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Crop selection in dryland of North Lombok Regency: farmers search for more money and less risk

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Abstract. Dryland areas of North Lombok can be grown with a variety of crops and provide alternatives for farmers. This paper aims to: (1) identify farmer selection of crops in dryland areas of North Lombok Regency, Indonesia; (2) analyze farmer decisions in selecting the crops in the area. Results of this study can become the basis for developing agriculture in the area or other areas of similar conditions. Data were collected through surveys to sampled farmers in the dryland areas of North Lombok, with the focus of questions on farmer reasoning following their crop selection. Such an approach is guided by qualitative research principles, highlighting the importance of understanding and meaning of topics investigated. The surveys revealed that in dryland areas of North Lombok grew corn, rice (of dryland type), peanuts, long beans, chili, tomatoes, and cassava. Corn is a dominant crop among farmer choices. In their farming activities, farmers did not select soybean, one of the targeted crops. Farmer reasons behind crop selection directed to the conclusion that farmers in dryland areas of North Lombok are rational, in which they aim to generate high income from their activities and at the same time attempt to reduce risks associated with the chosen crops. This study results imply the importance of understanding the motivations of growers as the primary stakeholder in implementing farming.

1. Introduction

There are two main issues as the background of this study. They are agro climate condition of North Lombok and farmer choices in farming.

The climate of North Lombok consists of several factors, yet the main indicator is rainfall. Rainfall in North Lombok was about 1,300 mm per year in 100 days. The rain starts around October/November and finishes around April May [1]. In particular to dryland, there was a report by Jaya [2] who reported in more details on the bio characteristic of the dryland of North Lombok, including on temperature and relative humidity, which are considered not only suitable for growing crops in the rainy season but more importantly optimum for growing crops like maize.

The agro climate of North Lombok enables the region to grow many kinds of crops. The situation is very observable in the field as well as in reports and publications. For instance, the Central Body of Statistics of North Lombok office reports crops that have been grown in North Lombok annually and their production. In general, they can be grouped into agriculture, forestry, livestock, and fishery. Numerous crops reported were banana, papaya, coconut, shallot, beans (string, long, green, red), chili (big, small), water spinach, cucumber, cabbage, chinese cabbage, melon, watermelon, bell pepper, eggplant, tomato, potato, radish, cantaloupe, ginger, galangal, turmeric, mango, durian, orange, jackfruit, avocado, grape, star fruit, duku, guava, pomelo, mangosteen, pineapple, rambutan, salacca (snake fruit), sapodila, bread fruit, melinjo, cocoa, and coffee [1]. This final year statistic report did not include other observable crops, possibly because of the current tragedy of the earthquake and corona pandemic. The previous publication listed those main crops, including paddy (wet and dry types), corn, peanut, cassava, sweet potato, and green bean, in the group of food crops [3]. This last-mentioned publication also reported the crops from fishery groups, such as sea fish (of fresh, sea, and mixed water), pearl, and seaweed.

The numerous and various crops provide plenty of choices for people in general or farmers, in particular, to be grown. Those alternatives actually may satisfy people's choices according to their wishes and the resources they possess. However, there are crops of large production, medium, and small production, and even some potential crops were not cultivated at all. These all show the choices that people or farmers make.   Details of the number of crops and their production each year can be seen in the reports of the North Lombok government [1, 3-8]. This fact raises the question as to why people select particular crops and not other crops. The answers to such questions may provide understandings of farmer motivations and needs in their selection of crops. This understanding provides a basis for the successful implementation of development programs in several sectors ([9-12].

This paper aims to: (1) identify farmer selection of crops in dryland areas of North Lombok regency, Indonesia; (2) analyze farmer decisions in the selection of the crops in the area. Results of this study can become the basis for developing agricultural programs in the area or other areas of similar conditions or resources.

2. Research methods
To achieve the paper objectives, this study was designed as described in the following. It starts with identification of research samples, followed by data collection and ends with data analysis.

2.1. Sampling of locations and respondents
Since there were no quantitative data on the number of farmers growing each crop in each location within the North Lombok regency, samples were determined in non-random techniques [13-16]. Initial information of government report [3] showed two main food crops grown in North Lombok, i.e., rice and corn. This information led to the determination of samples in a quota of 30 farmers for rice and 30 farmers for corn. They were initially allocated six farmers for each crop and each of the districts of Pemenang, Tanjung, Gangga, Kayangan, and Bayan. Villages in each district were determined in purposive sampling as they have the most farmers of targeted crops (rice and corn). The final farmers to be respondents were determined in snowballing sampling, starting from information provided by the village leaders, farmer group leaders, or extension officers. In total, there were 60 farmer respondents. At the final respondent selection application, more than 30 farmers in rice and corn were recorded. This occurred as respondents were also recorded for the crop other than the targeted one. For example, in practice, the farmer respondent was targeted for rice, but he was asked to list other than rice, including corn and other crops, such that the respondents of rice became more than 30 farmers, and so as the corn farmer respondents.

2.2. Data Collection
Data were collected through surveys by interviewing [13-15] sampled farmers. The main questions to the respondents were on crops that farmers were growing at the time of interviews, followed by the

farmer reasons for growing each crop. Other questions accompanied the questions on why the farmer did not grow other crops, particularly soybean. Soybean together with rice and corn were three targeted crops of the government of Indonesia, for which the government made the program of increasing production, called 'pajale' (padi (rice), jagung (corn), and kedele (soybean)) [17-19].

2.3. Data Analysis
Collected data were analyzed by applying descriptive statistics [20-22] and using cross tables for items such that farmer reasons are identified, followed by qualitative explanations to interpret and make sense of the findings [23-25]. Findings in the analysis were discussed and were related to supporting data or information from literature or previous findings on the topics presented. The results of the analyses are presented in the next section.

3. Results and discussions
This section present the farming system applied in dryland areas of North Lombok. The farming system is important for understanding the decisions that farmers make. This is followed by the provision of information on types or kinds of crops that farmers were growing at the time of interviews or data collection, from which crops selection becomes identifiable. This results and discussion section is accomplished with farmer reasons in growing or not growing crops.

3.1. Farming system in dryland areas of North Lombok
The practice of agriculture in dryland areas of North Lombok relies much on rainfalls. Rains usually start at about October and cease at about April, with total rainfalls of about 1,300 mm in 100 days [1, 3, 4]. Farmers adapt their schedule to the situation by planting seasonal crops, such as grain cropss, in the start of the rain, and harvest at the end of the rain season. The land is not farmed (left fallow) outside the rainy season for risk that is considered threatening crop production. Perennial crops are also planted at the start of the rainy season but can produce and be harvested year-round and several years. Irrigation can be available irregularly but also connected to rainfalls; that is, it just sufficient during the rainy season. A more detailed farming system was reported by Sjah et al. 2017 [26]. This farming system is described briefly here. The farming system in the dryland areas of North Lombok is mixed, or more known as a multiple cropping systems [27-29].

The system consists of several forms, including specific, unspecific, and mixed. The specific farming system means that there is more than one crop on the farm, and they are planted with clear borders among the types of crops. The unspecific farming system occurs when the crops are farmed without clear boundaries among them. The third one is the condition in which some crops have clear borders and some other crops with unclear, called a mixed farming system. The crops consist of seasonal crops and perennial crops. Perennial crops are planted on the dykes and or within the paddocks. Considering the existence of perennial crops, the farming system can be simply called a mixed cropping system. Some farmers on the farms may also include livestock and fish. They do these to efficiently use their resources, using the waste of one crop by other crops. For example, waste or by-products of plants become the foods for livestock, and in reverse, waste of livestock is useable for plants as fertilizers. This farming system application demonstrates this paper title that farmers use their resources efficiently while reducing the risk of product failure and expect more income from various plant and livestock businesses. In strategic management, this strategy can be called making synergy amongst business units. Such an approach is crucial for achieving a business's competitive advantage in the long term [30-32]. The smartness and rationality of the farmers in the dryland of North Lombok start showing from this practice of the farming system.

3.2. Kinds of crops grown in dryland areas of North Lombok
The study interviewed 60 respondents of farmers, assigned 30 corn farmers and 30 rice farmers. When those sampled farmers also grew crops other than the targeted crops (corn and rice), then that additional crops were also recorded during the interviews. As a result, the number of respondents

became more than 60 respondents, given that there were respondents who were double-counted for the additional crops they grew. Table 1 shows the distribution of farmer respondents by crops grown in dryland areas of North Lombok. Although the table shows only seven crops, other crops, i.e., perennial crops, are grown on the dykes of the farm and even inside the crop paddocks at certain distances, as reported in the other paper [26]. The seasonal crops grown in the dryland areas of North Lombok were corn, rice (of wetland type), peanut, long bean, chili, tomato, and cassava. Reasons for growing these crops are presented in the next section.

Table 1. Kinds of crop and distribution of farmers growing each crop in dryland areas of North Lombok.

Crop	Number of respondents (person)	Percent of 60 respondents (%)
Corn	44	73
Rice (of dryland type)	38	63
Peanut	25	42
Long bean	2	3
Chili	2	3
Tomato	1	2
Cassava	1	2

3.3. Farmer reasons for growing crops in dryland areas of North Lombok

Reasons mentioned by farmers in growing crops at the time were diverse. Farmers mentioned seven reasons: the crops' suitability to the land, high productivity of the crops, easiness of production, experience with growing the crops, the crops can be consumed by the families, and the profit earned from the crops.

The suitability of the crops to the land is an important consideration for farmers. It is a logical consideration that crops must be suitable to the land because when it is not suitable, then the crop production may fail, with a further consequence of losing the costs that have been spent in the production process. Farmers do not want that to happen; they do not want to risk production failure and then lose the money they spent. The suitability of the selected crops (corn, dryland rice, and peanut) to the land (soil) is confirmed by related literature or theories (Table 2). The soil or land of North Lombok supports the growing of crops selected by farmers in the region.

Table 2. Suitability of selected crops to the land of North Lombok.

Land (soil) aspect	North Lombok	Corn	Rice (dryland type)	Peanut	Suitability
Soil pH	6 [33]	5.6-6.2 [34]	4-7 [35]	5-7 [36]	Suitable for all selected crops
Soil texture	Sandy loam [2]	Any type [37]	Any type [38]	Sandy loam, sandy clay, Sandy loam clay [36]	Suitable for all selected crops
Height above sea level (m)	5-10 [1]	0-1,300 [34]	0-1,500 [35]	0-500 [39]	Suitable for all selected crops

The next consideration was on the productivity of crops, meaning that farmers search for high productivity since high productivity brings more revenue (under the assumption of constant product price). Easiness of production is also an important consideration. Easy production implies light work or a shorter time to complete the work. The farmers can save time and energy and then be allocated for doing other works, for example, being workers in other farms or building development. The

farmers can generate additional income other than farming only. Farmers choose crops for the reason that own family can consume crops. This brings two sources of benefit: firstly, reducing cost by purchasing consumption (such as rice and corn), and secondly, reducing risk of market. In other words, it does not matter when the crop production is unsold because the products become consumable. Finally, farmers mentioned reason for growing crops was because the crops are profitable. This was an explicit statement about the economic reason for growing crops. Other reasons were implicit of economic reasons, i.e., increasing profit, either by increasing revenue or reducing cost. All of these reasons indicated that farmers were rational, in the sense that they attempted to gain profit as high as possible [40-43]. The claim of the title of this paper is now proven.

3.4. Reasons for not growing other crops

The reasons for not growing crops other than the one he was growing were a bit confusing for respondents, since other crops can be of various crops and become difficult to answer. The question was then altered to be more specific to soybean, which was the main government target but was not grown by farmer respondents in North Lombok. For this particular question then farmer respondents could answer specifically, too. The identification for these responses revealed that reasons for not growing soybean were also economic reasons, but they are put in the opposite way to reasons for growing crops that farmers actually farmed. The reasons for not growing soybean are that soybean is not suitable for the land, has low productivity, has low product price, can be attacked by lots of diseases, lacks seeds, lacks farmer experience, and is not a profitable crop.

The reasons are explained further here. Firstly, the main requirement in growing a crop is its suitability to the land. This requirement is considered important by farmers, and therefore it must be met since farmers do not want to take the risk of production failure in growing this crop. Secondly, soybean has low productivity, and this in the end accumulates into low income. Farmers as general people prefer higher income than lower one, called rational behavior [41-44]. The next reason for not growing soybean is because of low prices. However, this is not justified because soybean has a higher price than other crops, such as corn. For example, in 2020, the price per kilogram of soybean was about Rp 10,500, and corn was about Rp 7,900 [45]. Soybean is claimed to have more disease attacks. This is an apparent risk that threatened the production, and accordingly, farmers avoided it by not growing soybean. Some farmers also reported that they did not want to grow soybean since there was no seed available at the time to farm their lands. It has been a quiet long time that soybean was not grown in the location. As a result, farmers did not have stock for soybean seeds from their previous production. The statement of no seed available may also mean that growers could not access the seed from the market or no government provision of soybean in the region of North Lombok. The next reason for not growing soybean is that some farmers do not have experience with soybean production, which implies that growing soybean for the first time can be risky work, since a new application, the necessary expertise may not have been mastered, and this condition leads to a risk of production failure, and at the end lose the income from the crop. Finally, an explicit reason for not growing soybean is because soybean farming is not profitable. This reason is consistent with several previously mentioned reasons of low productivity accompanied with reasons of potential risks from the unsuitability of soybean to the land, disease attacks, and lack of experience in growing soybean. For all of these accumulative reasons of economic and risk lead farmers to not growing soybean.

To sum up, from reasons of growing certain crops or not growing other crops, it is very obvious that farmers are rational in the sense that they attempt to gain the most income while reducing or avoiding the risk associated with crop farming and subsequence follow up activities. The behavior of reducing or avoiding risk in a business has been documented in some studies [46-51], and has similarities with findings in this study.

4. Conclusion

The surveys revealed that in dryland areas of North Lombok grew corn, rice (of dryland type), peanuts, long beans, chili, tomatoes, and cassava. Corn is a dominant crop among farmer choices. In

their farming activities, farmers did not select soybean, one of the targeted crops. Farmer reasons behind crop selection directed to the conclusion that farmers in dryland areas of North Lombok are rational, in which they aim to generate high income from their activities and at the same time attempt to reduce risks associated with the chosen crops. This study results imply the importance of understanding the motivations of growers as the primary stakeholder in implementing farming. This study has shown the importance of income generated from crops and the risk associated with crop farming and its subsequence activities in gaining that income.

5. Acknowledgment

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