

Original Research Article

Research and strategy on the integration of environmental science oriented agricultural biotechnology and electronic machinery

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Abstract: The development of the integration of agricultural biotechnology and electronic machinery has increasingly attracted the attention of researchers, and environmental science plays an important role in it. This study deeply discusses the related issues and strategies of the integrated development of agricultural biotechnology and electronic machinery under the guidance of environmental science. First of all, guided by environmental science, we build a model that can promote the integration of agricultural biotechnology and electronic machinery. The model emphasizes that while implementing the integration of agricultural biotechnology and electronic machinery, it pays attention to the rational utilization of environmental protection, precise fertilization and application of medicine, energy saving and emission reduction. Secondly, we put forward strategies to realize the integration of agricultural biotechnology and electronic machinery, including strengthening scientific research investment, improving the automation and intelligence level of agricultural machinery, promoting the innovation and application of agricultural biotechnology, and strengthening the construction of policy guidance and market mechanisms. The results show that the implementation of environmental science oriented agricultural biotechnology and electronic machinery integration development model and related strategies can effectively improve agricultural production efficiency, strengthen agricultural environmental protection, and promote the sustainable development of agriculture.

Keywords: Environmental science; Agricultural biotechnology; Electronic machinery integration; Sustainable development

1. Introduction

In the context of the increasingly severe global environmental problems and the increasingly urgent need for sustainable agricultural development, it is imperative to explore innovative agricultural development models. As a basic industry for human survival and social stability, agriculture not only needs to meet the growing demand for food, but also needs to cope with resource shortages, environmental pollution and other challenges. The development of the integration of environmental science, agricultural biotechnology and electronic machinery provides a new way to solve these problems. The concept of environmental science orientation emphasizes environmental protection and resource conservation in agricultural production to achieve a win-win situation of economic, social and ecological benefits. The continuous innovation of agricultural biotechnology provides a strong support for improving agricultural production efficiency and reducing environmental impact. The development of electronic machinery provides technical support for the automation and intelligence of agricultural production. It is of great practical significance to combine these three elements and build a new

model of agricultural development oriented by environmental protection science for promoting sustainable agricultural development. This study deeply discusses the relationship between environmental science and agricultural biotechnology, analyzes the development strategy of the integration of agricultural biotechnology and electronic machinery, and the impact of the implementation of this integration on agriculture, aiming to provide theoretical basis and practical guidance for promoting the efficient, environmental protection and sustainable development of agriculture.

2. Development strategy of integration of agricultural biotechnology and electronic machinery

2.1. Increase investment in scientific research and improve the automation and intelligence of agricultural machinery

Scientific research investment is a key factor to promote the integration of agricultural biotechnology and electronic machinery. In the development process of modern agriculture, increasing investment in scientific research can effectively improve the automation and intelligence level of agricultural machinery, thereby improving agricultural production efficiency, reducing labor costs, and making important contributions to environmental protection.

Increasing investment in scientific research will help improve the automation level of agricultural machinery. At present, traditional agricultural machinery has certain limitations in terms of efficient operation, precise operation and intelligent monitoring. By strengthening the investment in scientific research, more advanced automated machinery and equipment can be developed, which can realize the intelligent control of the whole process and reduce the error and labor intensity of human operation. For example, the application of automatic seeder, intelligent harvester and other equipment can greatly improve the efficiency and accuracy of agricultural production. The combination of sensing technology, artificial intelligence technology and big data analysis technology also provides more possibilities for the intelligence of agricultural machinery, prompting agricultural production to achieve a greater leap in efficiency.

To improve the intelligent level of agricultural machinery, it is necessary to integrate various modern scientific and technological means. Intelligent agricultural machinery not only needs to have basic operating functions, but also needs to achieve accurate monitoring and operation through sensors, wireless communication, data processing and other technologies. Intelligent agricultural machinery can collect environmental data such as soil moisture, temperature, and light intensity in real time, and combine big data analysis and artificial intelligence algorithms to provide optimal crop planting decisions. Such an intelligent system can not only increase the yield of crops, but also effectively reduce the use of chemical agents such as fertilizers and pesticides, so as to save resources and protect the environment.

The enhancement of scientific research investment can also promote the organic integration of agricultural machinery and advanced agricultural biotechnology. Through the introduction of advanced biotechnology such as genetic engineering and plant protection technology, precise fertilization and intelligent prevention and control of diseases and pests can be achieved in combination with intelligent machinery and equipment to improve crop disease resistance and growth rate. For example, intelligent spray equipment can automatically adjust the spray dose and range according to the sensor feedback information, effectively avoiding excessive use of pesticides, thereby reducing environmental pollution.

Government and private investment in scientific research should also include the cultivation of talents

and technical training. By setting up special scientific research funds and supporting universities and research institutions to carry out research in related fields, more outstanding scientific researchers and technical personnel can be trained, and intellectual support and technical reserves can be provided for the development of agricultural machinery automation and intelligence. For front-line agricultural practitioners, various forms of technical training are carried out to enable them to proficiently operate and maintain intelligent agricultural machinery and equipment, so as to improve the overall technical level and productivity.

Increasing investment in scientific research can greatly improve the automation and intelligence level of agricultural machinery, which is an important way to realize the integrated development of environmental science-oriented agricultural biotechnology and electronic machinery. Only on the basis of continuously increasing investment in scientific research can we ensure the continuous upgrading of agricultural machinery in function and performance, so as to better serve modern agricultural production and promote the sustainable development of agriculture.

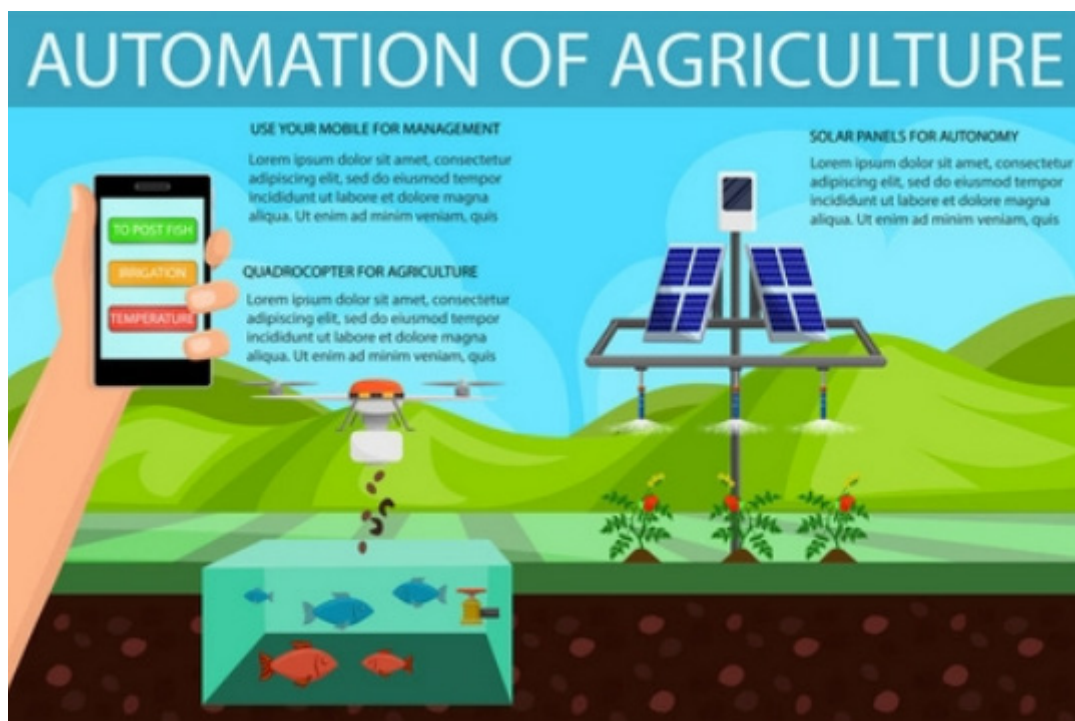


Figure 1. Automated and intelligent agricultural machinery and equipment.

2.2. Promote the innovation and application of agricultural biotechnology

Promoting the innovation and application of agricultural biotechnology plays a vital role in the integration of agricultural biotechnology and electronic machinery. To achieve this goal, it is necessary to proceed from the following aspects ^[1].

The research and development of agricultural biotechnology should be intensified in order to explore more new varieties with excellent characteristics such as high yield, disease resistance and stress resistance. This can not only significantly improve crop production efficiency, but also reduce the reliance on fertilizers and pesticides, thereby reducing environmental pollution. Through molecular breeding, gene editing and other modern biotechnology means, it can be more efficient to cultivate crop varieties that can adapt to various environmental conditions and meet the needs of agricultural development in different regions.

Promoting the industrialization application of agricultural biotechnology is the key link. Scientific research results need to be quickly and effectively transformed into actual productive forces in order to truly play its role. It is necessary to strengthen cooperation with enterprises and establish a sound industry-university-research integration mechanism to promote the commercialization and large-scale application of scientific research results. This can not only shorten the time for the transformation of scientific and technological achievements, but also obtain more opportunities in the market competition, so as to enhance the overall competitiveness of agriculture. The popularization and promotion of agricultural biotechnology requires strong technical support and training. To improve the scientific quality and operational skills of farmers, so that they can master and apply new technologies, is the basis of realizing agricultural modernization. The government and scientific research institutions can jointly organize technical training courses, write easy-to-understand operation manuals, conduct on-site demonstrations and technical guidance, and comprehensively improve the skills of agricultural technicians and farmers at the grassroots level. To promote the development of agricultural biotechnology, it is necessary to establish and improve the relevant policy and regulation system. Policy support plays a pivotal role in promoting scientific and technological innovation and the application of achievements. Formulate preferential policies to encourage scientific and technological innovation, production investment and achievement transformation, and provide various incentive means such as tax relief, financial subsidies and loan concessions, which can significantly reduce the innovation cost of enterprises and scientific research institutions and stimulate their innovation enthusiasm ^[2]. The establishment and improvement of the agricultural product safety supervision system will help ensure the safety of biotechnology products and the orderly development of the market, enhance the trust of consumers, and promote the wide application of agricultural biotechnology.

International cooperation and exchange cannot be ignored in promoting innovation and application of agricultural biotechnology. Scientific and technological exchanges and cooperation in the context of globalization not only help to introduce foreign advanced technology and management experience, but also provide new ideas and inspiration for domestic scientific and technological innovation. Through multilateral cooperation, technological exchanges and joint research and development, we can jointly meet the challenges in the development of modern agriculture, promote the common progress of global agricultural science and technology, and achieve mutual benefit and win-win results. To promote the innovation and application of agricultural biotechnology, it is necessary to make joint efforts from many aspects, such as scientific research, industrialization, technical training, policy support and international cooperation. Only by comprehensively improving the level of agricultural biotechnology can we achieve the goals of agricultural production efficiency, environmental protection and sustainable development, and provide a solid technical guarantee for the development of agricultural modernization.

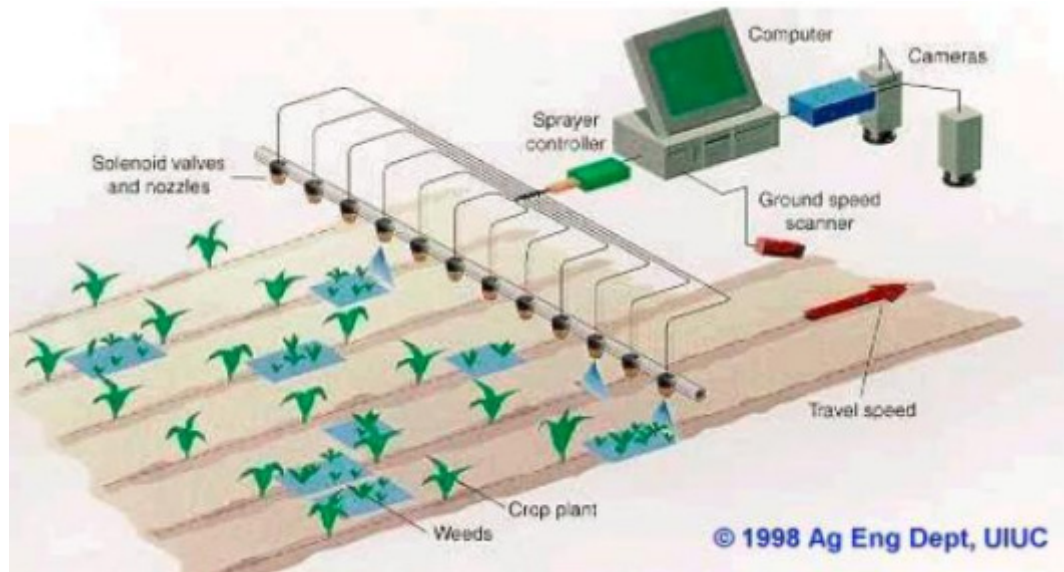


Figure 2. Sensor and remote sensing technology in precision agriculture.

2.3. Strengthen policy guidance and the construction of market mechanisms

Policy guidance and market mechanism play a crucial role in promoting the integration of agricultural biotechnology and electronic machinery. The government should formulate and implement development policies in line with the scientific orientation of environmental protection, encourage the use of environmental protection technologies and equipment, and provide financial subsidies and tax incentives to promote technological innovation in the agricultural field. It is necessary to establish and improve market mechanisms, and promote technological research and development and the transformation of achievements by improving the intellectual property protection system and market access standards. The market mechanism should also promote fair competition and encourage more enterprises to participate in the development and application of agricultural biotechnology and electronic machinery integration, so as to deepen the breadth and depth of the market and help the long-term development of agriculture.

3. The impact of the integrated development of environmental protection science-oriented agricultural biotechnology and electronic machinery on agriculture

3.1. Improvement of agricultural production efficiency

The integration of environmental protection science oriented agricultural biotechnology and electronic machinery is of great significance for improving agricultural production efficiency. It is embodied in the utilization efficiency of agricultural production resources, the precision of agricultural operation and the management of agricultural production.

The integration model of environmental science oriented agricultural biotechnology and electronic machinery can significantly improve the utilization efficiency of agricultural production resources. The combination of information technology and agricultural biotechnology enables farmers to monitor and obtain environmental data such as soil, water and climate in real time through sensor networks, remote sensing technology and other means. This real-time data collection and analysis can help farmers make more scientific and reasonable planting plans, reduce the excessive use of water resources, fertilizers and pesticides, avoid resource waste, and also help reduce environmental pollution.

Advances in agricultural biotechnology, such as gene editing technology and the application of microbial fertilizers, can be combined with automated agricultural machinery to improve the precision and efficiency of the planting process^[3]. Through precise fertilization and application technology, the amount and time of fertilization and application can be precisely controlled, reducing the waste of materials and the impact on the environment. The main advantage of automatic seeder, fertilizer applicator, harvester and other mechanical equipment is that it is efficient, accurate and programmable. These equipment can complete the operation of large areas of farmland in a very short time, greatly shortening the labor intensity and working time, and improving the efficiency of the entire production process.

The combination of intelligent agricultural machinery and agricultural biotechnology can also promote changes in the way agricultural production is managed. For example, using Internet of Things (IoT) technology and big data analytics platforms, agricultural producers can monitor and manage the entire production process. From sowing to harvesting, through sensors and machine learning algorithms, producers can automate decision-making and management, predict and prevent pests and diseases, and plan precise field operations to ensure efficient operation of every link.

This technology system can also realize the sharing of information and resources among agricultural producers. With the help of the agricultural cloud platform, producers in different fields and different regions can share data and experience to form the best planting scheme based on big data, thereby improving the overall efficiency of the entire agricultural production system. Information sharing also promotes the market-oriented operation of agricultural products, reduces the mismatch of supply and demand by connecting market demand and production, and improves the market competitiveness and economic value of agricultural products. Through the implementation of the environmental science oriented agricultural biotechnology and electronic machinery integration development model, advanced biotechnology and mechanization equipment are effectively integrated in the specific agricultural production process, thus improving agricultural production efficiency in resource utilization, operational precision and production management. This not only optimizes the production process and reduces costs, but also promotes the development of modern and intelligent agriculture, helping agriculture achieve greener and more sustainable development goals.

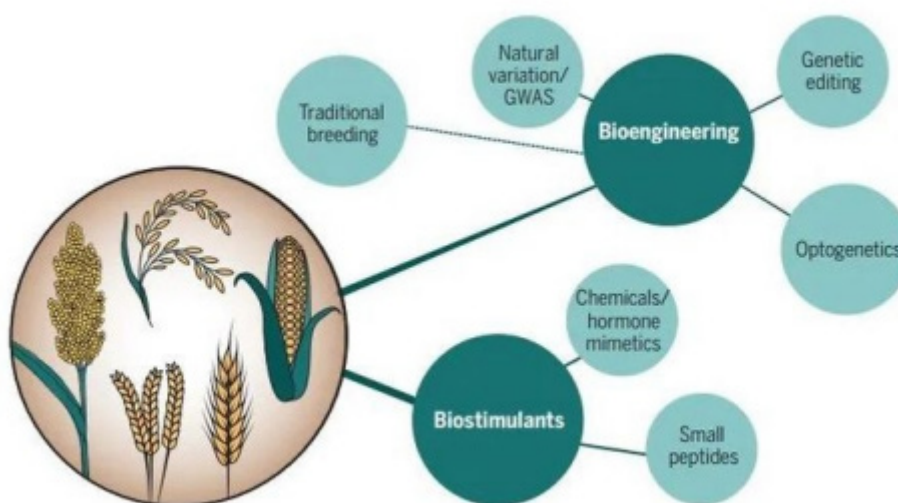


Figure 3. Biotechnology improved crops with environmental benefits.

3.2. Strengthening of agricultural environmental protection

The integrated development of environmental protection science oriented agricultural biotechnology and electronic machinery has a significant strengthening effect on agricultural environmental protection. In modern agriculture, traditional agricultural production methods are often accompanied by environmental pollution, resource waste and other problems, while the introduction of environmental protection science provides new ideas and methods for agricultural production^[4].

Environmental science oriented agricultural biotechnology focuses on the efficient use and recycling of resources. Through the rational application of biopesticides and biofertilizers, the use of chemical pesticides and fertilizers can be reduced, thereby reducing the pollution of soil and water. This technology can not only effectively control pests and diseases and improve soil fertility, but also maintain the balance and health of agricultural ecosystems.

In the process of crop planting, precision agriculture technology is adopted to monitor the soil, climate and crop growth status in real time by equipping advanced sensors and remote sensing equipment, and rationally arrange watering, fertilization and weeding operations, which greatly reduces resource waste and environmental load. Precision fertilization and drip irrigation technology can effectively improve the utilization efficiency of water resources, reduce the fertilizer loss rate, and reduce non-point source pollution. The development of intelligent agricultural machinery has also contributed to environmental protection. Automated and intelligent mechanical equipment can precisely control the spraying amount and spraying position of the application machinery to avoid excessive or uneven pesticide spraying, which is of great significance in protecting non-target organisms, maintaining biodiversity and reducing pesticide residues. Modern machinery and equipment through the application of energy-saving emission reduction technology, reduce greenhouse gas emissions, reduce the pollution of the atmospheric environment.

The integration and application of multi-field technologies reflect systematic and integrated environmental protection measures. This includes not only innovation at the technical level, but also the construction of policy orientation and market mechanisms. In terms of policy guidance, through the formulation and implementation of policies and regulations to encourage environmentally friendly agriculture, farmers can be guided to adopt environmentally friendly production models^[5]. In terms of market mechanism, through the establishment of green agricultural product certification system, the market competitiveness of environmentally friendly green agricultural products can be improved, farmers' income can be increased, and the application and promotion of environmental protection technology can be promoted.

Under the combined action of the above factors, the agricultural production mode has undergone a fundamental change, the negative impact of agricultural activities on the environment has been greatly reduced, and the sustainable development of agriculture has been effectively guaranteed. The integration of agricultural biotechnology and electronic machinery under the guidance of environmental protection science has not only improved agricultural production efficiency, but also strengthened the environmental protection function of agriculture, and promoted the green transformation of agricultural modernization.

4.3. Promotion of sustainable agricultural development

In the process of implementing the integrated development of environmental protection science oriented agricultural biotechnology and electronic machinery, it has played a significant role in promoting the sustainable

development of agriculture. This integration not only helps optimize resource use, but also provides a new path for sustainable agricultural practices.

The high degree of integration of environmental science and agricultural biotechnology has improved the efficiency of resource use. Through precision fertilization and precision irrigation technology, not only effectively reduce the waste of fertilizer and water resources, but also greatly reduce the negative impact of agricultural production on the environment. Less chemical input means less pollution of soil and water, which contributes to the health of the entire ecosystem. The development of the integration of electronic machinery has strengthened the intelligence and automation level of agricultural production, and improved the accuracy and efficiency of agricultural operations. For example, machinery equipped with advanced sensors and data analysis capabilities can monitor crop growth and soil conditions in real time to precisely regulate agricultural inputs. This not only reduces labor costs, but also improves crop yields and quality, making agriculture more efficient and sustainable. Agricultural biotechnology combined with environmental science also promotes the protection and utilization of crop germplasm resources. Through gene editing and molecular breeding technology, new crops with excellent traits such as disease resistance and drought tolerance can be cultivated. These new crops not only improve the resilience of agricultural production, but also reduce reliance on chemical pesticides and fertilizers, contributing to greener and more sustainable agricultural practices. Policy guidance and the improvement of market mechanisms have provided important support for the development of sustainable agriculture. Through the introduction of agricultural environmental protection policies and the establishment of green agricultural products market, farmers can be guided to adopt environmental protection science-oriented agricultural technology and equipment, and promote the popularization and promotion of green agricultural production methods.

The integrated development of environmental protection science-oriented agricultural biotechnology and electronic machinery has not only significantly improved the efficiency and environmental protection level of agricultural production, but also provided a strong driving force for the sustainable development of agriculture. The health and sustainability of agroecosystems will be further enhanced through improved resource use, increased intelligence and innovative biotechnologies.

5. Closing remarks

Based on the scientific concept of environmental protection, this research has innovated and constructed a new model of the integrated development of agricultural biotechnology and electronic machinery, plus a series of coping strategies. The practice of this model and strategy is enough to promote the progress of the integration of agricultural biotechnology and electronic machinery, greatly increase the efficiency of agricultural production, strengthen the environmental protection of agriculture, and promote the sustainable development of agriculture. But the status quo study has some limitations. In the journey of the integrated development of agricultural biotechnology and electronic machinery, it is necessary to further study how to accurately fertilize and apply medicine, and environmental protection goals such as energy conservation and emission reduction. The awareness and application of new technology and new equipment are both challenges and opportunities. In order to increase the investment in scientific research, improve the automation and intelligent level of agricultural machinery, encourage the innovation and application of agricultural biotechnology, and carry out measures such as policy guidance and the establishment of market mechanism, this series of complicated things require the policy makers, agricultural practitioners and related organizations to help each other and strive. In the future, we will further deepen research and explore effective ways to promote the integration of agricultural biotechnology and

electronic machinery through environmental science orientation, and put forward corresponding operational and implementive strategies, in order to promote the efficient, environmental protection and sustainable development of agriculture, but also provide valuable theoretical reference and practical guidance for related fields.

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