

DEVELOPING AGRICULTURAL ECONOMY WITH ADAPTING TO CLIMATE CHANGE IN AN GIANG PROVINCE

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ABSTRACT

An Giang is a province that has strengths in agricultural economic development. It is one of the provinces with the leading rice production in the country, the rate of agricultural development always increases every year. To achieve high results in agriculture, An Giang province has been building new models of agricultural economic growth with many positive changes. In particular, An Giang province always focuses on developing the agricultural economy with adapting to climate change, in order to improve economic efficiency. The content of the article, referring to agricultural economic development with adapting to climate change in An Giang province, is to point out the impacts of climate change on the province's agriculture. From there, it gives suggestions for the agricultural industry of An Giang province to develop higher and higher.

Keywords: development, economy, agriculture, climate change

1. Introduction

From 2011 up to now, climate change has become more and more complicated, challenging many countries in the world and causing great disturbance to the world. According to experts, agriculture is one of the industries heavily affected by climate change because the characteristics of the industries: cultivation, husbandry, forestry, fisheries and irrigation all depend on geographical location and is directly influenced by natural factors. Climate change affects economic development, society and environmental resources in the world in general and Vietnam in particular. Particularly in the Mekong River Delta, which is increasingly suffering from the negative impacts of climate change, and An Giang province is also affected by this change. With favorable natural conditions, An Giang province identifies agriculture as a key economic sector,

aiming to build An Giang to become the agricultural center of the Mekong Delta. But the harsh effects of climate change, which directly affect the agricultural economy, require An Giang province to actively find a direction to develop the agricultural economy in the right direction.

2. Method

Several research methods have been applied in this study to clarify issues of agricultural economic development with adapting to climate change in An Giang province.

Firstly, the methods of analysis and synthesis are applied to analyze documents related to research issues.

Secondly, the historical method is applied to describe the research problem according to the process, specifically over the years to clearly see the agricultural economic development of An Giang province.

Finally, the logical methods help to identify appropriate research issues.

3. Results

3.1. Theoretical basis

3.1.1. Climate Change

According to the definition in the United Nations Framework Convention on Climate Change (UNFCCC), climate change is a fundamental change in the climate that is attributed directly or indirectly to human activities that change the composition of the global atmosphere and this change is added to the natural variability of climate observed over comparable time periods (United Nations, 1992).

Climate change is a change in climate and related components including the oceans, land, Earth's surface, and the glacial atmosphere, such as increasing temperatures, melting ice sheets, and rising sea levels. Previously, climate change took place over a long period of time due to the impact of natural conditions. But recently, climate change has occurred due to the impact of human activities released into the environment. greenhouse gas field (Vietnam Open development Mekong, 2019). Climate change has directly impacted on socioeconomic development, human health, migration and displacement, food security, and terrestrial and marine ecosystems.

3.1.2. Agricultural economy

Agriculture is a production field with specific characteristics, a production industry associated with plants and animals, governed by biological laws, external conditions (land, weather- climate)

and is the industry that produces necessary products for the existence and development of society. So it has long been interested by economists and it is mentioned a lot in economic theories, especially in economic development models of less developed countries that are currently industrializing (Economic People., 2019).

We can understand that: agriculture, in the broad sense, includes forestry and fishery. Agriculture, in the narrow sense, is an industry that produces material wealth in which people must rely on the growth laws of plants and animals to create products such as food, foodstuff, etc. to satisfy their needs.

3.2. Situation of climate change affecting agriculture in An Giang province

The impact of climate change is becoming more and more serious, affecting the living environment, natural disasters, epidemics, directly affecting the production process, agricultural cultivation of people and causing heavy damage in agricultural production such as: hail, drought, flood, alum, salinity, etc.

Currently, agricultural production of our country in general and An Giang province in particular still depends on natural conditions, climate and weather. When the temperature of the weather and climate increase, it will greatly affect agricultural production, especially cultivation. The extreme changes of the climate change abnormally such as increasingly complicated droughts and thunderstorms, floods in the rainy season, lack of water for production and daily life in the dry season, and salinity penetrates deep into the land, the risk of forest fire... has frequently appeared in recent years, affecting the quality of agricultural production such as affecting growth, crop yield, planting season, increasing the risk spreading pests and diseases to crops, affecting reproduction, growth, productivity, quality, and products of livestock and poultry, increasing the possibility of pathogenicity and transmission of livestock and poultry, causing danger shrinkage of agricultural land.

The general situation of the Mekong Delta provinces is that they are directly and increasingly severely affected by climate change, especially in the heavily affected agricultural economy. The salinization also significantly affects the growth and development of rice plants such as: reduced germination of rice, reduced height and tillering ability, poor root system development, reduced biological nitrogen fixation and nitrogen mineralization in the soil. On average, rice yield can be reduced by 20-25%, even up to 50%. Typically, in 2013, a survey in An Phu is the upstream district and Chau Thanh is the downstream district of An Giang province, showing that the amount of flood water is low, this is one of the factors that reduce aquatic resources, especially the landless poor farmers (Nguyen Van Thieu, Nguyen Thi Ngoc Dung, 2014). Reducing fish and shrimp production, low rice yield because low and late floods will cause delayed crops, lack

of water sources for salt washing, leading to acid and saline soils. Climate change impacts on water resources, as changing rainfall patterns can cause severe flooding in the rainy season and drought in the dry season, making it difficult for water supply and water use.

In 2015, in An Giang, and other provinces in the Mekong Delta, the water level in the headwaters of the Mekong River and the inland area of the Long Xuyen Quadrangle was influenced by tides, the highest tide peak appeared in the last days of January, lower than the same period in 2015 from 0.10-0.20m; from the beginning of February to the end of March 2016, the highest tidal peaks were at 0.15-0.25m higher than the same period in the same period (Department of Minerals and Water Resources, 2016).

The lowest ebb tide level in January 2016 at the upstream stations of the Mekong River and downstream areas at Cho Moi, Long Xuyen was 0.10 - 0.20m lower than the same period in 2015, the interior area of the Mekong Delta is at a level of 0.10 - 0.20m lower than that of the same period in 2015. Long Xuyen quadrangle is lower from 0.05-0.10m; from February and March 2016 were all higher than the same period in 2015 from 0.10-0.30m (Department of Minerals and Water Resources, 2016).

In the dry season of 2015-2016, the salinity intrusion was earlier and deeper. Actual data measured in February and the end of March 2016 showed that the salinity in the estuaries of KienGiang province had entered the province. An Giang in the two districts of Thoai Son and Tri Tonis from 20-30 km, some places are over 30 km with the highest salinity in Phu Lam on the H7-Chu U channel at 1.9g/l (March 23), from March 29 salinity at stations gradually decreases (Department of Minerals and Water Resources, 2016). The weather and hydrological situation in An Giang province during the dry season of 2016 had complicated changes, with hot weather, drought and saltwater intrusion, especially in April and May 2016. This has had a significant impact on the agricultural cultivation of the people.

In 2017, the province's agricultural production still faced difficulties and challenges: saline intrusion, drought, prolonged rainstorms accompanied by thunderstorms, affecting crop yields in Winter-Spring and Autumn-Summer crops. The floods are big and come earlier than usual, so the production area of Autumn-Winter is much reduced.

In 2018, climate change also affected the early return of floods, also caused heavy damage to agriculture in An Giang province, the loss of nearly 500 hectares of rice outside the dike area in two communes Phu Hoi and Nhon Hoi, district An Phu.

In 2018, in Bac Dai hamlet and the area from Rach Xeo Tre to the border of Phu Hoi commune (An Phu district), due to prolonged storms, flood water rose rapidly, flooding the Summer-Autumn rice crop. The total area inundated by flood water, which cannot be harvested and

completely lost is 31.5 ha. In which, the damage of 50% is 15ha; 100% damage is 16.5ha (Thanh Lam, 2018).

In the year 2019 - 2020, in An Giang province, the water level in rivers and canals was low due to the lack of rain in the dry season. Along with that, drought and saltwater intrusion in the dry season of 2019 - 2020 occurred earlier, deeper and more intense than the average of many years. The drought situation also greatly affects the lives and production of people, lack of water for production and daily life in the dry season, in border and mountainous districts. Climate change also affects the growth, development, planting season, the ability to increase crops, lack of water for crops, increase diseases and pests, reduce productivity and output of the crops. In addition, climate change is likely to increase the frequency, intensity, variability and extremes of dangerous weather phenomena such as storms, floods, and droughts, reducing crop yields. and livestock, increasing risks to agricultural production.

3.3. Policy of An Giang province on agricultural development and climate change adaptation

In the face of increasingly harsh climate changes, An Giang province implemented the Party's Resolution, the Resolution of the An Giang Provincial Party Congress for the 2015-2020 term defining: Agriculture is a key economic sector, constructing An Giang became the agricultural center of the Mekong Delta. Accordingly, the An Giang Provincial Party Committee focused on leading and mobilizing many resources for agricultural development in depth, constantly increasing the productivity, quality, efficiency and competitiveness of agricultural products, improving the living standard of the material and spiritual life of farmers,... making the province's agricultural economy the spearhead economy of the province as oriented.

One of the solutions prioritized by the An Giang Provincial Party Committee is to build and consolidate irrigation works, ensure water for production and daily life, in association with the implementation of measures to reduce damage caused by natural disasters, disease.

In 2016, facing new pressures in the context of climate change, food security and international integration, An Giang province's goal is to develop agriculture and rural areas comprehensively and sustainably.

In 2017, An Giang surveyed and identified 28 points of canals, and rivers at risk of landslide, with a length of 2.7km, and at the same time examined areas of saline intrusion and drought.

In 2018, the People's Committee of An Giang province issued Decision No. 44/2018/QĐ-UBND, regulating the management, exploitation and protection of irrigation works in the province. It is strictly forbidden to act as: Drilling, excavating soil and rock, illegally building within the

protected area of irrigation works; illegally encroaching on and using land within the protection area of irrigation works; activities that obstruct the management and repair of works.

The Department of Natural Resources and Environment shall assume the prime responsibility for, and coordinate with the Department of Agriculture and Rural Development in, advising the Provincial People's Committee to guide the formulation of mining plans; granting permits for exploitation and use of water resources and discharge of wastewater into water sources according to regulations; carry out the appraisal and submit to the Provincial People's Committee for approval the plan on calculating charges for granting the right to exploit and use water resources to relevant individuals and organizations.

The province specifically prohibits acts of polluting the water source of irrigation works such as: discharging toxic waste, garbage, dead animal carcasses, bottles, pesticides; wastewater from industrial production facilities or industrial parks, wastewater from production and aquaculture zones, domestic wastewater from residential areas and business zones into irrigation works. The actions encroach on the river surface, obstruct flood drainage, change the flow, leading to local erosion in front and behind the structure.

- To organize the implementation of programs, schemes and projects on climate change response and adaptation, the People's Committee of An Giang province has directed branches and levels to develop and promulgate 10 plans provincial action (including action plans of 08 sectors and fields: water resources, land resources, agriculture and food security, fisheries and biodiversity, geological hazards and natural disaster prevention, construction, transportation, environment; action plan to respond to provincial climate change, communication plan for the period 2011 - 2015).
- Building a model of a water reservoir in arid areas to supply daily-life water to mountainous residents in Tri Ton district; Adaptive water management to climate change in An Giang province; Climate Change Adaptation in the Mekong Delta; Redirecting of flow to limit landslides, protect urban areas in Long Xuyen city to adapt to climate change...

Every year, branches and levels in An Giang province have developed plans and organized training courses for managers of provincial Departments, 11 districts, towns and cities in the province and the residential community; Organize workshops on climate change impacts and adaptation; Approving projects sponsored by international organizations related to climate change, many propaganda classes have been organized on knowledge and solutions to develop climate change adaptation plans for officials and farmers.

An Giang province has actively dredged 146/159 irrigation works with a length of over 233km,

reinforced 83km of dikes; repairing and upgrading 195 sluices, irrigation works... Locally managing and exploiting irrigation works, building projects on exploitation of water reservoirs in Tri Ton and Tinh Bien districts.

From 2015 to 2018, the An Giang Provincial Party Committee led the implementation of 62 provincial projects and topics, 67 grassroots scientific models and solutions. Irrigation works aim to facilitate agricultural restructuring, land accumulation and response to climate change (Nguyen Duy Hien, 2018). The Provincial People's Committee has approved 8 detailed plans for hi-tech agricultural production areas for 08 product groups; The Department of Agriculture and Rural Development has supported the implementation of 40 high-tech agricultural production models towards an efficient and sustainable agriculture associated with adaptation to climate change.

An Giang Provincial Party Committee has transformed from development by area, productivity and output to value and efficiency increase per unit area. Localities take the initiative in structuring agricultural products with comparative advantage in the market, identifying four key products, including: Rice, fish, vegetables, and medicinal plants. In particular, An Giang focuses on developing various types of farm economy, expanding the land tenure, accumulating large fields, prioritizing the conversion of land use purposes as a farm economy according to the model, joint stock company, mobilize people to contribute capital with land, together in production and business. Localities also actively converted inefficient rice growing areas to crops, fruit trees, and livestock. Currently, the province has shifted 9,316ha to grow mangoes and vegetables, nearly 22,000ha (Nguyen Duy Hien, 2018).

An Giang focuses on rapidly developing small and medium-sized enterprises specializing in vegetable production to associate with consumption enterprises. At the same time, training farmers to manage vegetable quality, building safe vegetable material areas and verifying and certifying safe vegetable products. To cope with the situation of drought and saltwater intrusion affecting agricultural development, An Giang province has enlisted the implementation of investment projects on upland irrigation systems, such as electric pumping stations, water reservoirs to store water and water conduit for agricultural production and people's livelihood, such as: O Thum Reservoir, Soai So Lake, O Ta Soc Lake, 3/2 Pumping Station, Chau Lang Pumping Station, Le Tri Pumping Station. The province has also invested in flood storage projects in areas that do not produce Autumn-Winter crops to store water in the flood season for use in the dry season and contribute to ecological regulation. At the same time, dredging large canals connecting main rivers such as Tien and Hau rivers to increase water supply flow into the Long Xuyen Quadrangle inland area. To build systems of regulating sluices, sluices to prevent salinity, and dams to prevent salinity.

3.4. Achievements in agricultural development adapting to climate change in An Giang province

Over the past time, the province's agricultural sector has made many positive changes, promoting agricultural restructuring to adapt to climate change.

In order to develop sustainably in depth with quality, the province plans to specialize in vegetable and color production in the direction of a model of linking consumption and production in the direction of high technology. At the same time, consolidating and improving the quality of cooperative organizations and cooperative groups; develop a cooperative economic model for each concentrated vegetable production material area.

Continue to change the structure of crops, switch to growing crops and fruit trees in order to increase income per unit area. Localities have also actively converted inefficient rice-growing areas to crops, fruit trees, and livestock with high economic value. To increase from 2,000 to 3,000 ha the area planted with some crops such as tall potatoes, tapioca, lotus, vegetable soybeans, baby corn, peppers, leafy vegetables, etc. (Report 69/BC-SNN&PTNT, 2018).

The province's current rice growing area is about 469,200 hectares, a decrease of nearly 20,000 hectares; the total area of fruit trees increased to 15,800 ha, especially the mango area over 9,300ha.

Rice: the total cultivated area is 634,254 ha (decreased by 7000 ha over the same period), the average yield of the whole year is: 6.24 tons/ha (+ 0.17 tons/ha compared to the average), the output is 3,957 million tons increased by 66,000 tons over the same period) (Report 69/BC-SNN&PTNT, 2018).

Crops: the total turnover is 60.2 thousand hectares (increasing by 2-3 thousand hectares over the same period), the average yield of the whole year is equivalent to the same period.

A number of localities in An Giang province have actively converted to efficient production models, shifting from inefficient rice land to growing crops and fruit trees with more than 3,000 hectares, bringing the total area of food crops to more than 5,200 ha, profit from 57 million to 234 million dong/ha. In places where rice is not effective, the province has deployed people to grow jaggery, increasing their income by more than 300,000 VND/month. In order to adapt agricultural development to climate change, An Giang province has built a "High-tech Seed Center" to provide good seeds and ensure quality for production requirements in the province and Mekong Delta provinces. investment of 10 million euros. (Nguyen Duy Hien, 2018).

In 2017, An Giang province had 45 enterprises signed to link production and consumption chains with farmers through the model of 19 cooperatives and 32 cooperative groups, accumulating nearly 20,600 hectares of production land according to the big field model; built 24 effective production models such as shrimp farming on rice land in Thoai Son, profit of 100 million VND/ha, 5 times higher than rice cultivation; VietGAP vegetable growing model, organic vegetable has nearly 20ha in Long Xuyen city; growing straw mushrooms; commercial catfish farming with an area of 336ha.

An Giang province has up to 84.4% of agricultural production land, so focusing on building and consolidating irrigation works, ensuring water for production and daily life, is associated with implementing measures to reduce damage caused by natural disasters and epidemics: it is an extremely urgent problem. In 2017, the province surveyed and identified 28 canals and rivers at risk of landslides, with a length of 2.7km, and at the same time reviewed saline and dry intrusion areas... On that basis, An Giang province implemented 532/537 irrigation works. Implemented 62 projects, provincial topics, 67 grassroots scientific models and solutions. The works are aimed at facilitating agricultural restructuring, land accumulation and local response to climate change.

4. Discussion and conclusion

Some recommendations in agricultural economic development to adapt to climate change The province has achieved in agricultural development adapting to climate change, to improve the results An Giang province needs:

- *Firstly*, it is necessary to identify the main solutions to respond to climate change: in which, continue to update, select and complete solutions to respond to climate change for the agricultural sector, the functional agencies need to identify and promptly announce climate change to people about water level rise, construction elevation, flood risk area, water shortage risk area... publicize it widely so that people can proactively respond and prevent.
- *Second*, reasonably and sustainably maintain land fund for agriculture in regions and localities to ensure food security in the context of climate change.
- *Third*, build more new growth models, adapt to climate change conditions, towards the development of agricultural economy. Change the use of suitable water, fertilizer and animal feed sources.
- *Fourth*, promote the development of green agricultural production. Developing and applying biotechnology, applying advanced production processes towards a modern, adaptive and flexible agriculture in increasingly harsh climate conditions.

- *Fifth*, apply new production model, apply modern technology, link regions. At the same time, solving capital problems, selecting new varieties, planning infrastructure, irrigation, and small-scale production in agricultural development.
- *Sixthly*, areas with frequent droughts, salinization, flooding and degraded land for inefficient rice production need to reduce the area of rice cultivation to switch to aquaculture and other suitable crops with higher economic profits. Building and perfecting the system of control and prevention of plant and animal diseases in the context of climate change.

Conclusion

Climate change impacts all fields, from natural to socio-economic on a global scale, both urgent and long-term. Therefore, in order to adapt to climate change in agricultural economic development, An Giang province has made constant efforts to achieve the goals set out in the province's agricultural economic development.

An Giang maximizes its potentials and advantages, effectively exploiting resources for agricultural development. Actively prevent natural disasters, protect the environment and adapt to climate change. Ensure regulation and creation of water sources for irrigation, drainage, combined irrigation and water supply pumps; flood drainage, flood prevention, storm surge prevention, saltwater prevention, salt suppression, salt washing, alum washing, and fresh water preservation; protect dikes against floods in sub-regions serving production and other irrigation according to the products that have been bid, ordered or delivered according to the plan. The province's agriculture is constantly improving productivity, quality, efficiency, competitiveness, changing the development mindset based on area, productivity, output to thinking about value and economic efficiency achieved in the land unit. From unceasing efforts in developing agricultural economy with adapting to climate change, An Giang province has achieved certain successes, being the leading province in the transformation of crops and livestock, as well as such as research on rice varieties adapted to fields contaminated with alum, salinity have been successfully tested and are being moderated to expand the area of rice cultivation to adapt to climate change. However, at present, climate change is increasing and has direct impacts on the economy, environment and society. Therefore, the development of agricultural economy to adapt to climate change is an important and urgent factor in the economic and social development of An Giang province in particular and the country in general.

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