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the area that inheres shiros and fruitbodies of *T. matsutake* will still have yields for a few years. The determination, selection and optimization of a suitable area are useful methods of the reconstruction, cultivation, treatment and protection of shiros, all these methods conduce to expanding the growth area of *T. matsutake*, prolonging the formation of fruit body, increasing the quantity of shiros, and improving the yield and quality of fruit body. Therefore it's an effective approach to conserve and utilize these precious resources.

Discussion of Issues on Several Crucial Basic Study Directions of Agriculture in China

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Abstract: To solve those problems such as farmland deficiency, ecological environment deterioration, high consumption of resources with low efficiency, serious agricultural pollution, and lack of scientific and technological support for agriculture, the basic researches in breeding theories, serious birds epidemic diseases, agriculture protections, multiple information acquisition methods and diagnosis mechanisms in precision farming, quality formation process of crop produces, and mechanisms of nondestructive examination were explored in this paper. And the results could provide information resources to strengthen the scientific and technological support for agriculture and its sustainable development.
Keywords: basic research in agriculture, agriculture development direction

In the 16th CPC National Congress, constructing an affluent society, and promoting modernization in China became today's major concerns. Thus, the agricultural development in China entered a new epoch. To settle those problems originated from agriculture, related rural farming areas and farmers becomes the most important task for Chinese government. At present, the development of agriculture in China faces several crucial problems, including 1) farmland deficiency; 2) the seriously deteriorated ecological environment; 3) the high consumption with low efficiency in the utilization of agricultural resources; 4) serious pollution caused by careless farming; 5) insufficient stamina of scientific and technological support in agriculture. To keep up with the advancement of world agricultural science and technology and be geared up to the needs of our national goals to build this affluent society, it has significant meanings to actively conduct the grand studies on important agricultural basic problems to activate scientific and technological innovation in agriculture, to continuously support agricultural development, to improve agricultural integrative productivity and its sustainable development, and to target the objectives of "high yield, high quality, and high efficiency with ecological and safety considerations".

1. Study on basic theories of crop breeding

The practice and history of the agriculture development indicated that the breeding and spreading of fine crop species is an important way to improve crop yield and insure food safety; it is also an important way to improve the quality of farming produces, to strengthen agricultural competitiveness, and to promote the adjustment of industry structure, and to increase income for farmers. In present years, crop-breeding theories in China lacked sparkles. Because of insufficient genetic studies on breeding materials, it's very difficult to innovate new germ plasmas and integrate multigenes with extensive adaptability, which controls excellent traits. It is prerequisite to improve crop yield and quality in the coming years. While insisting on high yield, those notable valuable indexes such as high quality, diseases and insects resistance, tolerant capability to environmental stresses, high-efficient utilization of resources, and sustainable development will be new important targets for plant and animal breeding. Now, integration of resistant multi-genes is an effective way to improve crop adaptability and resistance to biological and abiological stresses, and to prolong the application life of crop species.

The key academic directions of basic theories for crop breeding are as follows: (1) Study on genetic mutation rules and genetic regulation mechanisms of relative traits, including quality, yield, resistance, adaptability and high- efficient utilization, etc., in a triangle shape from colony, individual to molecule. The key point is the basic study in molecular genetics; (2) To meet the needs of national food safety and sustainable development, basic studies and application studies on excellent gene resources, innovation of fine breeding materials, and breeding of improved species should be carried out at the levels of molecule, cell and individual; (3) Study on functional genomics (gene cloning and function analysis) and comparative genomics of important

agricultural traits, including yield, stress resistance, plant diseases and pest resistance, high-efficiency nutrition and high quality et al.. The targets of these studies are to explore and clone new genes, to regulate important agricultural traits, to analyze their function, expression, and regulation characteristics, and to detail those formation mechanisms of important agricultural traits. (4) Applying the whole information of genomics, transcriptomics, proteomics and metabolomics, thus, the rules of biological metabolism, development, differentiation and evolution could be recognizable and predictable. These information could be used for protein and nucleotide design and species design. This study includes obtaining the whole genomes of each crop, establishing genetic database and information system that could be consulted to regulate important agricultural traits, and developing methods and software for crop design in molecular level. (5) Basic study on the application of heterosis. It includes establishing a perfect system with breeding theories and techniques, strengthening the basic research on "two-line" heterosis, carrying out the research on genetic basis of photoperiod and thermo sensitive male sterility, and setting up a theoretical system for the utilization of "two-line" heterosis.

2. Basic researches on severe diseases of livestock and birds

Diseases of livestock and birds are the primary obstacles in the development of animal farming. Some of serious diseases can bring fateful beats to national economy in a country or in a region. For example, Bovine Spongiform Encephalopathy (BSE) occurred in Europe and caused serious losses to British economy; the deadly Bird Flu in Hong Kong forced the government to stamp out millions of chickens; Between 1998 and 1999, the pig cefhalitis caused by Nipah virus (The Nipah virus which caused Swine Encephalomyelitis) caused 265 cases infected and 105 cases dead in Malaysia; In 1997, the Food and Mouth diseases brought destructive beat to pig breeding industry in Taiwan Region; In 2000, the Food and Mouth diseases also brought heavy beat to breeding industry in Korea and Japan; In the same year, the Food and Mouth diseases burst out in Europe, which cost a loss of 590 hundred million pounds in Britain and delayed their election for prime minister; Between 1999 and 2000, the pandemic Food and Mouth diseases in China also cost huge economic losses.

In addition, some zoonoses such as Schistosomiasis, Rabies, Japanese B Encephalitis, Streptococcus and Flu disease etc., have direct relations between diseased animals and pathogens, and then, these pathogens can spread from animal to human. As an example, in 2003, SARS had brought serious economic losses to China and world; in the early 2004, when Avian Influenza (AI) burst out seriously in Asia, 16 provinces, municipalities, and autonomous regions in China were involved in. All of these made severe impacts to stockbreeding economy and animal feeding industries. As Director General of FAO (Food and Agriculture Organization of the United Nations), Dr. Jacques Diouf denoted that AI frustrated poultry industry in Asian countries when he participated in the regional conference concerning food safety in Bangkok. It did bring destructive impact not only to poultry breeding industry but also threatened the foodstuff safety and food safety. Therefore, it has significant meanings to strengthen researches on basic theories and controlling techniques for these severe diseases of domestic animals.

The epidemiological investigations by Institute of Poultry in Shandong Academy of Agricultural Sciences in 1997 and 2002 showed that: the number of poultry contagious diseases were as high as 202, and 85 of them were poultry epidemic diseases and 70% of which were infective; in nearly 20,000 poultry disease cases, there were 68% virus diseases, which were the major diseases of all; the percentage of bacteria disease was 15%, and other pathogen diseases were 17% (including coccidiosis); in all cases, the proportions of AI, ND, IB, E.coli and chronic respiratory diseases were the highest. The weakness in basic researches results in lack in knowledge of causes and rules of these diseases that happened in fauna, so lots of serious livestock and bird diseases haven't been overcome from the headstream so far.

The main research contents in future include: 1) Studies in structure and function of big molecules of pathogens which caused diseases in livestock and birds, their living essences from individual, cell and molecule, analysises on functions and control mechanisms of pathogenic genes and immunity genes; 2) Researches on interactions between pathogens, their macro molecules and animal hosts, clarifications for the infectious trends, and genetic variation rules of these pathogens in China; 3) Breakthroughs in the studies of mechanics of genetic evolution, infection and immunity of these pathogens; 4) Establishment of relative theories on molecule etiology for community infection, and to further supply technological resources for policy making,

disease prevention and surveillance, and biological product development; 5) Basic research on severe zoonosis, the relations and infectious mechanisms of serious diseases that popularize in animals and further will be delivered to human community, especially Foot and Mouth virus, animal Flu virus, Japanese B Encephalitis and Corona virus.

3. Basic research on protected agriculture

Protected agriculture can avoid seasonal limitations for crop growth on a certain extent. This obviously strengthens disaster sustainability and seasonal-independent productivity, and it ensures the supplies of horticultural productions such as vegetables, flowers, and high quality yield of field crops annually. In developed countries, the protected agriculture was developed based on their grasped plant growth mechanisms, growth controlling technologies and corresponding environmental circumstances. At present, research trends for protected agriculture are: 1) To promote industrially controlled simple transplantation mechanisms to physiologically controlled mechanisms; 2) To promote steady-state single factor control to kinetic multi-factor control; 3) To promote empirical control to precise control based on plant growth mechanisms and physically designed crop growth models; 4) Integrated utilization of modern biological engineering and information technologies in modern environmental regulable agriculture; 5) Studies in crop modeling based on interactions between crops and their corresponding environments, and in nondestructive examinations for crop growth and diagnosis, are more integrated; 6) Researches on controlling mechanisms for system dynamic optimization based on above studies become one of the hot spots.

The areas of protected agriculture in China have reached to 2.1 million hectares, which accounts for more than 70% of that in the world. China has obtained abundant achievements from approximate 20-year scientific research and practice, the protected agriculture system in accordance with Chinese environment and resource characteristics has been established with its infant shape. But compared with developed countries, China still has a lag for around 15 to 20 years. The main reason is that the weakness in basic researches, especially in several basic mechanisms, such as environmental influences on crop growth, yield and quality, disease infection, formation and accumulation of harmful chemical materials, crop self-regulation in adversity and environmental stress, and regulation of dynamic complex optimization of biological environment. Thus, to strengthen the basic theoretical research on protected agriculture has crucial meanings to sustainable and high-efficient development of agriculture in China.

The following researches should be strengthened in the near future: (1) Researches on the relations between crop growth, environmental factors and their regulation mechanisms: including key ecological limitation factors and regulation mechanisms influencing crop growth, yield and quality indexes, environmental inducing factors and regulation mechanisms for disease outbreaking, spreading and jeopardizing, and the environmental control mechanisms during the process of pesticide residue degradation and the formation and enrichment of harmful metabolism substances; (2) Influences of environmental stressing factors on crop growth: including physiological reactions and regulation mechanisms of the primary crops to environmental stress, methods to overcome physiological obstacles caused by environmental stress, adaptation mechanisms and pathways to unfavorable weather and ecological conditions in extreme circumstances, ecological adaptation abilities and productivity potentials of crops; (3) Researches on integrated control mechanisms of Crop-Environment-Management system: including systematic models of how environmental system impacts primary crop growth, yield and quality and absorption process of mineral materials, the nondestructive examination and diagnosis for the key growth information of field crop, and the dynamic optimization control methods for the biological environmental system based on plant language and crop models.

4. Research on diagnosis mechanism and multiple information sources seeking in precision agriculture

The research in precision agriculture developed with a projected rate with a short history of only 20 years. Accompanied with the development of GIS, GPS, and remote sensing, precision agriculture has been gradually applied in the management of crops such as wheat, cotton and corn, etc. The choice of precision agriculture technologies improved water utilization efficiency and reduced pollution caused by fertilizer and pesticide. Since shortage in fertilizer and water resource has restricted sustainable agriculture development in china, precision agriculture has huge application potentials.

Due to the rapid development of observation and information acquisition technologies, the 3rd

generation of satellite has been developed as aerospace platform for remote sensing, and the resolution of satellite sensors has reached 0.61m. The commercial satellite "DMC+4" launched in Russia in 2005 was specially used for Beijing area and it could capture panchromatic images with a resolution of 32m and area coverage of 600km. These images could be used to monitor agriculture and forestry resources, vegetation growth situation, plant diseases and pests, crop yield estimation and foodstuff safety. As aerial platform, HIS, whose spectrum range is between visible light and NIR, was developed. Shanghai Institute of Physics of CAS designed OMIS and PHI, which has been applied in vegetation and soil information acquisition in China, Japan and Malaysia, and obtained useful image research information. Variable-ratio fertilization machine, which can fast acquire crop growth information from light sensors, calculate crop nutrition status, and provide fertilization prescription according to fertilization models, was also developed. Variable-ratio fertilization worked in $1m^2$ resolution of accuracy.

With the fast development of hardware for the earth observation and information acquisition, and the fusion of "polygon information" (obtained from aviation remote sensing platform) and "point information" (obtained from ground) can surely supply reliable and cheap data sources for precision agriculture. This could not only bring opportunities to the development of precision agriculture but also challenge the agricultural basic research. Related basic theories in China were limited. How to interpret and apply this abundant information to promote the capabilities in crop and soil diagnosis? How to fuse these data and dig out further knowledge in different management scales and productivity levels as well as various data sources with precision agriculture? All these problems produced the "bottleneck" in the extension of precision agriculture in China.

We suggest developing basic theories and methods focused on multi-source information acquisition, and the diagnosis of variable-rate fertilization and irrigation according to the demands from different levels of users in the practice of precision agriculture. These researches include: 1) The establishment of basic theories of multi-source information acquisition, analysis, and diagnosis; 2) Those remote sensing and monitoring mechanisms for crop carbon-nitrogen nutrition, and water percentage; 3) The models and algorithms for crop precision variable-rate fertilization; 4) The decision models and algorithms for variable-rate fertilization and irrigation based on multi-source data; 5) The information acquisition and diagnosis of crop nutrition and water stress; 6) Establishment of variable-rate fertilization and irrigation optimization mechanism, algorithms and models based on crop growth status, collection of nutrition and farmland environmental data by nondestructive examination techniques, and crop carbon-nitrogen and water diagnosis methods.

This research can help agronomists understand the dynamics of crop growth and farmland environment, and improve those analysises in crop and soil information and good plant species according to relevant mechanisms, consequently improve farmland management decision-making and achieve the goals of agricultural production: high quality, high yield, high efficiency, sustainability, and safety.

5. Research on quality formation and nondestructive examination mechanisms of rice and wheat

Rice and wheat are two dominant crops in China. Since China's participation in WTO, farm produces in China have been confronted with more pressure than before in the global competition, and even in domestic market, quality problems have become more serious. Especially for those traditional staple crops such as rice and wheat, because of the shortage in special species, hardly standardized planting and the deficiency in the process of quality examination, neither the quality of seeds nor other quality indexes can be guarantied. These problems have not only limited the development of foodstuff produce but also negatively influenced foodstuff safety. The survey for rice and wheat quality in the whole nation in 2002 showed that there were only 43.1% qualified primary crop species in China with the third level criterion of GB/T17891 - 1999 national standard for high quality rice. But if we evaluate these above species according to the high quality rice standards (NY122-86) promulgated by Chinese Agriculture Ministry, this percentage would be lower. The areas of high quality wheat for special use were up to 38% of the total wheat harvesting acres in 2003. And according to the examination results of high quality wheat by State Grain Administration, 82.7% of all exanimated samples were not qualified with the national standard.

The production of high quality rice and wheat is penetrated in a three-stage process: preparation, protection, and harvest. In the developed countries, the insurance of the quality of those produces undergoes the following serious protection measures: 1) The selection of high

grade species in the preparation stage; 2) Large scale cultivation with standardized management, and the quality surveillance of those growing produces in the same time during protection stage; 3) The classification and refinement of those produces according to the quality examination results in the harvest stage. In recent years, China has emphasized her concerns on selecting and breeding high quality species, and on the crop acreage allocation. These concerns have stimulated and increased the production of those produces greatly, but the bankrolled supports for those practical researches, such as standardized high production methods for high quality produces, the real-time surveiling and predicting technologies for their growth, and the quality control for their seeds, were relatively kept in a small shape. In a word, this resulted in two major issues: first, it has not gone in such deep in the researches on quality formation mechanisms and the ecological adjustment mechanisms of high quality seeds, so it is difficult to establish the standardized production system and quality examination system for these produces; second, although those traditional physiological and biochemical examination methods have high precision, but they are low throughput. As the researches on real-time large range surveillance of seed quality are still in their initial stage, and those existent basic researches in high quality produce production are seriously lagged, so, they can't offer necessary support for the quality surveillance researches. This problem has become one of the most serious problems in the process of industrialized development of high quality rice and wheat.

In summary, there exists four projected issues: 1) There are few systemic researches on nondestructive examination for protein, soluble sugar, lignin and cellulose content, etc., and their relationships with high quality rice and wheat; 2) The microclimate in farmland has an important influence on crop quality formation, but the researches in the mechanisms that microclimate factors have influenced crop quality, and in remote sensing theories and methods are insufficient presently; 3) Researches on crop physiology and biochemistry were much more than those on crop optics mechanisms. However, the researches on crop reflection spectrum, fluorescence emission mechanisms and functions lacked considerations. Thus, the biological information obtained is limited to some extent; 4) the physiological knowledge and accurate description of crop are the basis for information acquisition and quantity analysis, but so far researches in crop modeling and information modeling such as remote sensing fusing mechanisms and methods were weak that the spreading application of crop information was restricted.

So we suggest that we should 1) focus on the quality formation process of the seeds of rice and wheat and corresponding nondestructive examination methods; and clarify their physiological and biochemical indexes, morphological development indexes, and ecological environmental indexes according to the metabolism rules of major biochemical contents, such as carbon and nitrogen contents in crown canopy, and intrinsic mechanisms for the quality formation process of their seeds; 2) construct cross disciplinary subjects between physics, mathematics, crop physiology, and ecology, etc., to clarify the spectrum response and the nondestructive examination mechanism in the process of quality formation; 4) and then, put forward the theories and models supporting those computation algorithms for the quality prediction of surveiled produces; 5) finally provide information resources to establish selective rules and quality diagnosis system of these produces.

The above researches has great academic values and strategic meanings for stabling food produce, pushed high quality agriculture development and agricultural informationlization, provided information resources for management decision-making and for crop acreage allocation and agricultural standardization, upgraded the technique levels of modern agriculture in China and strengthened our international competitive capability for specially utilized crop production. Finally, these basic studies on high quality crop produce and surveillance would endue Chinese farm produces with unique features.