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THE POSITIVE EFFECT OF GREEN AGRICULTURE DEVELOPMENT ON ENVIRONMENTAL OPTIMIZATION

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Abstract:
Green development is a concept of sustainable development, aiming to protect the environment and ecosystems while meeting economic development needs.According to the study of the environmental impact of green agricultural development, this paper selects 12 basic indicators from the three dimensions of "ecological agriculture, green production, and output benefits" for the construction of China's green agricultural development index. There are eight basic indicators used in the construction of the environmental index system, including the area of nature reserves and the level of environmental protection expenditures.

Keywords: Agricultural Green Development; evaluation framework; regional disparities; spatial dynamics; evolutionary trends

INTRODUCTION

Taking root around 12,000 years ago, agriculture triggered such a change in society and the way in which people lived that its development has been dubbed the "Neolithic Revolution." Traditional hunter-gatherer lifestyles, followed by humans since their evolution, were swept aside in favor of permanent settlements and a reliable food supply. Out of agriculture, cities and civilizations grew, and because crops and animals could now be farmed to meet demand, the global population rocketed—from some five million people 10,000 years ago, to eight billion today.

There was no single factor, or combination of factors, that led people to take up farming in different parts of the world. In the Near East, for example, it's thought that climatic changes at the end of the last ice age brought seasonal conditions that favored annual plants like wild cereals. Elsewhere, such as in East Asia, increased pressure on natural food resources may have forced people to find homegrown solutions. But whatever the reasons for its independent origins, farming sowed the seeds for the modern age.

The wild progenitors of crops including wheat (Triticum aestivum), barley (Hordeum vulgare), and peas (Lathyrus oleraceus) are traced to the Near East region. Cereals were grown in Syria as long as 9,000 years ago, while figs (Ficus carica) were cultivated even earlier; prehistoric seedless fruits discovered in the Jordan Valley suggest fig trees were being planted some 11,300 years ago. Though the transition from wild harvesting was gradual, the switch from a nomadic to a settled way of life is marked by the appearance of early Neolithic villages with homes equipped with grinding stones for processing grain.

The origins of rice and millet farming date to the same Neolithic period in China. The world's oldest known rice paddy fields, discovered in eastern China in 2007, reveal evidence of ancient cultivation techniques such as flood and fire control.

In Mexico, squash cultivation began around 10,000 years ago, but corn (maize) had to wait for natural genetic mutations to be selected for in its wild ancestor, teosinte. While maize-like plants derived from teosinte appear to have been cultivated at least 9,000 years ago, the first directly dated corn cob dates only to around 5,500 years ago.

LITERATURE REVIEW

Corn later reached North America, where cultivated sunflowers (Helianthus annuus) also started to bloom some 5,000 years ago. This is also when potato (Solanum tuberosum) growing in the Andes region of South America began.

Cattle (Bos taurus), goats (Capra hircus), sheep (Ovis aries), and pigs (Sus domesticus) all have their origins as farmed animals in the so-called Fertile Crescent, a region covering eastern Turkey, Iraq, and southwestern Iran. This region kick-started the Neolithic Revolution. Dates for the domestication of these animals range from between 13,000 to 10,000 years ago.

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Genetic studies show that goats and other livestock accompanied the westward spread of agriculture into Europe, helping to revolutionize Stone Age society. While the extent to which farmers themselves migrated west remains a subject of debate, the dramatic impact of dairy farming on Europeans is clearly stamped in their DNA. Prior to the arrival of domestic cattle in Europe, prehistoric populations weren't able to stomach raw cow milk. But at some point during the spread of farming into southeastern Europe, a mutation occurred for lactose tolerance that increased in frequency through natural selection thanks to the nourishing benefits of milk. Judging from the prevalence of the milk-drinking gene in Europeans today—as high as 90 percent in populations of northern countries such as Sweden—the vast majority are descended from cow herders. Healthy, sustainable and inclusive food systems are critical to achieve the world's development goals. Agricultural development is one of the most powerful tools to end extreme poverty, boost shared prosperity, and feed a projected 10 billion people by 2050. Growth in the agriculture sector is two to four times more effective in raising incomes among the poorest compared to other sectors.

Agriculture is also crucial to economic growth: accounting for 4% of global gross domestic product (GDP) and in some least developing countries, it can account for more than 25% of GDP.

But agriculture-driven growth, poverty reduction, and food security are at risk: Multiple shocks – from COVID-19 related disruptions to extreme weather, pests, and conflicts – are impacting food systems. The goal of ending global hunger by 2030 is currently off track. Conflicts, climate change, and high food prices are driving food and nutrition insecurity, pushing millions into extreme poverty, and reversing hard-won development gains. Around a quarter of a billion people now face acute food insecurity.

The growing impact of climate change could further cut crop yields, especially in the world's most food-insecure regions. At the same time, our food systems are responsible for about 30% of greenhouse gas emissions.

Current food systems also threaten the health of people and the planet and generate unsustainable levels of pollution and waste. One third of food produced globally is either lost or wasted. Addressing food loss and waste is critical to improving food and nutrition security, as well as helping to meet climate goals and reduce stress on the environment.

Risks associated with poor diets are also the leading cause of death worldwide. Millions of people are either not eating enough or eating the wrong types of food, resulting in a double burden of malnutrition that can lead to illnesses and health crises. Food insecurity can worsen diet quality and increase the risk of various forms of malnutrition, potentially leading to undernutrition as well as people being overweight and obese. An estimated 3 billion people in the world cannot afford a healthy diet. Another barrier to improved agricultural policy is inadequate, unreliable, data due to under-funded and poorly focused statistical systems. For example, every year agriculture agencies in the Pacific report production to the FAO, for compilation into Food Balance Sheets. Yet measurement of indigenous food production does not inform these figures (in contrast to efforts spent measuring minor introduced food crops such as rice). The colonial era had micro-level measurement attempts for root crops and tree food crops (e.g. breadfruit), such as Conroy and Bridgland (Citation1947), but more recent figures are just extrapolations from earlier periods by assuming that food production keeps up with population growth. Even with proper efforts, root-crop farming systems are harder to measure than cereals-based ones. Production cannot be estimated remotely (e.g. by satellites); vegetative growth is not proportional to tuber production, especially after crop failures when the data would be most useful (Kanua, Bourke, Jinks, & Lowe, Citation2016).

MATERIALS AND METHODS

Harvesting is progressive, with second and third crops taken as the smaller tubers mature, and so no single point-in-time measurement can capture production like post-harvest surveys do in cereals-based farming systems. Households have complex margins of adjusting utilisation of food production which also complicates measurement. For example, PNG's first national household consumption survey (Gibson & Rozelle, 1998) volumetrically measured consumption from own-production (respondents used standardised sacks to measure for two weeks and local weighing trials provided metric conversions), finding that national accounts understated household agricultural production by almost one-half (Gibson, Citation2001).

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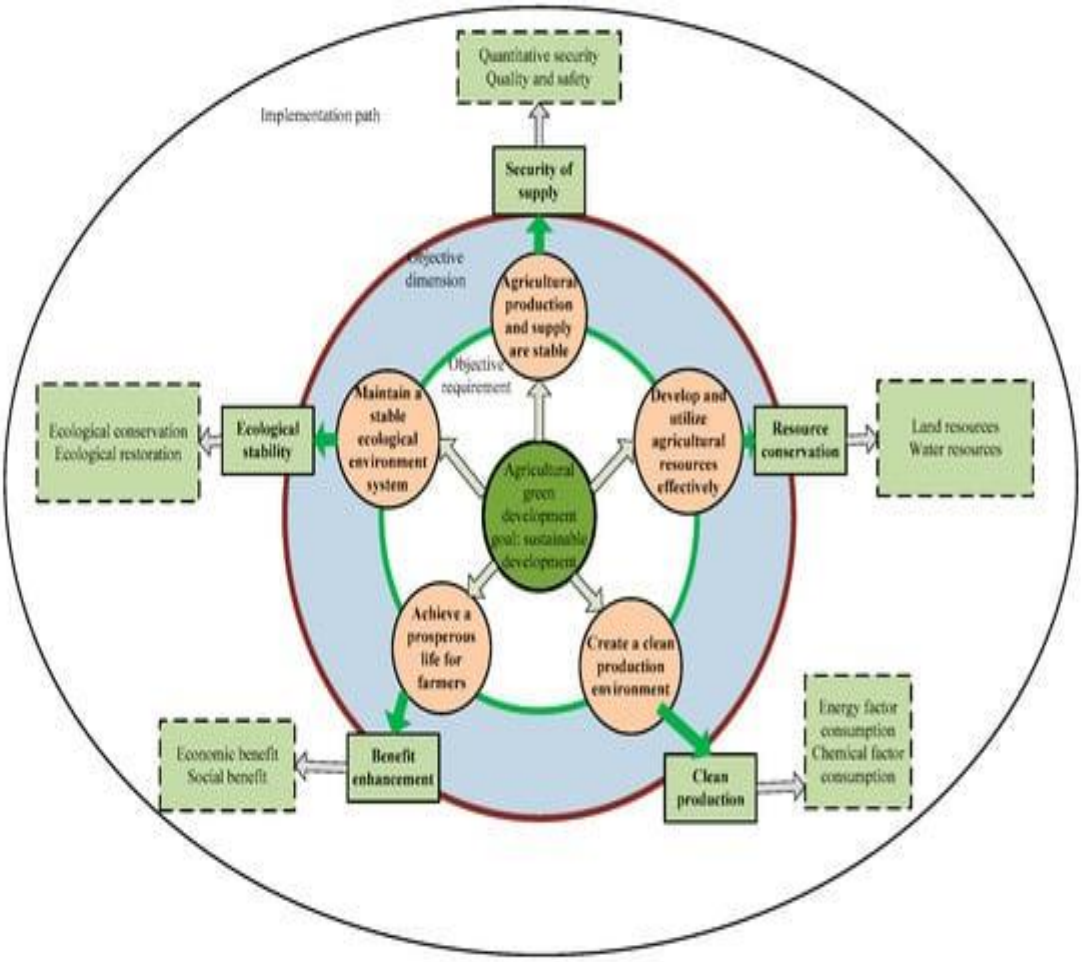

Figure 1. The evaluation framework for agricultural green development.

Yet the imputed production of key staples like sweet potato was still far lower than estimates by expert agronomists; part of the gap was due to the survey just measuring food bought back to houses, and not everything grown in the food gardens – normally the opportunity cost of female time is such that small tubers are not harvested and instead left for pigs to eat in situ after the best tubers have been harvested for humans but if a food shortage looms the small tubers (and other in-ground food stores such as cassava roots) get harvested for humans. By means of a literature review, the factors influencing agricultural green development can be categorized into economic, policy, technological, and other factors. In terms of economic factors, Luo et al. (2023) assessed the green total factor productivity of agriculture using a non-radial and non-angular super-efficiency measurement model. Their study examined the impact of agricultural production agglomeration on green total factor productivity in agriculture and found an inverted U-shaped relationship between agricultural production agglomeration and green total factor productivity. Saghaian (2022) employed panel data from 23 developed countries and 43 developing countries to empirically analyze the impact of agricultural product exports on environmental quality. This study revealed that the expansion of agricultural product export trade had adverse effects on the environmental quality of developing countries but reduced environmental pollution, such as N2O emissions, in developed countries. Xu et al. (2021) investigated the relationship between trade openness, agricultural trade, and agricultural carbon emissions using a panel threshold model. The study found a significant single threshold effect of agricultural trade openness on agricultural carbon emissions. Ge et al. (2023) measured China's green total factor productivity (AGTFP) and agricultural labor surplus using the SBM-DDF–Luenberger method. They empirically examined the heterogeneous effects of urbanization on the efficiency of agricultural green development. The results showed that both household registration urbanization and permanent population urbanization significantly

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promoted the efficiency of agricultural green development, although the former had a smaller effect. Ben Jebli M (2017) studied the relationship between agricultural product trade and agricultural sustainability using a vector error correction model (VECM) and Granger causality. The research concluded that international trade can optimize the allocation of development resources in the agricultural sector and reduce agricultural resource and environmental pollution. Meanwhile, Wein ZJ (2018) used a mixed multi-regional input–output (MRIO) approach to examine the relationship between agricultural product trade and agricultural ecological environment. The findings indicated that agricultural product trade had a negative impact on agricultural green development to a certain extent.

In terms of policy factors influencing agricultural green development, Du et al. (2023) conducted an empirical study using panel data from Chinese prefecture-level cities between 2011 and 2020. They employed a difference-in-differences model to construct a quasi-natural experiment and investigated the impact of policies on agricultural carbon emissions. The research found that environmental protection policies significantly reduced agricultural carbon emissions by reducing emission sources . Sun et al. (2022) measured the impact of environmental regulations on green total factor productivity in agriculture across 30 provinces and cities in China using a partially linear coefficient panel model. This study revealed that the impact of environmental regulations on green total factor productivity in agriculture was limited when the regional economic development level was low. However, as the regional economic development level gradually increased, the influence of environmental regulations on green total factor productivity in agriculture became more significant. Wang et al. (2022) simulated the impact of various government policies on agricultural green development using a system dynamics model. They found that government policies for green development played a significant role in improving ecological benefits in agriculture. Xu et al. (2022) investigated the interactive effects of environmental regulation and fiscal support for agriculture on agricultural green development using provincial panel data from China. Their study concluded that the interaction between environmental regulation and fiscal support for agriculture had a positive spatial spillover effect on agricultural green development.

In terms of technological factors influencing agricultural green development, Lin et al. (2023) conducted a study using interprovincial data from China. They employed the entropy method and SBM-GML index to investigate the impact of digital technology on green total factor productivity in agriculture. The research found that digital technology in agriculture can effectively promote green growth through green technological innovation, agricultural scale management, and the optimization of agricultural planting structures. Zhu et al. (2022) analyzed the impact of agricultural mechanization on green total factor productivity (GTFP) in crop production using panel data from 30 provinces in China. They employed a stochastic frontier analysis based on the output-oriented distance function and found that agricultural mechanization significantly promoted green total factor productivity in crop production. As the level of mechanization increases, the promotion effect on green total factor productivity becomes more evident. Zhang et al. (2022) studied the influence of agricultural technological innovation on agricultural green development from the perspectives of factor spillover pathways and product spillover pathways. The research revealed that the level of agricultural technological innovation not only improves the level of agricultural green development within a region but also promotes the agricultural green development of neighboring areas through positive spillover effects

ANALYSIS

In the early 20th century, foreign researchers began studying green agriculture. It was not until the end of World War II that the green revolution began to gradually gain momentum and depth. The green agriculture movement represents the pinnacle of modern agriculture. On the connotation of green agriculture, there are several main viewpoints: Albert Howard 1931) and kamga (2013) emphasized the relationship between natural resources and economic benefits. Agriculture based on the petroleum industry has caused great danger to society, resources, and the environment. Green agriculture should pay full attention to the relationship with nature and reduce the use of petroleum products in the agricultural production process (Howard, 1931; Kamga et al., 2013). Haggblade 1989) believed that green agriculture should follow the ecological law, make rational use of agricultural ecological resources, develop agriculture on the basis of recycling of material flow, energy flow, and information flow, and make the agricultural economic system harmoniously integrated into the cycle of the natural ecological system, and realize the green transformation of agricultural economic activities (Haggblade and Hazell, 1989). Labatt (2002) believes that the existence of green finance can effectively transfer the risk of environmental pollution and is an

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effective financial tool to optimize the environment. (LabattEnvironmetal Finance, 2002).Donald W. Lotter (2003) believed that sustainable land use should be evaluated by nine indicators, including fertilizer, integrated water resources management, land output rate, pest control management, output assurance, and corresponding output rate of inputs (Lotter, 2003). Q Zhou and LI Cheng-Gu (2004) studied the attributes of green agriculture and pointed out that the development of green agriculture cannot be separated from the support of the environment and is a new agricultural model that needs to be developed in a reasonable environment (Zhou and Cheng-Gu, 2004). Mohammad S. Allahyari (2009) made a quantitative analysis on the sustainable development of green agriculture by means of sampling survey. The research shows that the expansion mechanism of green agriculture development path is conducive to the development of green agriculture (Mohammad, 2009). David Carfi, Daniele Schiliro5 (2012) proposed a synergetic game model for the sustainability of global green environment, advocating the use of renewable energy to maintain the current natural resources, and at the same time, ensuring the sustainable realization of the environment from the aspects of people's awareness and relevant policies (Carfi and Schiliro, 2012). Sri Novianthi Pratiwi (2013) discussed the role of the agricultural sector in developing green agriculture against the background of Indonesia, and affirmed the importance of green agriculture development (Sri Novianthi, 2013). Prabhat Barnwal and Kotani K (2013) believed that the production basis of green agriculture is high-quality land and water. In production, it is necessary to ensure the quality of land resources and water resources, effectively use resources (nutrients, water, energy, etc.), reduce the dependence of agriculture on external inputs, ensure the sustainable use of resources, and ensure the safety of resources (Barnwal and Kotani, 2013). Jie, LI and Shuzhuo LI (2010) pointed out that the compensation and reward of ecosystem services (CRES) is an effective tool for poverty reduction and mitigation. The government can establish corresponding mechanisms and systems to reduce transaction costs, thus promoting the development of green agriculture (Jie and Shuzhuo, 2010). Since "ecological agriculture" was put forward, agricultural ecologization has begun to flourish. With the deepening of the road of agricultural ecologization, organic agriculture has gradually emerged and has taken the lead in the practice of some developed countries in Europe and achieved success (Luttikholt, 2007; Padel et al., 2009). The European Community believes that five indicators, such as per capita arable land, land use change, and the use of chemical fertilizers and pesticides, should be used to monitor the green development of agriculture. Foreign countries have established green agriculture information technology websites in an earlier period, which can enable farmers to obtain the latest knowledge, technology, market changes, and other green agriculture-related information. The popularization of new agricultural science and technology is of great help in improving production efficiency (Tadesse, 2001). Ju et al. (2018) discussed that China's traditional extensive agricultural production mode is not conducive to the development of agricultural modernization and pointed out that the formation of green agricultural ecological subsidies is the key to promoting the development of green agriculture in China (JU et al., 2018). However, these literature studies are rather one-sided and not exhaustive.

CONCLUSION

We have developed the following proposals as ways to develop production cooperation of enterprises of agriculture and processing industry:

1 Cooperation has emerged as a socio-economic form of economic activity, both in production and in trade. It should develop on an equal footing with the private and public sectors, participating in the integration of agriculture and industry in a market economy as an important factor in strengthening economic, sectoral and intersectoral economic relations and a mechanism of social support for the population, implementing a cluster system and improving trade.

2. Industrial cooperation must incorporate democratic principles at the economic, social and current levels. Only by taking these principles into account within clusters and making full use of them can we ensure the development of agricultural cooperation as an integral part of the economy.

3. The common economic interests for each group of agricultural producers, defined by the specifics of the delivery of works and services to the consumer, are the basis for the development of sectoral and intersectoral cooperation and the agricultural sector of the economy as a whole. This should help increase the activity and initiative of business entities.

4. Successful cooperation in agriculture can be achieved only through the strengthening of economic, sectoral and intersectoral cooperation with businesses of all forms of ownership, especially in the early stages of the development of horizontal cooperation, the extensive use of necessary resources and credit.

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