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FOOD SECURITY ON DRYLAND FARM HOUSEHOLDS IN SELO SUB-DISTRICT, BOYOLALI DISTRICT

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Abstract

Background: Population growth has led to an increase in the participation rate of rice consumption. This has led to constant pressure on the limits of food supply. Meanwhile, the uneven distribution of food causes food inequality in local areas. These conditions will cause some regions in Indonesia not to achieve food security, even though food availability is sufficient, if people's food access is not good and food utilization is not in accordance with the rules of balanced and safe nutritious food consumption, then the area cannot be categorized as achieving food security. Drylands have great potential and role in supporting national food availability. Food security at the national or regional level does not automatically guarantee the achievement of food security at the household level.
Purpose: This study aims to 1) assess the level of food security of dryland farmer households and 2) analyze the factors affecting the food security of dryland farmer households in the Selo Subdistrict.
Design/methodology/approach: Sampling was done by simple random sampling from a sample frame of dryland farmer groups totaling 100 respondents. Household food security was analyzed using the Food Insecurity Experience Scale (FIES) indicator. The factors influencing household food security were analyzed using binary logistic regression.
Findings/Result: The prevalence rate of moderate food insecurity is 10.74% of total households in the Selo Subdistrict. Farmer households in the Selo Subdistrict experiencing moderate food insecurity is a serious problem that must be addressed immediately. Although the prevalence rate is relatively small, the actual number is relatively large. The prevalence rate of severe food insecurity in the Selo Subdistrict is 0.00% of total households. The food security status shows that most households in Selo Sub-district fall into the food security category with the majority of households being food producers. Factors that significantly influence the food security status of dryland farming households in the Selo Subdistrict are the length of education of the household head, the number of household members, the ratio of expenditure on rice, and the total household income.
Conclusion: The prevalence value of the moderate food insecurity category amounted to 10,74%. The most significant factor is the ratio of household expenditure on rice with an Exp (B) value or odds ratio of 401,150.611. The unstable price of rice has led most households to reduce the amount of rice purchased.
Originality/value (State of the art): This study explains that dryland farmer households still have a moderate food insecurity category, although the number is small but must be considered. The rice expenditure ratio is an important factor in influencing food security status which has implications for more optimized government policies.

Keywords: binary logistic regression, food security, food insecurity experience scale (FIES), household

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INTRODUCTION

Food is a basic need for human survival. As time goes by, the population is increasing, so the demand for food is increasing. This is why there is always pressure on the limits of food supply. According to BPS (2022), the participation rate of rice consumption in Indonesia has almost reached 100%, more precisely 98.68%. The availability of rice in Indonesia per capita is sufficient to meet the rice consumption needs of the Indonesian people (Kementan, 2022). Domestic rice supply is obtained from domestic production, changes in stocks from the beginning to the end of rice, imports, and exports. Nevertheless, meeting the consumption needs of the Indonesian people is a considerable challenge, which must be balanced with an increase in the availability of sufficient food production. Fulfilling the consumption of the Indonesian people is a considerable challenge, which must be balanced with an increase in the availability of sufficient food production.

Food security is an important aspect of maintaining the well-being of both individuals and households. FSVA (2022) states that even though there are surplus areas of rice or other food commodities, it does not necessarily mean that food distribution can be evenly distributed. Uneven food distribution causes food inequality in the area. The condition of food security at the national or regional level does not automatically guarantee the achievement of community food security. National food problems cannot be solved if problems at the household level cannot be resolved (Saputra et al. 2019).

According to BPS (2023b) regarding the prevalence of moderate or severe food insecurity by measuring the scale of food insecurity experience. The prevalence results show that there are differences in food insecurity at the level of Indonesia and Central Java Province. The number of Indonesians experiencing moderate or severe food insecurity from 2018 to 2022 decreased. In contrast to Central Java Province, from 2018 to 2019 there was a decrease in the number of residents, but from 2020 to 2022 there was an increase. This strengthens the opinion of Arida et al. (2015) state that food security at the national or regional level does not guarantee the level of food-secure households. According to Darsono (2012), food insecurity and poverty are mostly at the household level in rural areas. The natural conditions and potential of rural areas are identical to their agriculture, making it an opportunity for agricultural development. The potential of paddy fields in fulfilling staple foods cannot be expected in the long term. The rise of land conversion for non-agricultural development is one of the causes of the reduced function of paddy fields. As an alternative in the long term to the reduction of paddy fields, dry land is utilized. The potential of dry land to be developed as productive land with a very wide distribution of about 144,47 million ha in Indonesia (Priyanto, 2022). Drylands have a great potential and role in supporting national food availability.

Boyolali District has a dry land area of 78,800.04 ha, which is greater than the rice field area of only 22,710.16 ha (BPS, 2021). In addition, this district is one of the food barn areas in Central Java. The Food Security Index (IKP) states that Boyolali District in 2021 is ranked 35th out of 514 districts in Indonesia. Boyolali District is categorized as food secure because the IKP value shows 85.14% (BKP, 2021). The ranking of Boyolali District in 2022 increased, which is ranked 34th out of 514 districts with a value of 85.26% (Bapanas, 2022).

The Selo Subdistrict is one of the subdistricts in Boyolali District with an area of 60.26 km^2, all of which is dry land (BPS, 2023a). The causes of the Selo Subdistrict in the food-vulnerable category are seen from FSVA (2022), mentioning that first, the ratio of per capita normative consumption to net availability of major cereals and tubers is very low with a score of 5. The first indicator occupies priority 1 with a very vulnerable category. This is due to climatic conditions, drought, and not a food crop production center. Second, the percentage of households with access to clean water is very low, reaching 100%. Low access to clean water causes a high incidence of malnutrition. The second indicator occupies priority 1 with a very vulnerable category. Third, the average years of schooling of women in the Selo Subdistrict show that the quality of formal education is still low. The third indicator is a priority 2 with a vulnerable category.

Judging from its existence on the slopes of Mount Merapi and Merbabu, this area has fertile soil. Despite the fertility of the soil, the area does not cultivate rice as the main commodity. In contrast to several other Sub-Districts, most of which cultivate rice. The Selo Subdistrict is the highest producer of vegetable crops in 2022 (BPS, 2023a). Abundant food availability does not necessarily guarantee food security if people's purchasing power is still low. Good access to food is

also needed to strengthen rural household food security strategies. Talking about the availability of food, especially rice, which is adequate in the market does not necessarily achieve food security at the household level.

Based on the background and problems described earlier, the research question of this study concerns the condition of food security and what are the factors that affect food security at the household level of dryland farmers in the Selo Subdistrict, Boyolali District. This study aims to assess the level of food security and analyze the factors that influence the food security of dryland farmer households in the Selo Subdistrict, Boyolali District.

METHODS

The location of this research is the Selo Subdistrict, Boyolali District, which is a local food center in the form of horticulture. The location was chosen by considering that it is an area categorized as highly food secure (Samiran Village) and food insecurity (Jeruk and Jrakah Villages) in the Selo Subdistrict. The research was conducted in August 2023–September 2024. The data used is cross-section data for the last one year. The data source is primary data from farmer household interviews. Secondary data from the Badan Pusat Statistik (BPS), Indonesian Food Security and Vulnerability Atlas (FSVA), books, national journals, and international journals. Sampling was conducted using a simple random sampling method from the sampling frame of dryland farmer groups in Samiran Village, Jeruk Village, and Jrakah Village. The number of farmer households sampled in this study was 100 farmers.

Analysis of Household Food Security

The Food Insecurity Experience Scale (FIES) indicator is a suitable indicator used to measure food security (Ballard et al. 2013). The FIES indicator has good validity and reliability compared to other indicators for the individual level (Manikas et al. 2023). In addition to individual-level measurement, the FIES can also be used at the household level (FAO, 2017a). The FIES has been widely used to measure food insecurity experiences in developing countries, as the proposed questions have been designed to measure household-level food insecurity.

The FIES has been widely used to measure food insecurity experiences in developing countries, as the questions asked have been designed to measure household-level food insecurity. The FIES consists of 8 event questions related to food insecurity experiences that have occurred over 12 months. The questions have been tested for validity and reliability using the Rasch model. Each event question consists of two answer options, namely: 0= no and 1= yes. The following are the event questions from the FIES indicator according to (FAO, 2017b). Table 1 describes the food insecurity experience questions experienced by households.

Table 1. Common questions of the Household-level food insecurity experience scale (FIES) for 12 months

Standard Label	Question-Wording
Worried	Was there a time when you or others in your household were worried you would not have enough food to eat because of a lack of money or other resources?
Healthy	Was there a time when you or others in your household were unable to eat healthy and nutritious food because of a lack of money or other resources?
Fewfood	Was there a time when you or others in your household ate only a few kinds of foods because of a lack of money or other resources?
Skipped	Was there a time when you or others in your household had to skip a meal because there was not enough money or other resources to get food?
Ateless	Was there a time when you or others in your household ate less than you thought you should because of a lack of money or other resources?
Ranout	Was there a time when your household ran out of food because of a lack of money or other resources?
Hungry	Was there a time when you or others in your household were hungry but did not eat because of a lack of money or other resources for food?
Wholeday	Was there a time when you or others in your household went without eating for a whole day because of a lack of money or other resources?

Source: FAO (2017b)

Binary Logistic Regression Analysis

This model is used to describe the relationship between the dependent variable and the independent variable. The dependent variable used has two categories, namely zero (0) for failed events and one (1) for successful events. The independent variables in the binary logistic regression model can be categorical or numeric. The following is the regression equation of the determinants of food security of dryland farming households in the Selo Subdistrict, Boyolali District.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots + \beta_p X_p + \varepsilon \ldots\ldots. (1)$$

Description: Y (Represents the dependent variable (household food security status); Y (1 for food-secure farmer households); Y (0 for food-insecure farmer households); β_0 (Constant); β_p (Represents the coefficient that can be estimated from each category); X_1 (Years of education of household head (years)); X_2 (Number of household members (people)); X_3 (Receiving food assistance (0= not receiving and 1= receiving)); X_4 (Nearest distance to the food market (km)); X_5 (Nearest distance to financial institution/ facility utilized (km)); X_6 (Rice to food expenditure ratio (%)); X_7 (Ratio of food expenditure to total expenditure (%)); X_8 (Land size narrow); X_9 (Land size large); X_{10} (Side job off the farm); X_{11} (Side job non-farm); X_{12}(Total household income (0= low and 1= high); ε (error)

The rationale for this research can be seen in Figure 1. Fulfilling consumption is a considerable challenge due to the growing population. Dryland becomes a place to fulfill food so that food production remains safe. One of the potential dryland areas is the Selo Subdistrict, but the Food Security Index value in the Selo Subdistrict is in the food insecurity category. This is reinforced by uncertain household income. Therefore, it is important to conduct research on food security at the household level. This study analyzes the status of food security at the dryland household level. The analysis used is the measurement of the Food Insecurity Experience Scale (FIES). In addition, it also measured the factors affecting food security using binner logistic regression analysis. From the analysis, it can be seen the condition of food security of dryland farming households in the Selo Subdistrict.

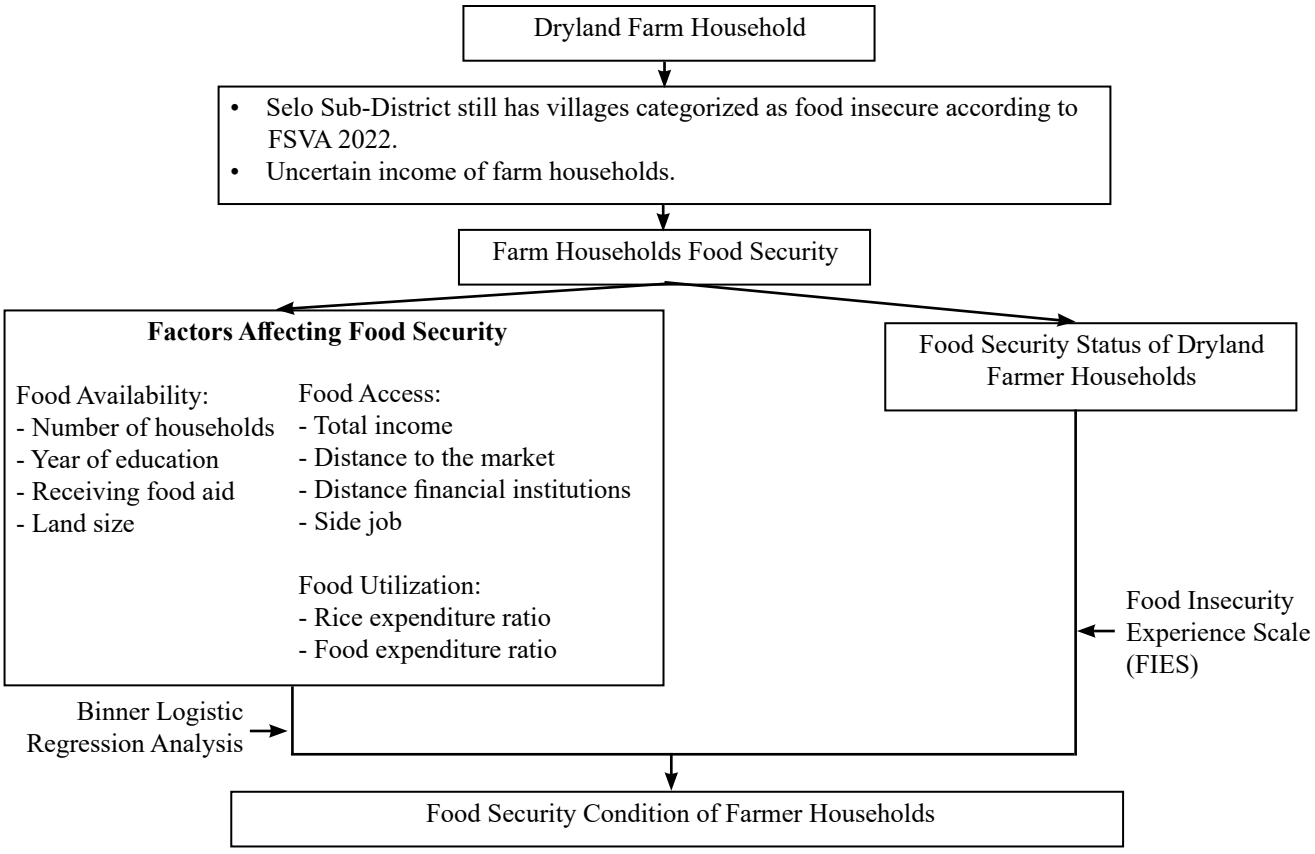

Figure 1. Research framework

RESULTS

Analysis of Food Security

In terms of the characteristics of the respondents, most of the respondents are aged 46–66 years, amounting to 43 people, and are included in the productive age of the population. The majority of respondents only graduated from elementary school 56 people. The largest land area respondents own is 1,000–4,999 m^2 owned by 63 people. Respondents have the most household members in the group of 4–6 people as many as 64 households. The measurement parameters of the FIES consist of three validity measurements, namely severity, infit, and outfit. The following is an explanation for the validity of the FIES question items.

Based on Table 2 the order of severity from the lowest result was “worried”, “fewfood”, “ateless”, “ranout”, “skipped”, “health”, “hungry”, “wholeday”. The infit values on all FIES question items were acceptable and showed a good fit with the Rasch Model. This is because the infit values on all FIES question items are in the range between 0,7 and 1,3. This means that all FIES question items can reliably distinguish respondents and be associated with latent traits (Jubayer et al. 2023). The outfit values in Table 2 show that all question items have values ≤ 2. This means that the FIES question items fit the Rasch Model.

The prevalence rate of moderate food insecurity is 10.74% of total households in the Selo Subdistrict. This value means that for every 100 households, 11 households are experiencing moderate food insecurity. The prevalence rate is equivalent to 1.081 households in the Selo Subdistrict that experience moderate food insecurity. Farmer households in the Selo Subdistrict experiencing moderate food insecurity is a serious problem that must be addressed. Although the prevalence rate is relatively small, the actual number is relatively large. In line with research from Kadir et al. (2023) on the measurement of FIES in agricultural households in Indonesia. The study states that the prevalence of households experiencing moderate to severe food insecurity is around 3.27%, equivalent to 0.7 million out of a total of 20 million households in Indonesia.

The prevalence rate of severe food insecurity in the Selo Subdistrict is 0.00% of total households. This means that for every 100 households, no households are experiencing severe food insecurity. The table shows that most households in the Selo Subdistrict are food secure with the majority of households being food producers.

Factors Affecting Food Security of Dryland Farmer Households

The results of the food security status analysis show that this study uses ten variables that are thought to affect the food security status of households. These variables include the year of education of the household head, number of family members, receipt of assistance, distance to the nearest market, distance to financial facilities, rice expenditure ratio, food expenditure ratio, land area, side job, and income/household/year. The factors of household food security were analyzed using binary logistic regression as follows.

The first step with multicollinearity testing is used to determine the correlation or strong relationship between independent variables. A sign that the model used is good is that there is no multicollinearity. The multicollinearity test is shown in the following Table 3.

Table 2. Estimation results of severity, infit, and outfit parameters on each FIES question items

Question Items	Severity	Infit	Outfit
Worried	-4.16	1.07	1.66
Healthy	2.20	0.73	0.07
Fewfoods	-1.77	0.95	0.82
Skipped	0.71	1.12	0.49
Ateless	-1.07	0.89	0.78
Ran out	-0.31	0.97	1.11
Hungry	2.20	0.99	0.17
Wholeday	2.20	1.14	1.28

The multicollinearity test results are seen from the Tolerance and VIF (Variance Inflation Factor) values. Based on Table 3 The Tolerance value for each independent variable shows a value ≥ 0.01. The VIF value for each independent variable shows a value < 10. This means that overall the independent variables in this study do not occur multicollinearity. Therefore, it can be continued by analyzing food security factors using the independent variables in Table 4 with formula 1, the binary logistic regression analysis. Table 4 shows the estimation results of the factors that can affect food security status.

Years of Education of the Household Head

Table 4 shows that the length of education of the household head Sig. is 0.075 < α (10%) and the coefficient value (B) of this variable is negative at -1.843. This means that if the length of education of the household head increases by one unit, it is likely to reduce the food security status of farmer households. This is related to lifestyle and food consumption, low education has a simple lifestyle with food utilizing their own fields. Whereas higher education has a modern lifestyle, food consumption is more often fast food. Thus, it affects the lack of demand for local food which will reduce food security. Research by Rondonuwu dan Tendur (2022) states that income and lifestyle simultaneously affect people's consumption patterns.

Table 3. Multicollinearity test of factors affecting food security

Variable	Tolerance	VIF
Constant		
Year of education	0.829	1.206
Number of households	0.751	1.331
Receiving food aid	0.772	1.296
Distance to the market	0.368	2.716
Distance to financial institutions	0.539	1.855
Rice expenditure ratio	0.735	1.361
Food expenditure ratio	0.860	1.163
Narrow land size	0.510	1.959
Wide land size	0.444	2.255
Side job off the farm	0.693	1.442
Side job non-farm	0.736	1.359
Total income	0.640	1.563

Table 4. Factors affecting the food security of dryland farming households in the Selo Subdistrict

Variable	B	S.E.	Wald	df	Sig.	Exp(B)
Constant	77.647	7491.851	0.000	1	0.992	5.27E+33
Year of education	-1.843*	1.037	3.161	1	0.075	0.158
Number of households	-1.842*	1.020	3.261	1	0.071	0.158
Receiving food aid	-3.317	2.740	1.466	1	0.226	0.036
Distance to the market	-1.148	0.870	1.741	1	0.187	0.317
Distance to financial institutions	0.891	0.799	1.242	1	0.265	2.438
Rice expenditure ratio	12.902*	7.411	3.031	1	0.082	401150.611
Food expenditure ratio	1.868	7.053	0.070	1	0.791	6.478
Narrow Land size	-14.388	5803.675	0.000	1	0.998	0.000
Wide Land size	-18.813	5803.675	0.000	1	0.997	0.000
Side Job off the farm	-20.310	4737.573	0.000	1	0.997	0.000
Side Job non-farm	-36.518	4737.589	0.000	1	0.994	0.000
Total income	-12.787*	7.772	2.707	1	0.100	0.000

Information * and **significant at α= 10% and 15%

Number of Household Members

The estimation results in Table 4 show that the number of household members Sig. is 0.075 < α (10%) and the coefficient value (B) of this variable is negative at -1.842. This means that if the number of household members increases by one person, there is an opportunity to reduce the food security status of farmer households by 0.158. As the number of household members increases in the Selo Subdistrict, food needs also increase. Increased food needs can trigger a decrease in food security status, if not accompanied by an increase in income sufficient to meet food needs. Tigistu and Hegena (2022); Fikire dan Zegeye (2022); and Lestari (2024). Mentioned that larger household sizes will have a higher probability of experiencing food insecurity.

Receiving Food Aid

The estimation results show that receiving food aid Sig. is 0.226 > α (10%). This means that receiving food assistance has no effect on food security status. Food assistance in this study is in the form of Non-Cash Food Assistance (BPNT), which is 10 kg of rice. Although rice expenditure is reduced for beneficiaries, this does not rule out the possibility that other food expenditures have decreased. In addition, some households said that the food assistance provided was not evenly distributed. Ridha and Rumayya (2024) on the Non-Cash Food Assistance (BPNT) program explained that the average food expenditure for beneficiaries increased by 6.52%. This was caused by the inappropriate distribution of assistance to households in the agricultural sector, especially those with female household heads and larger household members.

Distance to the Nearest Market

The estimation results show that the distance to the nearest market Sig. is 0.187 > α (10%). This means that the food security status of farmer households is not influenced by the distance from the house to the nearest market. The market in question is a traditional market with an average distance from the farmer's house to the nearest market of 3 km. The closest distance is 0.5 km while the farthest distance is 7 km with good road conditions to the market. For all households, the availability of rice or other foodstuffs is available at the nearest shops at affordable prices. Thus, the distance to the market, both near and far, is not problematic for households. According to the results of Mohammed et al. (2021) explain that the closer households are to the market, the more benefits they will get, such as lower transportation costs. In addition, the opportunity to participate in activities in the market because more can access food easily.

Distance to Financial Institutions/Facilities Utilized

The estimation results show that the distance to financial facilities Sig. value is 0.265 > α (10%). This means that the food security status of farmer households is not influenced by the distance from the house to the utilized financial institutions/facilities. The financial facilities in question are banks, ATMs, or other financial institutions with an average distance of 3 km. The closest distance to a financial facility in the Selo Subdistrict is 0.5 km and the farthest distance reaches 7 km. Many households prefer the nearest bank agent and mobile banking. In addition, there are still households that do not save money in banks. This causes the distance of financial institutions to have no effect on the food security status of farmer households. In contrast to research from Sharimakin and Dada (2020) on financial access in Nigeria. The results of this study state that distance has a negative effect on food security. Long distances to formal banks and road access that cannot be passed by motorized vehicles make it difficult for households to get credit. In the end, it will reduce the food security status of households in Nigeria.

Rice Expenditure Ratio

The rice expenditure ratio variable has a Sig. value of 0.082 < α (0.1) with a coefficient value (B) of 12,902. The Sig. value shows that the rice expenditure ratio has a positive effect on household food security status. It implies that farmer households with a high rice expenditure ratio are more likely to be food secure than those with a low rice expenditure ratio. Increased rice consumption, supported by good rice availability and stable rice supply, maintains food security. This means that households in the Selo Subdistrict have easy access and the ability to purchase rice. Rice is widely available in markets and shops in the Selo Subdistrict. The price had reached Rp.15.000, but households were able to fulfill their rice needs. Research from Aliciafahlia et al. (2019) and Saputro and Fidayani (2020) stated that

the price of rice affects the share of rice expenditure. According to Wardani et al. (2019), if rice production can be maintained and population growth can be controlled with stable per capita consumption, it can maintain rice security performance. Reducing rice consumption according to Janti et al. (2016) by optimizing local food diversification, namely cultivating various grains, tubers and fruits according to regional conditions. In addition, the results of this cultivation can be processed into alternative local food ingredients as a substitute for rice.

Food Expenditure Ratio

The estimation results show that the closest food expenditure ratio Sig. is 0.791 > α (10%). This means that the food security status of farmer households is not influenced by the food expenditure ratio. In contrast to previous research from Sugiyanto and Pintakami (2021) explain that food expenditure has a contribution to the energy consumption of farmer households. Manyullei and Arundhana (2021) stated that food expenditure determines the level of food security.

Land size

There are two categories of land area in this study: narrow at 200-4,999 m^2, and large at ≥ 5,000 m^2. The estimation results show that the land area of the two categories is not significant. The Sig. value of land area 200-4,999 m^2 is 0.998 and ≥ 5,000 m^2 is 0.997. This is because the Sig. value in both categories of land area is more than α (15%). This means that the food security status of farmer households is not influenced by land area. Land size is not significant because the income received by farmers is different and uncertain. Some farmers choose to cultivate monoculture planting because it is easier to maintain. The area of land cultivated during the dry season for households that have large land areas is only half of it. This is due to the lack of irrigation to agricultural land which has an impact on reducing crop production. In line with previous research which explains that land area has no effect on the food security of farmer households in Subak Sembung (Pradnyadewi *et al.* 2021). According to the study, farmers' income from narrow land is not necessarily high.

Side Job

There are two categories of side jobs in this study, namely off-farm and non-farm. Off-farm side jobs have a Sig. value of 0.997 and a Sig. value on non-farm side jobs of 0.994. This is because the Sig. value in both side job categories is more than α (15%). This means that the food security status of farming households is not influenced by side jobs. Side jobs have no effect due to differences in income earned. This is because most of the side jobs of farmers in the Selo Subdistrict have uncertain incomes. In contrast to previous research from Fikire and Zegeye (2022), off-farm income has a positive effect on household food security status. Explaining that it is possible to increase wealth if participating outside of farming activities.

Total Income

The total household income/year variable has a Sig. value of 0.100 < α (0.15) with a coefficient value (B) of -12,787. The Sig. value shows that household income/year has a negative effect on household food security status. This implies that farmer households with high total incomes are more likely to experience food insecurity than those with low total incomes. Household income in the Selo Subdistrict has a negative effect in relation to working time. Low-income households generally work as farm laborers, construction workers, farmers with a narrow land area, seed sowing, and others whose income is uncertain. In contrast to the results of Addisu (2015); Nanda et al. (2019); and Mengistu et al. (2021) that income is positively related to household food security. The results of these studies reveal that increasing income makes household food access easier.

Managerial Implication

From the results of the study, it was found that the rice expenditure ratio is very influential on household food security. This is related to the food assistance policy in the form of Non-Cash Food Assistance (BPNT). Basically, this policy is very helpful for families who are hampered in fulfilling rice. The results of this study show that the food assistance policy does not affect food security because the registered data is not updated again so a lot of assistance is not on target. Therefore, the role of the government is very important in monitoring the policy.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

From the research results it can be concluded the prevalence rate of food insecurity among dryland farming households is 10.74%, categorized as moderately food insecure. This means that the value is equivalent to 1,081 households out of a total of 10,061 households in the Selo subdistrict that are moderately food insecure. Factors that significantly affect the food security status of dryland farmer households in the Selo Subdistrict are the length of education of the household head, number of household members, rice expenditure ratio, and total household income. The most influential factor is the ratio of household rice expenditure with an Exp (B) value or odds ratio of 401,150.611.

Recommendations

From the research results it can be concluded that there is a need to optimize policies and periodic assistance in achieving improvements in household food security in terms of education and household income. Rice expenditure is proven to improve food security status, but the unstable price of rice makes most households reduce the amount of rice purchases. Therefore, it is necessary to control and monitor rice prices by the government to maintain rice price stability in anticipation of rising rice prices.

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