Role of Nanfan Base and Recommendations about Construction and Management

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Abstract This paper first analyzes the important role of Nanfan Base in China: "accelerator" for breeding new varieties of crops; "unallocated store" to ensure the varieties for agricultural production; "lightning rod" to ensure the quality and safety of seeds; "big stage" for variety and technical exchanges and cooperation; "big school" for cultivating seed industry technology talents; "booster" for promoting local economic development. Then it points out the main problems about Nanfan Base and finally sets forth the relevant recommendations.

Key words Nanfan Base, Important role, Main problems, Construction and management recommendations

1 Introduction

"Nanfan" refers to the autumn and winter seed breeding and production work using the typical tropical climate resources and favorable ecological conditions in Sanya, Lingshui, Ledong and the surrounding areas in Hainan Province to meet the needs of plant growth and reproduction of animals[1]. The main object of study includes rice, corn, cotton, sorghum, melon, vegetables and other 24 kinds of crops. The research areas include germplasm innovation, material processing, seed purity identification, seed breeding, pilot test, production and operation, as well as some basic researches of plant physiology, biochemistry, crop genetics, developmental and molecular biology. In recent years, as the two-line hybrid rice is promoted on a large scale, Nanfan has become the main source of GMS line seeds, and the aquatic Nanfan, livestock and poultry Nanfan and herb Nanfan has also become new fields. Some seed companies increase the Nanfan working hours from six months to a full year, and extend the use of time to comprehensive utilization of time, space and resources. Nanfan Base is the platform to carry the Nanfan work. Through more than 50 years of development, Nanfan Base has become the largest, most open, and most influential agricultural science and technology experimental zone in China, known as "China's Silicon Valley of Seed Industry Science and Technology"[2].

2 Important role of Nanfan Base

2.1 "Accelerator" for breeding new varieties of crops Owing to unique climate resources and species resources, Nanfan Base is the largest "natural greenhouse" and "natural gene pool" in China. Agricultural researchers use such special conditions of Hainan for winter reproduction and breeding to speed up selection and breeding of new varieties[4]. As early as 1956, the researchers from Liaoning Academy of Agricultural Sciences went from the cold Northeast to warm Sanya, to carry out the breeding of corn and rice varieties, kicking off the work of Nanfan. They carry out the breeding work in local areas during spring and in Hainan during winter using the technology roadmap of "propagation in south, breeding in north". Some even breed two generations, shorten breeding cycle by half, and create a number of excellent new varieties. According to statistics, more than 80% of 5000 crop varieties promoted across the country have been bred in Hainan. It speeds up the upgrading and replacement of crop varieties, and reduces the variety replacement cycle from 10 years before the 1980s to current 5 to 7 years, which effectively promotes the development of food and agricultural production in China. According to expert estimation, it contributes about 30% to China's agricultural production, and Nanfan Base really boosts Chinese agriculture.

2.2 "Unallocated store" to ensure the varieties for agricultural production To ensure agricultural security, the priority is to ensure seed supply. Using Nanfan Base for seed production in winter to make up for deficiencies and enhance the ability of emergency regulation is an effective way to ensure the supply of varieties for production. For example, in the case of a considerable reduction in medium hybrid rice seed production in Hubei Province due to natural disasters in 2004, Hubei provincial government allocated special subsidies for seed production in Hainan, and then the seed production area was over 1733 hectares in winter and 4 million kilograms of seeds were produced, playing a crucial role in ensuring the seed supply for farmers in the province after disaster. In addition, the lack of parent population in some newly bred varieties often restricts the seed production. According to incomplete statistics, for more than 50 years, the seed production area by Nanfan has totaled 0.2 million hectares, and it has bred more than 600 million kilograms of seeds of 20 kinds of crop such as rice,

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corn, cotton and melon.

2.3 "Lightning rod" to ensure the quality and safety of seeds An important indicator to ensure seed quality is seed purity. The field planting identification is the most accurate and effective way to test whether the seed purity is up to the standard. Hainan has unique climate resources, and in winter, the field planting purity identification can be conducted on the seeds of rice, corn, cotton, vegetables and other crops to monitor seed quality conditions in advance, reduce and prevent poor quality seeds into the market, maintain market order, ensure seed supply for agricultural production and avoid the risk. Annually, all levels of seed management departments and production enterprises regard Nanfan identification as an important measure to monitor the quality of seeds. The qualification rate of hybrid rice seed purity increased from 68.1% in 1995 to 96.5% in 2014; the qualification rate of hybrid corn seed purity increased from 47.9% in 1995 to 94.3% in 2014; the qualification rate of hybrid cotton also increased from 60.5% in 1995 to 98.5% in 2014.

2.4 "Big stage" for variety and technical exchanges and cooperation For over 50 years, many agricultural research institutes and seed companies have established permanent crop breeding base in Hainan. Firstly, there are multifarious units gathering in Nanfan Base. Currently, about 700 units such as research institutes, universities, seed companies come from 29 provinces (cities, autonomous regions) to Nanfan Base all the year round. Secondly, there are many scientific research personnel. Every year, about 5000 researchers permanently stay in Nanfan Base for more than five months. Thirdly, there are many meetings related to Nanfan. Annually, there are more than 100 meetings related to Nanfan such as "863" Annual Conference, "Agricultural Innovation System" Annual Meeting, and Nanfan Association Annual Meeting, involving more than 10000 representatives participating in the conference.

2.5 "Big school" for cultivating seed industry technology talents In half a century of the history of Nanfan, more than 300000 people come to Hainan to engage in Nanfan work from the four corners of the nation. Generations of Nanfan people toil in Nanfan Base, which not only creates "Green Silicon Valley" of Chinese agriculture, but also fosters a number of well-known breeding experts and tens of thousands of agricultural science and technology workers, such as "hybrid rice father" Yuan Longping, "Shanyou 63" breeder Xie Hua'an, founder of "transgenic insect-resistant cotton" and famous cotton breeder Guo Sandui, famous corn breeder Li Denghai, "melon king" Wu Mingzhu, who have made outstanding contribution to China's agricultural development.

2.6 "Booster" for promoting local economic development Every autumn and winter, breeders and technicians from across the country gather in Nanfan Base, effectively promoting the development of local agriculture and the social economy. Tens of thousands of agricultural scientific workers from hundreds of agricultural seed research institutions in dozens of provinces, not only bring the best breed resources and most advanced science and technology, but also bring open idea and advanced management experience, playing a significant demonstration role in local agricultural and rural economic development. Over the years, Hainan's characteristic winter melons and vegetables have formed a scale, established a brand, increased farmers' income, and graced people's dining table. Currently, the melon planting area in Haitangwan Town is over 467 hectares, and the melon planting area in entire Hainan has reached more than 4000 hectares. Meanwhile, Nanfan annually leases about 6667 hectares of land, bringing direct benefits of over 100 million yuan to local areas; the Nanfan-related tourism, transport, employment and social services also create indirect economic benefits of hundreds of millions of yuan[5].

3 Main problems in Nanfan Base

3.1 Lack of overall planning Nanfan is the spontaneous behavior of independent innovation by research institutes and seed companies, so there is a messy situation in history. Since the 1960s, China has started the project construction of Nanfan Base, and has invested some financial funds, laying some foundation for the development of Nanfan. For example, in 1978, the relevant departments established "Nanfan Building" in Lingshui County; in 1996, the Ministry of Agriculture established Nanbin Base of National Nanfan Research Center, Lizhigou Seed Breeding Base, Xinfengyang Base and Anmayang Base[6]. But now it seems that with the development of modern agriculture, the original Nanfan planning can not adapt to the rapid development of current Nanfan cause, leading to disorderly development of Nanfan Base, disorderly construction, ecological damage and other issues.

3.2 Backward infrastructure Overall, the current infrastructure is backward in Nanfan which lacks necessary road, water, electricity and other basic facilities, as well as supporting public experimental platform, information exchange platform and service platform for life. According to the survey, it is found that the owning rate of development type facilities is 36% while the owning rate of advanced facilities is about 18%. More than 60% of Nanfan units and individuals urge the state to provide the Nanfan public service platform. 67% of them require the provision of standardized seed breeding base; 65% of them require the provision of common platform for scientific experiment; 64% of them require the provision of improved seed display and trading platform[7]. Poor infrastructure makes the Nanfan scientific research units difficult to carry out systematic breeding in Hainan, and most of the research work has to be conducted in the original units, limiting the research work and affecting the gathering of personnel, information and achievements in local areas.

3.3 Prominent land use contradiction According to the statistics of National Office of Nanfan, the land use area for Nanfan has been more than 6667 hectares in recent five years, while the area of Nanfan key research base built by the Ministry of Agriculture is only 600 hectares, less than 10% of the Nanfan area, and the remaining land for Nanfan is dependent on research units and seed companies to lease land from local farmers[8]. The land suit-

able for Nanfan is concentrated in Sanya, Lingshui and Ledong. Affected by the expanding winter melon and vegetable area in Hainan, occupation of land for building new high-speed road, increasing Nanfan units, rapid construction of international tourism island of Hainan and urbanization development, difficult land lease for Nanfan has become a constraint on the healthy development of Nanfan. In recent years, the average rental fee of land for Nanfan is about 18000 yuan/ha, and the rental fee of high quality land in Sanya Yacheng has reached 42000 yuan/ha. These factors greatly increase the uncertainty of land use for Nanfan, thus making the Nanfan units dare not invest in infrastructure and local farmers reluctant to maintain farmland.

4 Recommendations

4.1 Formulating and implementing national development strategies for Nanfan Nanfan is related to national agricultural development strategy and food security, so it is necessary to formulate national development strategies for the development of Nanfan[9]. Firstly, *National Planning Framework for Building Nanfan Scientific Breeding Base* being prepared should perfect the top-level design and come out as quickly as possible; secondly, the State Council should come up with the ideas to accelerate the development of modern Nanfan and promulgate *National Nanfan Law* at appropriate time; thirdly, it is necessary to establish national Nanfan protected area, and prohibit the encroachment on Nanfan Base; fourthly, the state should develop preferential policies in finance, taxation and insurance for the development of Nanfan Base, including the establishment of special funds for the modern development of Nanfan, establishment of venture capital fund for the Nanfan industry, and establishment of Nanfan Venture Joint-stock Company. It is necessary to encourage multi-channel financing, and attract national leading agricultural enterprises to become shareholders and undertake the Nanfan industrialization projects. The local government should take full advantage of Hainan's reform practice as a forerunner, make full use of favorable opportunity of the national structural tax cuts, and attract more global seed companies to register in local areas, to promote integration of production, teaching and research, enhance sharing of public research resources and push forward the combination, cooperation and restructuring of seed companies to form "World Seed Industry Headquarters Base".

4.2 Building national Nanfan Base park and solving the problem of land and supporting facilities It is necessary to rely on the government at national and local levels to achieve long-term stable use of the Nanfan land through administrative and market means[8]. Therefore, based on the overall demand of modern agricultural development on Nanfan Base, the state should provide funds to unify expropriation of land or it is recommended to lease 30 – 50 year land use rights. According to the requirements of crops on the ecological conditions and the corresponding regional geographical advantage, there is a need to enclose the land to build three national Nanfan Base parks in Sanya, Lingshui and Ledong in order to focus on solving the problem of land use for numerous Nanfan units. Meanwhile, it is necessary to make multi-stage investment in the construction of roads, and water conservancy electricity. For the land with sound infrastructure construction, it is necessary to carry out joint construction by provinces and the Ministry of Land and Resources, to build Hainan National Nanfan R & D Center, Nanfan New Variety Evaluation and Exhibition Center, Nanfan Genetically Modified Environment Safe Release and Experimental Evaluation Base, and other public R & D platforms[10].

4.3 Strengthening management and innovating upon Nanfan operation service system In order to strengthen management, it is recommended to further strengthen the functions, increase staff and confer power on the basis of National Bureau of Nanfan Management that has been established. It is necessary to implement the management, monitoring and coordination functions, and guarantee the implementation of national Nanfan strategy and various Nanfan policies in order to provide better public services for all Nanfan units. In terms of operation service of Nanfan Base, it is necessary to take the road of reform and innovation, give full play to the decisive role of market in allocating resources, and build government-led market service mechanism involving many parties. In the specific operation, Guangling Tech Industrial Company provides logistical support, production and processing and science and technology service platform for the Nanfan research institutes, and carries out various integrated social services such as entrusted management of research field farming operation and entrusted processing of seeds, which has saved a lot of manpower and financial costs, avoid duplicate construction, and reduce the waste of resources, to achieve a "win-win" situation.

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