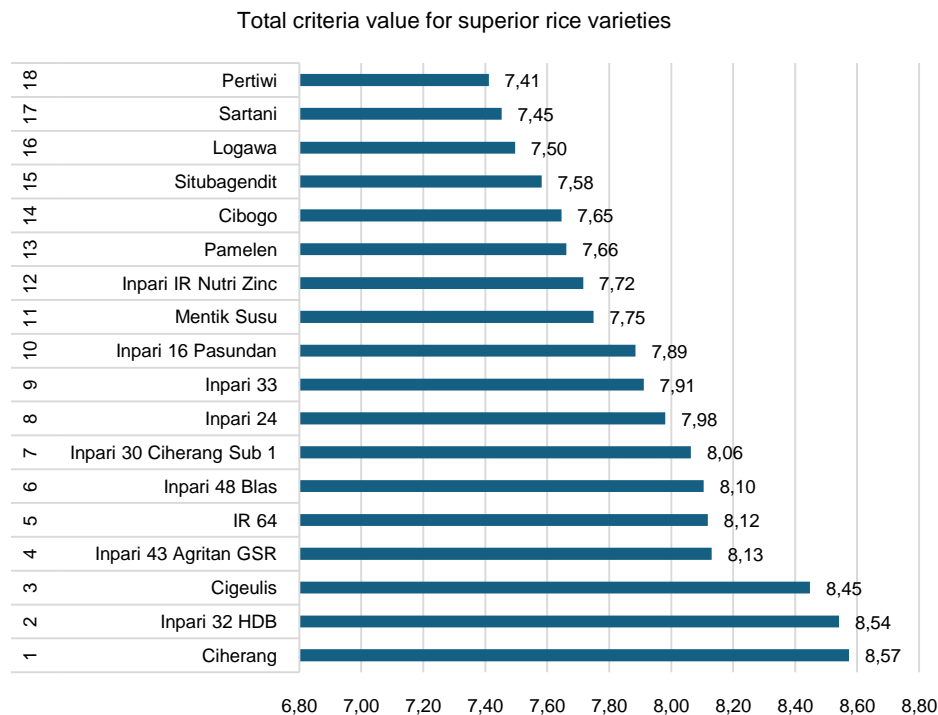


Figure 2 – Total value of priority superior rice varieties cultivated by farmers in Bali

Efforts to increase rice production should be the main agenda in agricultural development in Bali. A development balance between tourism and agriculture is very important for the Balinese population. Through the application of integrated, modern and environmentally friendly technology, it will foster a sense of optimism towards rice self-sufficiency in Bali. Many innovations have been developed by researchers in an effort to increase rice production. Several factors that support increased productivity include: 1) Use of superior varieties, 2) Land management, 3) Control of pests and plant diseases, 4) Balanced fertilization with the addition of organic elements, 5) Management of irrigation water according to plant needs, 6) Planting arrangements and 7) Utilizing smart farming technology (Saito et al., 2018; Wihardjaka et al., 2020; Li et al., 2023; Zaman et al., 2023; Midya et al., 2021; Mallareddy et al., 2023). Some of these programs have already been implemented in Bali, but still need hard work, seriousness and continuous implementation to achieve food self-sufficiency.

## CONCLUSION

Rice productivity in Bali still needs to be increased, considering that the need for rice is not only for the Balinese population, but also for the needs of tourists visiting Bali. The development of new infrastructure to accommodate tourist needs is a threat to the reduction of agricultural land. Efforts to increase production through intensification are an option, including through planting superior varieties of rice which have the potential to produce high production. However, this has not been fully adopted by farmers. This is because the types of seed varieties do not match the preferences of the Balinese people.

From this research a conclusion can be drawn, namely:

- In tourism areas, especially in Bali, it is necessary to maintain the availability of basic necessities, especially rice, taking into account the presence of local residents and





domestic tourists visiting Bali;

- Identified as many as 18 superior rice varieties cultivated by farmers in an effort to meet consumption needs in Bali Province;
- Farmers' preferences for superior rice varieties, of the top five priority ones to cultivate are: Ciherang, Inpari 32 HDB, Cigeulis, Inpari 43 Agritan GSR and IR 64. These varieties need to get the attention of seed producers in producing further seeds, so that uptake superior varieties of rice seeds by farmers will be higher.

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