Practices and Challenges of Women-Led Agricultural Economy in Coping with Climate Change

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Abstract. As climate change intensifies, agricultural production faces greater uncertainty, especially the frequent occurrence of extreme weather, which poses severe challenges to crop yields, agricultural resource utilization efficiency and rural livelihoods. To this end, this paper studies the practices and challenges of women in coping with climate change in the process of leading the agricultural economy, and explores how to enhance the ability of rural women in agricultural climate adaptation through measures such as optimizing agricultural management, enhancing the application of science and technology, and improving resource utilization efficiency. Based on field investigation and data analysis, this study uses a combination of quantitative and qualitative methods to focus on the specific practices of rural women in agricultural resource management, meteorological disaster prevention, and agricultural technology application. Through in-depth interviews and data analysis, the contribution of women in planting decisions, soil and water resource management, and climate-adaptive agricultural technology adoption is evaluated, and combined with case analysis, effective strategies to enhance women's agricultural decision-making capabilities are explored. The study shows that the experimental group showed significant improvements in women's decision-making power, economic independence, and leadership. Specifically, women's decision-making power increased from 30% at the baseline to 60%, an increase of 30%.

Keywords: Women-Led Agricultural Economy; Climate Change; Adaptive Agricultural Practices; Technological Innovation; Policy Support

1 Introduction

In the context of increasingly serious climate change facing the world today, agriculture, as one of the industries directly affected, urgently needs to take effective response measures. Especially in many developing countries, women play an important role in agricultural production. They are not only the main force in food production but also an important pillar of family economy. However, due to the increasing number of extreme weather events caused by climate change, the challenges faced by women are also increasing. In this context, studying how the agricultural economy led by women responds to climate change, exploring its coping strategies and challenges is of great

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significance for achieving sustainable agricultural development and promoting gender equality.

This study aims to analyze how women can improve agricultural productivity through adaptive agricultural practices, policy support and technological innovation in the context of climate change, and in the process promote the improvement of women's economic status. By comparing agricultural production data of the experimental group and the control group, the study evaluated the changes in women's decision-making power, economic independence and leadership in the agricultural economy, and explored the positive impact of relevant policies on improving women's agricultural production capacity and responding to climate change. Through these analyses, this study hopes to provide theoretical support and practical suggestions for the formulation of global agricultural and gender equality policies.

The structure of this paper includes five main parts: First, the introduction explains the background, purpose and importance of the study. Then there is a literature review, which reviews the research progress and existing research bottlenecks in related fields. Then there is the method section, which describes the experimental design, data collection and analysis process in detail. Next, the research results section evaluates the role of women in agriculture, climate change adaptation capacity and changes in socioeconomic status through experimental data and analysis. Finally, there is the conclusion, which comprehensively summarizes the research findings and puts forward policy recommendations and future research directions.

2 Related Work

Climate change, socio-cultural factors, gender equality and policy support play an important role in agricultural production and women's economic empowerment. Next, we will explore the practical strategies and challenges of how to cope with climate change in women-led agricultural economies, and analyze the impact of corresponding policy support and technical training on the improvement of women's status. Warsame et al. analyzed the impact of climate change factors (precipitation and temperature) and non-climate factors on maize production in Somalia from 1980 to 2018. The results showed that climate change and political instability significantly suppressed maize production, especially temperature and precipitation, which had a negative impact in the long term [1]. Kwakye et al. proposed a conceptual model for policymakers, emphasizing policy tools, stakeholder engagement, and monitoring frameworks to optimize bioenergy outcomes, help mitigate greenhouse gas emissions, enhance climate resilience, and promote sustainable development [2]. Moscona and Sastry studied how innovation responds to climate change and affects its economic effects, focusing on U.S. agriculture. The study showed that targeted innovation may mitigate or exacerbate potential economic losses caused by climate change [3]. Sargani et al. used grounded theory to propose a new model of sustainable livelihoods for small farmers based on seven types of household assets, and used mixed methods to analyze the livelihood assets of growers in climate adaptation. The study found that social, cultural, economic, and human assets have a positive impact on sustainable livelihoods [4]. Ren et al.

pointed out that changes in precipitation and farm size will further exacerbate the spatial differences in global nitrogen use and loss, but managing farm size can increase global farmland nitrogen use efficiency to more than 70% by 2100 [5]. Tsiaousi and Partalidou used feminist agricultural food system theory to analyze this phenomenon based on official data, expert interviews, and in-depth interviews with 71 female farmers. The study showed that the increased visibility of women in agriculture has not changed the existing gender hierarchy in the family and society [6]. Asare-Nuamah et al. evaluated the impact of the cassava dough industry on women's economic empowerment through interviews and focus group discussions. Local women face marginalization due to lack of access to arable land [7].

3 Method

3.1 Causes and Impacts of Feminization of Agricultural Labor

With the transfer of rural labor to non-agricultural sectors, the trend of feminization of agricultural labor is becoming increasingly obvious. However, compared with men, rural women face greater challenges in working outside the home, including restrictions on land system, family responsibilities, fertility, education level, gender discrimination and household registration system. As it is difficult for women to completely leave agricultural production, they have become the main labor force in rural agriculture. Therefore, in the process of promoting rural economic development and promoting the construction of new countryside, the role of women should be fully recognized, and effective support measures should be taken to address the difficulties they face.

3.2 The Role of Rural Women in Family and Agricultural Management

Women have long played an important role in family management and agricultural production. Studies have shown that women have a stronger environmental awareness and resource management capabilities, and can influence family consumption patterns to make them more in line with the concept of sustainable development. Especially in rural areas, as male laborers go out to work, women not only take on household affairs but also dominate agricultural production and become the backbone of the family economy. For example, agricultural activities such as courtyard economy and family breeding are usually managed by women, and these activities are not only related to family livelihoods but also closely related to the agricultural ecosystem. Women play a key role in deciding which crops to plant and how to optimize resource utilization. Their knowledge and decisions directly affect the sustainable development of agriculture.

3.3 The Role of Women in Agricultural Resource Management

In rural households, resource allocation is an important factor in determining economic income and quality of life. As decision makers and actual operators in agricultural production gradually separate, the effective use of agricultural resources faces challenges. The study finds that although women account for a higher proportion of actual operations in agricultural production, they have lower decision-making power, which may lead to irrational use of agricultural resources. For example, in terms of land and water resource management, since women have fewer opportunities to receive agricultural training and extension practices, it is difficult for them to master scientific agricultural management methods, which in turn affects resource utilization efficiency. Therefore, improving rural women's agricultural knowledge and enhancing their decision-making power in resource management are crucial to the sustainable development of agriculture.

3.4 Meteorological Disaster Prevention and Women's Participation

In the face of increasingly frequent meteorological disasters, the government needs to establish a sound defense system, including emergency response mechanisms, infrastructure construction, and agricultural meteorological disaster risk assessment. At the same time, mastering meteorological laws and optimizing agricultural layout are also important means to improve agricultural disaster resistance. In this process, women, as important participants in agricultural production, should play a greater role in disaster prevention and reduction, promotion of ecological agriculture, etc. For example, women can improve the adaptability of agriculture and reduce the impact of disasters by adjusting crop planting structure, promoting water-saving technology, and developing ecological agriculture.

4 Results and Discussion

4.1 Selection of Test Group

Region selection: Agricultural areas that are more seriously affected by climate change (e.g., areas prone to drought and flooding) are selected.

Women farmers group:

Experimental group: Women-led farmer groups, receiving climate-smart agricultural technology training, water-saving technology training and policy support.

Control group: Women-led farmer groups, not receiving technical training and policy support, continuing with traditional agricultural practices.

Approximately 30-50 female farmers are selected in each group (depending on the actual situation in the region) to ensure a representative sample.

4.2 Experimental process

4.2.1 Pre-experimental stage.

All participants undergo a preliminary survey to collect baseline data on current agricultural practices, climate change impacts, resource access, socio-cultural factors, etc.

An experimental and control group are identified to ensure minimal differences between the two groups in the initial phase.

4.2.2 Implementation phase.

Training and technology introduction:

The women in the experimental group are provided with training on climate-smart agricultural technologies, including drought-tolerant crop planting and water-saving irrigation technologies.

The experimental group is provided with policy support (such as funds, loans, technical support, etc.).

The control group continues to use traditional agricultural methods and maintains the original production model.

Agricultural practice observation and tracking:

Throughout the experiment, farmland production conditions are regularly tracked and recorded, including soil quality, crop growth, water resource usage, etc.

The participation and changes of the two groups of women in agricultural decision-making are observed and recorded.

4.3 Evaluation Phase

4.3.1 Yield and economic benefits.

By collecting the yield and income data at the end of the experiment, the differences between the experimental group and the control group are compared.

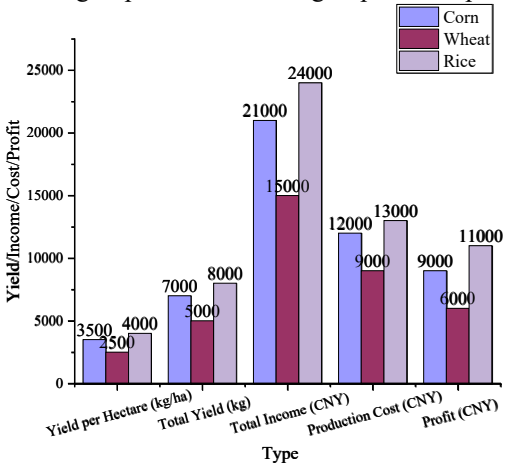

Fig. 1. Yield and economic benefits of the experimental group

According to the data analysis of the experimental group in Figure 1, the yield, income and profit of different crops vary significantly. The unit area yield of corn is 3500 kg/hectare, the total yield is 7000 kg, the total income is 21000 CNY, the production cost is 12000 CNY, and the profit is 9000 CNY, showing a relatively high economic benefit. In comparison, the yield per unit area of wheat is 2,500 kg/hectare, the total yield is 5,000 kg, the total income is 15,000 CNY, the production cost is 9,000 CNY, and the profit is 6,000 CNY. Although wheat has a lower income, its production cost is relatively small, indicating that it is more cost-effective. The yield per unit area of rice is 4,000 kg/hectare, the total yield is 8,000 kg, the total income is 24,000 CNY, the production cost is 13,000 CNY, and the final profit is 11,000 CNY. Rice performs better in total income and profit, but its production cost is higher.

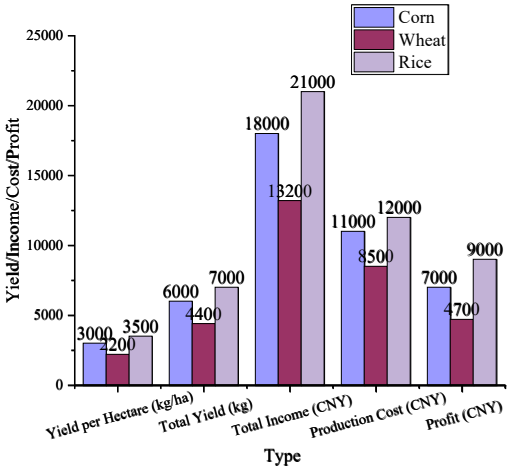

Fig. 2. Yield and economic benefits of the control group

The yield per unit area of corn is 3,000 kg/hectare, the total yield is 6,000 kg, the total income is 18,000 CNY, the production cost is 11,000 CNY, and the profit is 7,000 CNY. Compared with the experimental group, corn has decreased in yield and income, but the profit remains at a high level. The yield per unit area of wheat is 2200 kg/hectare, the total yield is 4400 kg, the total income is 13200 CNY, the production cost is 8500 CNY, and the profit is 4700 CNY, as shown in Figure 2. In general, although the control group has lower income and profit than the experimental group, the profit of each crop still shows that it has certain economic benefits. The selection of different crops and cost control are still important factors in improving agricultural production efficiency.

4.3.2 Climate adaptability.

Evaluating the resilience and coping capacity of agricultural production in the experimental and control groups after encountering extreme weather (such as drought and heavy rain).

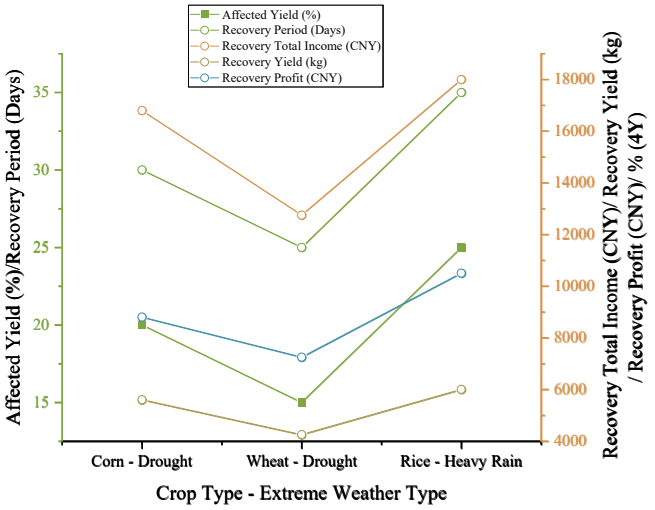

Fig. 3. Climate adaptability of the experimental group

The yield of corn affected by drought conditions is 20%, and the recovery period is 30 days. The yield after recovery is 5,600 kg, the total income is 16,800 CNY, and the profit after recovery is 8,800 CNY. The yield of wheat affected by drought conditions is 15%, and the recovery period is 25 days. The yield after recovery is 4,250 kg, the total income is 12,750 CNY, and the profit after recovery is 7,250 CNY. The rice yield is affected by 25% under heavy rain conditions, and the recovery period is 35 days. The yield after recovery is 6,000 kg, the total income is 18,000 CNY, and the profit after recovery is 10,500 CNY (as shown in Figure 3). Overall, although extreme weather caused yield losses, each crop is able to recover to a relatively considerable yield and profit after a certain recovery period, showing a certain degree of climate adaptability.

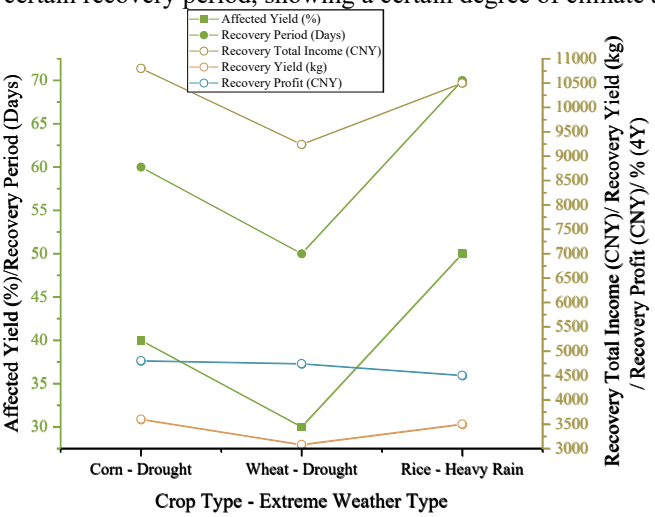

Fig. 4. Climate adaptability of the control group

The yield of corn affected by drought conditions is 40%, the recovery period is 60 days, the yield after recovery is 3,600 kg, the total income is 10,800 CNY, and the profit after recovery is 4,800 CNY. The yield of wheat affected by drought conditions is 30%, and the recovery period is 50 days. The yield after recovery is 3080 kg, the total income is 9240 CNY, and the profit after recovery is 4740 CNY. The yield of rice affected by heavy rain conditions is 50%, and the recovery period is 70 days. The yield after recovery is 3500 kg, the total income is 10500 CNY, and the profit after recovery is 4500 CNY, as shown in Figure 4. In general, the crops in the control group are greatly affected by extreme weather, with a long recovery period and significantly lower yields and profits after recovery than those in the experimental group, showing weaker climate adaptability.

4.3.3 Gender equality.

The impact of policy support and technical training on the improvement of women's status is analyzed through the evaluation of women's decision-making power, economic status and independence.

Table 1. Gender equality evaluation

Group	Indicator	Base-line Data	Post-Experiment Data	Change (%)
Experimental Group	Women's Decision-Making Power	30%	60%	30%
Experimental Group	Economic Independence	40%	75%	35%
Experimental Group	Leadership Position	20%	45%	25%
Control Group	Women's Decision-Making Power	30%	35%	5%
Control Group	Economic Independence	38%	42%	4%
Control Group	Leadership Position	18%	20%	2%

The experimental group shows significant improvements in women's decision-making power, economic independence, and leadership. Specifically, women's decision-making power increases from 30% at the baseline to 60%, an increase of 30%. Economic independence increases from 40% to 75%, an increase of 35%. Leadership increases from 20% to 45%, an increase of 25%. These changes indicate that policy support and technical training has a positive impact on women's status and participation in the agricultural economy in the experimental group. In contrast, the changes in the control group are smaller. Women's decision-making power increases from 30% at baseline to 35%, an increase of only 5%. Economic independence increases from 38%

to 42%, an increase of 4%. And leadership status increases from 18% to 20%, an increase of 2%, as shown in Table 1. These results show that the control group failed to achieve the same level of progress as the experimental group, indicating that in the absence of appropriate support and training, the improvement of women's status is limited.

5 Conclusion

This study explores the coping strategies and challenges faced by women in leading the agricultural economy in the context of climate change, revealing the key role of women in agricultural production and their unique ability to cope with climate change. The results show that policy support and technical training can significantly improve women's decision-making power, economic independence and leadership in agriculture. Experimental data show that in the face of extreme weather events, agricultural practices led by women show stronger adaptability and resilience, and the yield, income and profit after recovery are higher than those of the control group. In addition, the study also finds that although women play a vital role in agriculture, they still face challenges such as resource constraints, gender discrimination and insufficient policy support. Therefore, future policies should further focus on how to provide women with better education, technical training and financial support to promote their comprehensive development in the agricultural economy. In summary, this study provides useful ideas and policy recommendations for promoting women's economic empowerment in agriculture and enhancing their ability to adapt to climate change, and also contributes to the advancement of global agricultural sustainable development and gender equality.

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