Agricultural Heritage Research in China: Progresses and Perspectives

MIN Qingwen¹*, HE Lu¹,² and ZHANG Dan¹

1 Institute of Geographic Sciences and Natural Resources Research, CAS, Beijing 100101, China;
2 Graduate University of Chinese Academy of Sciences, Beijing 100049, China

Abstract: One of the legacies of the time honored agricultural development in China has been varied farming practices that adapt well to different natural conditions. These old but still functioning farming systems continue to inspire us to find solutions to various environmental problems caused by so-called modern agriculture. This paper reviewed the studies on agricultural heritage in China, including two categories: document-based researches and practice-oriented researches on dynamic conservation and adaptive management of these traditional agricultural heritages. Studies on the history and archaeological findings about the Chinese traditional agricultural heritage have laid a solid foundation for any further study. Dynamic conservation and adaptive management of agricultural heritage was promoted by the Globally Important Agricultural Heritage Systems (GIAHS) project initiated by FAO in 2002. Until now, researches on the conservation and adaptive management of agricultural heritages have touched on many aspects of the issue, including theoretical consideration of agricultural heritage, agrobiodiversity characteristics of agricultural heritage, multi-values of agricultural heritage dynamic conservation, substitutive industries, legislation and institutionalization for the conservation of agricultural heritage. We conclude the paper with an agenda for future studies on agricultural heritages, including the broadening of the research scope, innovative research methodologies and methods and the development of strategies that combine conservation and utilization of agricultural heritages.

Key words: traditional agriculture; Globally Important Agricultural Heritage Systems (GIAHS); China; FAO; eco-agriculture

Agriculture has flourished in China from time immemorial. One of the legacies of the time honored agricultural development in China has been varied farming practices that adapt well to different natural conditions. The value of these traditional practices or models are rediscovered and cherished today when the so-called modern agriculture fails to be sustainable due to all kinds of ecological and health problems and risks that are manufactured by the modern systems. The rich Chinese agricultural heritages are not only vivid examples for the application of traditional Chinese philosophies but also inspirations for a new wave of sustainable agriculture movement throughout the world (Li 2001). However, the sustainability and development of these traditional farming systems have been under threat from population growth and demand for economic development. More and more farmers are giving up the traditional ways of farming and adopted modern agricultural techniques that aim to achieve higher yields through high inputs of a wide range of chemicals. This high-input-high-output agricultural model has been, and will be, a useful approach to increase food production but the intensive production practices in modern agriculture resulted in significant negative externalities (Pimentel et al. 1992).

The unsustainability of the modern agriculture forced people to look for alternatives and reflect on policies, patterns and technologies associated with agricultural development. Recent years have seen growing awareness of the value of traditional farming practices for the sustainable development of agriculture. In 2002, FAO launched the Globally Important Agricultural Heritage Systems (GIAHS) project aiming to establish the basis for the global recognition, conservation and sustainable management of outstanding traditional systems and their

Received: 2011-01-18 Accepted: 2011-02-28
Foundation: National Public Benefit (Environmental) Research Foundation of China (201009020) and FAO/GEF project (GCP/GLO/212/GEF).
* Corresponding author: MIN Qingwen. Email: minqw@igsnrr.ac.cn.
associated landscapes, biodiversity, knowledge systems and cultures. The initiative aims to “protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements” [cf. CBD: Article10(c)], specifically within agricultural systems. Chinese Rice-Fish system is one of the pilot GIAHS along with preliminary important agricultural systems selected in Chile, Peru, Philippines, Algeria and Tunisia (FAO 2009). Recently, growing concerns are drawn to the protection and development of China’s agricultural heritage and a higher demand has been raised for the related academic researches. In fact, researches on China’s agricultural heritage have been started since the end of 19th century, focusing on agricultural archaeology, agricultural history, traditional Chinese philosophy, and agricultural folklore, etc. (Wang et al. 2010). Since 2005, scientific research interest has shifted to the basis of the dynamic conservation and adaptive management of China’s agricultural heritage, including multi-functions and evaluation of agriculture, agricultural diversity conservation, tourism development, etc. A review on the academic studies on China’s agricultural heritage will help the orientation of the agenda for future researches.

1 Documents-based research

Farming activities in China can be traced back to 10 000 years ago. China was and remains the most important agricultural economy in the world. China is also rich in colorful agricultural heritage systems.

Prior to the intervention of GIAHS project in 2005, Chinese researchers had already done plenty of work on traditional agricultural heritage with emphasis on agricultural history, agricultural archaeology, ecological ideas of traditional agriculture and agriculture custom. These studies tried to discover and identify the agricultural heritages through history records. The results have laid the foundation for any further study.

1.1 Initial phase

Agriculture, Chinese medicine, strategies and classical literature are the four great cultural heritages of China. However, the agricultural heritage has not received due attention on for a long time, and there has always been a lack of systematic collection, sorting and research. Conscious research on Chinese traditional agricultural heritage was carried out in the end of the Qing Dynasty, which was still in the bud.

Agricultural History Documentation in China, which includes 456 books, was compiled in the period of the Republic of China. Wan Guoding, the chief editor of this series, is acknowledged as the founder of Chinese agricultural heritage research (Wang et al. 2010).

Since 1949, the Government of the New China has attached great importance to inheritance and discovery of Chinese agricultural heritages. With the support of the authorities, Agricultural Heritage Research Center was established, and two earliest academic journals, Bulletin of Agricultural Heritage Research and Bulletin of Agricultural History Research on Chinese agricultural science, were published. The establishment of special organizations on agricultural heritage marked a new phase of researches on Chinese agricultural heritage. Since then researches in this field were much better recognized and organized.

1.2 Main contents

Traditional agricultural heritage researches mainly focused on three themes: agricultural history and archaeology, ecological ideas of traditional agriculture and agriculture custom.

1.2.1 Agricultural history and agricultural archaeology

China’s ancient agricultural books as an example had as many as 12 million categories, including a considerable number of agriculture, medicine and other scientific and technological heritage. Now China has more than 1000 categories of the existing ancient agricultural books (Wang et al. 2010). These books not only introduce the specific production technology, but also describe many principles on botany, soil science, climatology and so on. These ancient agricultural books and records are an important asset handed down from our ancestors. The collection, check and annotation of them form the base for China Agricultural Heritage research. Most of the early works on agricultural heritage was committed to this. Domestic institution related to agricultural heritage has expanded systematic and deep research on China’s agricultural science and technology history and agricultural economic history based on the reduction of the literatures of ancient agricultural books. The research involves soil tillage, crop cultivation, agricultural history, regional agricultural history, agrarian system inspection, agricultural production tools, irrigation, sericulture, animal husbandry and veterinary, horticulture, tea and other aspects. A series of important research results sprang up.

As the study progressed, scholars on the agricultural heritage turn the research based on historical written documentations into combination of archeological materials and documentations through application of archaeology and ethnology. With the gradual excavation of earlier Neolithic Age sites such as Peiligang, Cishan and Hemudu in 1970s, a great amount of farm implements, crops and skeleton of livestock were unearthed. Some scholars began to consciously apply archaeological discovery to study the origin of agriculture. This change stimulated new ideas and significant progress of traditional agricultural heritage research.

1.2.2 Ecological ideas

In the long process of development, Chinese farmers
have accumulated rich experience with and knowledge on agricultural production and created many traditional agricultural systems harmonious to environment with distinctive national and folk features, such as fish ponds system Sankey, fruit-based pond systems, the system of rice terraces, rice-fish system, rice-duck farming system, dryland agriculture irrigation systems, forage mutual support system and so on. These precious traditional agricultural systems have high scientific value and practical significance. These mixed agricultural systems have long been a prominent feature of China’s agriculture, reflecting the recognition in Chinese culture of the interrelations between organisms, environment and human beings, and between heaven, earth and humans. They stressed holism and the interactions between the multiple components of complex biological-social-economic systems. Whenever possible, the approach seeks to combine agriculture, forestry, horticulture, animal husbandry, aquaculture, as well as other biological production, into an interconnected system. Study on the ecological ideas behind these farming systems is an important part of agricultural heritage research.

The traditions and custom attached to these farming systems contain ecological knowledge. The human being and their livelihood activities have continually adapted to the potentials and constraints of the environment and also shaped the landscape and the biological environment to different degrees. This has led to an accumulation of experiences over generations, an increasing range and depth of their knowledge systems and generally, but not necessarily, a complex and diverse range of livelihood activities, often closely integrated. The collection and organization of the custom and folks have a role in understanding historic agricultural development.

2 Practice-oriented research

Compared to the systematic collection and documentation of agricultural history materials and agro-archaeological achievements, the research on other aspects of agricultural heritage had been neglected before. Since 2005, based on previous researches, many Chinese scientists have studied on China’s agricultural heritage from different perspectives, using modern methods. These would be very helpful for the agricultural heritage conservation and management.

2.1 Theoretical developments

FAO defines GIAHS as “Remarkable land use systems and landscapes which are rich in globally significant biological diversity evolving from the co-adaptation of a community with its environment and its needs and aspirations for sustainable development”. However, controversies exist regarding the concept of agro-cultural heritage, mainly focusing on its interpretation from English and its exact connotation (Min 2007; Han et al. 2007; Zhang et al. 2008; Wang et al. 2010).

According to FAO, GIAHS is about remarkable land use systems and landscapes which are rich in globally significant biological diversity evolving from the co-adaptation of a community with its environment and its needs and aspirations for sustainable development. It lays emphasis on systems, landscape, techniques, knowledge, species, culture and the co-adaptation to local community. GIAHS is quite different from the definition of the previous so-called agricultural heritage in China. To a certain extent, GIAHS shares Cultural Landscape concept, a new heritage category added to the Convention concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention) in 1992, but GIAHS is more focused on the “combined works of man and nature” and biodiversity conservation. The concept of GIAHS has not positive connection with location and tends to represent intangible systems, while the concept of cultural landscape is definitely about territory. The agro-cultural heritage systems are comprehensive, dynamic and strategic.

Some researchers considered GIAHS not equivalent to agricultural heritage, but as an important component of agricultural heritage. They defined agriculture heritage as the integral and important part of the human culture heritage. And it is also the synthesis of essential tangible and intangible remnants which are closely related to human agricultural activities, including ten aspects as agricultural ruins, agricultural species, agricultural facilities, agricultural landscapes, agricultural technology, agricultural tools, agricultural literatures, agricultural special products and agricultural folk culture (Wang et al. 2010).

2.2 Agrobiodiversity evaluation

Agrobiodiversity refers to the variety and variability of living organisms that contribute to food and agriculture in the broadest sense, and the knowledge associated with them (Qualset et al. 1995). Sometimes agrobiodiversity is considered to encompass a broader definition, to include the full diversity of organisms living in agricultural landscapes. Under this definition, planned agrobiodiversity is the biodiversity of the crops and livestock chosen by farmers, while associated agrobiodiversity refers to the biota. Included are croplands and fields, as well as habitats and species outside of farming systems that benefit agriculture and enhance ecosystem functions (Vandermeer et al. 1995).

Agrobiodiversity not only provides humans with a primary source of cloths and foods but also of nutritive elements and medicines for health. The various new varieties of crops and gene resources allow humans to develop biotechnology researches and provide them...
with a favorable ecological environment for survival. However, with population growth and other factors, such as popularization of high-input, high-output new crop varieties, application of chemical fertilizers and pesticides, forest destruction, excessive exploitation, environment deterioration, excessive animal grazing, pest invasion, social changes and economic development, crop varieties and farmland biodiversity are becoming increasingly dependent on chemical pesticides, which results in the destruction of soil organisms’ environment. Thus studies on agrobiodiversity can advantage agrobiodiversity conservation and sustainability (Zhang et al. 2010d).

One of the salient features of agricultural heritage is their high degree of agrobiodiversity. The early studies on agrobiodiversity of agricultural heritage focused on the performance information gathering and compilation. Research reports from that period mainly aimed to answer questions like what species are there? How many? How to use? Later researches on agrobiodiversity of agricultural heritage employed more quantitative research methods (Zhang et al. 2010d) and focused on the mechanisms of ecological effect, such as diseases, pests and weeds control in species coexistence systems (Wang et al. 2007; Zhang et al. 2010b).

Taking rice complex farming system as an example, the studies show that compared with rice monoculture, integrated rice-duck farming system have positive effects on improvement of quantity, activity and functional diversity of soil microbial community in paddy field (Zhang et al. 2009). The species-richness and Shannon-Wiener diversity indices under integrated rice-duck farming system increased markedly, and the Pielou community evenness indices rose, indicating the species composition of weed community was greatly changed, which inhibited the occurrence of the former dominant weed species. It was concluded that integrated rice-duck farming system was a feasible farming system to control the weed community in rice field (Zhang et al. 2010b). These studies suggested that establishment of species diversified to control crop diseases, pests and weeds in fields is an effective way.

Some researchers established the model of Hierarchical agrobiodiversity index, based on Shannon-Wiener index and Hierarchical diversity; and the agrobiodiversity Information Gain index, after introducing the concept of Information Gain (Zhang et al. 2010d). These indices were ever used to assess dry land of Congjiang County in Guizhou Province.

The structure and trophic relationship of food webs are fundamental research topics in modern ecology. Food webs are important for understanding patterns and processes of an ecosystem. Inventory of the stable isotopes of carbon and nitrogen in organisms has been used as a powerful approach to study the structure and dynamics of food webs and trophic relationships in rice complex farming system. The results show that compared with rice monoculture, both rice-fish and rice-fish-duck farming system achieved higher nutrient levels, and the food webs were more complex, which enhanced ecosystem stability (Zhang et al. 2010c).

The significances of traditional culture and indigenous knowledge in biodiversity conservation and natural management have been widely recognized throughout the world. Cultural diversity has been considered as one of the important component of biodiversity (Dasmann et al. 1995). Base on the traditional farming practices, the agricultural heritage has formed special culture, which plays an important role in biodiversity conservation (Min et al. 2008; Liu et al. 2010).

2.3 Multi-values analysis

Agriculture is the foundation of national economy, as well as accumulation of human civilization. Agriculture has played important roles in many aspects including food production, environmental protection, landscape preservation, rural employment and food security etc. The agriculture has the multi-functions (Lv 2009; He et al. 2010). Due to specific natural conditions and human activities, agricultural heritage sites always have a fragile ecological environment, rich cultures, undeveloped economy as well as multi-functionality in agriculture. This means that agricultural heritage sites have production, ecological, cultural and other functions.

From perspective of ecosystem services (ES), besides crops, agriculture supplies all three major categories of ES—provisioning, regulating and cultural services (Spurgeo 1998). Meanwhile, agriculture also supplies an array of ecosystem dis-services (EDS) that may produce undesirable impacts on the other ecosystems (Zhang et al. 2007; Min et al. 2011). The flows of these ES and EDS directly depend on how agricultural ecosystems are managed. The services of agriculture can be higher, if fields were managed by bio-control pest; the EDS of agriculture can be lower, if neither chemical pesticides nor herbicides were applied (Sandhu et al. 2008; Zhang et al. 2010). There is a growing consensus that traditional agriculture does indeed offer certain environmental benefits over and above those of modern ones.

The Multi-values of agricultural heritage have been gradually recognized and many efforts were put on it, from qualitative research (Sun et al. 2008; Li et al. 2009; Gao et al. 2010) to quantitative research (Qin et al. 2010; Zhang et al. 2009a, 2010b; Zhang et al. 2010; Liu et al. 2010). Through these studies, we reached a conclusion that the traditional agriculture is more adaptable to the physical conditions in certain areas in China. Furthermore, compared with the modern agriculture, multiple products and ecological services from the traditional ones are
beneficial to local farmers and the environment (Zhang et al. 2010b; Liu et al. 2010; Qin et al. 2010).

These works also demonstrate that the potential economic value of the services provided by the traditional agriculture is huge but often untapped. The local people obtain little or no profits from it directly. With the increasing of farm labor opportunity cost, more and more farmers prefer working at cities to living on farming. That means, from an economic perspective, farmers lack positive incentives to undertake agricultural production, especially traditional ones. Therefore, it is particularly important to establish eco-compensation mechanism that would serve as strong incentives to farmers for adopting traditional agriculture. To this end, thorough evaluation of agricultural heritage is highly important to inform the policy and decision makers the value and importance to maintain the diversity of farming systems.

Other researches, which from the ecological footprint composition perspective (Jiao et al. 2009a, 2009b), from the quantitative evaluation of sustainable development capacity perspective (Yang et al. 2009) and from the ecosystem services demand perspective (Jiao et al. 2010), also support the above-mentioned conclusions. There is no doubt about the roles that traditional agriculture plays in regional ecological conservation and cultural heritage but also in sustainable regional socio-economic development through changing the agricultural production mode and consumption patterns of local people.

2.4 Dynamic conservation approaches

The agricultural heritage and its dynamic conservation and adaptive management have attracted increasing attention in recent years and have been becoming an emerging field of inquiry (Sun et al. 2009).

Some researchers paid attention to the ecological museum, and discussed the value of ecological museum in the conservation of agricultural heritage (Wang et al. 2007; Wang 2008). Some researchers considered building multi-stakeholders’ collaborative mechanism as a key part of capacity building on conservation and sustainable development of these systems. Discussions have focused on how to build multi-stakeholders collaborative mechanism, especially how to build communication-based integrated management mechanism (Geng et al. 2008). It has become a consensus that agriculture heritage conservation should be integrated with the local socio-economic development. This requires the development of alternative income sources for local farmers so that dynamic conservation of agricultural heritage will be possible (Liu et al. 2008; Zhang et al. 2008b; Cui 2008). Suggestions range from developing ecotourism (Min et al. 2007; Yan et al. 2008; Chang et al. 2008), developing organic agriculture (Liang et al. 2010; He et al. 2009), production of high-quality agricultural products, development and industrialization of characteristic agriculture, to promoting ecological agriculture and related industries.

In order to fully understand and exploit the resources of agricultural heritage and to explore the modes and methods for their development and protection, current status of agriculture heritage in China were carefully investigated, and most concentrated on the tourism resources at agricultural heritage sites (Pan et al. 2008; Sun et al. 2009; Zhang et al. 2009).

In general, tourism resources at agricultural heritage sites bear specific and unique, wide-spread, fragile, participative and comprehensive characteristics, which are dominating factors affecting evaluation of the tourism development at agricultural heritage sites (Sun et al. 2010a, 2010b). Accessibility was found to be a critical factor for realizing tourism resources potential. Since tourism resources potential is the base and a key factor for developing tourism at agricultural heritage sites, a tourism resources classification framework of “Core-Assistant, Tangible-Intangible” and a tourism resources potential assessment system have been established to assess resources at an agricultural heritage site (Sun et al. 2010b). In addition, the temporal and spatial suitability of the agricultural heritage was assessed by using quantitative method and an index system from the temporal and spatial point. This index system is easy to implement and can quickly provide a base for other studies on agricultural heritage tourism development (Sun et al. 2009).

2.5 Legislation and policy suggestions

The current legal framework for the protection of agricultural heritage is sporadic. At the international level, the relevant regimes include: Convention on Biological Diversity (CBD), UN Convention to Combat Desertification (CCD), UN Framework Convention on Climate Change (FCCC), International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGR), Convention Concerning Indigenous and Tribal Peoples in Independent Countries ( ILO No. 169 ), Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention), World Heritage Convention (WHC) and The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The international declarations and resolutions which protect agricultural heritage include Agenda 21, The Forest Principles, Johannesburg Declaration on Sustainable Development, The United Nations Declaration on the Rights of Indigenous Peoples, United Nations Millennium Declaration, and so on.

Apart from complying with the international conventions mentioned above, relevant legislations on the protection of agricultural heritage mainly comprise the law on local community through recognition of self-
government, such as the Protection of Kazak by Xinjiang Uygur Autonomous Region (Zhou et al. 2009; Wu et al. 2010).

The weaknesses and problems concerning the existing legislations and policies lay in the fact that the national interest, especially the interest of traditional communities are not taken consideration during the implementation of the international conventions (Li 2007; Xu et al. 2009). There is no specific law on the maintenance, protection and utilization of the agricultural heritage. And, the law of protection of agricultural culture is absent. In short, legislations and policies at both international and national levels should be better coordinated and integrated for effective protection of agricultural heritage (Wu et al. 2010).

3 Perspectives

Although the promotion of GIAHS has received great enthusiasm and support from related governmental departments and organizations, agricultural heritage is still a new concept. Greater effort should be made in the future to advance the study of agricultural heritage. First, we need further enrich the content of investigation. It is important to accelerate mechanistic and quantitative research on the good and typical traditional agro-ecological model, not just limited to qualitative research. Multi-disciplinary and inter-disciplinary research frameworks and teams need be established to address more complicated problems in reality. Second, innovative methodologies and methods need be developed to allow the cooperation between different disciplines. Third, the general investigation, collection, exploration and organization of agricultural heritage resources in China need be accelerated. The last but not the least, protection and exploration of traditional agricultural heritage need adapt to the changing social, economic and policy contexts to incorporate with the ideas like circular agriculture, low-carbon agriculture and etc. So that “past serves the present.” Future research agenda should shift from static literature studies to dynamic explorations and focus on agricultural heritage conservation and utilization, which has greater concern about people’s livelihood. The ultimate goal is to achieve the objectives for both protection of traditional agricultural systems and the sustainable development of the local population.

Acknowledgements

The authors wish to thank Dr. Pariz KOOHAFKAN and Dr. Mary Jane dela CRUZ from FAO Headquarter in Rome for their support. We also would like to thank Academician and Prof. LI Wenhua and Prof. CHENG Shengkui from IGSNRR,CAS for their guidance.

References


中国农业文化遗产研究的进展与展望

闻文文1, 霍 露2, 张 丹1

1 中国科学院地理科学与资源研究所，北京 100101；
2 中国科学院研究生院，北京 100049

摘要：中国农业文明历史悠久，勤劳智慧的劳动人民在长期的生产实践过程中一直在探索适应不同自然条件的农业生产方式，创造了灿烂的农业文化遗产。当今农业发展所面临的生态环境退化、资源污染严重、遗传资源丧失、食品安全问题严重等问题，促使人们重新审视传统农业的智慧与经验。本文将基于文献的传统农业文化遗产研究和基于实践的动态保护与适应性管理研究两个方面，较为系统地回顾了中国农业文化遗产研究的主要进展。指出，积淀深厚的、成果丰富的农业历史和农业考古研究，为农业文化遗产保护实践和发展农业奠定了坚实的基础。2002年联合国粮农组织（FAO）发起的全球重要农业文化遗产（GIAHS）项目，极大地提高了人们对农业文化遗产价值的认识，使农业文化遗产保护研究与实践进入了一个新阶段，在农业文化遗产的概念与内涵、农业生物多样性、多重价值、替代产业发展以及法律与政策保障等方面都有新的探索。未来研究中应进一步丰富研究内容，改进研究方法，深入开发农业文化遗产的保护和利用的探索等。

关键词：传统农业；全球重要农业文化遗产（GIAHS）；中国；联合国粮农组织；生态农业