The current status and strategy of agricultural green development in Jiangsu Province

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Abstract: In the face of extensive pattern of agricultural development, how to improve resource utilization efficiency and ecological efficiency are urgent problems to be solved. Jiangsu province has developed modern agriculture system with the idea of green development, coordinating the agricultural production with the environmental protection, and achieved some initial achievements. However, there are still some problems such as imperfect market mechanism, lack of green production standards, too short industrial chains and shortage of talents. This paper puts forward some developing strategies: cultivating new agricultural operating subjects; optimizing the layout of agricultural industry; improving the utilization efficiency of resources; and promoting e-commerce marketing model, which can contribute to the intensive and sustainable development of agriculture.

1. Introduction
China's agricultural development has made great achievements, but the extensive pattern of agricultural production has not been fundamentally transformed, the trend of environmental pollution and ecological degradation has not been effectively curbed, and the supply of green agricultural products cannot meet the growing needs of the people. In September 2017, the general office of the CPC central committee and the general office of the state council issued “opinions on innovating systems and mechanisms to promote agricultural green development”, which is the first document on agricultural green development issued by the CPC central committee, marking the "green" reform of China's agricultural development. Subsequently, the “green storm” blows up all over the country, every part of the country explores to find a suitable and new green production ways based on their own situations.

The concept of agricultural green development has not been clearly defined at present, but many scholars have studied green agriculture. According to Liu et al. [1], green agriculture is an agricultural model that makes full use of advanced science and technology, advanced industrial equipment and advanced management concepts. Green agriculture aims at promoting the safety of agricultural products, ecology and resource, and advocates the standardization of agricultural products. Yan et al. [2] believe that green agriculture not only includes green agricultural products, but also includes the recycling utilization of agricultural materials, the effective usage of rural energy, as well as the protection of agricultural species and the improvement of their living environment. Zhong et al. [3] think that green agriculture is not the return of traditional agriculture, nor the negation of ecological agriculture, organic agriculture, natural agriculture and any other types of agriculture, but a new type of agriculture that learns from many strong points from the others to offset its own disadvantages.
2. Current status of agricultural green development in Jiangsu province

2.1 Achievements
In 2016, Jiangsu’s agricultural added value reached 432.35 billion Yuan, ranking third in China. As a province with a large population and a small land area, Jiangsu has fed nearly 80 million people with about 1 percent of the country's land area and produced 6.8 percent of the country's agricultural added value. Jiangsu province attaches great importance to the construction of agricultural ecological civilization, and has achieved remarkable performance. Firstly, the green development system has basically taken shape. Since 2003, centering on the green ecological agriculture and sustainable development, Jiangsu province has launched a series of policies and regulations on the ecological civilization construction, water pollution prevention, air pollution control, soil pollution control, Taihu basin area pollution prevention, and agricultural circular economy.

Secondly, the pattern of recycling utilization of agricultural waste has gradually formed. Jiangsu province has vigorously promoted the recycling utilization of agricultural waste. In terms of the pollution control of livestock and poultry breeding, Jiangsu has explored and formed the field manure storage tank, heterotopic fermentation bed of microbial degradation, and the third-party centralized processing system, which makes the integration of farming and breeding by transforming the traditional development mode.

Thirdly, the supply of green agricultural products has continuously increased. Jiangsu province vigorously promotes the construction of agricultural production standardization, implements the certificate management system of edible agricultural products, and strengthens the whole process of the supervision and management of agricultural production. Jiangsu focus on building brands of featured and advantageous agricultural products to meet the green consumption needs of urban and rural residents. At present, the sampling inspection qualification rate of provincial agricultural products has been stable at more than 98%, higher than the national average (96%). In 2016, the total number of "three products and one mark" reached 17,000, ranking the first place in the country, with more than 40 registered geographical marked agricultural products.

2.2 Some indicators

2.2.1 Industrial structure Jiangsu province is located in the Yangtze River delta, with obvious geographical advantages and rapid economic development. As can be seen from figure 1, the industrial structure has constantly optimized. The scale of the primary industry gradually shrinks without obvious fluctuations, reaching the minimum proportion of 5.4% in 2016. From 2001 to 2005, the proportion of the secondary industry increased gradually and reached a peak of 56.6% in 2005. This has a lot to do with the vigorous development of the tertiary industry in Jiangsu province, because the trend of tertiary industry is just opposite to the secondary industry. After 2014, the tertiary industry surpassed the secondary industry and the industrial Pattern changed.

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1 "Three products and one mark" refers to the pollution-free agricultural products, green food, organic agricultural products and agricultural products geographical mark.
2.2. Input of resources and factors

In the process of agricultural production, a large number of resources and factors must be invested, including land, machinery and equipment, electricity, fertilizer, pesticides, agricultural film and so on. It can be seen from table 1 that the usage of agricultural film, diesel fuel, the total power of machinery and rural electricity consumption has been increasing from 2006 to 2016. However, the plow land area and the application amount of pesticides and fertilizers has been decreasing year by year.

Table 1. Input of resources and factors in Jiangsu Province from 2006 to 2016.

| Year | Fertilizer (10^4 t) | Agricultural film (10^4 t) | Agricultural diesel (10^4 t) | Pesticide (10^4 t) | Plowing area (10^3 hm^2) | Agricultural machinery power (10^4 kW) | Irrigation (10^3 hm^2) | Rural electricity consumption (10^8 kW.h) |
|------|---------------------|-----------------------------|-----------------------------|--------------------|---------------------------|----------------------------------------|------------------------|------------------------------------------|
| 2006 | 342.0               | 7.51                        | 81.3                        | 9.86               | 4768.70                   | 3278.50                                | 3837.70                | 1011.8                                   |
| 2007 | 342.0               | 8.04                        | 80.6                        | 9.68               | 4763.77                   | 3392.44                                | 3835.15                | 1159.0                                   |
| 2008 | 340.8               | 8.54                        | 83.9                        | 9.38               | 4763.79                   | 3630.86                                | 3817.10                | 1234.1                                   |
| 2009 | 344.0               | 9.43                        | 91.9                        | 9.23               | 4612.93                   | 3810.57                                | 3813.66                | 1316.6                                   |
| 2010 | 341.1               | 10.02                       | 97.5                        | 9.01               | 4595.52                   | 3937.34                                | 3819.74                | 1472.9                                   |
| 2011 | 337.2               | 10.64                       | 100.0                       | 8.65               | 4587.80                   | 4106.11                                | 3817.92                | 1606.8                                   |
| 2012 | 331.0               | 11.26                       | 103.0                       | 8.37               | 4584.66                   | 4214.64                                | 3929.72                | 1696.4                                   |
| 2013 | 326.8               | 11.68                       | 106.8                       | 8.12               | 4581.58                   | 4405.62                                | 3785.27                | 1801.9                                   |
| 2014 | 323.6               | 11.98                       | 107.5                       | 7.95               | 4574.24                   | 4649.98                                | 3890.53                | 1834.9                                   |
| 2015 | 320.0               | 11.32                       | 108.6                       | 7.81               | 4574.85                   | 4825.49                                | 3952.50                | 1836.2                                   |
| 2016 | 312.5               | 11.39                       | 108.7                       | 7.62               | 4571.13                   | 4906.55                                | 4054.07                | 1869.3                                   |

Data source: National Bureau of Statistics of China

Due to the excessive use of chemical fertilizers and pesticides, a large number of agricultural exports suffer from green trade barriers every year, resulting in inestimable indirect losses [4]. In fact, since 2006, the intensity of chemical fertilizer application in Jiangsu province has seriously exceeded the internationally recognized environmental risk level of 225 kg/ hm². However, as to the intensity of fertilizer and pesticide, figure 2 shows that they have been decreasing after 2009. This shows that Jiangsu puts the idea of green agricultural development in a prominent position, and the use of fertilizers and pesticides is subject to strict external controls.
Fig. 2 Intensity of fertilizer and pesticide application in Jiangsu Province from 2006 to 2016. Data source: National Bureau of Statistics of China

2.2.3 Carbon emissions In 2015, the European commission revealed that the agricultural sector had become the third largest source of greenhouse gas emissions, following the energy and transport sectors. According to previous studies [5], it is believed that carbon emissions caused by agricultural activities mainly come from four aspects: Carbon emissions directly or indirectly caused by the inputs of agricultural materials such as fertilizers, pesticides and agricultural film; Carbon emissions from diesel fuel used in agricultural machinery; Loss of organic carbon by ploughing and damaging the topsoil; Carbon emissions from the use of electricity for agricultural irrigation activities.

Taking the model and coefficient used by Li bo et al. [6] as a reference, There are six direct or indirect carbon sources: chemical fertilizer, pesticide, agricultural plastic film, agricultural diesel oil, effective irrigation, and plow land. The emission coefficients respectively are 0.8956 (kg/kg) for fertilizers, 4.9341 (kg/kg) for pesticides, 5.18 (kg/kg) for agricultural plastic film, 0.5927 (kg/kg) for diesel oil, 20.476 (kg/hm\(^2\)) for irrigation, and 312.6 (kg/km\(^2\)) for plowing. As table 2 shows, we can get the carbon emissions of each carbon source, and then get the total carbon emissions in all the agricultural activities.

| Year | Fertilizer | Agricultural film | Agricultural diesel | Pesticide | Irrigation | Plowing | Total carbon emissions | Growth rate |
|------|------------|--------------------|---------------------|-----------|------------|---------|------------------------|-------------|
| 2006 | 306.30     | 38.90              | 48.19               | 48.67     | 7.86       | 1.49    | 451.40                 |             |
| 2007 | 306.30     | 41.65              | 47.77               | 47.76     | 7.85       | 1.49    | 452.82                 | 0.31%       |
| 2008 | 305.22     | 44.22              | 49.73               | 46.30     | 7.82       | 1.49    | 454.78                 | 0.43%       |
| 2009 | 308.09     | 48.82              | 54.47               | 45.54     | 7.81       | 1.44    | 466.17                 | 2.50%       |
| 2010 | 305.49     | 51.90              | 57.79               | 44.47     | 7.82       | 1.44    | 468.90                 | 0.59%       |
| 2011 | 302.00     | 55.14              | 59.27               | 42.68     | 7.82       | 1.43    | 468.33                 | -0.12%      |
| 2012 | 296.44     | 58.30              | 61.05               | 41.29     | 8.05       | 1.43    | 466.56                 | -0.38%      |
| 2013 | 292.68     | 60.53              | 63.30               | 40.04     | 7.75       | 1.43    | 465.74                 | -0.18%      |
| 2014 | 289.82     | 62.08              | 63.72               | 39.24     | 7.97       | 1.43    | 464.25                 | -0.32%      |
| 2015 | 286.59     | 58.66              | 64.37               | 38.54     | 8.09       | 1.43    | 457.68                 | -1.42%      |
| 2016 | 279.88     | 59.02              | 64.43               | 37.59     | 8.30       | 1.43    | 450.64                 | -1.54%      |

Data source: National Bureau of Statistics of China

3. Existing problems
At present, green development still faces many institutional problems. Firstly, the market mechanism is not fully used. It is the government that mainly purchases services to introduce other subjects, and other subjects are not willing to invest. In the actual operation, the enterprises market roles are not fully played. There is no mature innovation mechanism in technology and product research and development, and the
market effect has not been formed in green production and promotion. Secondly, green production standards and the operational norms lack. At present, there is no unified national or local standards on the evaluation of the reclamation products of wastes, which makes it difficult for these green products to become circulating commodities. Thirdly, the industrial chain is too short and the product value is too low. In the agricultural production, the industry chain is limited to the mode of "producing - rough machining - Selling", located at the bottom of the "smiling curve", and the product value is not insufficiently exploited. So it is necessary to further excavate the market potential from the aspects of product research and development, the product diversification, the fine processing, the technology services, or marketing. Fourthly, the compound talents of green development lack, including the lack of government management personnel and service personnel. According to the survey, among the existing agricultural resources institutions and environmental protection institutions, 86% of the existing personnel are not suitable for the current requirements of green development, mainly due to their low professional expertise [7].

4. Development strategies

4.1 Cultivating new agricultural operating subjects
We should encourage farmers to cooperate in various forms via the land, capital, labor, technology and products as the bridge, to expand the scale of agricultural production. It is important to actively develop family farms, large professional households, farmers' cooperatives, agricultural enterprises and various types of agricultural service organizations. We should give full play to the role of agricultural technology promoting agencies, supply and marketing cooperatives, agricultural reclamation enterprises in providing socialized agricultural services, and cultivate new types of agricultural operating subjects in diversified ways.

4.2 Optimizing the layout of agricultural industry
Rational planning should be carried out through the whole process from the production sources to the waste utilizations, so as to realize the recycling utilization of resources and achieve the balance of planting and breeding. Centering on the utilization of agricultural waste, we should build the green development mode with a complete industrial chain of integration of three industries to obtain remarkable economic and ecological benefits. We should promote the concentration of resources, expand the circular industrial chains, and support the innovation of industries and products. We should promote the "Internet plus" modes and build a modern industrial system that integrates processing, energy, logistics and tourism together, to realize the interconnected development of primary, secondary and tertiary industries.

4.3 Improving the utilization efficiency of resources
We should improve resources utilization efficiency by developing the green production technology, controlling the amount of pesticides, fertilizers and plastic film reasonably, and advocating the application of biological fertilizer and biological pesticide. In the area of non-point source pollution, it is necessary to implement mandatory measures, which strictly limits the usage of pesticides, fertilizers and film; we should carry out comprehensive control of groundwater over-extraction, advocate water-saving agriculture, and increase the utilization efficiency of water resources. We should popularize and apply water-saving irrigation technologies suited to the local conditions, and establish water-saving ecological agriculture demonstration sites.

4.4 Promoting e-commerce marketing model
We should pay attention to the brands marketing and carry out extensive publicity through the Internet, television, newspapers, outdoor advertising, brochures and so on. We can also carry out promotional activities in large and medium-sized cities and achieve production and marketing docking relying on all kinds of national and provincial agricultural fair. We should expand marketing channels and reduce
marketing costs. In this way, the products or brands can go into the hearts of consumers more quickly and more deeply.

5. Conclusions
Overall, the green development of agriculture in Jiangsu has made some initial achievements. The structure of the industry has constantly optimized, the use of fertilizers and pesticides has achieved a steady negative growth rate, and carbon emissions have been decreasing year by year since 2010. However, the cultivated land area is also decreasing year by year, and the per capita arable land area is far below the national average level. The energy consumption is much too high, and the intensity of fertilizer is also too high compared to the international standards.

Therefore, the primary task is to give priority to protecting the ecological environment and reducing the agricultural non-point sources pollution. It is urgent to strictly control the excessive use of chemical fertilizers and pesticides, to reduce the energy consumption, to use the land and water efficiently and to realize the recycling utilization of agricultural waste, which can contribute to the intensive and sustainable development of agriculture in Jiangsu.

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