

Methodology Article

Seeking Inevitable from the Accident——Discussion on the Methodology of Sublimating Agricultural Science and Technology

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Abstract: Many agricultural technology theory and results is derived from “accidental discovery” of production practice, to explore the general laws of this kind of accident occurred, and found it contains inevitability. Searching actively for accidents in agricultural production and technology promotion and conducting meticulous in-depth and unremitting research can sublimate the theory of agricultural science and technology and have important guiding significance for production practice.

Keywords: Agricultural Technology, Accidental Events, Technology Signs, Inevitability, Sublimation Technology

1. Introduction

The history of science and technology development shows that many new theories and new technologies are derived from the accidental discoveries of researchers in production practice. Closely grasping these accidental findings and conducting related research, analyzing and verifying their technical factors, supplementing and sublimating improvement can form a practical new technology or new invention that has important guiding significance for production practice in the end. This is especially true for agricultural technology. It is clear that the nature of the technology discovery in the process of agricultural technology promotion is an inevitable event. Changing “accidental discovery” to “active search” can significantly improve the probability of discovering “technical signs”. Researching on “technical signs” has raised it to a theoretical level and has become a general principle guiding large-area production, which has sublimated agricultural technology. In China, farmers are independent production units, and their production scale is small and large. It provides superior conditions for searching for technical signs in agricultural

technology promotion. Agricultural technicians should pay attention to and make full use of these favorable resources to promote agricultural science and technology.

2. Agricultural Production Practice Is the Source of Agricultural Science and Technology Development

Mr. Jin Shanbao who are the second president of the Chinese Academy of Agricultural Sciences, the famous breeder and the agricultural educator once wrote the article "Agricultural Science Research Should Take the Forefront of Production", [1] and expounded the important guiding significance of agricultural science theory to production practice. Today, with the rapid advancement of science and technology, it is unquestionable to emphasize that "agricultural scientific research must go ahead of production." However, if we weaken or even abandon the understanding of the basic role of agricultural production practices in agricultural scientific research, it will inevitably limit the scope of research of agricultural science and technology workers, reduce the ways to explore new theories

and new technologies, and slow down the pace of agricultural science and technology development.

Practice is both a source of understanding and a driving force for understanding development. This is the primary basic point of dialectical materialism epistemology. From practice to understanding to re-practice to re-recognition, this form is cyclical and infinite, and the content of each cycle of practice and cognition has entered a higher level. [2] The development of agricultural science and technology also follows this law without exception. Deeply understand that "agricultural production practice is the source of agricultural science and technology development", deepen the understanding of the basic role of agricultural production practice in agricultural scientific research, and help agricultural science and technology workers to broaden their horizons, open their minds, broaden their fields, and thus sublimate agriculture technology.

3. “Occasional Discovery” in Agricultural Production Practice Is Often the “Initiator” of Agricultural Science and Technology Progress

3.1. “Occasional Discovery” to Produce High-Yield Dwarf Wheat

American Norman Borlaug cultivated high-yield dwarf wheat varieties in Mexico in the mid-20th century and promoted the use of it. It proved that “the rate of food growth can exceed the rate of population growth” and changed the pessimistic view of the mankind future in the mainstream society at that time. He won the Nobel Peace Prize in 1970 and became the only agronomist in the world to receive the Nobel Prize. Norman Borlaug was able to breed high-yielding dwarf wheat varieties, thanks to the inspiration that was discovered by chance. At that time, the US national standard stipulated that the highest indicator of applying chemical nitrogen fertilizer in wheat field was 100 pounds of pure nitrogen per hectare. In the practice of Norman's wheat breeding work in Mexico for 8 years, the fertilization amount of the experimental field followed this index. The results of breeding work are not outstanding. One day in 1952, Norman and his assistants looked at the experimental field and found a strange phenomenon that the entire experimental field was like a big "checkerboard". The green wheat was very strong on each small square on the "checkerboard", but the wheat surrounded presents a listless look. He felt that there must be a reason for this. He asked for a trial operation worker. When asked “How do you apply fertilizer?” The fertilizing workers honestly admitted that they did not apply fertilizer evenly as require. One direction is subdivided and subdivided again in the vertical direction in the field. Each land is made wide in order to improve work efficiency. The fertilizer in both directions causes a small overlap. The amount of fertilizer that has accumulated in those overlapping areas is more than double that of other places due to the distribution of

sprinkling fertilizer is not completely uniform. Norman concluded two conclusions: First, the actual fertilizer requirement of wheat is more than double that of the highest index specified by the state. Second, the yield of wheat varieties in the experimental field can be doubled. He thus cultivated the highest-yielding wheat varieties in the world at the time and solved the food shortage problem for many countries. [3]

3.2. “Occasional Discovery” Created the “Father of Hybrid Rice”

Yuan Longping, a former teacher of the Anjiang Agricultural School in Hunan Province, came to the early rice field to observe the test after a class in July 1960. He accidentally discovered a rice plant with a specific shape and like a crane standing among the chickens. The plant type was excellent and the ear was large with many grain. He carefully harvested a seed and prepared to use the system breeding method for the second year. However, after planting in the second year, the plants were of different heights, and the heading, flowering and maturity were also inconsistent. The traits of each plant were worse than the previous ones. To this end, Yuan Longping based on Mendelian genetics theory, detailed records of those plants with different traits, and statistical analysis, the results are in full compliance with Mendel's separation law. Therefore, he concluded that the rice plants like a crane standing in chickens are natural hybrid rice, it indicating that there are also obvious heterosis in rice. Since natural hybrid rice exists in nature, it can be used to explore the laws and directly use the heterosis. After years of experimental research, he finally succeeded in cultivating indica type three-line hybrid rice in 1973, who is known as the "father of hybrid rice". [4]

3.3. “Accidental Discovery” Contributed to the Doubling of the Benefits of Wheat and Rice Cultivation

Before the wheat harvest in 1981, Li Like, the former vice president of the Shaanxi Academy of Agricultural Sciences, went to Ganjing Township, Heyang County, Shaanxi Province with the task of farming and animal husbandry. The local dry and low rainfall caused low wheat yield (average yield of 3.33 kg per hectare), and farmers generally lacked the food seriously. Li Like accidentally saw a small piece of wheat seedlings stood out, and its wheat straw was strong and the head was fat in a large wheat field with sparse plants in the village of Huri, 3 kilometers away from the township government. The reason was that the custodian dumped phosphate fertilizer fulling of a wheel barrow into 133.4 Square meter ground like dumping garbage when he cleaned the warehouse in the previous year. Li Like immediately began to study the relationship between fertilizer, water and wheat yield, and set up a comparative experiment in the next wheat growth cycle. The results showed that the phosphate fertilizer increased the length of wheat roots by 93%, the number of strips by 98%, and the weight by 170%. Because the roots are deep, the water in the lower layers of the soil

can be used to increase the yield. According to the natural characteristics of drought and little rain in Weibei and the law of wheat growth, Li Like pointed out that the wheat yield in Weibei is a problem of "fertilizer" from low yield to middle production, from middle production to high yield is the problem of "water" and improving the utilization of precipitation by wheat need the measures to take more measures. This lay the theoretical foundation for improving the yield of dryland wheat. He used the cultivation techniques of "rooting with phosphorus, rooting with water" and "covering the whole process of dryland wheat with long stalks", which increased the local wheat yield from 750kg/ha to 6000kg/ha. The technology of fertilizer-to-water promotion in the Loess Plateau has increased wheat yield by 2.4 times and farmers' per capita net income by more than 6 times. [5] Li Like precisely grasped the "accidental discovery" to conduct research and created the dry farming technique of "expanding wheat yield by fertilizer and water."

Professor Xing Danying from the Agricultural College of Yangtze University set trials in counties such as Lichuan, Xuanen and Xianfeng during working in Enshi Prefecture in order to solve the problem of low seedling survival rate for Rice Dry Premature High-yield Cultivation Technology, but the effect was not significant. One day in 1993, he accidentally learned that a farmer named Tang in Shiqiaogou Village of Xianfeng County used a double-layer membrane to carry out early rice dry-feeding, and the effect was good. Immediately he went to the site to investigate, then researched in-depth and solved the problem of low rate of seedling survival. The achievement was won the first prize of Hubei Province Science and Technology Progress. [6]

In the field of agricultural research, there are many such examples. To analyze these cases, it is not difficult to see that accidental discoveries in production practice are often the initiators of advances in agricultural science and technology. At the same time, we should also realize that these "accidental discoveries" cannot be fortunate enough to be "initiators" of technological advancement if they are not valued by researchers. Therefore, agricultural scientific research workers should establish awareness of production practice and guide their own scientific research with dialectical materialism epistemology.

4. The Essence of "Technical Signs" and "Accidental Discovery" Is an Inevitable Event

According to the principles of Marxist philosophy, the inevitability is hidden behind the contingency, and the inevitability opens the way for itself through countless accidents. Accidental is an opportunity in scientific activities and plays an important role in scientific discovery. The task of scientific research is to grasp the opportunities provided by the accidental phenomena in the development of things and reveal the inevitable laws behind them. [7]

The promotion of agricultural technology is fundamentally

the application of certain agricultural new technologies by farmers, which is one of the forms of agricultural production practice. When the promoters provide new technology to the farmers, they must provide corresponding operational standards. The farmers implement new technologies according to the operating standards. Because the production scale of Chinese farmers is small and the number of farmers applying new technologies is large, and the farmers are independent production units, different farmers will have different degrees of deviation from the operating standards in the process of implementation according to the operating standards. The degree of deviation from the operating standards will lead to the difference in the application of new technology effects. The greater the degree of deviation, the more effective the application of new technologies is. Although it accounts for a small proportion of the total number of farmers, the probability of farmers with particularly prominent technical applications will increase when the number of farmers trying new technologies increases. [8]

According to the sample distribution principle of statistical sampling theory: if the farmers using this technology is set as the sample group, each farmer is a sample, and the effect of applying new technology is a specific sample observation; as long as the number of samples (farmers) is sufficient, and the observed values of all samples show a continuous distribution (approximate normal distribution) centered on the average of the sample observations. The farther the observations deviate from the mean (indicating the application effect is the more prominent), smaller proportion of the sample it has. As long as the number of participating farmers is sufficient, there will always be a sample with outstanding performance (the best application effect), [9] which is the "technical sign" that we should find and focus on in the promotion of agricultural technology.

It can be seen that the emergence of "technical signs" is inevitable in the promotion of agricultural technology. [10] The "accidental discovery" in production practice has the same characteristics as the "technical signs" in the promotion of agricultural technology: both are cases that deviate far from the general application effect. Although they are not high in the group of technical applications, they always exist. If we actively search, the possibility of being discovered will be greatly improved.

5. Actively Search for "Technical Signs" and Sublimate Agricultural Science and Technology

In the agricultural technology promotion activities, actively searching for the typical application effect, grasping the typical research, and generalizing the measures into general principles to guide large-scale production will quickly sublimate the original promotion technology, which is shortcuts to a result of half the effort. The scale of production of Chinese farmers is small and the number of

farmers is large, it is extremely unfavorable for the natural risks and market risks of resisting agricultural production. However, these are richly endowed by nature for the results of agricultural science and technology workers.

The above methods have wide applicability and can be applied in the promotion of specific technologies for agriculture, animal husbandry and fishery. [11] The following problems should be noted in the application:

5.1. The Timing of the Application

It should be chosen to be applied in the demonstration phase of new technologies.

5.2. Scale of Application

The number of farmers participating in the demonstration should be more than 50 households. In the case where the total size of the demonstration area is equivalent, the demonstration is carried out in a place where the number of farmers is large.

5.3. Application Steps

5.3.1. Master the Relevant Situation of the Model Farmers as much as Possible

The demonstration scale of the demonstration farmers, the number of labors, and the background conditions and communication methods associated with the demonstration projects are all registered to facilitate the tracking of the demonstration projects and to track the reasons for the special circumstances in the demonstration. Many problems can be solved by modern communication methods, which are both economical and efficient. For example, when Hubei Provincial Seed Group Co., Ltd. develops Zhongyouza No. 2 rapeseed variety, it will produce large-area hybrid seed production according to the ratio of 1:2 of the male and female parent lines specified in the hybrid seed production operation technical regulations provided by the breeder. In practice, it was found that the purity of hybrid seeds produced by individual farmers was very high, and they immediately used the information of the registered books to trace the reasons. The result of the tracing was: "The farmers made a mistake in the ratio of the father to the mother, and changed from 1:2 to 2:2, and the operation error caused the seed to have high purity and good quality." Inspired by this "error", the company's technicians attempted to produce hybrid seeds with a 2:2 ratio. The result was a greatly improved purity of the hybrid seeds and an overall improvement in seed quality [12].

5.3.2. Open a Demonstration Meeting of the Demonstration Project

The two aspects of searching for demonstrations are particularly good and particularly poor.

5.3.3. Grasp the Typical Example of the Demonstration Effect, and Summarize the Practices of the Farmers into Principles to Guide Large-Scale Production

Good examples obtained in actual work are often not directly used, some have strong conditionality, and some are

the result of a combination of various measures. [13] At that time, it was unclear which measure was the key technology, which required the corresponding test. Conduct research to identify key conditions and key technologies in the integrated approach.

6. Conclusion

Most scientific discoveries come from accidental discovery in production practice, and the essence of accidental discovery is due to the law of inevitability. In this paper, several successful examples of the discovery of "technological signs" and sublimation of technological achievements in the course of agricultural technology extension show that finding "technological signs" is a new opportunity. Only scientific and technological personnel who pay attention to production practice and concentrate on research, can assume that the typical event is a new "technological signs", and the correct result can be popularized and applied in production practice by setting up scientific experiment to sublimate agricultural science and technology.

The characteristics of agricultural production in China are the large number of farmers and the small scale of production. According to the analysis of the statistical principle, the probability of farmers producing "technological signs" in the process of applying the new technology is relatively high. As long as the agricultural science and technology workers are willing to do so, it is necessary to actively search for "technological signs" in the process of production, increase the opportunities for new technology discovery, and carry out experimental research on the discovered "technological signs", so as to form the scientific and technological achievements guiding agricultural production.

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Biography



Sun Huilan (1961-), female, senior agronomist in higher vocational college. 1983 graduated from Huazhong Agricultural University, obtained Bachelor of Agriculture degree; 1990 graduated from Hebei Agricultural University, Master of Science degree. For many years engaged in teaching and research of agricultural courses, undertake plant physiology, agricultural extension courses and other courses. From 2003 to 2016, she has been the head of horticulture department of Hubei Vocational College of Biological Science and Technology, and has carried out the professional construction project supported by the central finance and Hubei Province.