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Status of Sustainable Development of Efficient Ecological Agriculture in Loess Plateau Gully Region

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Abstract

At present, the development of efficient ecological agriculture in the loess hilly and gully region is faced with slope problems, gully problems and resource utilization problems. The loess Plateau gully region is the traditional dry farming area in China, and it is also the main grain producing area with a long farming history. Due to natural factors such as terrain fragmentation, rainfall concentration and loose soil, deforestation, reclamation of steep slopes, and overgrazing, human factors such as deterioration of ecological environment, serious soil erosion, reduction of cultivated land resources, and decrease of land productivity in the region have aggravated the food shortage problem in the region. Ecological agriculture is an effective collaborative approach for ecological protection and high-quality agricultural development in the Loess Plateau, and can provide important support for ecological restoration and farmland regulation in the Loess Plateau gully region.

Keywords

Ecological Agriculture; Sustainable Development; Dry Farming; The Loess Plateau; Gully.

1. Introduction

As early as the pre-Qin period, people began to respect and conform to the laws of nature in the selection and transformation of the living environment on the Loess Plateau, and made great achievements in farmland water conservancy, soil environment construction, and soil and water conservation measures [1-2]. In recent years, there have been two different views on the development of agro-ecosystem in the Loess Plateau: one is the theory of tilted grain development; the other is the theory of environmental benefit. The former emphasizes on improving food production and supply based on local resources, which can not only solve the food problem nearby, but also lay the foundation for regional economic development. However, this view ignores the impact on society, environment and ecosystem. The latter believes that the natural conditions of the Loess Plateau should not be dominated by grain production, but by forest and animal husbandry. This view emphasizes the balance between agriculture and the environment, the impact of agricultural production and economic development on the environment, and emphasizes the coordinated and sustainable development of the three. In the 1980s, Academician Zhu Xianmo put forward a 28-word strategy for the development of agriculture on the Loess Plateau after a lot of research, namely, "all the precipitation in situ infiltration and storage, rice and grain flowing from the river to the upper source, forest and fruit flowing from the upper branch, and grass irrigated from the slope to the lower ridge"[3-

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4]. In the 1990s, Li Yushan further proposed the adjustment of land use structure, the comprehensive development of agriculture, forestry and animal husbandry, and the establishment of industrial economy. After the initial exploration of the sustainable development of the agro-ecosystem in the Loess Plateau, many experts and scholars have studied the agro-ecosystem in the Loess Plateau. It is pointed out that soil erosion and drought and water shortage are the limiting factors that restrict the sustainable development of agricultural ecosystems, and the technical and economic feasibility of rainwater utilization is pointed out. Finally, it is concluded that rainwater utilization is the fundamental way of agricultural development on the Loess Plateau [5].

2. Development of Ecological Agriculture

Ecological agriculture is an important measure to balance ecological protection and agricultural development. The term "eco-agriculture" was first proposed by W. Albrecht, a soil scientist at the University of Missouri in 1971, and this concept is a unique alternative agriculture model for Western scholars to overcome the crisis brought by petroleum agriculture [6]. In 1981, the British agronomist M. Worthington defined agroecology as "ecologically self-sustaining, low-input, economically viable, environmentally, ethically and aesthetically acceptable small-scale farming". From the early 1970s to the mid-1980s, the research on ecological agriculture in the United States was the spontaneous behavior of scientists and farmers, including the very familiar ecological agriculture experiment of Rodale Farm. In recent years, the development of ecological agriculture has become the government action of many countries, each country is paying more and more attention to the research and construction of ecological agriculture, Canada, Sweden, the Netherlands and other countries of "organic agriculture", the United Kingdom's "sustainable agriculture", the United States of "ecological farming", Australia's "durable agriculture", Japan's "natural agriculture law" are the epitome of ecological agriculture. China's ecological agriculture has emerged since the 1980s and has been developed to a certain extent. With the steady progress of China's ecological civilization construction and rural revitalization strategy, the research and practice of ecological agriculture has become a hot spot in the society. The construction of ecological civilization is to fully respect the ability of ecosystem to self-sustain, succession and organization, build a resource-intensive and efficient production system, and the optimal biological population structure and community. The basic of rural revitalization lies in the development of rural industry, and industrial prosperity comes from the rational use of rural resources by ecological agriculture and the orderly adjustment of the existing industrial structure [7].

In the process of developing ecological agriculture on the Loess Plateau, various types such as dry farming agriculture, organic agriculture, circular agriculture, low-carbon agriculture, three-dimensional agriculture, facility agriculture and precision agriculture have been gradually formed. In some areas, leisure and sightseeing agriculture, urban agriculture, white agriculture and ecological agriculture of soil and water conservation have been formed according to local conditions. Based on years of scientific research and practical production experience, the Institute of Soil and Water Conservation of Northwest A & F University put forward that the strategic goal of agricultural development in the loess hilly and gully region is to build a soil and water conservation ecological agriculture, that is, to strengthen the in-situ infiltration of precipitation resources and prevent soil erosion as the center, and rational utilization of land resources as the premise [8]. Take the protection and restoration of vegetation, the construction of basic farmland, the development of economic forest and aquaculture as the leading measures; The construction of soil and water conservation ecological agriculture system, to achieve the comprehensive development of agriculture, forestry, animal husbandry, ecological economy virtuous cycle, and clear the soil and water conservation ecological

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agriculture composition system and the theory and standard of the implementation of the stage, in the Loess Plateau ecological protection and agricultural development unique.

3. Problems in Ecological Agriculture

3.1. The Relationship between Man and Grain is Tense

Since 1999, the Loess Plateau has implemented the ecological strategy of "returning farmland to forest (grass), greening barren mountains, individual contracting, and providing food instead", forming a soil and water conservation policy based on biological management. With the local rural labor force going out for employment, the project has achieved remarkable results, mainly reflected in a substantial increase in vegetation coverage, a large reduction in yellow sediment, and a significant improvement in ecological conditions. However, after the return of sloping land to forest and grassland, the cultivated land area has been greatly reduced, only the cultivated land area has been reduced by 10.8% from 2000 to 2008, and the decrease is more in the core area of the project. The return of farmland to forest and grassland in the Loess Plateau has had a significant negative impact on regional grain production, and the human-grain relationship has been strained in some areas, affecting the livelihood of farmers and food security.

3.2. Project Water Damage

In the process of comprehensive management of gully, due to the lack of flood control measures or unreasonable planning of flood control projects, blind diversion of river channels, etc., will cause serious project water damage in the event of heavy rainfall. Small watershed in loess gully region often has strong water collection capacity, and it is easy to cause water damage when the runoff from the slope is gathered into a relatively narrow channel. For example, in July 2013, a heavy rainfall occurred in Yan 'a city and some of the fields, irrigation and drainage systems, field roads and slopes of the ditch construction project were damaged to varying degrees. On the one hand, it is due to the short and concentrated rainstorm, on the other hand, it is mainly due to the excavation of both sides of the slope in the process of ditching and land construction, the failure to pay attention to the collapsibility of loess in the construction of field roads and the filling of dam, and the unreasonable design of flood drainage ditches.

3.3. Ecological Damage

During the implementation of gully land regulation project, the high and steep slopes buried and cut in gully floodway cut off the original groundwater flow path, leading to the disaster caused by water system imbalance in the original watershed. Meanwhile, the gully land regulation project holds up surface runoff and changes the conversion mode of gully precipitation. A well-designed drainage system is the primary factor to ensure the safety of the project. Otherwise, the dam ground water and dam break will seriously affect the construction of the project. Secondly, the engineering cutting and excavating around the ditch will damage the slope environment, and aggravate the disaster of the ditch such as soil erosion and landslide. For example, Yan 'an area experienced continuous rainfall in 2013, due to the change of surface storage and flow path, the land in the gully regulation area was damaged by about 2000 hm2, resulting in soil flow and soil salinization in the gully regulation land, and some problems such as leakage and pipe sprouting in the blocking project, which seriously restricted the high-quality sustainable development of the region.

Therefore, to alleviate the deterioration of agricultural ecological environment, we should improve in many aspects. The establishment of an agricultural production system suitable for the regional endowment characteristics of the Loess Plateau is of great significance to ecological protection and rural revitalization. The emergence and development of ecological agriculture constantly optimize the agricultural industry environment, so as to maximize the limited

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resources of the Loess Plateau. At the same time, ecological agriculture can effectively change the agricultural development model, and is more conducive to the sustainable and healthy development of economy, which has a positive role in solving the contradiction between cultivated land, grain, population and ecology in the Loess Plateau.

4. Conclusion

In recent years, the development of eco-agriculture on the Loess Plateau has achieved remarkable results, produced a number of eco-agricultural technical systems and models with significant comprehensive benefits, introduced a series of policies and subsidies to benefit farmers and farmers, and initially explored a road for ecological protection and green growth and sustainable development of agricultural economy. However, the development of eco-agriculture on the Loess Plateau also faces many difficulties and challenges. The main performance is the low comprehensive agricultural production capacity, soil quality degradation, agricultural non-point source pollution is serious, according to the country's cultivated land classification, the loess plateau area is less than 7.6%, more than 92% of the cultivated land is low and middle land; The structure of vegetation ecosystem is still fragile and the function of ecological service is low. The market demand of ecological agriculture is not clear, the development lacks of large-scale production conditions, and the quantity and quality of labor force are not high; there are many ecological agriculture models, but the construction of efficient, intensive and green development technology system is relatively lagging behind.

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