Foxtail Millet Planting Willingness of Farmers in North China Based on Analysis of SPSS Statistical Data

Jinjun MA[1,2,3]*, **Huijun WANG**[1]

1. Hebei Academy of Agriculture and Forestry Sciences, Shijiazhuang 050035, China; 2. Hebei University of Science and Technology, Shijiazhuang 050018, China; 3. Postdoctoral Station of Northeast Agricultural University, Harbin 150030, China

Abstract Based on the field survey of the foxtail millet planting, processing and sales in foxtail millet production areas, it found out basic demands of foxtail millet farmers and processing enterprises for policies. It made statistical analysis with the aid of SPSS statistical software. It found that current situation of China's foxtail millet industry is not optimistic. Finally, it came up with policy recommendations including enhancing actual effect of policy, establishing special fund, increasing scientific and technological support, and encouraging mechanized planting.
Key words Foxtail millet, Planting willingness, Influence factors, SPSS statistics

1 Introduction

Foxtail millet (*Setaria italica*) is widely planted in North China. In the Neolithic Age, there was foxtail millet planting in China. From the foxtail millet planting, it also derived the long-standing foxtail millet culture. It can be said that the foxtail millet has cultured generation upon generation of descendants of the Yellow. The foxtail millet has diversified nutrition composition, has function of replenishing qi and enriching the blood, and can be stored for a long time. Thus, it can be used as strategic reserve crop for tackling the arid climate. It plays an important role in alleviating grain crisis. However, with constant development of China's market economy, the foxtail millet planting, sales and market are faced with serious problems, and the foxtail millet has become coarse grain crop and dietary supplement. In this situation, most farmers are unwilling to plant foxtail millet, leading to drop of foxtail millet planting area year after year. In view of these, the study on factors influencing farmers' willingness to plant the foxtail millet becomes urgent, and analysis on effective approaches for revitalizing vigorous development of the foxtail millet industry plays an important role in promoting increase of farmers' income and ensuring national grain security.

2 General situation of questionnaire

To realize rapid and sound development of the foxtail millet industry in North China and deeply understand current development situation of the foxtail millet in major production areas, we made many times of surveys in two years and visited major foxtail millet production areas in North China mainly through issuing questionnaire copies and individual interview of foxtail millet planting households, specialized farmers cooperatives, and agricultural enterprises. We designed two sets of questionnaire, namely the overall evaluation questionnaire and influence factor questionnaire. Each set of questionnaire includes 150 copies. We received 136 copies of overall evaluation questionnaire (125 copies are valid the response rate is up to 91.9%); we received 123 copies of the influence factor questionnaire (116 copies are valid and the response rate is up to 94.3%). Combining questionnaire and site survey, we analyzed factors influencing willingness of farmers planting the foxtail millet with the aid of SPSS statistical software. On this basis, we came up with recommendations for adjusting and optimizing the foxtail millet industry.

3 Analysis of major survey and statistical results

3.1 Analysis of the importance perception From analysis of 125 copies of overall evaluation questionnaire, we found that there are differences in importance perception for evaluation criteria of foxtail millet planting in the coming year due to difference of age and life experience.

Among all foxtail millet planting households interviewed, 52 people are younger than 40 and their rank of importance of evaluation criteria for the foxtail millet planning in the coming year is the estimated yield, purchasing price, sales channels, seed grain performance, input of production factors, state policies, and geologic condition, indicating that the closest attention to estimated yield and purchasing price. 73 people are 41 years old or older and their rank of importance of evaluation criteria for the foxtail millet planning in the coming year is the sales channels, input of production factors, seed grain performance, purchasing price, estimated yield, state policies, and geologic condition, indicating the closet attention to sales channels and input of production factors. Through comparing the above two groups, we found that the second group is slightly conservative: they firstly consider return and then focus on input of production factors. The first group is rela-

tively positive and optimistic and they focus on the estimated yield and purchasing price, expect better results and pay little attention to input of production factors. Besides, foxtail millet farmers 41 years old and older pay close attention to performance of seed grain, such as disease and pest resistance, and lodging resistance because the performance will directly influence the yield and qual-ity of foxtail millet, and ultimately influence their income. Farmers 40 years old and younger are adventurous. They think that the seed grain is reserved last year. With many years of experience, the seed grain itself will not go wrong. What's more, farmers are already familiar with special property of foxtail millet and have grasped the solution experience in case of problems.

Table 1 Statistics of the importance perception for foxtail millet planting evaluation criteria

Evaluation items	40 years old and younger (N = 52)			41 years old and older (N = 73)		
	Rank of importance	Mean value	Standard deviation	Rank of importance	Mean value	Standard deviation
A. Estimated yield	1	6.42	0.750	5	2.56	1.125
B. Seed grain performance	4	4.10	1.785	3	5.55	1.053
C. Geologic condition	7	2.06	0.802	7	1.58	0.730
D. Purchasing price	2	5.98	0.754	4	3.59	0.849
E. Input of production factors	5	2.58	1.513	2	5.95	0.653
F. State policies	6	2.25	0.860	6	2.53	0.872
G. Sales channels	3	4.77	0.962	1	6.39	0.681

From analysis on factors influencing their decision of planting foxtail millet, 73.6% stated that they considered decision of others, *i.e.* 92 out of 125 farmers consider planting decision of others. This means that more than 2/3 farmers fail to make decisions on their own and further provides that farmers have weak awareness of scientific planting and have high conformist mentality. Just following others will avoid many unnecessary troubles. For example, it is unnecessary to consider sales problem. All farmers planting the foxtail millet together will generate the scale effect. This is good. However, most farmers just plant the foxtail millet separately. In this situation, it is recommended to encourage them to establish planting cooperatives. Besides, only 15.2% farmers selected climate condition, indicating that farmers have weak scientific planting awareness when selecting planting crops, seldom consider climate adaptation of crops. The foxtail millet is a common crop planted by farmers. Due to low yield, unlike cash crops such as apple and pear, the foxtail millet farmers will not focus on whether local climate condition is suitable for planting the foxtail millet.

The overall analysis indicates that farmers pay closest attention to sales channels because smooth selling is the most essential factor for realizing their objective of getting rich. Nevertheless, selling of the foxtail millet puzzles farmers all the time. Since the foxtail millet is beyond the scope of the national reserve grain, local areas are not enthusiastic in purchasing the foxtail millet. As a result, much foxtail millet fails to be sold and is just directly consumed by farmers and a great portion is used as feed, which greatly reduces commodity rate of the foxtail millet. For example, in Dajikou Village of Dangba Town in Pingquan County of Chengde City, the average yield of foxtail millet is only 262.5 kg, and the lowest yield is only 77.5 kg. What's worse, the foxtail millet farmers have weak scientific planting awareness. They plant the foxtail millet relying on their experience without scientific and technological support.

3.2 Analysis on policy satisfaction perception The Likert Scale is invented by American psychologist Rensis Likert in 1932. It includes 5 levels of attitude: strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree. In this study, we employed Likert Scales to design the questionnaire, to analyze factors influencing farmers' foxtail millet planting willingness. As for the perception in satisfaction of the present state agricultural policies, the average score is 4.464 and the overall satisfaction percentage is 86.6%, indicating that foxtail millet farmers are highly satisfied at agricultural policies. The average score is 1.928 for perception in satisfaction of present state foxtail millet planting policies, and the overall satisfaction percentage is 23.2%, showing relatively low satisfaction of the state foxtail millet planting policies. In-depth interview and survey show that major reason is close attention of the state to agriculture. China has taken a series of support measures, including dismantling agricultural tax, paying seed subsidy and agricultural machinery subsidy, which summons up enthusiasm for planting the foxtail millet.

The state provides subsidy for major grain crops, such as rice, corn and wheat (the subsidy amount reaches 100 yuan/mu, including direct subsidy and comprehensive subsidy). However, the foxtail millet is not included. This will inevitably influence enthusiasm of the foxtail millet farmers. China launched the fine seed popularization subsidy for corn mainly in Inner Mongolia, Liaoning, Jilin, Heilongjiang, Hebei, and Henan. Common advantages of these regions are excellent foundation of development of the animal husbandry, high capability of fine and deep processing of corn, and large corn planting area. The *Project for Implementation of Subsidies for Growing Improved Varieties* funded by the central budget in 2012 adds peanut in Hebei, Liaoning and Jilin apart from rice, wheat, corn, and cotton, soybean, rape, and highland barley. However, the foxtail millet is not included in this scope. Compared with peanut, the foxtail millet industry lags behind in deep processing and product development, its industrialization level is low, industrial chain is short, and product added value is low. To bring the foxtail millet into the scope of the improved seed

subsidy, it is required to constantly increase input of industrial technologies and capitals, increase yield, improve the quality through new variety development, extend the industrial chain through market development, and raise the competitive advantage of the foxtail millet industry.

3.3 Analysis on influence factors and effect

3.3.1 Analysis of influence factors. On the basis of the above analysis and interview results, we determined 8 factors influencing farmers' planting the foxtail millet: preferential policy, financial support, unified planning of planting, guidance of scientific and technological personnel, planting cooperatives, industrial follow-up processing, mechanized planting, and prevention and control of plant diseases and pests. Then, we designed the influence factor questionnaire to make SPSS statistical analysis on the influence effect.

Table 2 Predicted variables and criterion variables

Variables	Foxtail millet planting volume	Preferential policies	Financial support	Unified planning of planting	Guidance of scientific and technological personnel	Mechanized planting	Prevention and control of plant diseases and pests	Planting cooperatives	Industrial follow-up processing
Foxtail millet planting volume	1								
Preferential policies	0.514	1							
Financial support	0.669	0.764	1						
Unified planning of planting	0.406	0.637	0.631	1					
Guidance of scientific and technological personnel	0.445	0.544	0.528	0.407	1				
Mechanized planting	0.725	0.616	0.746	0.553	0.55	1			
Prevention and control of plant diseases and pests	0.247	0.435	0.357	0.488	0.401	0.325	1		
Planting cooperatives	0.666	0.667	0.663	0.5	0.441	0.637	0.321	1	
Industrial follow-up processing	0.588	0.56	0.517	0.337	0.474	0.529	0.257	0.667	1

From Table 2, it can be seen that 8 predicted variables have significant positive correlation ($P < 0.001$), and the correlation coefficient is in the range of $0.257 - 0.764$ (no value is higher than 0.8). The correlation between two independent variables, "Preferential policies" and "financial support", is 0.764, indicating possible collinear problem. Between 8 predicted variables and criterion variables, there is significant positive correlation (only one P value is 0.004, and the rest 7 P values are lower than 0.001). The correlation coefficient of mechanized planting is 0.725, indicating high correlation with the criterion variable. The correlation coefficient with preferential policy, financial support, unified planning of planting, guidance of scientific and technological personnel, planting cooperatives, and industrial follow-up processing is in the range of 0.406 to 0.669, indicating moderate correlation with the criterion variable; the correlation coefficient with prevention and control of plant diseases and pests is 0.247, indicating low correlation with the criterion variable. High correlation between mechanized planting and planting volume indicates that high planting volume will bring higher mechanization level. In other words, mechanization level determines the planting volume. Further analysis on low correlation between prevention and control of plant diseases and pests and the planting volume shows that re-

spondents have high opinion to the predicted variable. There is no significant change due to change of planting volume, mainly because they care about prevention and control of plant diseases and pests no matter how much they plant. It ultimately determines their labor results and income of the whole year.

3.3.2 Analysis of influence effect. Analysis results indicate that the multiple correlation coefficient is 0.800 between 8 predicted variables and criterion variable. The coefficient of determination (R^2) is 0.640. The regulated R^2 is 0.613 and the estimated standard error is 6.284. Since there is only a regression model in the forced entry variable method, the regulated R^2 variable is equal to statistics of R^2 0.640, indicating that 8 predicted variables can explain 64.0% variation of the foxtail millet criterion variable.

The regression coefficient of predicted variables is listed in Table 3. From Table 3, it can be known that in 8 independent variables, the regression coefficient of financial support, mechanized planting, planting cooperatives, and industrial follow-up development is significant. The significance test value of t reaches $2.647(p = 0.009 < 0.05)$, $4.220(p < 0.001)$, $2.668(p = 0.009 < 0.05)$, and $2.214(p = 0.029 < 0.05)$ respectively.

Table 3 Regression coefficient and significance test results of predicted variables

Variables	Non-standardized coefficient		Standardized coefficient	*t*	Sig.	Collinear statistics	
	B	Standard error	Trial edition			Tolerance	VIF
(Constant)	−3.613	2.827		−1.278	0.204		
Preferential policies	−0.745	0.426	−0.181	−1.749	0.083	0.313	3.196
Financial support	1.254	0.474	0.292	2.647	0.009	0.277	3.611
Unified planning of planting	−0.317	0.375	−0.071	−0.845	0.4	0.477	2.096
Guidance of scientific and technological personnel	0.007	0.349	0.002	0.02	0.984	0.579	1.726
Mechanized planting	1.879	0.445	0.401	4.22	0	0.372	2.686
Prevention and control of plant diseases and pests	−0.014	0.471	−0.002	−0.031	0.976	0.7	1.428
Planting cooperatives	0.925	0.347	0.252	2.668	0.009	0.378	2.643
Industrial follow-up processing	0.833	0.376	0.183	2.214	0.029	0.495	2.021

According to data in Table 3, we can obtain following regression equation:

The foxtail millet planting volume = −3.613 + 1.254 × financial support + 1.879 × mechanized planting + 0.925 × planting cooperatives + 0.833 × industrial follow-up development Using this regression equation, we can estimate the predicted value and predict the foxtail millet planting volume of the coming year under the influence of the predicted variables. From the regression equation, we can see that the four predicted variables have greater influence on the dependent variable foxtail millet planting volume: the mechanized planting has the largest influence, and the next is financial support, followed by planting cooperatives and industrial follow-up development. Since the regression weight of these four predicted variables is positive (1.254, 1.879, 0.925 and 0.833), it means every increase of one will lead to corresponding increase of the predicted value of the foxtail millet planting volume. For example, if other predicted variables are not changed, increase 1 in the financial support, the foxtail millet planting volume will increase 1.254 units, indicating the importance of financial support; increase 1 in the mechanized planting, the foxtail millet planting volume will increase 1.879 units, showing that the importance of mechanized planting is higher than the financial support.

4 Recommendations for stimulating enthusiasm of farmers planting the foxtail millet

4.1 Enhancing actual effect of policies Compared with preferential policies, foxtail millet planting farmers are more eager to obtain financial support. In the survey, we found that foxtail millet planting farmers need obtain several levels of approval to obtain financial support, and it is extremely easy to lead to not in place of policies or farmers failure to obtain support. Besides, the policy preference is to promote increase of foxtail millet planting in an indirect way, so the actual effect is slow. Financial support is the direct input for production factors and can directly promote production and planting of the foxtail millet. The fund element receives close attention, which will be favorable for the foxtail millet planting winning support of farmers, fully ensuring actual effect of policy implementation, and effectively promoting development of the foxtail millet industry.

4.2 Establishing special fund system for the foxtail millet industry It is recommended to set up special fund for ensuring further development of advanced foxtail millet development enterprises and cooperatives, provide fund for them, and encourage them to energetically develop the foxtail millet industry. Local government should set up special fund for construction of provincial level key foxtail millet projects, and city and county level government should support construction of corresponding foxtail millet projects. Besides, it is required to increase financial fund support, strengthen support for the foxtail millet industry through social fund raising, foreign investment, and government investment guidance, mainly support deep processing of the foxtail millet industry.

4.3 Implementing scientific and technological support plan for the foxtail millet industry To realize sustainable development of the foxtail millet industry, we should constantly cultivate foxtail millet sci-tech research and application capability. On the one hand, it is recommended to provide special fund support for outstanding talents and their innovation teams and support them to carry out autonomous researches, academic exchanges, and training. On the other hand, it is recommended to cultivate key large planting households, provide nearby training, and carry out standardized management, to improve their scientific planting level. In

practical training effect, and backward scientific and technological services for rubber farmers. Many departments have held various technical training classes, but the training organizations have few technicians good at rubber production technologies. Scientific and technological service system is not perfect. It is difficult to perform constant scientific and technological service responsibilities and difficult to bring into full play technical consultation and technical guidance functions for private rubber industrial development. Therefore, it is recommended to take management of rubber technical training classes through specialized department, practice specialization of technical training, to invite specialized technical personnel to take charge of technical training, to carry out constant tracing technical guidance and services for rubber farmers and improve technical training effect.

4.3 Establishing standardized rubber farmer specialized cooperatives Rubber trees are perennial tropical arbor. Their economic life is as long as 30 – 40 years. They have higher technical requirements. With the private rubber tree gardens entering the rubber tapping and putting into production period, as well as gradual increase of tapping area and release of productivity, the private rubber industry becomes an essential part of China's natural rubber industry and will bring into play more and more significant role, and the position of rubber industry will gradually rise[3]. At present, private rubber tree planting is separate, so it is difficult to improve awareness of rubber farmers for scientific rubber planting and tapping. To effectively guide rubber farmers to popularize advanced and practical rubber production technologies, unify and standardize rubber production technical measures, increase content of production science and technology, constantly improve scientific and technological quality of rubber farmers and technological level of production and operation, and increase economic benefits of rubber, there must be a proper organization to fulfill this great mission. As for actual situations of rural areas, in combination with our field survey of implementation effect of rubber farmer specialized cooperatives, especially the survey of Qiongzhong Fudao Rubber Farmer Specialized Cooperative of Hainan Province, we conclude that it is appropriate to establish standardized rubber farmer specialized cooperatives. Standardized rubber farmer specialized cooperatives can take unified technical management and technical training of rubber farmers, implement production and technical measures, unify rubber tapping system, and unify rubber collection and sales, which are favorable for improving technical level of rubber tapping workers, increase economic output value of rubber and extend economic life of rubber.

References

[1] CHUAN XX, BAI YB, LI JT, et al. Natural rubber industry and its development in Dehong and Lincang regions of Yunnan Province[J]. Tropical Agricultural Science & Technology, 2012, 35(2): 9 – 15. (in Chinese).

[2] YE DL, LI XM. To improve the rubber industry growth level of MenLa County, Yun Nan Province by seizing the development opportunity[J]. Chinese Journal of Tropical Agriculture, 2007, 27(3): 43 – 47. (in Chinese).

[3] QI DL, WANG XQ, ZHANG ZY, et al. Current situation of Chinese natural rubber industry and development suggestions[J]. Chinese Journal of Tropical Agriculture, 2013, 33(2): 79 – 87. (in Chinese).

2012, No. 1 document of central government clearly stated "energetically cultivating new professional farmers". In 2013, the Ministry of Agriculture launched the pilot project of new professional farmers in the whole country. In response to this call, the foxtail millet industry took this opportunity, implemented education and training, certification and registration, and policy support measures oriented towards key large planting farmers, attracted and cultivated a good many high quality foxtail millet producers and operators, to support the development of foxtail millet industry and ensure qualified successors of the foxtail millet industry.

4.4 Encouraging mechanized planting Machinery scientific research departments should actively develop agricultural machinery for whole process of the foxtail millet production and strengthen development of light-duty special machinery for foxtail millet, such as sowing machine, harvest machine, and thresher, to satisfy demand of foxtail millet production in major production areas. Existing subsidy policies for agricultural machinery and tools are favorable for research and development of the foxtail millet machinery and favorable for simplification of production technologies. As long as suitable agricultural machinery is developed for the foxtail millet industry, the foxtail millet planting households can obtain fund subsidy, which will not only reduce the production cost but also increase labor production efficiency. Wide use of agricultural machinery not only stimulates enthusiasm for research and development, but also promotes mechanization of foxtail millet planting, so as to realize benign development of the foxtail millet industry.

References

[1] CHEN SK. Mastering SPSS statistics analysis[M]. Beijing: Tsinghua University Press, 2010. (in Chinese).

[2] WU XZ. Statistics: Conclusion from the data[M]. Beijing: China Statistics Press, 2009. (in Chinese).

[3] LI ST, ZHAO M, LIU B, et al. The existed problems of millet industry in Chifeng City and its countermeasures and prospects[J]. Inner Mongolia Agricultural Science and Technology, 2010(1): 82 – 83. (in Chinese).

[4] REN YM, LI YF, YANG Z, et al. Status and suggestion of millent industry development in Shuozhou Region[J]. Rain Fed Crops, 2010, 30(4): 312 – 313. (in Chinese).

[5] LI SG, ZHAO Y, WANG HJ. An investigation report on the needs of millet industrial zone construction and industrial benefit improvement[J]. Journal of Hebei Agricultural Sciences, 2010, 14(11): 149 – 152, 169. (in Chinese).

[6] TIAN GL. Development situation and countermeasures of millet industrial in Chaoyang District[J]. Heilongjiang Agricultural Science, 2010(12): 162 – 163. (in Chinese).

[7] MA JJ. Study on rural leading enterprises development in Hebei Province [J]. Agricultural Economy, 2011(8): 27 – 28. (in Chinese).

[8] QIU FC. New development trend of millet industry in China[J]. Modern Rural Sciences and Technology, 2013(7): 71 – 72. (in Chinese).