OPTIMIZING THE USE OF TECHNOLOGY IN CREATING CLIMATE SMART AGRICULTURE

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Abstract

Agriculture is an important sector for Indonesia. Because around 30% of the population works in the agricultural industry. Currently, agricultural conditions in Indonesia are facing challenges due to climate anomalies. Unpredictable climate changes, shorter growing seasons, an increase in pests and diseases and these conditions have an impact on increasing production costs while yields are not optimal. Climate change is one of the obstacles in increasing plant productivity. The negative impacts of extreme global climate change include the degradation of land and water resources, damage to agricultural and irrigation infrastructure, the emergence of floods and droughts, and increased attacks by pests and plant diseases. Therefore, farmers need knowledge and farming skills that are adaptive to climate change or what is known as Climate Smart Agriculture (CSA). Climate Smart Agriculture is a useful approach to guide the actions needed to transform and reorient agricultural systems to effectively support development and ensure food security in conditions of climate change. CSA technology focuses on climate resilience and food security with the main objectives being: 1.) Increasing agricultural productivity and income in a sustainable manner, 2.) Adapting and building food security to climate change, 3.) Reducing and minimizing greenhouse gas emissions (Mitigation), 4.) Optimizing the use of various resources. So it is hoped that optimal results will be obtained in the agricultural sector. This research is qualitative research with a descriptive approach. The researchers use research data in the form of secondary data obtained from a number of credible sources such as scientific articles, books and a number of other sources that are credible and commonly used in research. These data were analyzed using analytical tools with stages of data collection, data selection, data reduction and drawing conclusions.

Keywords: Climate Smart Agriculture, Climate Change, Modern Agriculture

1. INTRODUCTION

Current global climate change has caused an increase in average temperatures throughout the world, changes in rainfall patterns, and changes in weather extremes such as droughts, floods, and more frequent storms. Agriculture, as a sector that is highly dependent on climate factors, is significantly impacted by these changes (Nugroho, *et. al.*, 2023).

Agriculture is an important sector for human life, although from year to year the problems faced by the agricultural sector become increasingly complex (Waskitojati *et. al.*, 2019). However, agriculture has the greatest potential so the government must be dominant through its policies to be able to continue to overcome challenges and increase production results (Yeti, *et. al.*, 2021). Currently, agricultural conditions in Indonesia are facing challenges due to climate anomalies. Unpredictable climate changes, shorter growing seasons, an increase in pests and

diseases and these conditions have an impact on increasing production costs while yields are not optimal (Surmaini, *et. al.,* 2017).

In Indonesia, around 30% of the population works in the agricultural industry. However, some rural communities also have other livelihoods to meet their living needs (Haris, 2018). Apart from agriculture, natural forestry, other natural areas also make a significant contribution to the household income of rural communities. Natural forests contribute around 28% of total household income. So rural communities in Indonesia still depend on finding food from nature to survive (Noveira, *et. al.,* 2015).

The Indonesian Ministry of Agriculture has mapped the impact of climate change in Indonesia. Among these are degradation of land and water resources, infrastructure (irrigation), floods and droughts and shrinkage and land degradation which have the potential to threaten a decline in productivity, production, quality of results, efficiency and others which will lead to food security and ultimately to social and economic life and welfare. farmers and farming communities. The global climate change phenomenon has destroyed many vital infrastructures that support the strength of the national economy, destroying agricultural land in various parts of the world, including Indonesia. Changes in rainfall patterns and extreme climates have resulted in rice areas in several regions experiencing drought. The area experiencing drought increased from 0.3-1.3% to 3.1-7.8% (Setiyanto, *et. al.,* 2018).

Climate change is one of the obstacles in increasing plant productivity. The negative impacts of extreme global climate change include: 1.) Degradation of land and water resources, 2.) Damage to agricultural and irrigation infrastructure, 3.) The emergence of floods and droughts and 4.) Increased pest attacks and plant diseases. Therefore, farmers need knowledge and farming skills that are adaptive to climate change or what is known as Climate Smart Agriculture (CSA) (Kementan, 2024). Climate Smart Agriculture is a useful approach to guide the actions needed to transform and reorient agricultural systems to effectively support development and ensure food security in conditions of climate change (FAO, 2013).

CSA (Climate Smart Agriculture) focuses on climate resilience and food security with the main objectives being : 1.) Increasing agricultural productivity and income in a sustainable manner, 2.) Adapting and building food security to climate change, 3.) Reducing and/or minimizing greenhouse gas emissions (Mitigation), 4.) Optimizing the use of various resources (Mirawati, *et. al.,* 2024).

Climate change has a significant impact on food security and the livelihoods of farming communities. Climate change affects crop production, which can lead to food depletion for the rural poor (Raj, 2022). Crop losses not only reduce food availability but also reduce agricultural income, which could worsen food crises in rural areas. Decreased income due to crop failure can threaten small farmers. Low income levels in rural areas hamper the availability of available food. Small and marginal farmers also find it difficult to access capital compared to large capital owners. Climate change also affects the livelihoods and income of small-scale farmers, if this situation continues continuously it will affect food security (Nugroho, *et. al.,* 2023).

2. METHODS

Researchers believe that optimizing Climate Smart Agriculture (CSA) technology to create sustainable agricultural productivity results can create food self-sufficiency for Indonesia. Therefore, this research aims to optimize Climate Smart Agriculture (CSA) technology. This research is qualitative research with a descriptive approach, namely describing the impact of Climate Smart Agriculture (CSA) technology which can help increase agricultural productivity. The data used in this research is secondary data that researchers obtained from books, credible websites, scientific articles, books, and other things that are usually used as data references from

researchers (Sugiono, 2011). The data sources were analyzed using the stages of data collection, data selection, data reduction, and drawing conclusions (Maksum, 2020).

3. DISCUSSION

Climate Smart Agriculture (CSA) or climate-smart agriculture is an approach that transforms and reorients agricultural production systems and food value chains so that they are able to support sustainable agriculture and ensure food security in conditions of climate change (Bantolo, 2022). According to FAO (2013), there are three main points offered by this Climate Smart Agriculture based approach, namely:

1. Increase agricultural productivity and agricultural income periodically or sustainably
2. Adapting and building resilience to climate change
3. Reducing greenhouse gas emissions (greenhouse gasses)

Efforts to increase agricultural productivity and income in a sustainable manner in climate change must be done by cultivating more than one type of commodity, so business risks can be reduced. For example, harvest failure on one commodity can be covered by the harvest of other commodities. A drop in the price of one product can be helped by better prices of other products. In addition, reducing dependence on external imports will ensure the sustainability of farming. This is not the case that we don't need technological innovation, because it is impossible for us to achieve the agricultural productivity that we expect for without technological input. However, the technological support needed is technological innovation that is adaptive to climate change, in the sense that it can increase productivity while avoiding the impact of environmental damage (Rouw, 2018).

Therefore, efforts to increase agricultural productivity and farmer income in a sustainable manner in the Climate Smart Agriculture approach include two important aspects, namely:

1. An agricultural model that combines a diversity of genetic resources to reduce risks and maintain sustainable productivity
2. Support for climate change adaptive technology innovation.

Agricultural genetic resources must be well understood because they are an important basic aspect for sustainable agriculture (Rouw *et. al.,* 2015). The United Nations (UN) through FAO (Food and Agriculture Organization) places agricultural genetic resources as a priority program in the era of climate change.

Climate change and its impacts need to be conveyed and fully realized by farmers. Because farmers are not only educated through technological innovation, but how to prepare farmers' mentality and way of thinking about climate change and its impacts. The various efforts that have been made should be able to increase farmers' ability to adapt to the impacts of climate change. This task is not only carried out by extension workers or researchers, but is the responsibility of all parties related to agricultural development. In the adaptation approach, the most important thing is the ability to understand and predict climate change, related to changes in rain patterns, dry seasons, rainy seasons, the vulnerability of regions and agricultural systems to climate stress, the possibility of explosions of plant pest attacks, and so on which can influence the level of production, food security and farmer income (Rouw, 2015).

In this context, we must be able to understand and use various predictions and analysis results from various research bodies such as the Intergovernmental Panel on Climate Change (IPCC) which is tasked with analyzing and projecting global climate change, the National Oceanic and Amospheric Administration (NOAA) which also carries out observing the atmosphere and ocean (ocean) and analyzing climate variability, the Japan Meteorological Agency (JAICA), the Meteorology, Climatology and Geophysics Agency (BMKG), and various other agencies tasked with analyzing and predicting climate change. Science and technology capabilities are important prerequisites in this process. Here the role of researchers from

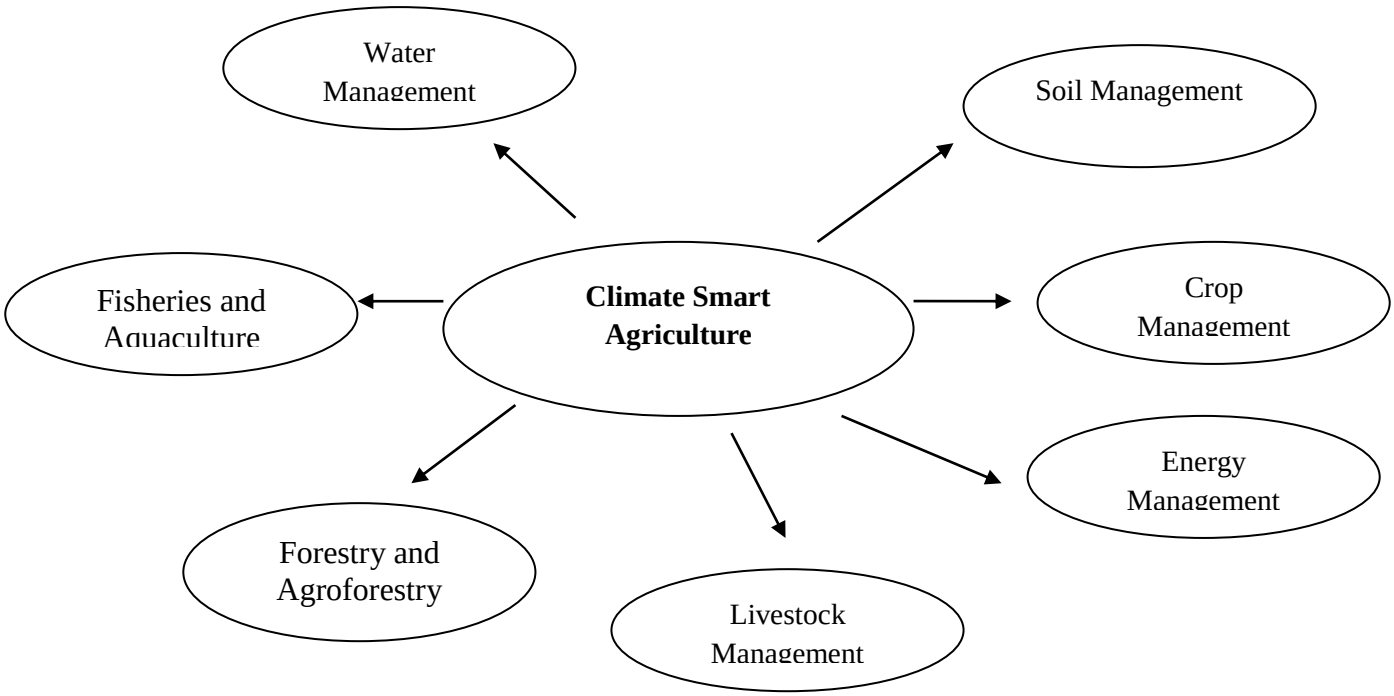
universities and research institutions is required to make this happen. So far in the era of climate change, access to climate variability information from competent international institutions is very easy (Rouw, 2015).

Reducing greenhouse gas emissions is a goal in the Climate Smart Agriculture approach. The main principle in this goal is to use plants and cultivation techniques that have low greenhouse gas emissions. Rice plants are known to contribute to methane greenhouse gas emissions, and certain agricultural models can even contribute to greenhouse gases and global warming (Yagi, 1991). Research and development must continue to be carried out to understand this aspect. So far the Agricultural Research and Development Agency has produced rice varieties with low greenhouse gas emissions. Furthermore, to address the impact of climate change, the Agricultural Research and Development Agency has produced various innovations in climate change adaptive technology, including drought-resistant types of rice and secondary crops, rice varieties that can grow on saline land, submersion-resistant rice varieties, water-saving irrigation technology, crop and livestock cultivation techniques, feed composition with low greenhouse gas emissions, and waste processing technology. Exploratory research needs to continue to be carried out to identify this potential.

In the end, the value that is most prioritized in implementing Climate Smart Agriculture is the value of sustainability. In practice, several practices related to Climate Smart Agriculture include Crop Management, Soil Management and Water Management. Where this can be done by regulating or managing inputs for agricultural systems such as seeds, irrigation, fertilization, and also tillage. However, basically there are no definite benchmarks for its implementation practice (Faza, 2018).

According to Faza (2018), the relationship with the Climate Smart Agriculture approach and several practices that can be used are as follows:

Table 1. Climate Smart Agriculture approach and its practical application



1. Water Management

Water management in the field is carried out by regulating water availability through irrigation, groundwater, river basins (DAS) and existing rainfall. The water management carried out will affect the planting pattern for one year.

2. Soil Management

Soil management is carried out by regulating fertilizer doses. Where use is adjusted to soil conditions and plant needs.

3. Crop Management

Crop management or plant management itself, what is done in the field is by selecting and using superior seed varieties that suit the existing planting conditions.

4. Energy Management

For energy management itself, there are no practices implemented in the current rice production system.

5. Livestock Management

Livestock management is management related to livestock, this was not carried out because it is not related to the case study.

6. Forestry and Agroforestry

Forestry and agroforestry are practices that combine annual crops, fruit crops and livestock.

7. Fisheries and Aquaculture

Fisheries and aquaculture are related to fisheries.

4. CONCLUSION

Based on the explanation above, several points can be concluded regarding the Optimization of Climate Smart Agriculture Technology on climate change in Indonesia as follows:

1. Increasing agricultural productivity and income in a sustainable manner
2. Adapting and building food security to climate change
3. Reducing and minimizing greenhouse gas emissions
4. Optimizing the utilization of various resources

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