

# Banyumas and It's Surround Region Farmers Adaptation to Three Years La-Nina 2020-2022

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**Abstract.** Normal rainy season follows the annual normal rain pattern, which takes place during the rainy season in tropical rain areas. During the last three years (2020–2022), the Banyumas Regency rainfall and its surroundings have been above normal. The significant rainfall fell in all months including May to October (dry season), so that that was a prolonged (La-Nina). To that, farmers made adaptations to crop cultivation and soil tillage with the aim of being able the land and cultivated plants productive. Related to this adaptation, survey research on La-Nina adaptation of farmers has been carried out. Survey research used a questionnaire interview technique of selected farmers groups: medium-highland (400–700 MASL) and lowland (50–250 MASL) of selected villages (Banyumas and Banjarnegara Regency). Data was processed by tabulation, descriptive analysis, and map. The selected villages were 21 villages with 66 respondents in this study. The results show: (1) the adaptation pattern of farmers obtaining adaptive rice varieties and vegetable crops, (2) organic fertilization lead land productive and adaptive La-Nina crops in three years, and 3) local wisdom, organic fertilizer, and selected adapted crops can be as a mix model farmer and region to adapt prolong rainy seasons.

## 1 Introduction

During the last three years (2020-2022) most parts of Indonesia have experienced the La-Nina phenomenon. The Banyumas district and its surroundings are included in the province of Central Java - Indonesia. The Banyumas area and its surroundings including the districts of Purbalingga, Cilacap and Banjarnegara. Besides that, there are other districts included as the Banyumas agglomeration area, namely: Kebumen, Brebes and Tegal. However, climatologically, only two districts have a relatively similar climate to Banyumas district, namely Purbalingga and Banjarnegara districts. The Banyumas Agglomeration Region has experienced La-Nina in the last three years. In 2020-2022 the region is experiencing continuous rain without a break, so it can be said that the rainy months are raining, and the dry months are also raining. Statistical data shows 12 months of monitored rainfall during 2020-2022. Banyumas and Banjarnegara District January to December in 2020-2022 has rain fall as depicted in Table 1.

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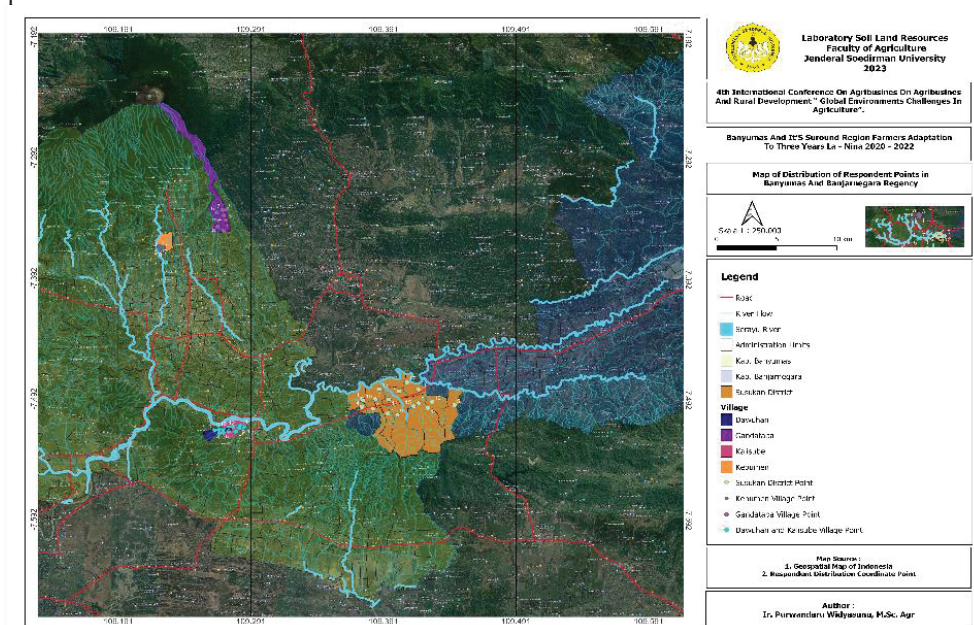
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**Table 1.** The Banyumas and Banjarnegara District monthly rain fall 2020-2022

Month	2020 rain fall (mm) in District		2021 rain fall (mm) in District		2022 rain fall (mm) in District	
	Banyumas [1]	Banjarnegara [2]	Banyumas [1]	Banjarnegara [2]	Banyumas [1]	Banjarnegara [2]
January	397	334	421	460	322	329
February	380	461	525.47	316	257	287
March	382	415	433.80	305	842	647
April	97	269	338.87	107	154	149
May	233	236	300.97	81	133	160
June	70	12	190.63	185	401	401
July	20	0	49.63	12	86	161
August	17	0	29.80	33	243	222
September	27	5	81.13	156	223	277
October	528	435	617.17	212	903	727
November	663	-	707.47	403	212	570
December	401	-	-	480	-	399

Source: [1, 2]

During the three La-Nina years, farmers in the Banyumas and surrounding areas experienced various difficulties in cultivating crops, especially in adapting cropping patterns in one year during the three La-Nina years. Adaptation patterns vary between regions, especially the expanse of different altitudes and the consolidated system of community agricultural organizations (farmer groups and irrigation). There is an adaptation phenomenon.



**Fig. 1.** Research area in Banyumas regency (Gandatapa, Kebumen, Dawuhan, and Kalisube villages) and 17 villages in Susukan district, Banjarnegara regency.

This research has been carried out to monitor adaptation patterns using a survey method of respondents to select villages and districts in Banyumas and Banjarnegara districts. This article discusses and reports the adaptation patterns of farmers of seasonal food crops in the following areas: 1) Banyumas district includes the medium plains of Gandatapa village,

Sumbang district (500-600 MASL), medium lowlands of Kebumen village, Baturraden district (229-270 MASL), lowland of Dawuhan village (75-150 MASL) and Kalisube village (75-100 MASL), and 2) Banjarnegara district includes 17 district villages (50-670 MASL). Different farmer adaptation patterns emerged for the 2020-2022 La-Nina which were determined by: information received by farmer groups, customary cropping patterns, altitude, and cultivation techniques. Figure 1 presents the research area in two districts (Banyumas and Banjarnegara). Previous research background was study about pattern of farmers land management concerning their fertilizing the paddy land of surrounding Serayu Watershed Regency Banjarnegara and Banyumas [3, 4]. They were studied in 2022 and show that farmers did adaptation around 2020-2022 in part of: fertilization, cultivation, and rice varieties chosen. But, they did not producing data information about how the farmers adapted for their crops during La-Nina 2020-2022. For this point we assume that farmer must be known or unknown about their adaptation was right or not for their work. Though then we did research on the area to know: 1) how was farmer known about La-Nina and 2) how then farmer adaptation during La-Nina 2020-2022 for their 3 years cropping pattern.

## 2 Research Methods

**Table 2.** Respondent, location, topography, altitude, and cultivation system of area study

No.	Villages	Sum of Respondent	Areas of village (ha)	Topography Altitudes (MASL)	System of cultivation
1.	Dawuhan	10	25	Hilly 75-150	Organic Farming
2.	Kalisube	10	40	Level 75-100	Organic Farming
3.	Gandatapa	10	40	Mountainous 500-600	Organic Farming
4.	Kebumen	10	25	Mountainous 229-270	Organic Farming
5.	Piasa	2	98	Level-hilly	Conventional
6.	Pakikiran	2	284	Level-hilly	Conventional
7.	Brengkok	2	162	Level-hilly	Conventional
8.	Panerusan Kulon	2	308	Level-hilly 62.4	Conventional
9.	Panerusan Wetan	2	345	Level-hilly 83.3	Conventional
10.	Gumelem Kulon	2	812	Level-hilly 101	Conventional
11.	Gumelem Wetan	2	973	Level-hilly 101	Conventional
12.	Derik	2	402	Level-hilly 93.6	Conventional
13.	Berta	2	478	Level-hilly 83.7	Conventional
14.	Karangjati	2	216	Level-hilly	Conventional
15.	Kedawung	2	264	Level-hilly 64.9	Conventional
16.	Dermasari	2	181	Level-hilly 55.8	Conventional
17.	Susukan	2	283	Level-hilly 77.2	Conventional
18.	Kemranggon	2	232	Level-hilly 64.2	Conventional
19.	Karangsalam	2	288	Level-hilly 46.7	Conventional
Total		70	5,456		

The research was carried out from April 2022 to August 2022 using a survey method of selected respondent farmers, selected villages, selected districts in two selected altitude categories in the Banyumas and Banjarnegara districts of Central Java province. The selection of topographic elevations is the middle plains and lowlands in the selected Banyumas and Banjarnegara districts in the selected villages and selected farmer groups; Topography selected medium plains and lowlands. The number of villages in the middle lands is less than in the lowlands because the area of land for seasonal food crops is less than that in the lowlands. The selected land was taken on the basis of paddy fields with varied

annual cropping patterns in normal rainfall years (non-La-Nina and non-El-Nino). Selected farmer groups are farmer groups that have often carried out community empowerment activities with the hope that filling out questionnaires is more reliable (valid). There were two criteria for selecting farmer groups: 1) the overlay group was used to applying organic fertilization, and 2) the overlay group was not used to using organic fertilizer.

The respondent farmer was visited directly by the researcher and interviewed directly; each respondent farmer received 28 questions in the questionnaire. The questions posed to the respondent farmers revolved around: 1) knowledge about La-Nina, 2) ways of adapting soil management, land, drainage in dealing with year-round rainfall, 3) cropping patterns and agronomic measures, 4) increase and decrease in yield seasonal food crops, 5) temperature and humidity disturbances, and 6) types and varieties of seasonal food crops that are considered the best and adaptive during the three La-Nina years 2020-2022.

The primary data obtained were all written down in a paper questionnaire and then recorded on an excel spread-sheet, tabulation manipulation was performed, and calculations were carried out on the basis of villages, midlands and lowlands, and variations in La-Nina adaptation patterns were sought. All respondents were recorded on a map so that their whereabouts could be recorded for further research. Secondary data needed as additional/complementary data is taken from research data that has been carried out by the author and thesis data of UNSOED Faculty of Agriculture students; Other auxiliary data is taken from local BMKG data and Districts in Figures (Banyumas and Banjarnegara Regencies). Everything is used to study.

### 3 Literature Review

The La-Nina/El-Nino southern oscillation (ENSO) has a major impact on patterns that vary throughout the world. This phenomenon is a natural phenomenon that involves fluctuations in ocean temperature in the central and eastern equatorial Pacific, these conditions affect atmospheric changes. The development of science in an effort to understand and model the ENSO phenomenon (La-Nina / El-Nino) allows the skills to predict the next nine months in terms of benefits to be improved, which makes it an opportunity for people to prepare for possible hazards, including heavy rains – very heavy rains, floods, and drought [5]. According to WMO info, the three years of La-Nina (2020-2022) are a 'triple dip' of the occurrence of La-Nina and entering 2023 tropics Pacific ENSO in neutral status. There is a prediction from [5] that 40% of ENSO conditions will be neutral between May and July 2023. Thus, the three (3) La-Nina of 2020-2022 is declared complete, then changes to neutral, but is predicted to continue to El-Nino 2023 starting July or August 2023. [5] prediction (2023) regarding the change to El-Nino 2023: slowly increasing 60-70% in June-August, but 70-80% is expected to occur in July-October 2023; the change from ENSO-neutral is estimated to be around 30-40% and 20-30% in that span of the month. This indicates that farmers' adaptation to the 2020-2023 La-Nina phenomenon was properly recorded in the final months of 2022 and before June 2023. Research on adaptation reported in this article was completed in May 2023 (when this article was written). Furthermore, it is possible to record the 2020-2023 La-Nina adaptation for the wider Banyumas agglomeration area and the potential impact of 2023 El-Nino with adaptation by farmers.

The characteristics of the tropical atmospheric response in the Indonesian region were reported by [6] that there was observed excessive rain and cloudiness and an average strong wind. Furthermore, he said there would be cloud cover and that it would rain far above and near the surface of Indonesian territory in August 2022. At the same time, atmospheric and ocean conditions were monitored which indicated a clear La-Nina. This shows that the ongoing La-Nina in Indonesian territory in August 2022 until then the weakening of La-Nina, which is stated by the WMO (2023) towards neutral in May to June 2023. The estimated

possibility of ENSO-neutral 40% will still be until May-July 2023, 30-40% between June to August 2023, and an estimated 20-30% over July–August 2023 and August–October 2023 [5]. Thus, even though there is an estimate of an ENSO La-Nina from May-August 2023, there is still a possibility of rain between June-October 2023. The forecast data indicates that there is still a possibility of a La-Nina influence to ENSO neutral to zero until October 2023.

Multi-year La-Nina conditions (2020-2022) (Indonesian conditions are also the same) are related to ENSO forecast conditions in Australia as reported by the Australian Government (2023, Contact Dr Zoe Gillett, UNSW Sydney) (ARC Center of Excellence for Climate Extremes Briefing Note 20), that at the end of September 2020-2021 and the beginning of autumn 2021, the tropical conditions of the Pacific will be ENSO neutral. The second La-Nina event is when Australia experiences late spring to early summer and lasts into early winter 2022 (circa June 2022). The third year La-Nina phenomenon (2022-2023) is recorded by several climate models which indicate that the third year La-Nina is in the range of spring and summer 2022-2023 in Australia (Gillett, Australian Government, 2023). La-Nina in Australia promotes the occurrence of winter-spring rainfall in western Australia and increases the late summer-autumn rainfall along the east coast of [7].

### **3.1 Climate adaptation**

Research on the effect of extreme climate change on rice yields has been carried out, among others, by [8] on the time series of rice production in Banten in 2002-2015. The results of his research show that during this period El-Nino events reduced rice production while La-Nina increased rice production. During this period, rice production in Banten district fluctuated. Using the Oceanic Niño Index (ONI) value which is the standard index used by NOAA <https://ggweather.com/enso/oni.htm>, [12] recorded El-Nino and La-Nina events before 2020, namely: in 2002-2003 there was a moderate El-Nino, in 2004-2005 a weak El-Nino, a weak El-Nino in 2006-2007, a moderate El-Nino in 2009-2010, and a very strong El-Nino in 2015-2016. La-Nina events were recorded in the weak 2005-2006, strong 2007-2008, weak 2008-2009, strong 2010-2011, and moderate 2011-2012. In 2015-2016 another strong El-Nino occurred. In China [9] that the La-Nina phenomenon had more positive effect than that the El-Nino effect on the grain productivity based on data set satellite-based vegetation and climate index, also based on national and province of China crop production statistics. Trend of that was in contrast reported by [10] that La-Nina caused decreased yield in North and Northeast of China, but the El-Nino phenomenon had increased the yield. The so both phenomenon (La-Nina and El-Nino) suggesting us that both events had picturing that that was dominantly phenomenon among the two climatic cyclic phenomenon on agricultural productivity (crop and land).

## **4. Results and Discussion**

This research process was assisted by several students of Land Resource Planning. The number of farmers (70), farmer groups (21), villages (19), districts (2), and sub-districts (4) in this article is still limited; there will still be more extensive for further studies involving students. In this article, we only discuss recordings of adaptation phenomena and do not explore variations in climate elements during the 2020-2022 La-Nina; it will report to another journal articles (we will use this article as a reference).



#### 4.1 Knowledge of farmers / farmer groups about the La-Nina period 3 years 2020-2022

Table 3 presents enumeration data regarding knowledge and understanding that three consecutive years of La-Nina 2020-2022 have taken place in the Banyumas district and its surroundings. The farmer members of the farmer groups in the 21 target villages of the respondents apparently differed in their understanding from the existence of three (3) years of La-Nina. The range of knowing that there are three seasons and an elongated rainy month range from 60-100%, only 20% do not know about it in Kebumen village, Baturraden district. Most of the farmers and farmer groups know about La-Nina's understanding of the results of interviews through the media WA, Youtube, and television. However, what they feel is that the three consecutive La-Nina years 2020-2022 are an unclear boundary between the rainy season (MH) and the dry season (MK); the range of ambiguity is 50-90%, a range of understanding that is significantly different from the Mataram knowledge of climatic management) regarding prey rendheng (MH) and prey ketigo (MK). [11] noted that the Agricultural Stress Index System can be used to identify how far phenomenon of drought was by monitoring the effect on crop production (satellite monitoring). But, in our research here, data set producing by data answer from farmer directly that they are responsible also for their farmer group, though he was known well how the three years was of prolong La-Nina 2020-2022.

**Table 3.** List of the percentage of knowledge and understanding of farmers in the research area about La-Nina 2020-2022.

Question	Answer	Gandatapa 10 respondents (%)	Kebumen 10 respondent s (%)	Dawuhan dan Kalisube 13 respondents (%)	Susukan 33 responde nts (%)
Knowing about La-Nina?	Know	100	80	100	60
	No	0	20	0	40
	Others	0	0	0	0
Knowing 3 years La-Nina rainy seasons was prolonge?	Know	0	40	40	24
	Do not know	0	10	0	3
	Not clear rainy – dry season	90	50	60	70
	The air cool	0	0	0	3
	The air hot	10	0	0	0
Knowing 2020-2022 is La-Nina?	Know & understand	80	20	23	24
	Don't know & don't understand	20	50	77	0
	No info	0	30	0	6
	Others	0	0	0	0

The percentage range for understanding La-Nina in three consecutive years was between 20-80%, the percentage for understanding the range was quite high (20-70%) with a range of 50-70% not understanding from two villages (23 respondents). The scarcity of information was recorded in this study in several villages, although the percentage was small, there were the farmer group who did not receive information about prolong La-Nina. This means that the Government/State must begin to intensify the need for farmers, farmer groups, and agricultural extension workers to know about the variation in the significance of climate

change/anomaly which is quite long. We argue that the 2020-2022 La-Nina example case includes long (3 years) prolonged (consecutive) MH. Countries should start planning advocacy to farmers about climate change and anomalies in all aspects of farming review including aspects of land management, irrigation, and agronomy.

#### **4.2 Changes in cropping patterns, plant wilting, and reliability of irrigation water**

Table 2 presents enumeration data for farmers, farmer groups and farmer leaders in 21 villages and 66 farmers. In recent years and in the future, cropping patterns in an area (village, district) are diverse in nature and there are no specific rules governing cropping patterns in a stretch of agricultural land for food crops, as well as for the cultivation of fruit-producing crops (annual crops). Bearing in mind this, the crop data and cropping patterns reported in this article are also various summaries of the diversity that exists in the field.

The results of enumeration on the question of which cropping pattern is most suitable during the 2020-2022 La-Nina period, it can be said that rice is not necessarily the mainstay even though there is availability of rain for rice cultivation; [12] theory states that the probability of rain is 75% in the rainy season and the need for rainwater is around 200 mm/month. The results of the data recap show that different districts have different cropping pattern management, and this is related to the adequacy of irrigation services in paddy fields. In the case of Susukan district, the cropping pattern considered most suitable by farmers was paddy-rice-empty; although the enumeration results show that the Susukan farmers stated that irrigation was sufficient, most of them recorded the rice-paddy-empty pattern (90%). Kali Sapi Banjarnegara climate station shows low CH in July and August [2]. The same pattern was recorded at a lower percentage (20-30%) in Banyumas District (Gandatapa, Kebumen, Dawuhan, Kalisube). Paddy-rice-vegetables / rice-rice-vegetables cropping pattern was recorded in the lower range (10-23%), but secondary crops became the mainstay of some of the respondent farmers (20-30%). Respondents' data experienced plant wilting ranging from 0-40%, but Kebumen respondents stated that plants did not experience wilting. The technique of providing water during hot sunny days is the mainstay of the respondent farmers. Organic farming systems with compost fertilization are recorded in Kebumen, Dawuhan, and Kalisube farmers (10-20% of the population). Kebumen and Gandatapa belong to the eastern katenan (Banjaran and Pelus sub-watershed) of the volcano's southern slope of Mount Slamet whose characteristics are very similar to the central katen (Logawa sub-watershed and Koran sub-watershed). The eastern and central catena areas to the upper and lower middle plains have hilly landscapes with a slope of 10-25%, so that water flows smoothly, and water infiltration is fast to very fast [13], so that high rainfall does not cause inundation in agricultural land.

#### **4.3 Types of plants / varieties considered suitable during the La-Nina period 2020-2022**

Types of plants and varieties of annual food plants, the main adaptation data for the three-year La-Nina period in 17 villages of Susukan district, Banjarnegara district, varied more in types and varieties (especially rice plants. This is presented in Table 3. The IR-32 rice variety is the mainstay of 30% of respondents in Susukan district, but 24% of respondents also rely on Ciherang rice during the 2020-2022 rice planting season. Furthermore, mentik susu rice is the mainstay of 30-50% (Gandatapa, Kebumen, Dawuhan, and Kalisube), Susukan subdistrict farmers only 3% consider mentik susu adaptive. Planting of HT and Logawa varieties of rice in Susukan district was recorded, the percentage of which was in the range of 6-12%. The landscape position of the Susukan district is lowland to almost the highlands

of the tectonic mountains, so that the implementation of technical irrigation is only possible in most of the lowland rice fields.

**Table 4.** Information on the percentage change in cropping pattern, plant wilting, and aspects of irrigation reliability recorded data for the La-Nina period 2020-2022

Question	Answer	Gandatapa 10 respondents (%)	Kebumen 10 respondents (%)	Dawuhan dan Kalisube 13 respondents (%)	Susukan 33 respondents (%)
Most suitable cropping pattern: La-Nina 2020-2022?	Rice-rice-rice-vegetables	10	20	23	3
	Rice-rice-rice-non rice cereal-vegetables	10	10	15	3
	Rice-rice-non rice cereal-vegetables	10	10	16	0
	Non rice cereals	30	20	23	0
	Rice always	10	10	0	4
	Rice-rice	30	30	23	90
Lack of irrigation for 3 years La-Nina? 2020-2022?	Yes, due to water does not arrive at field	20	30	15	94
	No	10	10	69	6
	Enough	10	10	16	0
Was irrigation water good enough during 2020-2022?	Yes	30	30	69	63,64
	No	70	70	15	15,15
	Enough	70	0	7	6,06
	Not enough	30	0	7	9,09
Plant wilting during 2020-2022?	Yes	40	0	15	36,36
	No	40	100	85	60,61
	Sometimes	20	0	0	3,03
How to overcome crop wilting during La-Nina 2020-2022?	Irrigate when hot of day	10	40	50	0
	Organic agriculture	0	10	20	0
	Not answer	80	50	20	100
	Drainage	10	0	10	0



**Table 5.** Data on types of plants and varieties considered appropriate by respondents

Question	Crop / variety	Gandatapa 10 respondents (%)	Kebumen 10 respondents (%)	Dawuhan dan Kalisube 13 respondents (%)	Kec. Susukan 33 respondents (%)
Crop / variety suitable during periode of La-Nina 2020-2022?	<i>IR 32</i> rice	10	10	10	30
	Hibride corn	50	10	0	0
	Soybean	0	0	0	0
	Vegetables/ sweet potatoe / cassava	0	20	10	0
	Chili and cucumber	10	10	0	0
	<i>Ciherang</i> rice	0	0	0	24
	Red rice	0	0	0	9.09
	Corn <i>cob 2</i>	0	0	0	3
	<i>Pertiwi</i> corn	0	0	0	3
	<i>IR-42, 46</i> rice	0	20	30	3
	<i>Thailand</i> rice	0	0	0	3
	<i>Cibatu</i> rice	0	0	0	3
	<i>Mentik susu</i> rice	30	30	50	3
	The <i>HT</i> rice	0	0	0	12
<i>Logawa</i> rice	0	0	0	6	

The mentik susu rice in the villages of Dawuhan and Kalisube is the mainstay of rice and is processed using an organic system; most of the farmers stated that the organic system (compost fertilization) and the provision of POC, biological agents helped farmers in maintaining the productivity of the soil and mentik susu plants. Kebumen village farmers also stated the same thing about the cultivation of mentik susu rice. Research data shows that the land reclaimed using organic matter and the application of biological agents increased maize crops in Entisol soil of Mount Tugel Banyumas [14] and in Andisol soil of Baturraden Banyumas [15].

#### 4.4 Records of Increases and Decreases in the yield of the main annual crops for the La-Nina period 2020-2022

Data for recording the phenomena of increasing and decreasing annual crop yields were carried out on main food crops, vegetables and fruit producing plants. This article only reports record data for the main food crops of rice, corn and soybeans. The increase in rice yields was only experienced by a small number of farmers in the Susukan district (3%), while the majority of farmers from four villages (Gandatapa, Kebumen, Dawuhan, and Kalisube) stated that their rice yields were stable (50-79%); farmers in the Susukan district were 79% declared stable rice yield (IR-32).

**Table 6.** Data on recorded increases and decreases in annual crop yields for 2020-2022

Question	Answer	Gandatapa (n=10) (%)	Kebumen (n=10) (%)	Dawuhan dan Kalisube (n=13) (%)	Susukan (n=33) (%)
Rice yield was increasing during La-Nina 2020-2022?	Not planting	10	10	14	0
	Yes, but sometimes	0	10	10	6
	Stable	50	50	53	79
	No answer	10	0	23	12
	Yes	0	0	0	3
Corn yield was increasing during La-Nina 2020-2022?	Yes	30	20	0	0
	No planting	10	60	30	0
	Stable	40	20	70	10
	No answer	0	0	0	90
	Sometimes decreasing	20	10	0	0
	Never	0	0	0	0
Soybean yield was increasing during La-Nina 2020-2022?	No	10	10	20	0
	Not decreasing	20	60	40	100
	No answer	30	20	40	0
	Yes	40	10	0	0
Vegetable yield was increasing during La-Nina 2020-2022?	Yes	10	20	0	0
	Stable	20	10	50	0
	Sometimes	20	0	0	0
	No	40	60	0	100
	Not planting	10	10	50	0

The increase in corn yields was experienced by Gandatapa and Kebumen farmers (30 and 20%). Farmers who planted corn in the villages of Dawuhan and Kalisube stated that 70% yield was stable, farmers in Gandatapa and Kebumen villages stated that corn yields were stable (40 and 20%); most of the farmers in Susukan district do not cultivate corn and only 10% say that 10% is stable. Most Susukan farmers realize that corn cultivation is unprofitable because of the relatively large rainfall during the 2020-2022 La-Nina period. Corn farmers in Gandatapa and Kebumen villages dare to plant corn because the sloping landscape and the physical properties of the soil allow maize cultivation; 10-15% sloping landscape and porous soil properties [16] are still suitable for maize cultivation. The areas of Gandatapa and Kebumen villages also have high CEC due to high soil organic matter of 3.70-5.30% [16]; the Keniten area and the surrounding southern slopes of Mount Slamet have a textured crumbly soil and 3.36% organic matter [16].

Soybean cultivation in the Susukan district is not carried out by farmers in the Susukan district; they argue that it is very risky to cultivate soybeans during the climate disturbance season (anomaly) due to rain throughout the three years 2020-2022. Only a few of the farmers from the villages of Gandatapa, Kebumen, Dawuhan and Kalisube have the courage to cultivate soybeans; 20-60% of farmers do not cultivate. The increase in soybean yield was only experienced by farmers in Gandatapa and Kebumen villages, respectively 40% and 10% of the respondents. Gandatapa and Kebumen farmers dare to cultivate soybeans for landscaping reasons that allow the land to drain quickly when there is very heavy rain. Here to be considered a rather new finding of China researcher [15, 18, 19] relating to mitigation and adaptation in agronomy as their written: that crop growing condition both the La-Nina–El-Nino cycles by satellite, it can help researcher to understand farmer with their crop

development condition; and though in land area researcher can catch newest info from farmer in the way they make their farm adaptive to climate change. The impact of ENSO better to understand by past data and future by survey data respondent from on-farm farmers; [20] agree with that statement.

## 5 Conclusion and Suggestion

### 5.1 Conclusion

Adaptation of selected farmers in the middle and lowland areas of Gandatapa, Kebumen, Dawuhan, and Kalisube (Banyumas districts), and 15 villages of Susukan district, Banjarnegara district for three years La-Nina (2020-2022) were supported using organic fertilizers, local wisdom knowledge, good maintaining of landscape, soil physical quality, and information about climate anomalies. The increase in yields of rice, corn, soybeans ranged from 10-30% of respondents, while most of the respondents stated that crop yields were stable during the three La-Nina years 2020-2022. Rice varieties that were relatively adaptive during the three La-Nina 2020-2022 years were IR-32 and Mentik Susu. The cropping patterns that were considered adaptive by the respondent farmers were rice-rice-vegetables, rice-rice-secondary crops, and empty rice-rice.

### 5.2 Suggestion

The enumeration pattern for middle-highland and lowland volcanic and tectonic landscapes is better for one district with selected villages and for increasing number of respondent farmers in more than one stretch farmer group. Involve the active role of farmer group leaders and P3A administrators (Association of Farmers Using Water) in the form of FGDs.

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