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Analysis on the advantages on location of potato planting and its development and utilization in Northwest Hebei

Abstract: Northwest Hebei has a cool climate, loose soil, and large temperature difference between day and night. In addition, it features high altitude and dry air, which is exactly conducive to the growth of potatoes. It is the main potato producing area in northern China. It is of great practical significance to study the regional advantages of potato planting, guide the development of the potato industry, and promote the increase of farmers' income in the advantageous regions.

Key words: potato planting, advantages on location, cellaring technology

Potato is the fourth largest food crop in the world after rice, wheat and corn. It is also a food and vegetable crop. It is rich in protein, vitamins and dietary fiber. Potatoes begin to earn growing popularity among people for its rich nutrition and soft taste. Potatoes are mostly grown in barren, arid and semi-arid areas. Its planting area ranks first in the world and plays an irreplaceable role in ensuring national food security and increasing farmers' income.

The planting area of potatoes in Hebei Province in China is extensive, mainly distributed in Zhangjiakou City in the northwest of Hebei Province. Take Zhangbei County in the Bashang area of Zhangjiakou for instance, it is especially known as the "Hometown of Potatoes in North China" (Liu,2021), and the regional public brand "Zhangbei Potato" has been registered and protected by the Ministry of Agriculture's geographical indications of agricultural products. (Wang,2019)

With the increasing constraints on food production resources, potato has the characteristics of resistance on low temperature, drought and barren as well as strong adaptability, which makes its position in the national grain industry continue to improve. Under the background of "promoting potatoes to become the staple food on the table", it is of great practical significance to study the regional advantages of potato planting, and then guide the development of the potato industry and promote the income of farmers in the advantageous regions.

1. Analysis of the advantages on location of potato planting in Northwest Hebei

1.1 Analysis of natural advantages on location

1.1.1 Soil

Soil is not only the material basis for planting potatoes, but also can provide protection for the water, nutrients and necessary temperature for the growth of potatoes. Therefore, soil conditions have a very important impact on potato cultivation. Potato is a shallow-rooted crop with a small absorption range. At the same time, the growth and development of tubers requires sufficient oxygen. Therefore, it requires a high content of soil organic matter and a loose texture, preferably loam and sandy loam. (Yu) The main soils in the Bashang area of northwestern Hebei are sandy chestnut soil and meadow chestnut soil. The soil has high sand content, good air permeability, strong ability on heat absorption and dissipation, fertile soil and loose texture. The soil conditions in northwestern Hebei were favorable for the expansion of potato tubers, accumulation of starch and the formation of good appearance quality.

1.1.2 Temperature

The growth and development of potatoes requires cool climatic conditions. When the temperature is too high, both plant growth and tuber formation are inhibited. When the daily average temperature exceeds 25°C and the nighttime temperature exceeds 23°C, the formation and expansion of tubers will be inhibited. (Yu) In addition, the higher the nighttime temperature, the less favorable the tuber formation is; the larger the temperature difference between day and night, the more favorable the photosynthetic product is to the tuber. Northwest Hebei has an East Asian continental monsoon climate with large temperature difference between day and night. Its climate is cool with distinct seasons. The city's annual average temperature is -0.6 to 9.6 °C, (Ma,2010) with more in spring and summer and less in winter. Most areas of Zhangjiakou City, especially Bashang area, have a cool

climate and a large temperature difference between day and night, which is conducive to the formation of high potato yield; the relatively low temperature in summer is conducive to reducing the occurrence of potato diseases and insect pests. The above superior climatic conditions ensure the high yield of potatoes in the northwest of Hebei, as well as the quality advantages of large tubers and high starch content. The climatic conditions in the northwest of Hebei meet the temperature requirements of potatoes in each growth and development period, and are conducive to the accumulation of starch in potatoes.

1.1.3 Lighting

Potatoes are light-loving plants and belong to the long-day type. During the growth period, the sunshine time is long and the light intensity is large, which is suitable for the production of photosynthesis. The growth, plant structure and yield of potato all have higher requirements on light intensity and light duration. The growth of potato stems and leaves likes long sunshine. When the sunshine time is long and the light intensity is high, it is very beneficial to the growth, flowering and results of the stems and leaves on the ground. (Yu) The formation and development of tubers require low night temperature conditions. Northwest Hebei is rich in light energy resources. It ranks first in the province, and it is also a region with high quantity percentage in the country. It is second only to the Qinghai-Tibet Plateau and the northwest region. The total annual radiation in Zhangjiakou City is 132-146 kcal/cm². In the Bashang area, it can reach 140 kcal/cm². The annual sunshine hours of 2 600-3 100 h. (Ma,2010) can fully meet the potato's demand for light. Adequate light conditions are fit in promoting potato growth.

1.1.4 Rainfall

Water is of vital importance to plants. The main component of plants is water, for which water is used for photosynthesis and transport of nutrients to ensure plant metabolism. Potato is a water-loving crop, which is very sensitive to drought conditions due to its shallow distribution and small number of roots. (Yu) The peak precipitation period in northwestern Hebei coincides with the expansion period of potato tubers. The number of light days is annually stable in Bashang and the northern mountainous areas, with an average annual rainfall of 300-800 mm, mostly concentrated in July and August. The average altitude of Bashang area is 1 200 ~ 1 500 m, and the climate is cool, which is suitable for the growth of potatoes. (Li) Rain and heat are in the same season, and the precipitation concentration period accounts for about 70% of the annual precipitation, which is the period when potato growth requires the most water.

1.2 Analysis of humanity advantages on location

1.2.1 A long history of planting

Potato planting in Northwest Hebei has a long history. The initial potato development stage began in 1950. It has gone through multitudes of stages of cultivating, introducing new varieties, demonstrating together with promoting new technologies and comprehensively promoting the application of virus-free potatoes and other technological products. Until now, Zhangjiakou has become a major potato planting city in Hebei Province, and has a certain influence in the province and even the whole country.

1.2.2 The honor of products

The potatoes produced in Zhangbei County have high yield, and have the characteristics of good commercial effects, regular potato shape, shallow bud eyes, smooth skin, good maturity, bright color, sand sponge in the mouth, and strong potato flavor. On February 12, 2018, the former Ministry of Agriculture of the People's Republic of China officially approved the registration and protection of geographical indications of agricultural products for "Zhangbei Potato". On July 27, 2020, Zhangbei Potato was selected into the second batch of China-EU Geographical Indication Agreement Protection List. The products are exported to 10 provinces, municipalities and autonomous regions including Inner Mongolia, Shandong, Guizhou and Shanghai.

1.2.3 Technological advantages

Northwest Hebei has a number of scientific research units engaged in the breeding, production and promotion of potato varieties, such as the Hebei Provincial Institute of Alpine Crops and Hebei North University. The bred potato varieties have wide adaptability and are suitable for promotion and planting in North China, Northeast China and winter crop areas.

1.2.4 Traffic advantages

The northwestern region of Hebei has obvious geographical advantages, surrounded by Beijing-Tianjin and Bohai Sea, and has developed transportation. It is located at the intersection of the

Beijing-Tianjin-Hebei Economic Circle and the Shanxi-Hebei-Mongolia Economic Circle. The urban area of Zhangjiakou is only 180 kilometers away from the capital Beijing, 340 kilometers away from Tianjin Port, 808 kilometers of expressway and 623 kilometers of railway. The northwest region of Hebei can not only radiate the three major markets of North China, Northeast China, and Northwest my country, but also is close to Beijing. It is a logistics circle with support in the surrounding areas of Beijing, Shanxi, Hebei and Mongolia and an important node in the supply chain of the modern logistics industry in the north. In addition, the Zhangjiakou competition area of the 2022 Beijing Winter Olympics, as the main venue for snow sports, has been fully developed in terms of transportation and infrastructure construction. The advantages of geographical location and convenient transportation are favorable for the transportation and sales of potatoes.

1.2.5 Storage advantages

With the increase of potato sales capacity and the increase of staggered sales profit, the northwestern Hebei region has increased the storage capacity by building and utilizing a large number of storage warehouses and constant temperature warehouses. Through storage, the supply period of fresh potatoes can be adjusted, the processing and utilization time of processed raw potatoes can be extended, and value-added can be realized. At the same time, combined with the characteristics of the dormant period of potato pieces, they are treated with chemical reagents to form a unique cold chain storage method. The cold chain storage method effectively solves the storage loss problem of potatoes, prolongs the dormancy period of potatoes, inhibits the germination loss of potatoes, and improves the storage quality of potatoes. It has created conditions for the sustainable and healthy development of the potato industry in Northwest Hebei.

1.2.6 Development advantages of related industries

The potato industry, as one of the characteristic agricultural industries in northwestern Hebei, has a large number of leading enterprises in potato production and processing. They are engaged in the processing of potato whole flour, starch, as well as staple food noodles, steamed buns and potato vegetables, with an annual processing capacity of over 700,000 tons. Driven by enterprises such as Xuechuan Agriculture, Hongji Agriculture, and Fuxin Agriculture, (Wang,2022) the potato production and processing industry in Northwest Hebei has developed rapidly. A standardized industrial chain integrating breeding, commercial potato planting, warehousing and processing has been basically formed. With the establishment of standardized demonstration production and quality standardization, the production capacity of product processing enterprises will continue to grow and develop.

2. Current situation of potato development in Northwest Hebei

2.1 Analysis of advantages on current situation

2.1.1 The stable development scale of potato industry in northwest Hebei

Zhangjiakou City has a vast potato planting area, with a potato planting area of 76,451 hectares and an annual output of 2.28 million tons. (Wang,2022) The potato processing industry started early, with an annual processing and storage capacity of 700,000 tons. Due to the good quality of potatoes in Zhangjiakou City and good market prospects, Zhangjiakou City's potato production base has established stable supply and marketing relations with many cities and provinces across the country.

2.1.2 The reasonable variety structure

The research and development capabilities of the Research and Development Center of the Potato Agricultural Sciences Research Center are at the leading level in China. The currently planted potato varieties include Damshu series, Atlantic, Xiapodi, Zaodabai, Feiwu Ruita, Kexin No. 1 and other new and excellent varieties. (Ma,2010) It has formed a potato seed structure in which early, middle and late maturing varieties are matched, seed potato type is dominant, edible type and processing type are combined, and white, yellow, purple and other colors are matched. (Wang,2019)

2.1.3 Beneficial potato industry integration to the local area

The integration of the potato industry has made the relationship between enterprises and farmers increasingly close, and has also made great contributions to the increase of farmers' income and the development of related industries. The construction of a potato industry base has established a stable income-increasing channel for local farmers, increased jobs, which later helped farmers achieve poverty alleviation and prosperity.

2.2 Existing problems

2.2.1 Low level of industrialized production

In terms of potato planting, the planting methods of potatoes in northwestern Hebei are backward and cannot form large-scale planting; in terms of potato storage, there are irregular operation methods and unscientific storage management during storage in cellars, resulting in a high rate of potato damage

during storage ;In terms of industrial value-added, compared with more than 2,000 kinds of potato processing products in the world, (Ma,2010) the processing structure of potato products in northwest Hebei is quite single.

2.2.2 Restrictions caused by water shortage

There is a shortage of water resources in northwestern Hebei in recent years. With the rapid population growth and the development of industry and agriculture, the problems of water shortage and environmental deterioration have become increasingly prominent, which brought about the huge pressure.

2.2.3 The impact of net labor outflow on industrial development

Potato planting is a labor-intensive industry. However, with the increase of migrant workers in northwestern Hebei in recent years, labor shortages have been caused to a certain extent. How to guide correctly, make overall arrangements, and transfer effectively is the key to realizing agricultural modernization and even the stable development of rural society. It is also an important link in the formation of potato industrialization.

3. Countermeasures and suggestions

3.1 Change the current situation of low level of industrialization

It's of vital importance to establish the concept of potato industry development and change the status of low level of industrialization. To develop the potato industry in Zhangjiakou City, it is necessary to further emancipate the mind, transform people's concept and explore the establishment of agricultural cooperatives. A potato planting industry with reasonable layout, optimized planting structure and high degree of specialization is supposed to be formed. Also farmers need to rely on the modern agricultural system to improve the planting level.

Governments should standardize hoarding techniques, guide farmers to adopt standardized hoarding methods, and establish the idea of modern agriculture. Based on resource advantages, storage time should be extended and the product quality should be improved, relying on advanced technical means

and standardized operating procedures.

To optimize the industrial structure and the processing and production capacity of potato products, enterprises need to give full play to their advantages, actively introduce and research potato products, and give full play to the leading role.

3.2 Reduce the impact of water shortage

Potatoes require a lot of water throughout their lives, and good irrigation conditions can greatly increase its yields. At present, the integrated technology of water and fertilizer under film drip irrigation has been applied in potato production in Northwest Hebei, which saves water resources, reduces fertilizer application and labor costs while achieving high yield and high efficiency of potatoes. In addition, by reducing the planting area of varieties that consume more water, promote water conservation of varieties, and reduce the impact of water shortages by means of water localization and quantitative guarantee of reasonable planting areas and planting areas.

3.3 Pay attention to the development of the potato industry and retain the rural labor force

Zhangjiakou City is the main potato producing area in northern my country. At present, there are more than 660,000 farmers planting potatoes in the city. In the dominant potato producing area in the Bashang area, the average contribution rate of potatoes to the income of growers reaches 38%, (Ma,2018) which plays an important role in the rural economy of the city. Exploring the way to retain rural labor force and get rid of poverty by relying on the development of the potato industry will play an part in the development of Zhangjiakou's characteristic agricultural industry and poverty alleviation work. The paramount existing problem of encouraging farmers to play a role in the development of potato industry is how to guarantee that in an effective way. Governments are supposed to provide services well during this process, building a benefits-sharing mechanism between managers and farmers. For the sake of mobilizing the farmers, it is considered that farmers should participate in the industrial complex as agricultural workers rather than as operators, without bearing market risks.

3.4 Strengthen product publicity and enhance market influence

With the utilization of the Internet, newspapers, television and other media, the potato industry in Zhangjiakou as well as product promotion can be strengthened while product popularity and market influence can be enhanced. In addition, it's necessary to attach importance to actively exploring and promoting the integrated development of potato industry and tourism. As the host city of the 2022 Winter Olympics snow sports, Zhangjiakou has brought a rare opportunity for the development of urban tourism. As a part of the characteristic agriculture and animal husbandry industry in Zhangjiakou, the potato industry can further expand domestic and international markets with the help of expositions, tourism festivals and other activities.

3.5 Strengthen the construction of intelligent platform for production and sales

Energetically exploring and promoting the application of new technologies in potato production, storage, and sales is essential, for instance, the Internet of Things, mobile Internet, and big data. Moreover, it's crucial to promote the collection of data on resources, environment, production process and circulation. Carrying out analysis of production capacity along with market data contributes to the improvement of potato production and product safety. The goal of leading the balanced development of potato industry structure can be achieved through the construction of smart platform.

The COVID-19 outbreak in 2020 promoted the development of digital economy in China and made digital agricultural products e-commerce blowout type development, by taking advantage of which the potato industry can be extended. E-commerce can well solve the contradiction between "small farmers and big market" in China's agriculture, and realize the connection between agricultural production and market demand. However, the current development status of online marketing of agricultural products generally has problems such as lack of brand awareness, closed information, and scattered resources. Therefore, in the construction of the potato e-commerce sales system, it is necessary to focus on establishing quality and brand awareness. As an ordinary farmer participating in e-commerce sales, first of all, we must attach importance to standardized production and strictly control quality, and secondly, we must actively participate in vocational training and become professional farmers, making e-commerce healthy and sustainable in the sales of agricultural products such as potatoes.

The experience of agricultural industrialization in various countries shows that the government plays an important role in agricultural industrialization. In recent years, Zhangjiakou Municipal Government has actively promoted the integrated development of the potato industry and provided policy support for industrial integration. As the government further improves the investment and

financing environment of the potato industry, provides support in corporate credit, taxation, etc., as well as strengthens the construction of agricultural science and technology, market information, etc., and improves the degree of farmers' organization, Zhangjiakou's potato industry will develop soundly and become a source of poverty alleviation. The pillar industry of getting rich.

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