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Exploration of Future Agricultural Development Trend Based on Food Security

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Abstract

In the context of the increasingly severe global food security situation, it is extremely urgent to explore the future agricultural development path. This paper aims at ensuring food security and promoting the sustainable development of agriculture, and analyzes and discusses the future development direction and trend of agriculture. The development path of agriculture in the future is expounded from three aspects: efficient utilization of resources, environment-friendly agriculture and precise and intelligent agriculture, thus providing theoretical basis for the modernization of agricultural science.

Keywords: Agricultural Development; Efficient Utilization; Environment Friendly; Accurate; Intelligence

Introduction

According to the latest data released by the United Nations, the global population has reached 8 billion by November 15, 2022, and will continue to grow in the coming decades. With the increasing population and the increasing constraints of resources and environment, the global food security situation has become more severe, and agriculture, which provides basic food sources for human beings, is facing great pressure and challenges. According to the analysis of the Food and Agriculture Organization of the United Nations, the number of undernourished people in the world continues to increase. In 2020, the number of hungry people increased by about 118 million compared with 2019, and the number of severely hungry people increased sharply in 2021. The current war in Ukraine has continuously pushed up the prices of food, energy and fertilizer, which makes the prospect of global food security even more worrying. Generally speaking, it is difficult to achieve the goals of "eliminating hunger, realizing food security, improving nutritional status and promoting sustainable development of agriculture" in the United Nations Agenda for Sustainable Development in 2030. In order to ensure global food security, the future development direction and trend of agriculture is a question that must be considered and answered. The author thinks that the three major directions of agricultural development in the future are efficient utilization of resources, eco-friendly agriculture and precise intelligent agriculture.

Efficient use of resources in agriculture has become inevitable

Agricultural resources are the foundation of grain production and the cornerstone of agricultural development. Land, water and nutrients are the basic resources for agriculture to operate and survive [1-2]. Cultivated land is defined as the land suitable for growing crops, which is the prerequisite for feeding all people [3]. China, Indian and other eastern countries have been based on agriculture since ancient times, and cultivated land is called "Mother" [4]. Cultivated land is the basis of food security, and the sustainable utilization of cultivated land resources is the premise and guarantee for sustainable agricultural development. Agriculture is the biggest user of fresh water resources [5], and water supply is the main source of changes in grain output. It is predicted that only 5% of future grain growth will come from rain-fed agricultural areas, and most of it will come from water-irrigated agricultural areas [6]. Therefore, irrigation water resources are particularly important for the future agricultural development of the world, especially developing countries. As an important material for maintaining plant growth, nutrients have long been an

important guarantee for increasing grain production. Nutrient resources include all nutrients provided by soil, chemical fertilizer, organic fertilizer and environment. Nutrient deficiency is the main limiting factor for crop productivity, food security and economic development [7].

Therefore, in order to promote the sustainable development of agriculture, we should pay more attention to nutrient resources. However, with the problems of climate change, resource shortage, environmental degradation, depletion of some non-renewable resources and slow land expansion becoming increasingly prominent, crop production will become more difficult [8], coupled with the increasingly fierce competition for existing resources and inefficient use of these limited resources, it will have a great impact on the poor farmers in the world, especially in developing countries [9], and these problems have become major challenges for sustainable agricultural development. At present, the development of sustainable agriculture is a global consensus, and intensive and efficient use of agricultural resources is an important way to achieve sustainable agricultural development, but also an important prerequisite and fundamental guarantee for sustainable agricultural development [10]. The agricultural revolution in the next 40 years must be an agricultural ecological efficiency revolution, in which 50%~100% of agricultural ecological efficiency depends on the utilization efficiency of scarce resources such as land, water, nutrients and energy [11]. Improving the utilization of existing resources and making effective use of these resources are the characteristics of a good agricultural system [9]. Therefore, the efficient use of resources in agriculture is not only an inevitable choice to meet the challenges, but also the key to realize the sustainable development of agriculture.

Environment-friendly agriculture has become the mainstream

The history of agriculture is the history of human civilization. The development of agriculture has experienced from slash-and-burn primitive agriculture to self-sufficient traditional agriculture, and then to modern agriculture accompanied by industrial revolution. Agriculture is a production activity in which human beings transform nature and obtain the necessities of life from nature. In order to meet the growing food demand of the world, the high yield of agriculture at the expense of environmental quality has caused some severe ecological and environmental problems [12,13]. The adverse changes of environment and ecosystem, such as soil degradation, land desertification, global warming and biodiversity loss, will make the environmental quality unsustainable in the future, which will greatly threaten human survival [14]. Sustainable food security is a major challenge in the world, especially in developing countries [15]. At the Rio Summit in 1992, the concept of "Environment-friendly" was put forward and extended to the category of agricultural technological innovation. The Japanese Ministry of Agriculture, Forestry and Fisheries defined environment-friendly agriculture as "sustainable agriculture that gives full play to the material circulation function of agriculture, while seeking to improve productivity and reduce environmental load" for the first time in "New Food, Agriculture and Rural Policy Direction" [16].

Environment-friendly agriculture has been widely concerned and valued by all countries in the world, and the exploration and practice of environment-friendly agriculture have been carried out from the aspects of law, system, management and technology [17-19]. Nowadays, due to the negative effects of climate change, rising global temperature and increasing environmental pressure, agricultural productivity is declining [20]. At the same time, agriculture is increasingly integrated into the agricultural food chain and the global market, and the environment, food safety and quality also have adverse effects on agriculture [17]. In order to meet these challenges, realize the sustainable development of agriculture and increase the agricultural products that feed people all over the world, environmental friendly agriculture such as organic agriculture [21], green agriculture [22], ecological agriculture [23] and cleaner production agriculture [24] has been developing continuously. Techniques such as returning straw compost to the field [25], controlling grass with straw mulching [26], regulating rhizosphere bacteria [27], green agrochemicals [28], and scientific agronomy management [29,30] are promoting the sustainable development of environment-friendly agriculture.

Accurate and intelligence agriculture has made continuous progress

Accurate agriculture focuses on accuracy, relying on high-tech support and data-driven, and through the implementation of management decisions based on variation law, the resource utilization rate, productivity, quality, benefit and sustainability of agricultural production can be improved [31]. Intelligence agriculture focuses on "intelligence", an automated, personalized, artistic, ecological and large-scale agricultural production system with smart economy as the leading factor and big health industry as the core [32]. The combination of accuracy agriculture and intelligence agriculture is a major technological innovation in the agricultural field, and it is the new trend of agricultural development in the world today and the general trend of agricultural development in the future.

The development from traditional agriculture to accuracy and intelligence agriculture must go through the following steps: (1) the development process from traditional agriculture to agricultural mechanization; (2) the development process from agricultural mechanization to agricultural precision; (3) The development process from agricultural precision to intelligent infrastructure; (4) The development process from intelligent infrastructure to industrial development modernization. Technical means, including the development of artificial intelligence, the development and application of modern high-tech products such as drones in agricultural monitoring, planting production and remote sensing, and the application of data management platforms such as WEB GIS, WEB API and Html5 [33,34]. Through the above development process,

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the interconnection of agricultural information and the effective integration of agricultural resources will be realized, and the intelligent closed loop of the whole industrial chain will be gradually formed, and finally a sustainable agricultural economy will be formed. As a big agricultural country, it is an inevitable trend for China to develop precision and intelligent agriculture. On the one hand, through the accurate upgrading of agriculture, the competitiveness of regional agricultural economy will be enhanced; On the other hand, speed up the process of agricultural informatization, improve the ability of government affairs and change the mode of economic growth.

China's economic development has entered a new normal. Accelerating the transformation of development mode and establishing a wisdom operation mode are effective ways to improve the quality and efficiency of modern agriculture [35]. With the information technology such as Internet, cloud computing and e-commerce as the carrier, we will make every effort to build smart agriculture, take the development of accuracy and intelligence agriculture as the goal, accelerate the integrated application of agricultural high technology, improve the output benefit of unit land, and promote agriculture to move from low-end products to high-end brands. Accelerate the evolution of China's agriculture from mechanization to accuracy and intelligence agriculture, promote the intelligent integration and coordinated development of the whole agricultural industry chain, and truly realize the strong agriculture, rich agriculture and benefiting farmers.

Conclusion

Agricultural sustainable development is an important prerequisite for ensuring food security. Under the background of climate change and resource shortage, efficient use of resources is the fundamental guarantee to realize the sustainable development of agriculture. On this basis, we should give full play to the material circulation function of agriculture and promote the transformation from traditional agriculture to modern agriculture by building an environment-friendly agriculture. Meanwhile, relying on high-tech support and data-driven to combine precision agriculture with intelligence agriculture is not only a major technological innovation in the agricultural field, but also a new trend of agricultural development in the world today and a general trend of agricultural development in the future.

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