Drought Mitigation Strategy of Farmers in South of West Java

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Abstract. Around 10% of the population in Tasikmalaya and 8% in Sukabumi Districts are below the poverty line, of whom some lived in upland areas. This paper analysed the local farmers’ strategies in mitigating drought. The planting pattern in both districts varied, rice-rice-CGRT crops, rice-CGRT crops -rice, rice-CGRT crops -not planted and rice- not planted -not planted. This diverse planting pattern occurred because farmers are dependent on the rainy season. This paper described alternative food crops selection strategies for the farmers to mitigate drought.

1. Introduction
West Java places third as the province with the most number of poor people after East Java and Central Java Provinces. In September 2014, as many as 15% of the poor in Indonesia were living in West Java Province, of whom the majority lived in the Districts of Bogor, Garut and Cirebon. However, if divided by region, the southern part of West Java has more than half the number of poor people living in West Java. Not only poverty, the magnitude of West Java’s contribution to the agricultural sector does not guarantee that food needs can be fulfilled independently. Of the 28 districts/cities in West Java Province, there are some areas that are still food insecure since they cannot meet their own food needs, hence must obtain from other regions [1]. This indicates the need for efforts to increase agricultural production in the West Java region.

The potential for developing the agricultural sector in the West Java region is relatively larger than in any other regions because of its strategic location and a fairly good climate. As a region with large potential in agricultural production, the lands have not been utilised optimally. Based on the characteristics of the region, there are differences in conditions between the northern and southern parts of West Java. Unlike the fertile soil conditions in the northern part, the soil conditions in the southern region are dominated by dry land. Dry land in the southern region is the largest among the other two regions in West Java, namely the northern and central regions. The area of dry land in southern part of West Java Province reaches 55.98 percent of the total dry land in West Java. Sukabumi District is the area with the largest dry land in the southern region, totalling to 232,023 ha, followed by Tasikmalaya District [2]. The extent of dry land in the southern part of West Java was also due to lack of good irrigation system. This is due to the position of the agricultural lands that are above the river flow, making it difficult for irrigation canals to be developed. Thus, the supplies of water within these areas are very much dependent on rainfall.

Lack of irrigation canals on the dry lands has lessened the interests of farmers to manage the lands, even though lands are largely available, especially in Sukabumi and Tasikmalaya Districts. Potential
plants that can be developed on dry lands often include tubers, but agricultural yields in the southern part of West Java are not limited to only tubers but also include rice, corn and other horticultural crops. Of the total rice production in West Java, the southern part of the province contributes to 35% [3]. During the periods of 2010-2011, rice and corn productions in the southern region reached the highest among the other regions within West Java (north and centre). This is because most of the population in the southern part of West Java Province obtain their livelihoods in the agricultural sector. The agricultural production has the potential to be increased if the available lands can be utilised optimally. The largest dry land area is found in Sukabumi District totalling to 232,023 Ha (15.11%), whereas the potential of agricultural crops is very large in the Sukabumi District. Likewise with Tasikmalaya District which has a total dry land area of 170,489 Ha (11.10%).

Based on the above problems, this study has the objectives to optimise the use of dry land in Sukabumi and Tasikmalaya Districts and formulates policies in an effort to improve the welfare of the community. In particular, the objectives of this study were to: (1) analyse the current level of poverty of dry land farmers in Sukabumi and Tasikmalaya Districts; (2) analyze the farmers’ strategy to mitigate drought in Sukabumi and Tasikmalaya Districts.

Drought is a normal recurring event that affects the livelihoods of millions of people around the world. Climate variability, which includes erratic and unpredictable seasonal rainfall, floods and cyclones, contributes to the risk of farming across most of southern Africa, but especially in marginal rainfed agricultural areas that are characterised by low and erratic precipitation. A serious drought or a series of consecutive droughts can be a disaster-triggering agent that exacerbates social and economic problems, and reduces the overall livelihood security of a society. These problems are most severe where economies are least diversified and virtually everyone depends either directly or indirectly on agriculture [4].

Drought, according to the National Drought Mitigation Centre, 2006 in The Water Wheel 2016, is defined as “a decrease of water availability to substantially below the normal condition for a certain place and time”, typically associated with a period of below-average rainfall. Drought is unlike other natural hazards (such as floods), in that there is often no well-defined start and end. There are four basic categories of drought, namely meteorological drought, agricultural drought, hydrological drought and socio-economic drought.

While lack of water is the underlying cause of drought, a large number of other socio-economic factors compound have intensify its effects. [5] , states that the absence of a precise and universally accepted definition of drought adds to the confusion about occurrence and severity of drought. The various definitions of drought differ in their interpretations relative to their impacts and must be region and impact specific. Both the natural and social components of drought need to be better understood and addressed in the national, regional and international policy plannings [6].

2. Methods
2.1 Sampling Site
The survey was conducted in two areas comprising the largest dry land areas in the southern part of West Java Province, namely in Sukabumi and Tasikmalaya Districts. Cultivation and marketing technical mentoring activities related to the study were carried out in Surade Sub-district of Sukabumi District and Cipatujah Sub-district of Tasikmalaya District.

2.2. Type and Source of Data
The data used in this study were gathered from primary and secondary sources. Primary data was obtained directly in the field through surveys, independent interviews, questionnaires, and Focus Group Discussion (FGD). Secondary data sources were obtained from the Central Statistics Agency (BPS), the Ministry of Agriculture, the National Development Planning Agency (Bappenas), the Climatology and Geophysics Agency (BMKG), the Agriculture Service of West Java Province, national and international institutions, and various other sources from previous research.
3. Results

3.1. Drought in Sukabumi and Tasikmalaya

Dry lands in the Sukabumi and Tasikmalaya Districts have considerable potentials to be develop with regards to their agricultural productions. However, commercial dry land farming was not carried out optimally, thus there were still a large areas of dry land remained unworked. In general, there are no high economic superior commodities produced from the agrosystem zone that are very dependent on rainfall. Demographically, the majority of the farmers in this agrosystem zone have narrow land, small capital, and living on subsistence farming systems [7]. Subsistence farming systems have implications for non-uniform cropping patterns carried out by farmers. In addition, the household agricultural system is aimed more at meeting household consumption needs. Financially, this does not provide high income for farmers and dry land made agriculture seemed unprofitable. This makes their household expenditure low and caused many farmers to be below the poverty line. In fact, agriculture on dry land has great potential to be developed seriously. Moreover, the development of agriculture in West Java region that is geographically closer to the centre of the economy, should be relatively easier if compared to other regions.

Figure 1. Variability of Temperature of Surade and Cipatujah Januari 2017 – November 2018 [8, 9].

Figure 1 showed that the average maximum temperature in Surade was 32.21°C and minimum temperature of 24.15°C. The difference between maximum and minimum temperature in Surade is 8°C. Meanwhile, in Cipatujah, the difference between maximum and minimum temperature is about 6°C. In average, the highest temperature is 30.59 and the minimum temperature is 24.36°C.

Precipitation and rainy seasons in Surade and Cipatujah were very fluctuate, especially during rainy days. Figure 2 below indicated that the numbers of rainy days in both areas were experiencing a rise from the year 2017 to 2018. Year 2018 found less rainy days than 2017. In the same line, precipitation in 2018 was less than in 2017 for both areas.

Figure 2. Rainy Days and Precipitation in Surade from January 2017 to November 2018.
Changes in the physical condition has impacted on the social and economic conditions of the people (Table 1). Farmers in almost 90% of the areas stated that their farms were impacted by drought. With regards to water availability for agriculture, the Surade farmers stated that as much as 33.33% of the areas were impacted, whereas for Cipatujah, only around 4% that were impacted. The farmers need more money to obtain water. The expenditure were increased since the farmers need to buy water pumps and rent water pumps to increase their amount of available water.

Table 1. Farm-Related Problems in Surade and Cipatujah.

| Type of Problem                        | Surade | Cipatujah |
|---------------------------------------|--------|-----------|
| Land infertility                      | 0%     | 15.38%    |
| Drought                               | 89.47% | 84.62%    |
| Availability of water for agriculture | 33.33% | 4.00%     |
| Additional cost to get water          | 22.22% | 20.00%    |

According to [10], the farmers were planting rice 1-2 times a year. In third season, most of the land remained fallow, only a few farmers planted other crops in their land for 3rd session. In Cipatujah, some of farmers planted their land with secondary crop (CGRT) like soybean, chilli pepper, sweet potato, and maize.

Rice is the main crop. According to [10], the farmers are subsistence farmers, in which the farmers only focus on growing enough food to feed themselves and their entire families. As shown in Table 2, farmers planted rice for local requirements with little or no surplus in trade. According to the farmers, rice is better than other crops to fulfil their needs for food. Furthermore, about 75% of the farmers agreed that planting rice produced higher profits, as well as planting rice has lower risk than other crops. However, rice is less comforting to work on, while other crops are not too extensive than rice.

Table 2. The importance of rice plants than others.

| Scale of importance | Surade | Cipatujah |
|---------------------|--------|-----------|
| Fulfilling food needs | 94.74% | 96.15%    |
| Profit              | 73.68% | 76.92%    |
| Risk                | 15.79% | 11.54%    |
| Work comfortability | 21.05% | 23.08%    |
3.2. Poverty Level in Surade and Cipatujah

Results of the survey found that the average expenditure per capita per month in Surade was IDR 506,077, the largest being IDR 860,000 and the smallest IDR 264,267. According to the Statistics Indonesia, the poverty line in Sukabumi Regency is IDR 284,063 per capita per month. In Surade, according to this indicator, the poor population was only 10.53 percent.

Meanwhile in Cipatujah, poor farmers in this area comprised of 11.54 percent. The average expenditure per capita per month was IDR 548,154, with the largest of IDR 1,563,889 and smallest IDR 261,667. The poverty line for Sukabumi Regency is IDR 284,462 per capita per month.

Strategy to Mitigating Drought

Rice was the main crop planted in both study areas. Based on the study by [10], the farmers in both sub-districts planted rice in planting season 1 and 2, but in planting season 3, most of the land remained bare due to limited water. It is recommended that farmers should plant their land instead of leaving it bare.

Actually, the farmers wanted the third planting season to be used to plant crops other than rice. Farmers were reluctant to plant due to limited water availability, which adds considerable risk to their business. They were also limited in capital. Hence, in case of crop failure, they would face problems. The farmers in these areas fall into the category of people whose monthly income is less than the Regional Minimum Wage in both areas.

Responding to the farmers' expectation, one strategy to reduce the impact of drought is to provide information about alternative crops that can be planted, as well as information on ways to plant good crops. Some selected commodities, namely watermelon, melon, mustard greens and kale, were recommended to farmers because most farmers in both sub-districts have never planted these commodities, yet these crops are suitable to be planted on dry land. In addition, financially, these plants have high economic value, since some vegetables can be harvested every two weeks.

Table 3 showed the farm income from these commodities. According to this table, melon has the highest expenditure in cultivation per hectare, at IDR 60 million, with the highest return cost ratio (RCR), followed by watermelon at around IDR 34 million, kale and mustard greens, each with IDR 17 million and 9 million. The harvesting periods are around 4 months. The economic value of melon is the highest, whereas for mustard greens is the lowest. All of these commodities provide alternatives for the farmers to cultivate their land. The farmers may select the commodities that they wanted to plant, in which the decision would be influenced by the amount of capital that the farmers have.

### Table 3. Farm analysis for Kale, Mustard Greens, Watermelon and Melon per Hectare.

|                         | Kale  | Mustard Greens | Watermelon | Melon  |
|-------------------------|-------|----------------|------------|--------|
| Cost (IDR)              | 17,153,500 | 9,526,000     | 34,277,100 | 60,627,000 |
| Revenue                 |       |                |            |        |
| Quantity                | 1,773 | 2,400          | 25,000     | 40,000 |
|                         | bundle | kg             | kg         |        |
| Price per unit (IDR)    | 15,000 | 5,000          | 2,300      | 2,500  |
|                         |       |                |            |        |
| Income (IDR)            | 26,595,000 | 12,000,000    | 57,500,000 | 100,000,000 |
|                         | 9,441,500 | 2,474,000     | 23,222,900 | 76,200,000 |
| RCR                     | 1.55  | 1.26           | 1.68       | 4.20   |
| BCR                     | 0.55  | 0.26           | 0.68       | 3.20   |
4. Conclusion and Suggestion
As many as 10.53% in Surade of Sukabumi Regency and 11.54% in Cipatujah of Tasikmalaya Regency were categorised as poor according to the BPS poverty line. The cropping pattern strategy was expected to increase the farmers’ income in the form of rice-rice-horticulture (CGRT). During the third season, the farmers in these areas did not cultivate any crops on their land, hence to increase the farmers’ incomes, in the third season, they were advised to plant horticulture crops, such as watermelon, melon, mustard greens and kale. Farmers with capitals, could plant melon or water melon, but for farmers with limited capitals, could cultivate kale and mustard greens. Farmers should have the role of extension agents to be able to adopt the technology offered and educated other farmers to plant alternative crops to rice, plants that are more profitable than rice, such as watermelon, melon, mustard greens and kale to mitigate drought in South of West Java.

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References
[1] Priyambodo RH 2015 Deddy Mizwar: Empat daerah di Jabar rawan pangan
[2] Rachmat M 2013 Pembangunan Jangka Menengah Jawa Barat dan Prospek Pengembangan Pertanian Lahan Kering dalam buku Prospek Pertanian Lahan Kering dalam Mendukung Ketahanan Pangan. Ministry of Agriculture Jakarta.
[3] Ministry of Agriculture 2016
[4] FAO2004 Drought Impact Mitigation And Prevention In The Limpopo River Basin. A Situation Analysis.FAO Subregional Office for Southern and East Africa Harare Food And Agriculture Organization Of The United Nations Rome
[5] Wilhite DA 1999 Drought preparedness in Sub-Saharan Africa context. Proc. Int. Conf. on Integrated Drought Management - Lessons for sub Saharan Africa (International Hydrological Programme IHP-V Pretoria: UNESCO) p 22-36
[6] Abrams L 1997 Drought Policy - Water Issues
[7] Setiawan I 2008 Alternatif Pemberdayaan bagi Peningkatan Kesejahteraan Petani di Lahan Kering
[8] Accuweather 2018 Weather of Cipatujah, Tasikmalaya District
[9] Accuweather 2018 Weather of Surade, Sukabumi Distric.
[10] Falatehan AF, Syaukat Y, Raswatie FD, Sari DAP. 2017 planting and consumption patterns of upland rice farmer in indonesia ADRI International Journal Of Agriculture.