

Analysis on the Causes Affecting Vegetable Prices and Sales and Counter-measure Suggestions

Fantao Kong¹, Mengshuai Zhu¹, Jing Zhang¹, Hongyu Zhang¹, Jianzhai Wu^{1,a,*}

¹*Agricultural Information Institute, Chinese Academy of Agricultural Sciences/ Key Laboratory of Agricultural Big Data, Ministry of Agriculture and Rural Affairs, Beijing, 100081, China*
a. *wu-jianzhai@caas.cn*

**corresponding author: Jianzhai Wu*

Keywords: Vegetables, price fluctuation, planting expansion, cost.

Abstract: Vegetable industry, as an important source of income for rural residents in China, is not only related to the actual income of farmers, but also to the living standards of city residents. It is an important part of China's rural economy. In recent years, the vegetable industry has shown obvious comparative advantages in the process of structural reform on the agricultural supply side, storming of the uphill part of alleviating poverty and promoting the implementation of the Rural Revitalization strategy, so the vegetable planting area in many areas has been significantly increased. The rise of labor costs has also boosted the planting area of vegetable production, which is regarded as saving labor. Vegetable regional and structural differences between supply and demand are big, and long-distance trans-regional transportation leads to increased circulation costs and market fluctuation risks. On this basis, it is proposed to continue to improve the mechanism and informatization level of vegetable industry, strengthen the building of vegetable production capacity, improve vegetable commercialization treatment, and promote standardization of in-field market. Such counter-measures as stable planting and supply regulation, strengthening building of "vegetable-basket project", improving the dietary and nutritional structure of urban and rural residents, and promoting the upgrading of vegetable consumptions, etc. are hereby suggested, in all efforts to remove any possible violent fluctuation of vegetable prices.

1. Introduction

In recent years, with the continuous improvement of living standards, urban and rural residents in China pay more and more attention to dietary nutrition; therefore great changes have taken place in dietary structure. Vegetables account for more and more of the residents' living consumptions. In the meantime, the quality requirements of vegetable consumption are constantly improving. Vegetable yield is increasing quickly [1], and there are more and more varieties [2]. Over the years, the central and local governments have promulgated a series of vegetable industry development planning, management regulations, documents and guidance related to the docking of agriculture and supermarket, production and marketing, planting subsidies, price insurance and other aspects, which ensure the smooth development of the vegetable industry. Vegetable industry plays an increasingly

important role in the process of structural reform of agricultural supply side, storming of the difficult part of alleviating poverty and promoting the implementation of rural revitalization strategy.

Vegetables are not only an important source of income for vegetable farmers, but also a necessity for city residents to meet their nutritional requirements. The stability of vegetable price is not only related to the security of agricultural production and the stability of farmers' income, but also directly related to the daily life of residents. It is of great significance to the stable development of the whole national economy [3]. Under the market economy system, the normal fluctuation of vegetable price is the inevitable manifestation of the law of vegetable market operation [4]. Vegetable prices can regulate the supply and demand of vegetables to a certain extent, in an attempt to achieve a balance between supply and demand in the market. But frequent and violent price fluctuations will not only not regulate the market, but also bring adverse impact on the market, thus affecting the income of vegetable farmers and the lives of residents. In recent years, China's vegetable prices have fluctuated dramatically over and over again, and even appeared the paradox of "expensive to buy vegetables, difficult to sell vegetables", which has quickly become the focus of attention of the media, society and the government.

The Department of Market and Informatization carried out researches in six provinces and municipality including Hainan, Hunan, Beijing, Hebei, Liaoning and Shandong, through active cooperation with the Development and Reform Commission and other departments, organizing early warning team of vegetable information analysis in the whole industry chain and relevant experts of the Institute of Agricultural Information of the Chinese Academy of Agricultural Sciences, while doing well in the analysis of vegetable market situation and supply guarantee. By investigating and analyzing the new trend of vegetable industry in recent years, the factors affecting vegetable planting are obtained, and the strategies for the stable development of vegetable market are put forward, which can effectively guide vegetable production, guide vegetable circulation, stabilize the price of vegetable market, alleviate the fluctuation of vegetable price, and safeguard the common interests of vegetable farmers and urban and rural residents.

2. New Trends of Vegetable Industry in Recent Years

In recent years, the vegetable industry has shown obvious comparative advantages in the process of structural reform on the agricultural supply side, storming of difficult part of alleviating poverty and promoting the implementation of the rural revitalization strategy, so the vegetable planting area in many areas has been significantly increased.

2.1. Total Vegetable Supply Volume Increases Significantly in the Planting Structure

In 2017, the vegetable planting area, total output and unit yield of different regions reached 300 million mu (1 mu is approximate 666.67 sq. m.), 690 million tons and 2.3 tons per mu respectively, and increased by 2.9%, 3.9% and 1.0% annually in recent 10 years. Among them, the main measures to adjust the planting structure in Hebei Province are to reduce corn, cotton, stabilize wheat and increase vegetable planting areas. In 2018, the vegetable planting area in Hebei Province was 12.9218 million mu, an increase of 5.1% over the previous year. In order to accomplish the task of storming of difficult part of alleviating poverty, Hebei Province, on the premise of maintaining the basic stability of vegetable area in the plain "old vegetable areas", has increased the vegetable production facilities of poverty alleviation projects by 20-30%, in particular, Fuping, Yixian, Longhua, Chongli, Wanquan and Luanping counties developed facility vegetables as the focus of industrial poverty alleviation by promoting edible fungi of mushroom as dominant sector. Under the circumstance of low income of rice planting, Hunan Province implemented the policy of cutting

down double-cropping rice, expanding single-cropping rice and increasing one-cropping vegetables, thus the planting area of some vegetables was expanded significantly.

2.2. Regional and Structural Differences between Vegetable Supply and Demand Increase

With the adjustment of planting structure, vegetable production capacity gradually concentrates in the six dominant areas. The output in western region has grown rapidly, with an average annual growth rate of 8% in the past 10 years, which is 4.1 percentage points higher than the national average growth rate. "Moving western vegetables to the east" has become a useful complement to "moving southern vegetables to the north" and "moving northern vegetable to the south", and regional differences increased. Long-distance trans-regional transportation has increased the cost of vegetable circulation and the risk of market fluctuations. For example, from Shouguang in-field Markets in Shandong Province to Beijing Markets, the cost of fuel and driver fee alone accounts for about 10% of the retail price of vegetable terminal. In recent years, the income of grain planting has declined. According to estimates, the average cost-return rate of vegetables in 2016 is 49.8%, which is much higher than that of grain-7.3%, oil-2.6%, sugarcane-18.3%, and apple-16.6%, etc.

2.3. Co-existence of Unsalable Vegetables and Vegetables with High Quality and Price

Such case occurs over and over again as structural differences between supply and demand lead to more difficulties for common vegetables to sale. Since the winter of 2017, the weather has been generally good throughout the country, and the light, water and heat conditions match well, which is very conducive to the growth and development of vegetables. Vegetable in-filed area, unit yield and total yield in the six vegetable dominant areas have increased steadily. The Hainan Island, as the "vegetable basket" of moving southern vegetable to the north in winter and spring seasons, the price of winter and spring melon and vegetable has shown that the price starts low and rise slowly which is different from that of the previous period rapid rise since the marketing of winter and spring melons and vegetables. In addition to the reasons for its higher output, the run-in of market share of facility vegetables from the north is also an important reason why it is difficult to sell for winter and spring vegetables of Hainan Island. In the meantime, many regions regard vegetable industry as an important industry revitalizing agriculture with quality, and green sector. They pay close attention to characteristics, high-quality, green and brand vegetables. In comparison, such characteristic and high-quality vegetables are sold steadily and well.

3. Analysis of the Deep-rooted Reasons for the Expansion of Vegetable Planting Area

3.1. Supply-side Structural Reforms Have Made Vegetables an Important Species for Increasing Planting Area

Since 2017, the structural reform of agricultural supply side has been promoted nationwide. Governments at all levels have deployed agricultural and rural crop cultivation in an all-round way, guided by market information, rooted by innovative reform and aimed at balancing supply and demand of agricultural products. In the process of planting sector reform, one of the key tasks is to reduce the planting area of corn, rice and other large grain crops, and increase the planting area of soybean, small coarse cereals, potatoes, fruits and other characteristic crops. In this process, many regions choose to increase vegetable planting area to promote the structural change of rural planting industry.

3.2. Storming of the Difficult Part of Alleviating Poverty in Rural Areas Makes Vegetables an Important Mean to Increase Income of Rural Poverty-stricken Families

Industrial development is the fundamental policy to achieve poverty alleviation. Vegetable cultivation, with its good comparative advantages, has become a breakthrough for many regions to tackle the difficulties of overcoming poverty. The development of vegetable industry has become an important means to increase the income of the poor. In recent years, with the decline of the income from grain planting, some farmers in big grain-growing counties began to plant more efficient vegetables with higher comparative benefits. However, due to the variety of vegetables, vegetable farmers' production decisions mainly take into account vegetable prices in the same period of last year's and current prices, of which mode is regarded blind decision-making one, i.e. "planting those they think expensive", which usually result in "what they plant becomes cheap", resulting in increased supply of common vegetables, while increasing the risks of price fluctuations.

3.3. The Implementation of Rural Revitalization Strategy Makes Vegetable Planting an Important Choice for the Revitalization of Agricultural Industry

For the implementation strategy of rural revitalization, industrial prosperity is not only the key but also the difficult point. Many regions regard vegetable as an important industry of revitalizing agriculture with quality and greens, and begin to develop characteristic, high quality, green and brand vegetables. Liaoning Province allocated nearly 600 million Yuan of funds in 2017 to support the development of agricultural industry focusing on the adjustment of planting structure, adding 51,000 hectares of vegetable-efficient cash crops, and continued to provide financial support in 2018 to increase the total output of facility vegetables by more than 600,000 tons. The total output value of vegetable industry in Hunan Province reached 169.2 billion Yuan in 2017, accounting for half of the output value of planting industry; in the 4th quarter of 2018, the vegetable areas of both small arch shed, and large and medium-sized sheds increased significantly, and the vegetable sowing in greenhouses increased by 9.7% year on year, 80% of which were leafy vegetables, eggplants and fruits, melons, legumes, rootstocks, cauliflower and so on.

4. Cost Factors Affecting Vegetable Planting

The type, variety and number of vegetable planting are determined by local resource endowment, market expectation, planting customs and benefit-driven factors, etc. However, with the increase of labor cost, some vegetable, regarded as saving labor cost, such as Chinese cabbage and radish, etc. become the planting intention for vegetable farmers.

4.1. In Terms of Cost Composition, Labor Cost Accounts for the Largest Proportion of Total Vegetable Cost

Rising labor costs and declining demographic dividends are two major social problems facing China. Labor cost is the main factor for vegetable farmers to choose vegetable varieties. According to survey, the total cost of vegetable cultivation in 14 major cities has increased by 145% since 2008, among which material and service costs, labor costs and land costs increased by 69%, 250% and 96% respectively. Vegetable production, processing and circulation in the whole industrial chain are all labor-intensive industries. The survey shows that most of the labor costs of vegetables account for over 50% of the total cost (excluding land rental cost), and show a rising trend. In Feicheng City of Shandong Province, 100 Yuan of fertilizer, 100 Yuan of watering and 60-70 Yuan of pesticides are put into the cultivation of Chinese cabbage per mu, and 400 Yuan of labor cost input is

calculated according to 10 cents per kg. Without calculating land rent, the total cost per mu is 660-670 Yuan, of which the labor cost accounts for over 60%. Moreover, data from Liaoning Province show that labor cost accounts for 83.26% of total production cost.

4.2. Viewing from the Field Management, the Continuous Rise in Labor Costs Has Resulted in the Abandonment of Some Vegetables

Whether vegetable farmers abandon their crops or not is generally determined not by the cost of planting, but by the comparison of the cost of harvesting labor and in-field purchase price. When the labor cost of vegetable harvest is higher than in-field purchase price, the phenomenon of discarding the harvest often occurs; when the labor cost of harvest is lower than in-field purchase price, the enthusiasm of vegetable farmers for harvesting and selling will rise. Tan Liyang and Li Hongyao, from Dingcheng Town, Ding'an County, Hainan Province, introduced that the labor cost of screw-pepper harvesting is 80-100 Yuan per person per day, equivalent to about 0.6 Yuan per kilogram. The in-field purchase price was 0.6 Yuan at the time when we did survey, and it was only purchased on order. As a result, the screw pepper in some vegetable fields was discarded, some pepper was getting from green to red, and still no one picks it; For five-colored pepper, costs per mu, sprout 500 Yuan, land rent 1,000 Yuan, pesticide 500 Yuan, fertilizer 1,600 Yuan, racks 100 Yuan, planting costs of 3.0 Yuan per kilogram, when in good marketing before, each family income was 100,000 Yuan, but now it just meets the cost. Wang Huangzhi, from Yacheng Village Committee in Yazhou District, Sanya City, said that labor cost of vegetable planting was 100-120 Yuan per person per day and green pepper picking costs about 0.7 Yuan per kilogram, but now in-field purchase price is less than 1.3/1.4 Yuan per kilogram. If the price falls further, it will be discarded and not be picked in the field.

4.3. From the Perspective of Planting Desire, More and More Farmers Choose to Grow Vegetable with Less Labor

Although the price of vegetable planting labor varies from region to region and from type to type of work, it is about 100 Yuan per day. With the rise of labor price, more and more vegetable producers are inclined to choose leaf vegetables, rootstocks and other vegetables with less labor, while the area of eggplants and fruits that need to be planted irregularly, trained and pruned, and pollinated by shaking flowers, as well as the area of gourds and beans that need to be grafted, pollinated, hanging vines and so on, has been reduced. Hunan Province in 2018, the area of six kinds of vegetables, cauliflower, broccoli, bitter melon, towel melon, water spinach and taro increased considerably by more than 7% year-on-year, of which taro area was 221,500 mu, the largest increase 12.25%. In 2018, the planting area of Chinese cabbage, radish and other vegetables with less labor in Hebei Province increased greatly. Changguo Town, Huanghua City implemented the "order planting" model, actively guided farmers to develop white radish planting, with an area of more than 9,000 mu. Yutian County adopted the production and marketing integration model of "cooperative + farmer + market", vigorously developed radish cultivation, with planting area around 25,000 mu.

5.1. Vegetable Production Layout Should be Optimized and Market Effective Supply of High Quality Vegetables Should be Ensured

The mayor responsibility system of "vegetable-basket" in large and medium-sized cities should be further optimized. The layout of vegetable production should be improved. The self-sufficiency rate of "vegetable basket" products should be enhanced. The vegetable planting area in suburbs should be stabilized and increased. And the minimum amount of vegetable field should be determined for

all years through scientific planning. A catalogue system for regulating basic vegetable varieties should be established. Common varieties consumed by local residents and leafy vegetable varieties that are not durable for storage and transportation should be included in the catalogue of basic vegetable varieties. In accordance with the advantages of location, technology and market, focalized measures should be taken to focus on developing the production of basic vegetable varieties. The reasonable dimension of vegetable supply and demand radius should be studied and determined to ensure that vegetable supply should be on staggered peak marketing, seamless connection of "origin conversion" and "vegetables consumption in accordance with latitude". Priority should be given to support the development of high-quality characteristic vegetables. The construction of balanced vegetable supply facilities should be supported with attention. The level of integration of vegetable production and the tertiary industry production should be improved. The development of vegetable products should be accelerated and upgraded to middle and high-end. The strategy of vegetable brand development should be implemented. And the market differentiated needs and effective supply of high-quality vegetables should also be met.

5.2. Modernization Level of Vegetable Industry Should be Promoted. And the Building of Vegetable Production Capacity Should be Strengthened

In view of the labor-intensive nature of the vegetable industry, aiming at the problem orientation that the proportion of labor costs is relatively large and showing an upward trend, we should seize the historical development opportunities with AI, Internet of Things, big data and smart agriculture as the important contents, and further support for innovation and development of intelligent equipment of vegetable sowing, irrigation, fertilization, pesticide, picking, processing, refrigeration and fresh preservation in each link, reduce labor demand, expand use of machinery and equipment, and improve the contribution rate of information technology. Pilot demonstration of vegetable can be carried out, such as adding intelligent control equipment to vegetable facilities, integrated irrigation of water and fertilizer, application of pesticides by UAV, robotic picking, whole-course cold chain transportation, whole-course monitoring of the Internet of Things, intelligent decision-making of field management, prediction and early warning of pests and diseases, with all these means and efforts to improve the level of China's mechanization, intelligence and informatization comprehensively.

5.3. Building of Vegetable in-Field Market Should be Accelerated and the Standardization Development of Vegetable Industry Should be Promoted

Around the key counties of vegetable industry, especially the predominant areas of characteristic agricultural products, we should speed up building of vegetable in-field market, increase investment in commercial treatment facilities for in-field vegetables, implement grading, classing, cleaning, packaging and pre-cooling treatment in vegetable production origins, improve infrastructure of "the first kilometer" in an effort to realize "vegetable is clean when in cities". We also should continue to promote the "order vegetables" system, improve the interest convergence mechanism mode of "company + base", "company + farmer + base", "company + cooperative + farmer" and so on, to prevent the risks of vegetable abandonment. We should promote building of vegetable cold-chain logistics, and bring commodity processing equipment and cold-chain logistics equipment from agricultural production origins into the scope of agricultural machinery subsidies. We should promote the standardization and normalization of vegetable industry planting, production and circulation, reduce vegetables loss rate so as to safeguard the economic interests of vegetable growers in the vegetable industry chain.

5.4. Nutritional Structure of Urban and Rural Residents Should be Improved and Upgrading of Vegetable Consumption Should be Promoted

In 2018, China's GDP reached 90.03 trillion Yuan, an increase of 6.6% year-on-year; the Engel's coefficient was 28.4%, a decrease of 0.93 percentage points year-on-year; the consumption patterns was transforming, converting and upgrading, which laid a solid foundation for the transformation and upgrading of the entire national economy and for high-quality development. According to the Chinese Dietary Guidelines, the recommended daily intake of vegetables for a normal adult is 300-500 gram per person per day, but the deficiency of some nutrients such as calcium, iron, vitamin A and D still exists. Experts recommend that each adult should take "250g fruit and 500g vegetables" per day. The nutrition of various fruits and vegetables is of own characteristics, cannot replace each other, therefore the diversity of types and combinations should be emphasized. In recent years, China's vegetable consumption has been generally stable. In 2016, China's per capita vegetable consumption was 1.6 kg/day, far exceeding the reasonable intake of 0.5 kg/day, which was 3.4 times the world average level. Therefore, in the future, we should comply with the general trend of economic and social development, actively guide urban and rural residents to mix vegetable varieties with reasonable nutrition, increase vegetable intake, optimize dietary structure, and promote the upgrading of vegetable consumptions.

6. Conclusions

Vegetable production is the main part of agricultural production, an important source of farmers' income, a key industry of fighting the difficult part of alleviating poverty or support poverty lift. It is also the main non-staple food consumed by urban and rural residents. Only by guaranteeing the overall stability of vegetable supply and prices can the interests of both growers and consumers be taken into account.

Acknowledgments

This work was financially supported by National Natural Science Foundation of China (71573263).

References

- [1] Expert Committee on Market Early Warning of the Ministry of Agriculture: *Prospect Report on China's Agriculture (2017-2026)* [M]. Beijing: China Agricultural Science and Technology Press, P88, 2017.
- [2] Gu Pinqiang, Xu Huadong: *Vegetable Seed Introduction and Expansion should be given Attention to Climate Demonstration and Extreme Climate Influence* [J].*Shanghai Vegetables*, P27-28, 2004 (4).
- [3] Notice on Issuing National Key Regional Development Plan for Facility Vegetables (2015-2020) by the Ministry of Agriculture, the General Office of the Ministry of Agriculture [EB/OL].(Feb. 16, 2015)[Jan. 4, 2018].
- [4] An Yufa: *Analysis on price fluctuation in the wholesale markets of vegetable producing areas* [J].*Issues in Agricultural Economy*, P51-53, 1996(11).