

# The Importance of Socio-Economic Factors and Climate Constraints on Farmers' Preference for Using Ciherang

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## ABSTRACT

Ciherang is a High Yielding Variety (HYV) of Rice produced by the Indonesian Agency for Agricultural Research and Development Agency since 2000. Ciherang, as an agricultural technology innovation, is still used by most farmers in various regions in Indonesia, especially South Sulawesi as one of the national rice production centers. The objectives of study are to: (1) investigate farmers' decisions to grow the Ciherang variety and (2) Scrutinize the influence of socio-economic and climatic factors on the choices of farmers to grow the Ciherang variety. This research was conducted in South Sulawesi Province from December 2020 to January 2021 involving 101 respondent farmers in Sidenreng Rappang and Pinrang Regency. In this study, descriptive analysis and Binomial Logistic Regression were used. The results showed that 17.82% of the farmers choose the ciherang variety, while the rest select other varieties. The choice of farmers for the ciherang variety is significantly influenced by socio-economic factors, namely age of the farmer, farmer group education, income, as well as climatic factors, namely drought and floods. Other factors, such as land status, land area, experience, perimeter, and labor did not affect farmers' choices for the Ciherang variety.

**Keywords:** Varieties, Rice, Climate

## 1. INTRODUCTION

Variety is an input in rice farming which is very influential on production. Research by [1] stated that variety is a technological component that contributes greatly to increasing productivity and income of rice farming. The importance of the role of rice varieties to encourage national production targets, encouraging various institutions to produce new HYV (HYV) of rice, including the Indonesian Agency for Agricultural Research and Development. Until 2015 the Indonesian Agency for Agricultural Research and Development had produced 209 HYV rice varieties from more than 400 HYV rice varieties that had been released [2], one of which was Ciherang.

Ciherang released by the Indonesian Agency for Agricultural Research and Development in 2000. Ciherang has an age of 116-125 days, a plant height of 91-106 cm, with a fluffy rice texture, and an average yield of 5-7 tons/ha, and has the advantage of being resistant to

bacterial leaf blight III, brown planthopper biotypes 2 and 3 [5]. These performances and advantages become one of the attractions for farmers to use the Ciherang. The Ciherang is the HYV that is most in demand by Indonesian farmers and can survive for two decades [3]. This is evidence that the sustainable use and development of Ciherang has achieved success. This success is closely related to the benefits of the Ciherang variety for farmers as users. Research by [4] stated that the benefits felt by farmers from the varieties they plant affect the farmers' desire to reuse the varieties they plant.

Research by [6] stated that productivity, rice taste, market segment and relatively early age of the Ciherang variety are factors that cause this variety to still develop today. On the other hand, although the assembly of new HYV continues to be carried out, [7] states that the process of adopting new HYV is running slowly. Research by [8] state that the factor of low productivity of new HYV is considered the cause of low farmer adoption of new HYV. The slow adoption of new HYV

as a technology can also be caused by not paying attention to the socio-economic aspects of user farmers, the technology produced is not a solution to the problems faced by farmers in general, lack of focus on the need for innovation that actually produces added value, is socio-economically and culturally feasible as well as the user environment, lacks institutional funding support and the process of dissemination and transfer of technology is less than optimal [9].

Climate constraints are another problem faced by farmers in rice cultivation. Research by [10] stated that agriculture is the sector most vulnerable to climate change, especially the food crops sub-sector. This is due to the fact that food crops are little plants that are susceptible to stress, particularly excess and shortage of water. This will influence farmers to be selective in choosing varieties that are resistant to water stress.

Many previous studies have linked the genetic superiority and adaptive ability of a variety to the choice of farmers on the HYV rice varieties they prefer. However, there are still not many studies that link the socio-economic factors of farmers and climate constraints faced by farmers to farmers' preferences for HYV of rice, especially Ciherang which is the variety commonly used by farmers. The objectives of study are to: (1) investigate farmers' decisions to grow the Ciherang variety and 2) Scrutinize the socio-economic factors and climate constraints that influence farmers' preferences for the Ciherang.

## 2. METHOD

This study took place between December 2020 and January 2021 in Sidenreng Rappang and Pinrang Regencies which are rice production centers in South Sulawesi Province. The population in this study were rice farmers in South Sulawesi Province. A total of 101 respondent farmers were sampled in this study, namely 58 respondents from Sidenreng Rappang Regency and 43 respondents from Pinrang Regency. Determination of the sample was carried out by purposive sampling, namely farmers who had used the Ciherang. Methods of data collection using observation and direct interviews using questionnaires. Descriptive analysis was used to analyze farmers' preferences for the Ciherang and binomial logit analysis was used to determine the socio-economic and climate constraint influence of farmers' preferences on the Ciherang. The analysis uses the help of Microsoft Excel and SPSS 22. In this study, the dependent variable is a dummy variable, in this case, is the choice of farmers to like or dislike the Ciherang. The independent variables, namely age, education, land ownership status, farm size, farmer membership groups, farming experience, income, financing constraints, flood constraints, drought constraints and labor constraints are

also dummy variables. The equation can be formulated as follows:

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \beta_5 D_5 + \beta_6 D_6 + \beta_7 D_7 + \beta_8 D_8 + \beta_9 D_9 + \beta_{10} D_{10} + \beta_{11} D_{11} + e \quad (1)$$

$\ln(p/1-p)$  is Farmers' choice of liking or disliking the Ciherang (liked Ciherang =1, others =0),  $D_1$  is Farmer age dummy variable (age > 45 years old =1, others = 0),  $D_2$  is Educational dummy variable ( minimum senior high school = 1, other = 0),  $D_3$  is land ownership dummy variable (own property =1, other = 0),  $D_4$  is farm size dummy variable (Farm size more than 1 ha, 1 other = 0),  $D_5$  is farmers membership group dummy variable ( more than 14 years =1, other = 0),  $D_6$  is farmer experience dummy variable (more than 25 year = 1, other = 0),  $D_7$  On-farm Income dummy variable,  $D_8$  is dummy variable of financing constrains Financial Constrains dummy variable( There is constrains =1, other =0),  $D_9$  is flood constrains dummy variable Flood Constrains dummy variable (There is constrains =1, other =0),  $D_{10}$  is drought constrains dummy variable Drought constrains dummy variable ( There is constrains =1, other =0),  $D_{11}$  is Labor constrains dummy variable Labor constrains dummy variable ( There is constrains =1, other =0),  $\beta_0$  is intercept,  $\beta_1 \dots \beta_{11}$  is regression coefficients and  $e$  is residual variance.

## 3. RESULT AND DISCUSSION

### 3.1 Respondent Characteristics

Farmer characteristics are important to identify because they can influence farmers decisions-making on their farm. The age of the respondent is an important influencing factor in decision-making. The majority of the farmers who responded to this study are of productive age, namely 15-64 years old (90%). Research by [11] states that a person's needs and tastes will change according to age, so as a producer or marketer must pay attention to changes in interest related to one's age.

In addition to age, education is considered as a means to increase knowledge about new technological innovations. Education can be an encouragement so that the mental to be willing to accept profitable innovations can be created [12]. The formal education that has been undertaken by farmers is expected to support the adoption and utilization of technology such as HYV. Respondents were dominated by farmers with the equivalent of high school education (40.59%). The condition of the lack of employment in the non-agricultural sector makes high school graduates or equivalent choose to take advantage of the processing of their land rather than being unemployed [13].

Farming experience can influence farm decision-making. According to cognitive theory, a consumer's

behavior is strongly influenced by his memory of situations that occurred in the past, present and future [14]. Most respondent farmers have farming experience between 21 to 30 years. Farmers with more than 30 years of experience are more likely than farmers with less than 10 to 20 years of experience and less than 10 years. This shows that the number of respondents who have longer experience in farming is higher than the number of farmers who do not have long enough experience in farming rice.

The land is a very important input for farmers in the

**Table 1.** Respondent Characteristics

Characteristic	Amount (persons)	Percentage (%)
Age		
18-25 years old	5	4,95
26-45 years old	52	51,49
46-68 years old	44	43,56
Education		
Primary school	35	34,65
Junior High School	15	14,85
Senior High School	41	40,59
Bachelor	10	9,90
Farming experience		
≤ 10 years	16	15,84
11-20 years	24	23,76
> 20 years	61	60,40
Land Ownership Status		
Own property	62	61,39
Others	39	38,61
Farm Size		
< 1 hectare	75	74,26
1-2 hectare	18	17,82
>2 hectare	8	7,92
Farmers membership group		
1-10 years	35	34,65
11-20 years	45	44,55
21-30 years	15	14,85
≥31 years	6	5,94

Source : Primary Data Analysis 2021

success of production. The farm size and the status of ownership, can affect the decisions of farmers in farming activities. The grouping of farmers based on farm size is divided into three, namely farmers with small land ownership of less than 0.5 hectares, medium-scale farmers with ownership

land between 0.5 - 1 hectare and large-scale farmers with land tenure of more than 1 hectare [15], Most of the

respondent farmers use land for rice cultivation with an area of more than 1 hectare, so they are said to be large-scale farmers. The proportion of sample farmers who own their property is greater than that of farmers who use non-owned land (table 1.)

Farmer group membership is a social capital for farmers to build a network, trust, and social norms in running a farming business. Research by [15] states that the existence of networks, trust and social norms are factors that support technology adoption by farmers. The longest membership of respondent farmer groups is in the range of 11-20 years and the least is in the range of more than 21 years.

### 3.2 Farmer Preference for Ciherang

Ciherang variety is a HYV that is still used by farmers in South Sulawesi today. Nevertheless, farmers' preferences for HYV of South Sulawesi rice are very diverse. Based from the preference of farmers in the research location, it can be seen that Ciherang (17.82%) became the variety favored by farmers in second place after Inpari 37 (21.78%). The rest are farmers who prefer other varieties such as Inpari 32, Inpari 36, Inpari 44, Inpari 8, Inpari 4, Inpari 7, Mekongga and Ciliwung.

Inpari 37 is preferred over Ciherang. It is a new HYV variety produced by the breeders of the Indonesian Agency Agricultural Research and Development in 2015. This variety has the advantage of being resistant to tungro disease and at an early age compared to Ciherang. This is relevant to data from the Food Crops and Horticulture Protection Center of South Sulawesi in 2019 which states that Sidenreng Rappang and Pinrang are areas that frequently occur tungro occurrences from 2010 to 2018.

**Table 2.** Farmers' preferences for several HYV rice varieties in South Sulawesi

Varieties	Amount	Percentage (%)
Inpari 37	22	21,78
Ciherang	18	17,82
Inpari 32	17	16,83
Inpari 36	14	13,86
Inpari 44	9	8,91
Inpari 8	7	6,93
Inpari 4	6	5,94
Inpari 7	5	4,95
Mekongga	2	1,98
Ciliwung	1	0,99
	101	100

Source : Primary Data Analysis 2021

**Table 3.** Farmers' Preferences on Ciherang in Sidenreng Rappang and Pinrang Regencies

	<b>Amount (persons)</b>	<b>Percentage (%)</b>	<b>Amount (persons)</b>	<b>Percentage (%)</b>	<b>Amount (persons)</b>	<b>Percentage (%)</b>
Prefer to Ciherang	13	22,41	5	11,62	18	17,82
Prefer to Other Varieties	45	77,58	38	88,37	83	82,17
Total	58		43		101	

Source : Primary Data Analysis 2021

Although Ciherang is still ranked second, this is sufficient to illustrate that this variety is still able to compete with other newer HYV rice varieties.

Table 3. shows that as many as 22.41% of farmers in Sidenreng Rappang still prefer Ciherang while most of the rest prefer varieties other than Ciherang. The same condition also occurs in Pinrang Regency, where most farmers prefer varieties other than Ciherang. This is relevant to the current conditions, where farmers have more choices of varieties to plant and have performance that matches the wishes of farmers.

### 3.3 Factors Affecting Farmers' Preferences on Ciherang Varieties

The factors that influence farmers' preferences on the Ciherang were identified using Binomial Logistics Analysis in this study. The results of the analysis show that the value of the coefficient of determination is indicated by the value of Negelkerke  $R^2$  of 0.776 which means that 77.6% of the dummy variable of farmers' preferences for the Ciherang variety is explained by the dummy variables of age, education, ownership land status, farm size, farmer membership groups, farming experience, on-farm income, financial constrains, drought constrains, flood constrains, and labor constrains, Other variables outside the model account for the remaining 23.4 %. The Goodness of fit test was carried out to see the suitability of the model used by comparing the significance value in the Hosmer And Lemeshow table with the significance level at  $\alpha = 0.05$ . The results of the analysis show that the significance value in the Hosmer And Lemeshow Table is 0.682

which is greater than 0.05. This can mean that the model used is appropriate. Simultaneous test by looking at the significance value in the Omnibus test table where The study value of 0.000 which indicates that the independent factors have a considerable impact on the dependent variable at the same time. The partial test shows that there are several independent variables that affect farmers' preference for the Ciherang variety, namely age, education, farmer group membership, income, drought constraints and flood constraints.

According to the findings, farmer age dummy variable had a significant effect on farmers' preferences for the Ciherang. Farmers who are more than 4 years old are more likely to choose Ciherang than farmers who are less than 45 years old. Younger farmers have a better ability to seek information regarding new varieties than older farmers, so they have a greater chance of making a wide selection of new varieties that they prefer. Older farmers tend to be slower to adopt new innovations and tend to carry out their usual activities from generation to generation [16], such as the Ciherang.

Farmer education shows a significant negative effect on farmers' preferences for the Ciherang variety. Farmers with a minimum of high school education have a greater chance of liking varieties other than Ciherang. Education plays an important role in the promotion of technology [17]. The level of formal education will greatly influence farmers' understanding of the adoption of modern technology [18]. Farmers who have higher education will find it easier to access, understand, interpret information

**Table 4.** Results of Analysis of Factors Affecting Farmers' Preferences on Ciherang .

<b>Variable</b>	<b>B</b>	<b>Sig.</b>	<b>Exp (B)</b>
Age	<b>2.606*</b>	0.065	13.550
Education	<b>-2.168*</b>	0.068	0.114
Ownership Land Status	-1.497	0.177	0.224
Farm Size	1.709	0.224	5.523
Farmers Membership Group	<b>-2.621*</b>	0.078	0.073
Farming Experience	.099	0.951	1.104
On-Farm Income	<b>-2.457*</b>	0.053	0.086
Finacial constrains	1.232	0.369	3.429
Drought constrains	<b>-2.096*</b>	0.095	0.123
Flood constrains	<b>-2.647*</b>	0.094	0.071
Labour constrains	-.523	0.711	0.593
Constant		0.219	8.294

Notes: (\*) Significant at the level  $\alpha = 0.1$ , (\*\*) Significant at level (0.05), (\*\*\*)Significant at level (0.01)

Source : Primary Data Analysis 2021

better than farmers who are less educated [19]. This may be the reason why farmers with higher education have the opportunity to access, understand and choose information related to the latest technological innovations such as varieties. Educated farmers have the opportunity to have a large selection of new varieties that they like and will plant.

The length of farmers membership in farmer groups has a significant negative effect on farmers' preferences for the Ciherang variety. Farmer group membership provides opportunities for farmers to access more up-to-date information including information on new innovations in agriculture, such as varieties. This can provide an opportunity for farmers to have more references regarding HYV and choose the one they like the most. This is relevant to research [20].

Farmer's income has a significant negative effect on farmers' preferences for the Ciherang. Farmers with an income of less than 30 million rupiahs per year have a higher chance of choosing the Ciherang compared to farmers with an income of more than 30 million rupiah/year. Farmers with high incomes have the opportunity to invest their income in new technological innovations such as new high yielding. This allows farmers with higher incomes to buy newer high yielding varieties, so they also have the possibility of having a large selection of varieties that they like and grow.

The results of the analysis above can be used as a basis for policy makers to take steps so that farmers do not only like certain varieties such as Ciherang and use them continuously. This is done so that the new HYV of rice that have been produced can be utilized optimally so that varieties can be rotated. Research by [21] stated that the rotation of varieties can prevent a decrease in production, one of which is caused by the decreased durability of varieties against pests and diseases [22]. So that age, education, farmer group participation, and farmer income can all be considered in the spread and diffusion of new inventions in the form of varieties.

The findings of this study also show that the Ciherang flood constraint has a considerable detrimental impact on farmers' preferences. This means that the experience of farmers who experience flooding constraints makes them prefer varieties other than Ciherang. Some areas in South Sulawesi are areas affected by floods which affect the productivity of food crops, especially rice. Research by [23] states that every 1% increase in rainfall will reduce production by 0.088%. New HYV of rice that are tolerant to soaking have been released by the Indonesian Agency for Agricultural Research and Development, Ministry of Agriculture, such as Inpari 29 and Inpari 30, as well as varieties Inpara 3, Inpara 4, Inpara 5 which have resistance to immersion 10-14 days, while the varieties commonly used by farmers such as Ciherang are

currently only able to last 4-7 days [24]. Therefore, there is a need for continuous information and dissemination related to these climate stress-resistant varieties to farmers, especially in South Sulawesi in order to increase rice production and farmers' income.

South Sulawesi has a variety of topographical areas and different rainfall, thus affecting climatological conditions in the form of rainfall and temperature [25]. The results of the analysis show that the drought constraints experienced by farmers have a negative influence on farmers' preferences for the Ciherang. Farmers who experience flooding problems in their rice crops have the opportunity to choose varieties other than Ciherang. South Sulawesi is one of the centers of agricultural production of food crops in Indonesia which has been heavily affected by the drought [25]. Based on data from the South Sulawesi BPSB, in 2020, South Sulawesi farmers mostly planted the Ciherang variety, especially in Sidenreng Rappang Regency with an area of 10 hectares and Pinrang Regency with an area of 6 hectares. Furthermore, according to [26], the results of adaption studies of various new high yielding drought resistant rice varieties (inpari and inpago) exhibited higher output than Ciherang, ranging from 11.4 to 26.9%.

#### **4. CONCLUSION**

Ciherang as a new HYV is still in demand by farmers in South Sulawesi province for two decades. As many as 17.82% of farmers in Sidenreng Rappang and Pinrang regencies still like the Ciherang, while the rest prefer the new new HYV. In general, the Ciherang ranks second among the new HYV rice varieties in the two districts. Socio-economic factors, namely age, education, farmer group membership, and on-farm income have a significant effect on farmers' preferences for the Ciherang. Climatic constraints faced by farmers, namely drought and flooding also have a significant negative effect on farmers' preference for Ciherang.

The results of this study can be used as a basis for policy makers to be able to choose the right strategy in the dissemination of new new HYV rice varieties that have been produced. The policy-making refers to considerations of socio-economic factors that influence farmers' preferences for varieties, including age, education, farmer group membership and income. The climate constraint factors faced by farmers that affect the level of preference for Ciherang as a variety that has been used for a long time are another consideration for continuously disseminating new varieties that are resistant to climate stress.

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