

Food security status in Cirebon Regency and how it could lead To sustainability

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Abstract. Cirebon Regency is in West Java Province and it's one of the largest rice producer in Indonesia so that Cirebon Regency has a rice surplus. West Java is included as a region with access rice availability and the source of rice comes from within the West Java region itself, so there is minimal intervention from other regions in terms of meeting rice needs. In an effort to maintain rice resilience, strategies that can be implemented by West Java Province include maximizing the availability of rice in the region to meet local needs, distributing part of its production to surrounding deficit areas, and maintaining the productivity of rice fields. The results of the review literature, food security were not realized in Cirebon Regency because exports and imports of rice production were not properly recorded, distribution of rice production was not monitored, supply stability and price affordability were not controlled, access and information to markets are limited.. The regional government is implementing an agricultural intensification policy, especially in cultivating rice considering that the amount of agricultural land is decreasing, but behind the success there is the potential for climate change which could cause a decrease in productivity. In order to support sustainable food security in Cirebon Regency, it is necessary to analyzed the availability and distribution patterns of rice from upstream to downstream. This pattern is expected to answer the uncertainty of rice availability in Cirebon Regency and its relationship in supporting food sustainability in the future. The method that will be used to answer this problem is to carry out primary data analysis at the rice mill level in Cirebon Regency. Apart from that, the rate of land conversion as a factor influencing rice production is used as analysis material for recommendations for the sustainability of food availability in Cirebon Regency. Food security and sustainability efforts can be achieved with policy changes and transformation of food system governance.

1 Introduction

Population were increase day by day and technology change sophisticated, it is made our life style on food demand change and increase. Problem produced food to fulfilled population needed has become the global obsession caused explore natural resource. The food produced by the earth is decreasing while the need for food to meet the demands of the world community is increasing. This becomes increasingly difficult with the decline in environmental quality which has the potential to reduce food production.

Households in Indonesia currently consume around 98.53% of rice. Efforts are needed to increase national rice production so that these needs can be met. Efforts that can currently be made to encourage an increase in national rice production include an agricultural intensification program in the form of improving agricultural facilities (quality seeds, balanced fertilizer) and agricultural infrastructure (optimizing and rehabilitating farming irrigation networks).

Located between 108°40' and 108°48' South Latitude, and between 6°30' and 7°00' East Longitude, Cirebon Regency as part of West Java Province is bordered by several other districts/cities within the West Java province, namely Indramayu district and Cirebon city to the north, the district Kuningan in the south, Majalengka Regency in the west, and Central Java Province, namely Brebes Regency. Cirebon Regency has 40 subdistricts with 424 villages, based population projections for 2022, Cirebon Regency population were 2,315,417 people consisting of 1,173,871 male and 1,141,546 female population, with the population growth rate per year 2020-2022 are 0.98 percent. Limited by a land area of 1,070.29 square kilometers, Cirebon Regency has the potential to become one of the productive rice producing districts in Indonesia [4].

Cirebon Regency is ranked 8th out of the 10 highest rice producing districts in West Java with total rice production of 494,699.98 tons of harvested dry gain or the equivalent of 368,503 tons of rice in 2022. The assumed human need for rice is 312 grams per capita per day or 114 kg per year. In 2022, the population in Cirebon Regency 2,315,417 people, so 263,958 tons of rice will be needed, while the total rice production in Cirebon Regency will be 368,503 tons. There is excess production results to rice needs, meaning that rice production in Cirebon Regency in 2022 will have a surplus of 104,545 tons but the rice yield distribution cannot be known because a lot of harvest immediately sold in the fields.

Global population growth which is displaying an exponential increase, average growth 0,98 percent per annum in Cirebon Regency, become responsibility the regional administration of Cirebon Regency to ensure the provision and satisfaction of the population's nutritional requirements. Within the span a decade, extracts food systems known as intensification has implemented as food management policy the district government of Cirebon and rarely meets food and nutrition security objective [20]. Various forms of capital, natural resources, human and other tangible resources, are harnessed with the explicit goal of increasing agricultural output and profitability. It is crucial to recognize that the adoption of extractive practices caused unsustainable food production at the future [17]. In other words, while the pursuit of enhanced agricultural productivity and achieved of optimal crop yields are being prioritized, the principle of sustainability is being sacrificed in the process.

Even though rice as prime food are currently fulfilled, food security in Cirebon Regency cannot be realized because the rice production at Cirebon Regency cannot

meet the local food needs, the existence of rice yield production and its distribution is completely handed over to the market systems and companies, it caused grain has to be imported from the district or surrounding cities. It's also implies that there are obstacles in efforts to prepare the necessary nutrition [12].

It is not just increasing agricultural productivity and profitability, so that sustainable food security can be realized, a more comprehensive framework is needed by aligning the goals of household food security and sustainable agriculture. Guaranteeing that households and individuals have extensive and sturdy means to obtain food of superior quality is part of food security efforts, it cause they do not have to experience hunger or food insecurity, and then Sustainable Agriculture in this thing refers to an agricultural approach that seeks to maximize agricultural yields by considering environmental sustainability. Both of them involves more environmentally friendly and sustainable practices in food production, such as the wise use of natural resources. To produce food using land, water and climate resources, an analysis of food supply, distribution of wealth and land, food and household food needs, efficient allocation and prevention of food waste, the position of women in society, fertility and population as well as maintenance and rehabilitation of food resources is needed. "Achieving food security needs policy and investment reforms on multiple fronts, including human resources, agricultural research, rural infrastructure, water resources, and farm- and community-based agricultural and natural resources management. Progressive policy action must not only increase agricultural production, but also boost incomes and reduce poverty in rural areas where most of the poor live [1].

1.1 Food Security

The world's population is estimated come to 9 billion by 2050 [19]. Growing population, it is one from many causes increase demand for food. The demands of land and food we place on the earth may be growing, its available resources of land, water, minerals are finite. The difficulties presented by this demand-supply imbalance are compounded by changing environmental conditions which make food production increasingly difficult or unpredictable in many regions of the world; and production systems that not only undermine aspects of the ecosystem, such as biodiversity and water quality, upon which we ultimately depend, but also exacerbate zoonotic diseases and other risks that directly affect our health, these are factors that have trigger [11,18].

It is known, that vulnerability to food security increases significantly from year to year. Rapid population growth, changes in lifestyle, and efforts by international institutions to eradicate poverty are factors driving increased demand for food [18].

Food is an essential need for humans, without food people cannot live. Food is needed to structure the body, as a source of energy and certain substances to regulate metabolism [22].

Most researchers in their articles put forward a definition of food security as is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life [1, 11, 18].

Food and Agriculture Organization as world organization on food, was define food security with the following four dimensions (or pillars): availability, accessibility, utilization, and stability [1-2]. Food security can therefore be imagined to a house having three pillars of availability, access and utilization but the ground on which these three pillars are standing for continuous support is the stability factor. We must address each of these factors in ensuring sustainable food security. Each of these factors is dependent on several other subfactors or component which must all be taking into consideration in formulating a framework for sustainable food security globally [1].

Nowadays hunger and undernourishment are problems affecting many millions around the world, and the problem is now increasing after decades of progress and as one of the post pandemic consequences. Tremendous resources has provided by our planet for us, but unequal access and inefficient handling leave millions of people malnourished". Emphasis on scientific progress in harmony with societal and economic progress is important for the government to eradicate hunger. Guaranteeing consistent food production from source to table is the main focus in developing countries, while healthier eating habits and minimizing food waste are the main focus in developed countries. [16].

The world in the palm of your hand is a term that we often hear nowadays along with advances in information technology.

Advances in information technology also play a role in reducing the problem of hunger and malnutrition. For example, social media can play a role in increasing food security by sharing knowledge and sharing food products. This supports the improvement of the four pillars of food security (food availability, food accessibility, food utilization and food system stability) [18].

1.2 Sustainable Agriculture

A balance between humans and nature through responsible and sustainable use of the earth's resources to ensure the continuity of life of the earth's 9 billion people is something that must be realized. Understanding and maintaining the relationship between environmental carrying capacity and food production is the main focus that must be pursued, ensuring inputs whose availability is limited can produce optimal output [30].

The challenges of the agricultural sector in the form of land conversion into residential areas or industrial and urban areas are one of the factors causing the reduction in productive agricultural land.

Apart from that, hydrometeorological disasters and excessive use of agricultural inputs have caused a decline in agricultural production. Sustainable agricultural systems are a solution that must be implemented by implementing practices to maintain soil health and productivity in the long term to produce high quality food, including by reducing tillage to reduce excessive soil erosion and minimizing disturbance to protected land from the forces of erosion caused by rain and wind Planting.

Crops in alternating strips, and building shelter strips to provide habitat for beneficial species such as insectivorous birds, which help control crop pests, also contribute to the pursuit of sustainable agriculture. Another thing that needs to be done is a multifaceted approach that takes into account various aspects of human life aimed at developing individuals through real learning, including steps to slow and potentially stop human population growth. [8, 9, 30].

Increasing temperatures and prolonged drought are currently occurring in almost all countries in the world, especially countries in the tropics. This causes an increased risk of crop failure [14].

1.3 Sustainable Food Security

Decreasing fertility levels and loss of agricultural land, loss of biodiversity, resource depletion are the impacts of unwise natural resource exploitation practices that affect global food production [1].

So that water, air, land, flora and fauna resources remain sustainable, effective planning and management of natural resources is needed as well as the availability of policies to ensure the maintenance and increase of the earth's capacity and produce renewable resources. This is expected to reduce its impact on ecological damage and increase its impact on social aspects [29]. Increasing national food production can be done through agricultural extensification programs and agricultural ntensification programs.

Agricultural extensification programs are difficult to implement in densely populated areas because land is limited. Therefore, intensification programs are programs that can possibly be implemented through the balanced use of superior seeds, fertilizers, pesticides and medicines as well as rehabilitation of agricultural irrigation networks. is an element that supports increasing rice production at the national level. These efforts are exacerbated by the impact of climate change which will affect local food stability [24].

In order to support the implementation of sustainable agriculture, it is very important to build an effective food production system by combining resource management and respecting the benefits obtained from nature. Environmental performance is evaluated at various scales, with a particular focus on sustainability analysis. Several researchers have used environmental assessment methodology, so that the carrying capacity of the environment is not neglected. In order for the irrigation network to function to increase crop yields, conservation of water sources must be carried out, in addition, the use of fertilizer must be balanced as a land management

practice to increase plant productivity. Excessive management practices to obtain high and stable yields will have an impact on the sustainability of food production [30].

A food production transition needs to be carried out considering that excessive food production will endanger natural resources and encourage the impact of climate change which results in food scarcity and a decline in environmental quality so that sustainability in agriculture needs to be introduced. Food security undoubtedly has importance, however, food security must be based on various pillars, including food, ecology, water, world population, and politics. [14].

Analysis food miles approach used to affordable food access, especially rice for residents Indonesia. Analysis using the food miles approach, as well as a geographical spatial approach, is expected to provide appropriate solutions and strategies in efforts to national food security, in this case in the form of rice commodities. In general, there are six categories of food miles in this research, where each category has different characteristics. In general, there are six categories of food miles in this research, where each category has different characteristics. Category I is near-surplus food miles. This category shows that the region has a rice surplus and most of the rice supply comes from within the province. Category II is medium-surplus food miles, where regions in this category can basically meet local rice needs, but bring in rice from other regions over quite long distances. Category III is far-surplus, category IV (near-deficit), as big as Category V (Medium-deficit) and Category VI (far-deficit) [2].

Evaluation of the impact of management of food and agricultural systems on the environment can be used using the Guidelines for Sustainability Assessment of Food and Agricultural Systems (SAFA).

Table 1. SAFA Sustainability Dimensions and Themes

Themes	Dimensions
Good Governance	G1. Corporate ethics
	G2. Accountability
	G3. Participation
	G4. Rule of law
	G5. Holistic management
Environment Integrity	E1. Atmosphere
	E2. Water
	E3. Land
	E4. Biodiversity
	E5. Material and Energy
	E6. Animal Welfare
Economic Resilience	C1. Investment
	C2. Vulnerability
	C3. Product Quality and Information
	C4. Local y
Sosial Well-Being	S1. Desent Livel Hood
	S2. Fair Trading Practices
	S3. Labour Right
	S4. Equity
	S5. Human Health and Safety
	S6. Culture Diversity

The Sustainability Assessment of Food and Agriculture Systems), this method prepared by FAO takes into account the existence of four dimensions as objectives, namely the dimensions of effective governance, environmental preservation, economic resilience and social welfare. In order to define the elements of sustainability, as well as a framework for studying trade-offs and synchronization between all dimensions of sustainability, this document can be used as an international reference document and serves as a benchmark for determining the existence of sustainability components [14].

1.4 Governance and Sustainability

A sustainable food system can be realized through changing patterns from extractive to regenerative, namely providing food by paying attention to the sustainability of natural resources and the environment through a systemic, holistic, that takes into account all scales, actors and interrelationships between subsystems [5, 15, 21]. Many sources have stated that the correlation between sustainability, systems, and governance is very important, yet it remains a multifaceted and contentious undertaking. This involves a broader range of arrangements for governing the food system. It is a socio-ecological construction that encompasses a specific geographical area, but it is also fundamentally a political process. According to those reference, sustainability is viewed as an inherent political aspect of food and nutrition security [15, 12, 22, 31].

Regulating the food system is a subject of concern and aspiration, as well as an effective remedy. This represents a fundamental factor in the execution of sustainable alteration [7], [26]. Numerous obstacles emerge at this alteration :

- 1) multiple participants;
- 2) imbalanced distribution of power;
- 3) policies with multiple dimensions;
- 4) diverse circumstances; and
- 5) the dissemination of knowledge.

2 Materials and Methods

Data collection was carried out by collecting secondary data from the Cirebon Regency Agriculture Service, which is from 2018-2023 in the form of data on (1) area of rice fields and (2) rice production. RMU data was obtained from data collection on all rice mills in Cirebon Regency in 2023.

To determine food security in Cirebon Regency, It is necessary to analyzed the availability and distribution patterns of rice from upstream to downstream. This pattern is expected to answer the uncertainty of rice availability in Cirebon Regency and its relationship in supporting food sustainability in the future. The method that will be used to answer this problem is to carry out primary data analysis at the rice mill level in Cirebon Regency as an indication of rice availability in the region. Apart from that, the rate of land conversion as a factor influencing rice production is used as analysis material for recommendations for the sustainability of food availability in Cirebon Regency.

Using mathematical models, The amount of surplus rice in one year is compared with the amount of rice consumed by the entire population in the relevant year to obtain the surplus value of rice.

The projected need for rice in Cirebon Regency is calculated by taking into account the increase in the Indonesian population which is calculated using the Verhulst model by referring to census data from the Central Statistics Agency. The Verhulst model can display good accuracy and produces a correlation coefficient close to one [25].

Food miles analysis have six categories of food miles, where each category has different characteristics. Category I is near-surplus food miles. This category shows that the region has a rice surplus and most of the rice supply comes from within the province. Category II is medium-surplus food miles, where regions in this category can basically meet local rice needs, but bring in rice from other regions over quite long distances. Category III is far-surplus, category IV (near-deficit), as big as Category V (Medium-deficit) and Category VI (far- deficit). Figure 1, The distribution system, known as the supply chain, creates several chain routes to distribute rice harvests from farmers to consumers [2].

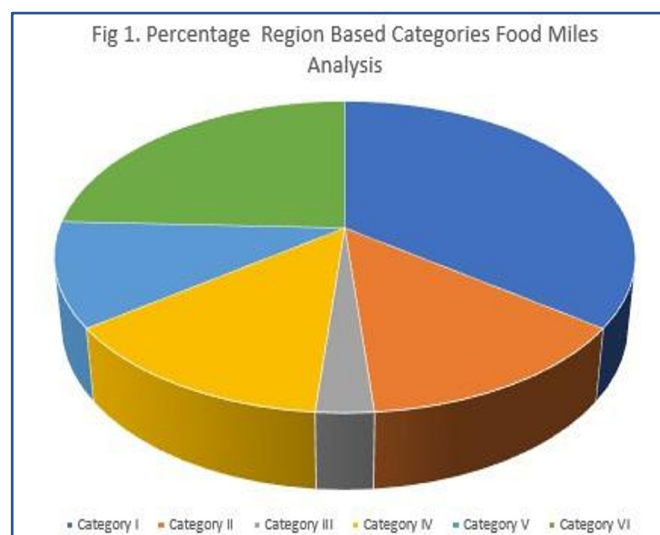


Fig 1. Percentage Region Based on Categories Food Miles Analysis

Categories for food miles analysis :

- I. Surplus-near: Aceh, Sumut, Sumbar, Sumsel, Lampung, Jabar, Jateng, Jatim, Bali, NTB, Sulteng, Sulbar, Sultara
- II. Surplus medium: NTT, Kalteng, Kalsel, Sulse, Gorontalo
- III. Surplus far : Sulut
- IV. Deficit near : Bengkulu, DKI Jakarta, DIY, Banten, Kaltim
- V. Deficit medium : Jambi, Kep. Riau, NTT, Maluku
- VI. Deficit far : Riau, Kep. Babel, Kalbar, Kalut, Malut, Papua Barat, Papua

The downstream process of rice production is drying, milling and trading [24] after it is in the form of rice. The process of trading rice through suppliers who take the rice to retailers or traditional markets or supermarkets, apart from that there is an alternative to selling it to the logistics affairs agency (BULOG).

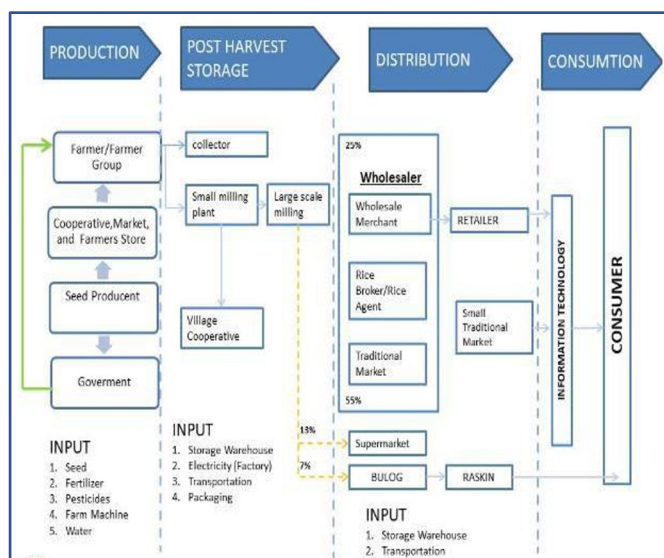


Fig 2. Rice Supply Network in Indonesia

The incorporation of sustainability values and aspirations into business planning is relatively new. The implementation of sustainability planning is increasingly important to become standard practice as a guide in good governance for sustainability efforts. The matrix emphasizes qualitative aspects over quantitative measurements. Internal progress is measured by assessing the extent to which plans are being implemented and specifically ensuring that all four dimensions of sustainability are covered [8].

3 Result and Discussion

Food security has 4 pillars of availability, accessibility, utilization and stability, each of which must be maintained to realize sustainable food security in Cirebon Regency. Maintaining food availability, there are production aspects that must be maintained so that they remain sufficient for the needs of the population in Cirebon Regency. The data needed to determine food availability, especially rice, requires land area data and rice production data in Cirebon Regency.

Agricultural land includes frozen rice fields and based on the calculation of agricultural statistical data from the Cirebon Regency Agriculture Service for 2018-2022, the frozen rice fields used for rice cultivation are depicted in Table 2.

Table 2. Area of Rice Field At Cirebon Regency In 2013-2022*

No	Year	Acre
1.	2013	53.560
2.	2014	53.368
3.	2015	53.560
4.	2016	53.368
5.	2017	52.725
6.	2018	52.591
7.	2019	52.579
8.	2020	52.622
9.	2021	53.518
10.	2022	53.471

*Cirebon Regency Agriculture Service, 2023.

In the last 10 years the area of rice fields in Cirebon Regency has fluctuated, the area of rice plants each year which is influenced by the planting area of commodity crops in the horticultural or plantation sectors. However, the trend has tended to decline in the last 2 years due to land conversion from rice fields to residential and industrial areas.

Table 3. Rice Production At Cirebon Regency In 2020-2023

No	Year	Ton
1.	2013	398.626
2.	2014	369.755
3.	2015	316.610
4.	2016	389.569
5.	2017	314.926
6.	2018	373.193
7.	2019	353.560
8.	2020	372.723
9.	2021	369.547
10.	2022	367.205

Cirebon Regency Agriculture Service, 2023.

Rice productivity is rice production which is calculated per unit area of land. The average rice productivity at Cirebon Regency in 2013-2022 is 6.34 tons per hectare.

The comparison of land area to production results, increasing land area does not always linearly increase the amount of rice production. This is due, among other things, to the influence of climate change which causes floods or droughts which cause crop failure. The monoculture pattern also causes low rice productivity.

Existence of Rice Milling Unit (RMU) also supports maintaining the availability of rice in Cirebon Regency. There are three categories of RMU, small-medium-large.

Table 4. Rice Milling Unit At Cirebon Regency In 2023

No	Type	Engine Capacity (Ton/Hour)	2020 *	2023 **
1.	Small	< 1,5	638	481
2.	Medium	1,5 – 3,0	64	31
3.	Large	≥ 3	3	16
	Total		705	528

*Central Bureau of Statistics, 2020;

** Census data

According to Central Bureau of Statistics, in 2020 there were 705 rice milling units (RMU) in Cirebon Regency, however, as a result of data collection carried out by author in 2023, there were 528 rice milling units in Cirebon Regency. There has been a decrease in the number of RMUs, the reason is that currently farmers directly sell their harvests in the fields to grain collectors to reduce production costs so that small-scale RMUs which act as providers of grain milling services are starting to decrease in number. Apart from that, the increase in grain prices encourages grain collectors to give good prices to farmers, thereby making farmers release their harvest to the fields.

Accessibility is one of the pillars that must be maintained so that Cirebon Regency can maintain food security. Based on Food Miles Category Jawa Barat include Cirebon Regency were in category I, it is near-surplus food miles. This category shows that the region has a rice surplus and most of the rice supply comes from within the province. Based on the food miles category, Cirebon Regency is an area that has easy accessibility to get food. This is supported by calculating the surplus using the surplus minus approach, data on annual rice consumption for people in Cirebon Regency with production 367.203 ton having a rice surplus of 104,545 tons in 2022. The green revolution is an effective approach to increasing crop yields through improving irrigation functions and balanced fertilization. Cirebon Regency has quite large potential as a grain producing region, but the challenge it faces is that information on the whereabouts of rice is unknown because farmers currently tend to sell grain in the fields to reduce production costs. However, from the Cipinang Rice Information Centre-Food Station, more than 20% of the rice in the Cipinang Rice Main Market in Jakarta comes from Cirebon.

The utilization pillar in food security is an important component in maintaining adequate food supply and access for the population of a country or region. This pillar involves a number of aspects that contribute to the ability of individuals and communities to access, utilize and manage food resources. Meanwhile, the pillar of stability in food security is also an important component to maintain the stability of food supply and access over a certain period of time. This stability focuses on the ability of the food system to remain robust, consistent, and reliable despite disruptions or changes in the environment. Exports and imports of rice production in Cirebon Regency was not properly recorded, distribution of rice production was not monitored supply stability and price affordability were not controlled, access and information to markets are limited. It is hoped that through the implementation of sustainable intensification and a sustainable diet in the future, the utilization aspect can be maintained in Cirebon Regency.

Table 5. Effort to Achieve Food Security and Sustainable

No	Sustainability Obstacles	Cirebon Regency Condition	Recommendation
1	Multiple Participant	Intensive production, processing, marketing and food consumption processes are handed over to market mechanisms	Collaborative-inclusive-collaborative, deliberative Governance
2	Imbalance distribution of power	No networked governance	Multi-scalar- multi-actor governance
3	Policies with multiple dimensions	inconsistency monitoring, implementation and evaluation of food systems governance	food sub-sectors coherence
4	Diverse circumstances	Diversity contexts, resources, actor systems, constraints	involving the role of the pentahelix
5	The dissemination of knowledge	innovation and transformation of food security are minimum	interdisciplinary governance

Nowadays the power of markets and companies become two arranged food systems governance that was proved unable to regulate the systems dysfunctions of globalization in Cirebon Regency. A short-term economic efficiency was the goal, without considered long-term effects and interactions.

Political will and transformation food systems was needed as strategy to achieve sustainability in Cirebon Regency, starting from changing extractive patterns to generative ones as well as making policy changes in an effort to face challenges that hinder its sustainability as show at Table 5.

4 Conclusion

The reduction in rice fields, low productivity and the impact of climate change are the causes of the decline in food production in Cirebon Regency. Regional governments should start improving to implement sustainable agricultural systems so that food availability, especially rice, is maintained

Qualitative evaluation based on SAFA shows that Cirebon Regency has not implemented sustainable agriculture, so the Department of Agriculture needs to choose to focus on improving sustainable agricultural practices by emphasizing indicators related to good governance, implementing a holistic management approach, and formulating sustainable management plans.

Food security and sustainability efforts can be achieved with policy changes and transformation of food system governance.

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