

The Models for the Development of Specialty Agriculture in the Hilly Areas of Southern Ningxia: Are They Truly Effective?

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Abstract The development of specialty agriculture is of great significance to western China's agricultural structure adjustment, and it's an essential way for the construction of ecological agriculture in Southern Ningxia mountainous area. This paper makes a summary about the development status of specialty agriculture in Southern Ningxia Mountainous Area and put forward the basic benefit goal and problems needing attention. On this basis, the paper studies the development pattern of specialty agriculture in Southern Ningxia Mountainous Area from the aspects of production factors and industry. This paper suggests that the development pattern of specialty agriculture in Southern Ningxia Mountainous Area should combine the regional agricultural pattern and innovative organization structure pattern, demonstration agriculture and market-directing pattern, engineering agricultural pattern and enterprise-driven pattern. The development of specialty agriculture in Southern Ningxia Mountainous Area should promote the three patterns, in order to achieve the construction of ecological agriculture and agricultural structure adjustment.

Key words The hilly areas of southern Ningxia, Specialty agriculture, Model, Efficiency goals

1 Introduction

Specialty agriculture is an unbalanced agricultural production system, aimed at pursuing the best benefits (i. e., the greatest economic benefits and optimal ecological benefits, social benefits) and improving product competitiveness in the market, according to the overall resource advantages and characteristics in the region. It highlights regional characteristics and the market demand, with a given production object or production purpose as the target^[1]. Since China proposed to play resource-rich advantages in the western regions and vigorously develop the western specialty agriculture in 2003, special agriculture has been developed by leaps and bounds in western China, attracting widespread attention of scholars^[2-3]. But specialty agriculture is an emerging concept, and the current researches on specialty agriculture are mostly at the theoretical level; there is a shortage of researches on the development model of specialty agriculture for the practice of specialty agriculture in specific regions. Specialty agriculture has strong regional characteristics and diversity; different regions have different features of geographical location, and the development model of specialty agriculture is also different^[4-5]. Carrying out the research on development model of specialty agriculture in specific regions, is of great significance to improving the theoretical system of specialty agriculture, and guiding regional development of specialty agriculture and agricultural industrial restructuring^[6]. The hilly areas of southern Ningxia are located in the northern agro-pastoral transitional zone, with complex and diverse landforms and extremely fragile ecology. It is also one of China's traditional poor areas. The administrative scope includes the entire Guyuan City

(Yuanzhou District, Xiji County, Longde County, Jingyuan County, Pengyang County) and Tongxin County and Yanchi County in Wuzhong City, Haiyuan County in Zhongwei City, with a total area of 30 456 km², accounting for 58.9% of total area of Ningxia. In 2010, the total population was 2.092 million, accounting for 33.0% of the total population in Ningxia. Development of ecological agriculture is the primary objective of agricultural development in the hilly areas of southern Ningxia, having important influence on the agricultural structure adjustment in Ningxia Hui Autonomous Region. How to coordinate the relationship between ecological restoration and rural development, farmers' income increase, is a key issue for achieving the sustainable development of ecological agriculture. Development of specialty agriculture is an important way to achieve ecological agriculture.

2 The current situation of the development of specialty agriculture in the hilly areas of southern Ningxia

2.1 Overall situation of agriculture and evaluation of current development of specialty agriculture In 2010, the total regional output value of eight counties in the hilly areas of southern Ningxia reached 18.1 billion yuan; the total value of the primary, secondary and tertiary industries accounted for 27.3%, 26.7%, and 45.9% of total regional output value. Agriculture plays an important role in the economic development of the hilly areas of southern Ningxia. The total output value of agriculture was 6.33 billion yuan, accounting for 62.3% of total output value of agriculture, forestry, animal husbandry and fishery, but the agricultural base was weak, per capita arable land area was only 0.28 hm², and the area of valley and terrace only accounted for 47% of the total arable land area.

In recent years the decision-making authorities have been emphasizing the development of ecological agriculture and special-

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ty agriculture, but from the statistical data of the crop sown area, the agricultural pattern in the hilly areas of southern Ningxia has not been changed significantly. Food crops still occupy a dominant position in agriculture, and the share of grain sowing area in the total area of arable land is large, but the share of high quality food crops is small in the food crops. For example, the production of basic food crops such as rice and wheat was 330 260 t in 2009, accounting for only 12.6% of the total output of food crops (Table 1). In addition, the level of output of food crops is low. The per capita food production was about 621 kg in the hilly areas of southern Ningxia, and per capita wheat and rice production was only 113 kg, far below the national average. The operation of food crops lacks adequate space for development, and we must propose new ideas and breakthroughs for the future agricultural structure adjustment in the hilly areas of southern Ningxia. Compared with the traditional forms of agriculture, specialty agriculture can better

play the comparative advantages of regional resources, but the development of current specialty agriculture in the hilly areas of southern Ningxia is still in its infancy, the share of sown area of specialty crops in total sown area of crops is still relatively low (only about 37% in 2010), and there are fluctuations in the growth of operation scale (Fig. 1). The development of specialty agriculture in the hilly areas of southern Ningxia is also subject to the constraints of fragile ecological environment and huge population and land pressure. The local farmers lack sufficient experience in developing specialty agriculture, so that the operation risks of specialty agriculture are high, leading to slow development of specialty agriculture at present, so there is an urgent need to be guided by comprehensive and stable development model. In the future, the development of specialty agriculture in the hilly areas of southern Ningxia still has great potential and strong urgency.

Table 1 Statistics of production of major crops in the hilly areas of southern Ningxia

Unit: t

Regions	Rice	Wheat	Corn	Potato	Beans	Oil crops	Flax	Sunflower	Medicinal material	Vegetable	Melons
Tongxin County	61 724	79 901	130 743	0	2 584	975	8	967	0	168 576	20 521
Yuanzhou District	0	31 527	51 728	60 453	1 000	28 287	7480	20 807	0	315 947	9 690
Xiji County	0	51 109	17081	135 588	4833	11 480	11 480	0	238	192787	0
Longde County	0	22 571	13 108	41 544	11 572	7 583	7 388	195	4577	59 140	4 235
Jingyuan County	0	6 637	5 505	26 158	234	1148	1 027	0	45	9 390	0
Pengyang County	0	31 579	99 689	23 410	1 288	3425	3 110	315	1 221	121 007	12 459
Haiyuan County	0	10 747	72 485	63 344	550	22 222	9 592	12 630	3 210	44 870	79 892
Total	61 724	268 538	543 750	370 390	22760	81 898	42 121	39 526	9291	948 358	229 094

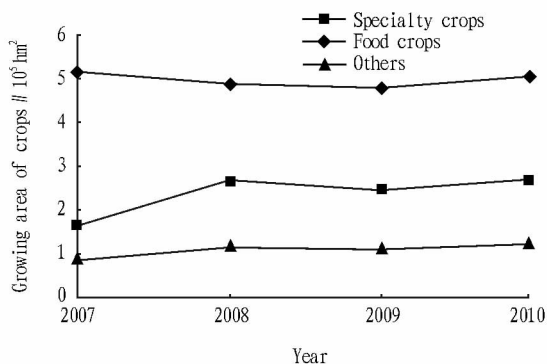


Fig. 1 The changes in the growing area of different types of crop in the hilly areas of southern Ningxia

2.2 Resource conditions for the development of specialty agriculture

The hilly area of southern Ningxia is ecologically fragile, but it has rich specialty crop resources. Compared with other regions of Ningxia, the hilly areas of southern Ningxia have more prominent advantages in the development of potato (*Solanum tuberosum*), maize (*Zea mays*), the facility crops with the characteristics of greenhouse vegetable, characteristic seedlings, flowers, herbs and other specialty crops, and other specialty crops, as well as the animal husbandry with Tan Sheep and beef cattle as features. Currently, a number of local brands of specialty agriculture have been formed, such as "Yuanzhou potato", "Xiji celer-y", "Pengyang pepper", "Liupan delicacies" and "Yanchi Tan Sheep". The hilly areas of southern Ningxia have complex and di-

verse internal geographical environment, and different geographical environments will often bring agricultural resources with their own characteristics^[7]. The loess hill and gully areas are very suitable for the planting of potatoes, small cereals and other specialty crops; the mountainous areas in the periphery of Liupan Mount have more rainfall, so there are rich high-quality seedlings, flowers, Leguminosae, Root of Pilose Asi abell, Glycyrrhizae and other medicinal resources; the valley ecological and economic zone has good conditions for developing cash crops; the northern arid areas have long sunshine time, very suitable for the planting of Lycium chinense, Xisha melon, Ziziphus zizyphus, and other special crops as well as licorice and other herbs.

2.3 The spatial distribution of specialty agriculture

Currently, the specialty agriculture in the hilly areas of southern Ningxia shows a trend of diversification of crop types and operation patterns, and specialty agriculture has different characteristics in different counties and districts. The specialty agriculture in the hilly areas of southern Ningxia can be roughly grouped into the following five types (Fig. 2):

(i) Planting industry of specialty food crops, mainly including potatoes, corn and small cereals. For corn and potatoes, the central Yuanzhou District, northern regions and northeastern Xiji County mostly adopt the operation model of agricultural demonstration base, with a large planting area, easy to develop scale operation; small cereals are mainly distributed in the southern Yanchi County and some areas of Pengyang County.

(ii) Specialty facility agriculture, focused on the planting of celery, tomatoes, onion and other vegetable crops. It is mainly distributed in western Tongxin County, eastern Haiyuan County, central Yuanzhou District, central Xiji County, western Yanchi County and other places; facility agriculture has higher requirements of technology and management, so it is often driven by large-scale leading enterprises.

(iii) Planting industry of mixed cash crops, including seedlings, flowers, herbs, etc., mainly distributed in Longde County, Jingyuan County, and other mountainous areas with more precipitation. The operation of these crops can create high ecological and economic benefits, but it is vulnerable to market demand fluctuations.

(iv) Planting industry of other specialty cash crops, including wolfberry, Xisha melon, round dates, cumin, apple and other characteristic regional crops. The operation of these specialty crops is relatively dispersed, for example, wolfberry, Xisha melon and Jujube are mainly distributed in Tongxin County and Haiyuan County in the hilly areas of southern Ningxia, cumin is mainly distributed in Xi'an Town of Haiyuan County and other places, and apples and other fruit forests are mainly distributed in Pengyang County and other places. The operation of such crops is relatively fragmented, but low labor costs and high economic efficiency make the location advantages of private operation.

(v) Specialty animal husbandry, including Tan sheep breeding in northern Yanchi and cattle breeding in Tongxin and southern Yuanzhou and Jingyuan. The hilly areas of southern Ningxia is located in China's agro-pastoral transitional zone, and livestock development has excellent tradition and variety advantages, having shown good economic benefits in recent years.

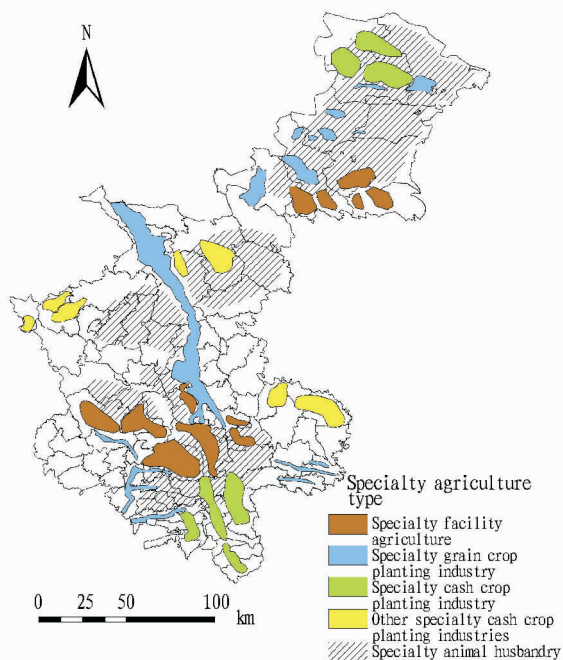


Fig. 2 The distribution of specialty agriculture in the hilly areas of southern Ningxia

3 Exploration of the development model of specialty agriculture in southern Ningxia

3.1 Three basic goals for the development of specialty agriculture

The development model of specialty agriculture must adapt to the resource endowment of the regions and their own characteristics^[8]. The exploration of development model of specialty agriculture in the hilly areas of southern Ningxia should be based on the following three basic objectives: (i) The goal of farmers' income increase; (ii) The goal of ecological restoration; (iii) The goal of rural life improvement. In the exploration of development model of specialty agriculture in the hilly areas of southern Ningxia, there is a need to be based on the above three basic objectives, to propose the optimal development and promote the sustainable development of specialty agriculture industrialization^[9].

3.2 Several issues concerning the development model of specialty agriculture

(i) It is necessary to handle the relationship between specialty agriculture and basic agriculture. Currently the agricultural operation is still based on food crops in the hilly areas of southern Ningxia. The aim of developing specialty agriculture is to make the farmers get rid of the shackles of traditional model of agricultural operation while ensuring basic food business subsidies and steadily pushing forward the construction of commodity grain, to relieve the worries of farmers.

(ii) It is necessary to develop together with other models of ecological agriculture. Due to the ecological fragile background in the hilly areas of southern Ningxia, the development of specialty agriculture must be placed in the context of ecological agriculture, and specialty agriculture model should be combined with leisure agriculture, landscape agriculture, and other development models of ecological agriculture, to achieve maximization of overall efficiency.

(iii) It is necessary to be based on specialty agriculture economy at the county level. Development of county economy is most likely to play the location advantages of specialty agriculture^[10-11]. The establishment of development model of specialty agriculture needs to be based on the county economy as a foothold, and consider the mutual cooperation between the districts and counties, to achieve maximization of the regional advantages.

3.3 The development model of specialty agriculture

3.3.1 Combination of location agricultural model and innovative organizational structure model. Location agricultural model is to carry out scientific production division and regional distribution, in accordance with the geographical characteristics and regional conditions of different regions, to develop the production of agricultural products with comparative advantage, thereby achieving regional production specialization, and forming the specialized industrial belt with characteristics^[12]. Practice has proved that the success of specialty agriculture industrialization hinges in a large measure on the choice of organizational model^[13]. The innovative organizational structure should explore farmers' spontaneous experience of innovation. Meanwhile, the "innovation" of innovative

organizational structure model does not mean unconventional, but closely reliant on regional resource advantages and practices of specialty agriculture. It should never blindly copy the successful experience of other regions, and there is a need to be combined with location agriculture model. Currently farmer (professional) cooperatives have become China's most basic model of agricultural industrialization operation, and also taken shape in the development of specialty agriculture in the hilly areas of southern Ningxia. Moreover, in the innovative organizational structure model of specialty agriculture, the government should also play a leading role, to promote the allocation of factors of agricultural production.

3.3.2 Combination of demonstration agricultural model and market-based model. The demonstration agricultural model, a form of agricultural operation, with modern agricultural technology and management as the main target, is to introduce high quality varieties and high-tech agricultural technology, and focus on the development and promotion of agricultural technology extension base and production base, in order to promote agricultural development. The formation and development of specialty agriculture need to take the cultivation and development of characteristic agricultural product market as the main line. The cultivation and development of characteristic agricultural product market can fundamentally achieve the comprehensive benefits of specialty agriculture. The market-based model requires us to change the traditional agricultural thinking when cultivating and developing characteristic agricultural product market, to expand market share and influence, and improve the market competitiveness. Currently, the hilly areas of southern Ningxia have built Yuanzhou vegetable base, Pengyang Changchengyuan mushroom base, and many other demonstration bases of specialty agriculture. In terms of the market, by the means of building agricultural logistics park and holding "Liupanshan Cold Vegetable Festival", the characteristic agricultural product market has spread throughout the cities of China and extended to Hong Kong, Macao, Taiwan, and Malaysia, South Korea, Saudi Arabia and other countries.

3.3.3 Combination of engineering agricultural model and enterprise-driven model. Engineering agriculture model, an agricultural form, with biotechnology and engineering technology as support, uses unique production facilities for agricultural production, such as facility agriculture, water-saving agriculture, rainfed agriculture, and precision agriculture. Enterprise-driven model is a form of integrated development of agriculture stemming from the enterprises with certain capital internally linking farmers and externally expanding the market while participating in the technology development and agricultural management. Engineering agriculture is an important manifestation of modern large-scale intensive agriculture. Water scarcity is an important factor restricting the economic development in the hilly areas of southern Ningxia, and engineering agricultural model can effectively compensate for the lack of water in the hilly areas of southern Ningxia, and has good ecological benefits. However, the cost of engineering agricultural model is high, which will inevitably require the industrialization of specialty agriculture, and combine it with enterprise-driven model.

Companies must rely on good agricultural facilities to achieve the economic benefits, and engineering agriculture can promote the construction of agricultural infrastructure. Currently, the hilly areas of southern Ningxia develop facility agriculture in the valley, water-saving agriculture in the irrigation area along the Yellow River, dry farming in soil erosion catchment area, and precision agriculture in mountainous areas of Liupan, and achieve initial comprehensive benefits. Meanwhile, these areas widely adopt the development model "leading enterprises + base + farmers". The combination of the three achieves the strong agglomeration of economic factors in the specialty agriculture. In the future, this model will play huge potential in the specialty agriculture construction in the hilly areas of southern Ningxia.

4 Conclusions

The hilly areas of southern Ningxia is China's traditional poor areas, where agricultural development has long been limited by fragile ecological background and huge population pressure, so the development of specialty agriculture is the only way. The development of specialty agriculture is still in its infancy in the hilly areas of southern Ningxia, and the development speed is relatively slow. The future development of specialty agriculture in the hilly areas of southern Ningxia urgently need to be guided by suitable development model, to give play to its huge potential in the construction of ecological agriculture and industrial restructuring. Based on the current resource conditions and specialty development of agriculture in the hilly areas of southern Ningxia, combined with the scholars' research results of development model of specialty agriculture, this paper studies the development model of specialty agriculture in the hilly areas of southern Ningxia. This paper suggests that the development pattern of specialty agriculture in Southern Ningxia Mountainous Area should combine the regional agricultural pattern and innovative organization structure pattern, demonstration agriculture and market-directing pattern, engineering agricultural pattern and enterprise-driven pattern. The development of specialty agriculture in Southern Ningxia Mountainous Area should promote the three patterns, in order to achieve the construction of ecological agriculture and agricultural structure adjustment.

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mission reduction performance evaluation system of each departments in the parks, strengthened the follow-up check for objective responsibility and work progress to guarantee an good ecological environment in the park.

3.4 To foster low-carbon environment and advocate the consumption pattern of low-carbon leisure agriculture During fostering of the low-carbon environment, the Xinglong tropical botanical park (1) continuously enhanced introduction of professionals in the fields of agricultural biotechnology, ecology, *etc.*, and increased the eco-park control capital investment and advocated sustainable development concept; (2) developed internal low-carbon tourism transportation, reduced pollutant discharge and advocated the simple and comfortable tourism pattern of nature; (3) established pipeline direct drinking water system to achieve the direct supply of the drinking water; advocated the low-carbon travel mode without mineral water carried; (4) applied the new energy-saving environmental-friendly building materials and energy saving equipments and advocated the green building concept; (5) established shopping mode of "the park is located in front of the shops" and advocated the green foods and ecological foods which were integrated with "production, processing and sales"; (6) conducted low-carbon healthy tourism experience activities including tropical crops cultivation technique, making of flower bonsai, national fishing championship, *etc.*, and advocated the low-carbon leisure tourism; (7) used the decontaminated wastewater by aquatic plants for crops irrigation and landscape stream recycling, the leaves of turf trimmed and remainings of products processed for fish farming, the crushed dead twigs and coconut shell and waste residue from production and drinking of tea and coffee for corps production coverage, *etc.*, to advocate the waste low carbonization; (8) applied high-tech means such as low-carbon temperature and humidity control intelligent greenhouse system and pest prevention pre-warning system, *etc.*, and advocated the concept of promoting agriculture and tourism development by the modern technologies.

4 Conclusions

The development model of low-carbon leisure agriculture in Xinglong tropical botanical park provides a useful exploration in the development of low-carbon leisure agriculture in agricultural science and technology experiment and demonstration park and has an important reference significance on the development of China's low-carbon leisure agriculture. As a kind of system engineering,

promotion of agricultural science and technology experiment and demonstration park to develop low-carbon leisure agriculture should seek appropriate development models based on the actual situations of the park, enhance the relation among related industries such as tourism, agro-forestry, *etc.*, speed up formation of low-carbon technology cluster and popularize the low-carbon tourism theory to better develop the demonstration model of low-carbon leisure agriculture and improve the overall competitiveness of the leisure agriculture all over the world.

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(From page 38)

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