Tongling White Ginger Plantation System in Anhui Province

GIAHS Proposal




Tongling Municipal People's Government

Anhui Province, People's Republic of China

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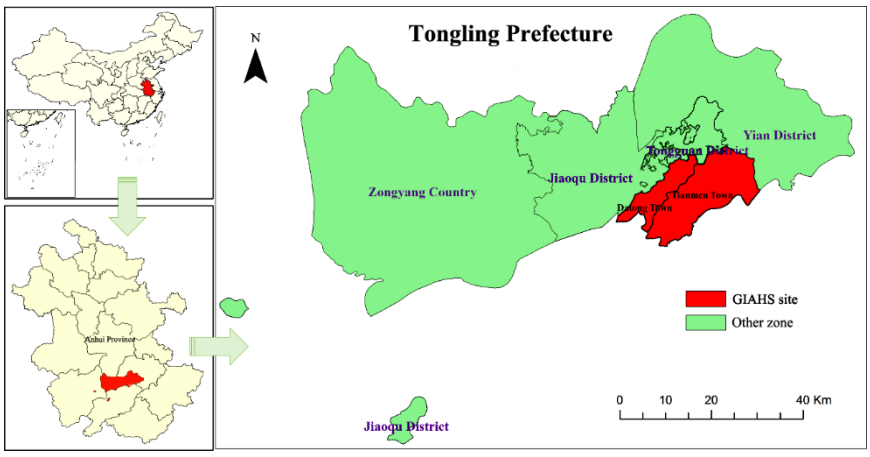
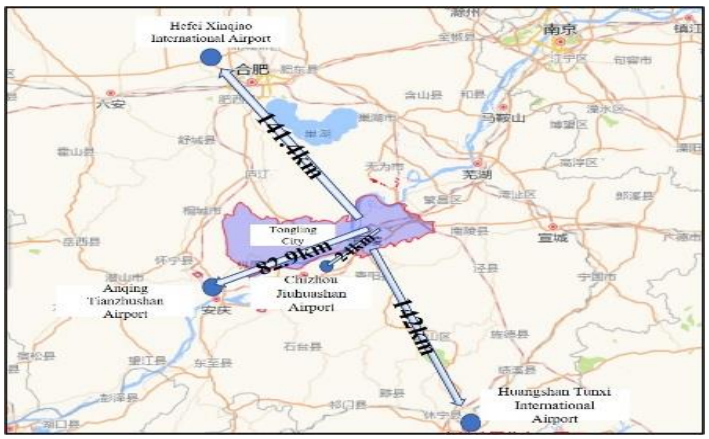
Contents

I. Basic Information

Name/Title of the Agricultural Heritage System	Tongling White Ginger Plantation System in Anhui Province
Requesting agency/organiza-tion	Tongling Prefecture People's Government, Anhui Province, P. R. China
Responsible ministry (for the Government)	Ministry of Agriculture and Rural Affairs of the People's Republic of China
Location of the site	Tongling Prefecture lies in the south-central part of Anhui Province, on the lower reaches of the Yangtze River (30°45'12"~31°07'56" N, 117°42'00"~118°10'06" E). Located at the center between Wuhan, Shanghai, and the Yangtze Golden Waterway, Tongling is 123 km away from Hefei, the capital city of Anhui Province, on its west, and is 384 km away from Shanghai on its east. It is also the gateway to both Mount Huang, one of the World Heritages and World Biosphere Reserves, and Mount Jiuhua, one of the four China's Buddhist Shrines and the birthplace of the Candied Ice Ginger. The GIAHS Site, lies in the east side of the downtown of Tongling Prefecture, consists of Datong Town in Jiaoqu District and Tianmen Town in Yi'an District (see Figure A).  **Figure A. Geographical location of Tongling Prefecture**

Accessibility of the site to capital city or major cities	The Site enjoys convenient transportation. It is the intersection point of *Beijing-Fuzhou High-speed Railway* and *Nanjing-Anqing High-speed Railway*. *G3 Beijing-Taipei Expressway* and *G50 Shanghai-Chongqing Expressway* meet here, too. It takes one hour by high-speed train to arrive Hefei. And it is 3 hours' drive to Shanghai, and 6 hours' drive to Beijing. Air transportation in Tongling is convenient, too. It is 141.4 km away from *Hefei Xinqiao International Airport* (*IATA: HFE*), 82.9 km from *Anqing Tianzhushan Airport* (*IATA: AQG*), and 142 km from *Huangshan Tunxi International Airport* (*IATA: TXN*) (see Figure B).  **Figure B. Accessibility of the site to nearby airports**
Area of the Site	8768.76 hectare
Agroecological Zones	Agroforestry Area in the Hilly Region of Southeast China
Topographic Features	The Site is mainly situated in the low hilly region with low altitude and gentle slopes. It belongs to the southern part of Tongling Prefecture.
Climatic Characteristics	North subtropical humid monsoon climate
Demographic Characteristics and Ethnicity	In 2020, the Site has a registered population of 65,453 (10,853 urban residents, 54,600 rural residents). The *Han* people account for over 99.8%. Of the less than 0.2% of ethnic minorities, half are the *Hui* people.
Main Source of Livelihood	Principal sources of income: ginger & rice plantation and related industries, and working as migrant labors. In 2020, per capita income for rural household was RMB 42,867.7 (Appx. USD 6,708), among which, averagely RMB 25,708.9 (Appx. USD 4,023) came from the white ginger plantation and RMB 2,229.6 (Appx. USD 349) from rice plantation, totally 65.2% out of household per capita income.

II. Executive Summary

China is one of the world's principal ginger-producing countries. In 2019, in terms of global ginger-planting area and yield, China made up 42.5% and 74.5% respectively. Tongling Prefecture is located in the southern-central part of Anhui province, belonging to the subtropical monsoon climate. The warm and humid climate brings rains in hot season and abundant sunshine. The Site is consequently part of both ginger-producing area and rice-planting area in southern China.

Under these local natural circumstances, Tongling people have long cultivated an indigenous species: white ginger. Based on the difference in life habits and growing environments between ginger and rice, locals have developed an ecological planting pattern of white ginger plantation. This pattern can improve the utilization of water and land resources, and optimize the efficiency of plant disease control. Unique ginger-cultivating methods are invented, including "Ginger-Pavilion for Seed-Preserving and Germination-Accelerating", "Planting with High-Plot and High-Ridge", "Shed for Shading", etc. Characteristic ginger cultures are fostered, such as, ginger planting, ginger food, ginger gifts, belief in Ginger God, Ginger Zen, etc. These elements constitute a particular system of agricultural heritage: Tongling White Ginger Plantation System in Anhui Province.

The earliest record of Tongling white ginger can be traced back to the Western Han Dynasty (202 B.C.~8 A.D.), i.e., a planting history of more than 2,000 years. As early as the Northern Song Dynasty (960~1127), the techniques of ginger-rice, ginger-wheat, and ginger-vegetables rotations already prevailed Tongling region, as well as the techniques of Candied Ice Ginger making and Ginger-Pavilions for Seed-Preservation and Germination-Accelerating. Tongling ginger had its heyday in Qing Dynasty (1644~1911): ginger cultivating techniques like "Bamao (Miscanthus floridulus) Shed for Shading" were detailed in books; ginger products, such as candy, vinegar, sauce, and salt, etc., were popular throughout China and Southeast Asia.

Tongling White Ginger Plantation System lies in the transition area between the low hilly region and Yangtze River Alluvial Plain. It comprises Datong Town in Jiaoqu District and Tianmen Town in Yi'an District, with a total territory of 23,673 hectares. Proposed heritage site area is 8,768.76 hectares. Ginger and rice planting area is 4625.31 hectares, accounting for 52.755% . For rural households, average per capita incomes from white ginger and rice are RMB 25,708.9 (Appx. USD 4,017) and RMB 2,229.6 (Appx. USD 348) respectively. In total, incomes from ginger and rice, which are main sources of livelihood for farmers of the Site, account for 65.2% of average household income.

Around the ginger-rice, ginger-wheat, ginger-vegetables rotation pattern, which is the core of the System, Tongling people make ingenious use of local resources. They pay respect to the theories and methods of ecological agriculture, ensure the sustainability of local agricultural production system and stability of economy and society, and make the system itself a successful story of sustainable small-scale farming. This story can be a reference for the rest of the world. Therefore, a unique ginger cultural landscape emerges from Tongling's characteristic natural environment, climate and soil. It contributes to the diversity of farming culture worldwide.

III. Importance of the System

3.1 Characteristics, Values and Global Importance of the System

3.1.1 Geographical Environment and Adaptive Features

(1) Geographical Location

Tongling Prefecture is located in the south-central part of Anhui Province, on the southern bank of the lower reaches of the Yangtze River (30°45'12"~31°07'56" N, 117°42'00"~118°10'06" E). Located at the center among Wuhan, Shanghai, and the Yangtze Golden Waterway, Tongling borders Wuhu on its east, Anqing on its west, Qingyang and Nanling on its south, and Chizhou on its west. It is 123 km away from Hefei, the capital city of Anhui Province. Meanwhile, it is the gateway of Mount Jiuhua (70 km away), one of the four China's Buddhist Shrines and the birthplace of the Candied Ice Ginger. The Site is comprised of Datong Town in Jiaoqu District and Tianmen Town in Yi'an District (see Figure 1).

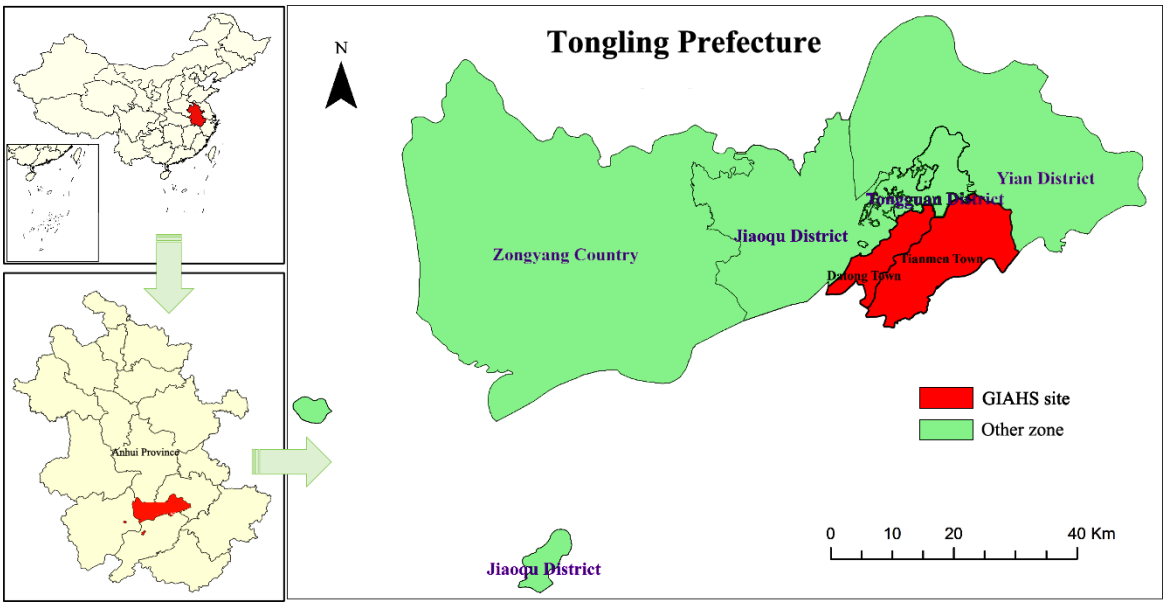


Figure 1: Geographical location of Tongling Prefecture

(2) Characteristics of its Natural Environment

Climate: It belongs to the north subtropical humid monsoon climate. It has obvious monsoon and four distinct seasons. The climate is warm and moist with abundant rainfall, sunlight, and rather high humidity. Tongling has rains in hot season. It enjoys a long frost-free period and 2,064 hours of sunshine annually on average. The annual mean temperature is 16.2°C. The extreme maximum temperature is 40.2°C, while the extreme minimum temperature is -11.9°C. The annual

precipitation is 1346 mm, 75% of which occurs from April to October. The annual frost-free period on average is as long as 258 days.

Landform: It mainly belongs to the low hilly region that features the transition between the Middle-Lower Yangtze Plain and the mountainous region of southern Anhui. Southern part of the Site is crisscrossed with low hills that tilt from southwest to northeast. The hills are in general 300m to 500m high, with 25°～30° slope gradients. The hills are in relatively complete form and decline from southwest to northeast. Gentle slopes are favorable for drainage.

Soil: It consists mainly of rendzina, with deep and thick soil mass in dark colors. The flat land is mainly comprised of black boulder clay fields and sand fields. These fields contain rich calcareous and organic contents that help humus accumulate. The unique geological conditions lead to high contents of humus. Its pH is around 7.0.

White ginger prefers warm and humid climate, it has very limited capability of cold or drought resistance. It grows during the frost-free period (optimal temperature: 25~28°C). The germination slows down when the temperature goes below 20°C. The rhizomes completely lose germinating ability in case of frost. On the other hand, rice prefers high temperature, intense humidity, and short sunlight. It is highly adaptable and suitable for a wide range of growth areas. The climate, landform and soil environments in Tongling provide favorable conditions for the growth of white ginger and rice, and other crops in this system.

(3) Land Utilization

Tongling White Ginger Plantation System covers a total area of 8,768.76 hectares. 4,625.31 hectares (52.75%) go to paddy field and ginger field; 58.90 hectares (0.67%) are used as garden plot; 788.37 hectares (8.99%) as dry farm; grassland: 664.08 hectares, 7.57%; water area: 2,541.68 hectares, 28.99% (see Figure 2 and Table 1). As we can see, paddy field and water area account for a major proportion. Of which, the water area consists of the Gāngyáo Lake and the Shuǐqiáo Lake, two natural lakes in the southwest of Figure 2 that constitute an irrigation network with reservoirs, dāngjiā ponds, riverways, and ditches within that region. It serves as principal water source of irrigation for white ginger, rice, and other crops within this region. Hundreds of upstream reservoirs and dāngjiā ponds compose a complete irrigation system with this water area. This system ensures that the water can be discharged timely from the fields of white ginger, rice and others in flooding season, and that the fields can be irrigated in case of drought. This phenomenon is closely related to the elements like favorable climate, suitable-for-growth soil, and landform riverside alluvial plain.

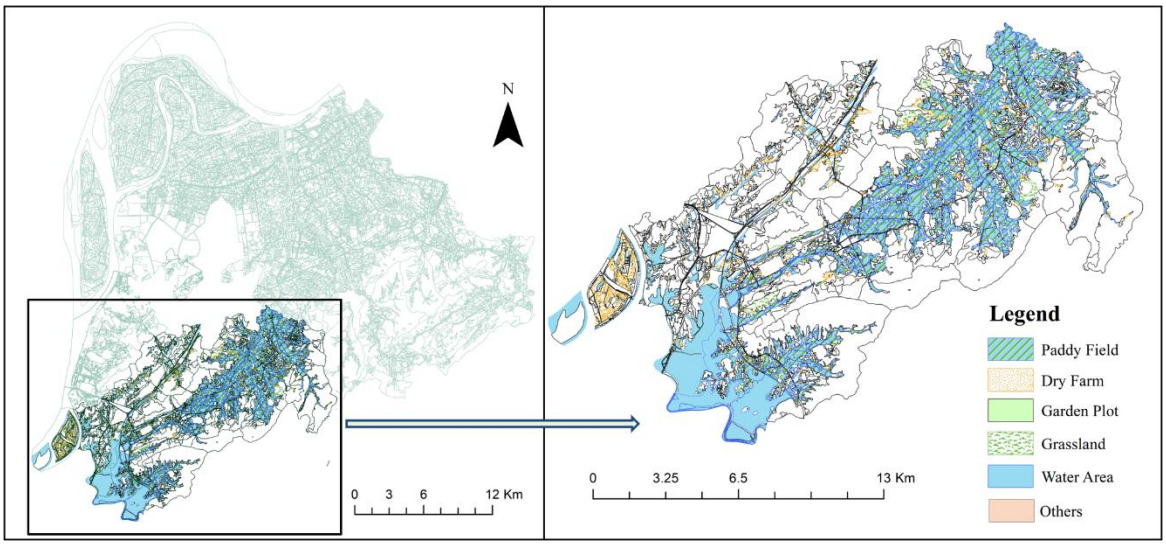


Figure 2: Land Use Types of the Site

Table 1: Land Use Types of the Site

Land Use Type	Area (in ha)	Proportion (%)
Garden Plot	58.90	0.67
Paddy Field	4,625.31	52.75
Dry Farm	788.37	8.99
Grassland	664.08	7.57
Water Area	2,541.68	28.99
Others	90.42	1.03
In Total	**8,768.76**	**100**

(4) Population and Economy

In 2020, the population of Tongling White ginger plantation System Site was 65,453, including 10,853 urban residents (16.6%) and 54,600 rural residents (83.4%). The population engaged in agricultural-related work was 34,989 persons, accounting for 64.1% of the rural residents. Agricultural output, which is an important source of livelihood for local farmers, valued RMB 0.497 billion (Appx. USD 77.7 million) in 2020. Rice-planting area was 1,743 hectares with a total output of 13,552 tonnes; 1,006 hectares for oilseed rape, 1,961 tonnes; and 277 hectares for ginger, around 6,746 tonnes. Area of white ginger plantation occupies 37.32% of the total agricultural acreage. Cultivation of Tongling white ginger, with its high economic benefits, is the most important source of income for local farmers.

3.1.2 Characteristics and Value of the System

(1) White Ginger Plantation System as a Source of Livelihood

The White Ginger Plantation System has been the most important source of livelihood for people in the heritage site since ancient times. In this system, rice and oilseed rape are planted as the main food crops and oil crops in the heritage site, ensuring the local demand for staple food and cooking oil. Although the planting area of white ginger is relatively small, it has high economic benefit and thereby is the main source of income for local farmers. Due to the unique variety and good taste of Tongling white ginger, fresh ginger has been processed into a variety of ginger-related foods, such as sweetened ginger, vinegared ginger, and pickled ginger, which have long been the favorite snacks of local people. In the Ming dynasty (1368-1644), Tongling white ginger was famous as the "tribute ginger". In the Qing dynasty (1636-1912), Tongling white ginger was further widely known. In Datong town, as one of the four famous ports in Anhui province at that time, about six or seven famous ginger shops specializing in selling Tongling white ginger, with an annual sales scale of 5000 tonnes. Ginger products sold well in China and even exported to Southeast Asian countries. Today, food and other products processed from Tongling white ginger are sold at home and abroad, and the white ginger industry contributes to 60% of farmers' total income in the heritage Site.

(2) White Ginger Plantation System That Implies an Ecological Wisdom

Tongling's White Ginger Plantation System is a compound agricultural system with the interannual rotation of white ginger and rice as its core. The ecological wisdom implied by the ginger-rice rotation manifests itself in following ways: firstly, paddy-upland rotation can cut off the interannual transmission channels of insect pests and plant diseases. It can particularly alter the adaptable environment of Pseudomonas solanacearum, the bacteria that causes ginger wilt. The incidence of ginger wilt is thereby reduced. Secondly, during the planting season of the rice, xerophyte weeds cannot survive from the submersion, while the seeds of aquatic weeds cannot germinate during the planting season of ginger. Thus, ginger-rice rotation can effectively lower the incidence of weeds damage. Thirdly, the rotation between water submersion and dry farming can change the soil structure and its nutrient structure. There is a huge difference between the land capacities needed by ginger and rice. Therefore, ginger-rice rotation can make full use of the nutrients and maintain the soil fertility. Fourthly, in summer and autumn, when the rice, white ginger, vegetables and woods interlace with each other, a composite agricultural landscape inlaid with various plants takes shape (see Figure 3). The separation between different organisms can effectively reduce the incidence of plant disease and insect pests, and make resources, such as water, soil, and heat, fully utilized. Lastly, ginger-rice rotation diversifies local plantation structure, enriches food supply, and meets local people's various food demands.

Alternative Distribution Between White Ginger and Vegetables

Alternative Distribution Between White Ginger and Rice

Figure 3: Intercropping between Different Crops

(3) Exceptional Agricultural Techniques for Ginger and Rice Planting

Shed-for-Shading Techniques. White ginger is a shade-loving plant that cannot stand direct sunlight. As a result, Tongling ginger farmers, drawing on local resources, build ginger sheds with woods and Bamao (Miscanthus floridulus) from the mountains after the sowing of ginger (see Figure 4). As ginger grows, it needs more and more sunlight. At the same time, with the gradual decomposition and falling of the Bamao, the light-admitting quality of the shed improves. This method dynamically satisfies the lighting requirements of ginger during its whole growth period (see Figure 5). The shed stands during whole period of growth, becoming a unique agricultural landscape in the Tongling white ginger production system.

Figure 4: Shading Shed in Early Stage of Growth

Figure 5: Shading Shed in Mature Period

White Ginger Plantation Techniques. Based on the commonality and complementarity between the growth habits of ginger and rice, Tongling farmers invented an interannual rotation pattern: same land, a 2-4 year life cycle—1 year for ginger, 1-3 years for rice or vegetables (see Figure 6). Since ginger requires generous fertilization, successive ginger-planting tends to cause short supply of soil nutrients and imbalance of nutrient. It also degenerates the diversity of soil microorganism and worsens plant diseases and insect pests. On the other hand, after the ginger harvest, the soil contains abundant nutrients and its structure is better than that of the farmland only planting rice for years. For example, this farmland for rice planting needs fertilizers that are lower 20-30% than that only for planting rice for years. The ginger-other crops rotation can also fully

utilize resources like water, soil, sunlight and heat, improve soil structures and composition of microorganism species and ensure the sustainable development of agriculture industry.

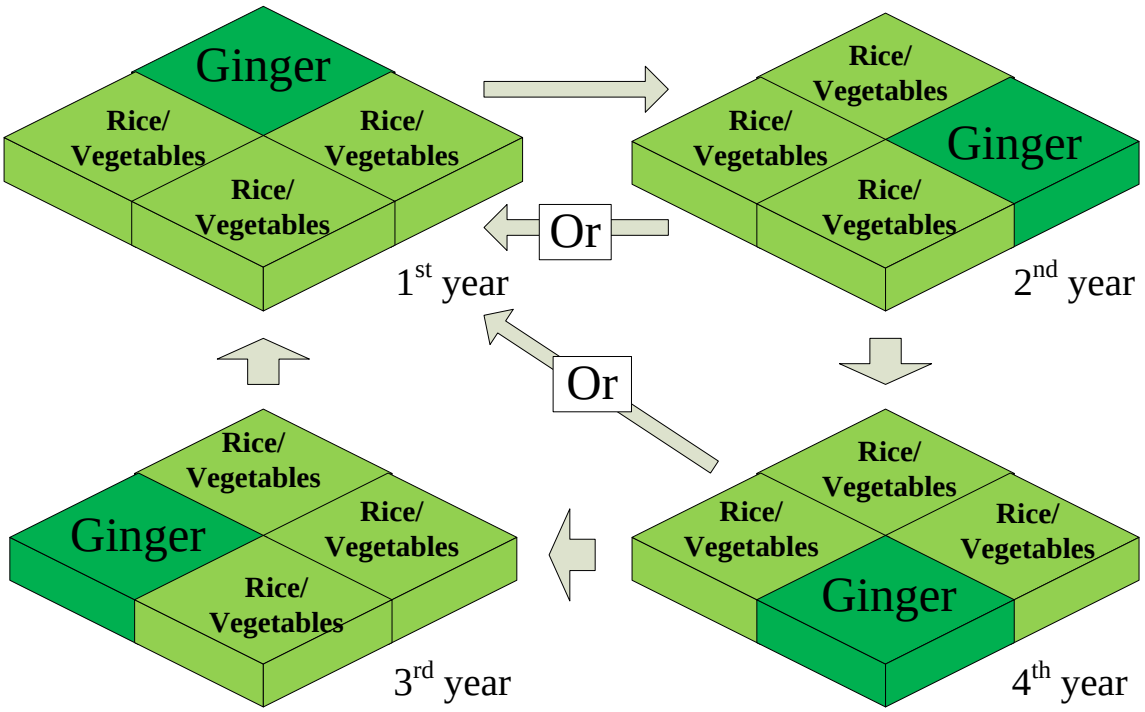


Figure 6: Ginger-Rice or Vegetables Rotation

Grow-in-Furrow, Harvest-on-Ridge: High-Plot High-Ridge techniques for white ginger. Tongling white ginger is fond of warmth and humidity, but is intolerant of drought and flood. It also requires abundant fertilization. However, the climate of Tongling area is rainy in spring and summer. In order to harmonize the growing habits of white ginger with local climate characteristics, farmers developed high-plot high-ridge cultivating techniques and multiple-fertilization-and-hilling techniques (see Figure 7). Specifically speaking, high ridges in high plots are built before ginger seeds are sown on the side walls of the furrows; during gingers' growth, soil on the ridges is mixed with organic fertilizer and re-earthed upon the ginger roots. After multiple topdressing and hilling, former furrows become ridges, while former ridges become furrows. This furrow-ridge exchanging technique can prevent waterlogging in rainy days, and guarantee nutrient supply during the growth period of white ginger.

Grow in Furrow **Harvest on Ridge**

Figure 7: Grow in Furrow, Harvest on Ridge

Ginger-Pavilion techniques for seed-preserving. The area of Tongling White Ginger Plantation System, i.e., Datong Town and Tianmen Town, lies on the bank of Yangtze River. It has low air temperature and high humidity in winter. Under this circumstance, measures against coldness and moisture need to be taken from November to the next March to ensure that ginger seed can survive during the winter and a high germination rate in the next year. Local farmers invented Ginger Pavilions for seed preservation (see Figure 8), i.e., ginger seeds, after being harvested and simple sun-cure, are put into the Ginger Pavilions. Inside the pavilions, a full series of seed-preserving techniques, such as dewatering by burning fire, warmth keeping, and germination acceleration, etc., are conducted. These techniques have been carried forward by local people for over 1,000 years.

Figure 8: Tongling Ginger Pavilion

(4) Characteristic Local Agricultural Products and Related Culture

A characteristic ginger culture emerges from long-time ginger plantation in Tongling and blends itself into all aspects of local life. For example, ginger planting, ginger food, ginger gifts, belief in Ginger God, and Ginger Zen, etc. Fresh ginger, after various processing, becomes Pickled ginger, Sweet-and-Sour Ginger, Candied Ice Ginger, and Honeyed Ginger. For local people, they are daily pastries, hospitality snacks, and great gifts.

Ginger-Ridge Treading is the most arduous work among all processes of white ginger planting. Mastery of ginger-ridge treading skills used to be an important husband-choosing standard for local women. Ginger-pavilion opening ceremony is held each year when the pavilion is reopened and people need to sing pavilion-opening chants to salute the Ginger God. Tongling people worship Yanju, the god of ginger. Buddhist culture of Ginger Zen is prevalent in this region, too.

3.1.3 Global Importance of the System

(1) Model for Sustainable Small-Scale Farming That Fully Utilizes and Transforms Natural Conditions

Tongling White Ginger Plantation System is an ecological, circular agriculture system as the result of local farmers' practice and exploration in low hilly region with subtropical humid monsoon climate. It consists of various ecological agricultural methods that suit the natural environment of Tongling, such as White Ginger Plantation, ginger-pavilion for seed preserving, high-plot high-ridge cultivation, shed for shading, precise management of water and fertilizer, and physical & biological pest control, etc. As the most important source of income, the System also provides locals with sufficient food. Over the past 1,000 years, the White Ginger Plantation system has safeguarded the food supply and livelihood security of the Site, maintained the local ecosystem stable, and ensured economic and social stability. It can be a reference to the rest of the world as a successful story of sustainable small-scale farming.

(2) A Nature-based Solution That Can Potentially Tackle with Problems and Provide Experience & Reference Globally

Tongling White Ginger Plantation System leverages methods, for example, paddy-upland rotation and biodiversity improvement, to reduce the occurrence rate of agricultural insect pests and plant diseases. It improves people's food and nutrition security with the help of diversified farming, such as ginger-rice rotation and ginger-vegetable rotation, etc. At the same time, the healthcare effects of Tongling white ginger bring better health status among locals. These nature-based solutions to ecological and environmental problems, food and nutrition security issues, and human health problems care can provide the international communities with experience and wisdom in tackling with global challenges.

(3) Characteristic White Ginger Culture That Contributes to the Diversity of World Farming Culture

China is a major ginger-producing country in the world. In 2019, ginger-planting area in China accounted for 42.5% of the world's total. This country produced 74.5% of the world's total ginger output in the same year. Tongling is one of the most important ginger-production bases in China. Throughout the Site, white ginger, Tongling's special variety, plays an important role in local people's life. Tongling people have long established a whole spectrum of white ginger culture. It prompts locals to cultivate white ginger, inherit and further develop the White Ginger Plantation system, and form a unique white ginger cultural landscape. It improves the diversity of world farming culture, and becomes an important reference for the sustainable development of agriculture under the interaction between contemporary economic and cultural effects.

3.2 Practical Significance

3.2.1 Meeting Local People's Special Food Needs and Livelihoods

White ginger plantation system can not only meet the food needs for ginger and rice, but also play an important role in promoting farmers to pursue higher income and realizing rural

revitalization. Data of 2019 farmer household survey shows that, averagely for ginger farmer households, income from ginger accounts for 60.0% out of total family income, i.e., RMB 25,708 (Appx. USD 4,017) per capita. At present, promoting the cultivation of white ginger has become one of the key industries that help local government in targeted poverty alleviation.

3.2.2 Promoting the Sustainable Development of Local Ecosystem

Through ginger-rice rotation, the System reasonably leverages the intrinsic balance mechanism among existing crops, climate, and soil environment, and effectively prevents high occurrence of ginger wilt. By means of biological and physical pest control, and the application of biological organic fertilizers, local ginger-rice rotation realizes balanced fertilization and prescription fertilization, therefore achieves a dynamic equilibrium. Consequently, output and quality of white ginger, rice, and related crops have been improved. In addition to the economic benefits, the System also avoids the ecosystem from being damaged, and promotes the sustainable development of the agricultural ecological system.

3.2.3 Stabilizing Local Rural Communities and Paves Way for Rural Revitalization

Traditional way of white ginger plantation is labor-intensive with very high yields. It attracts more and more young people and entrepreneurs to return home and establish cooperatives and startups. This extends the industrial chain of ginger and creates jobs for local women, the elderly, and other vulnerable groups. Tongling white ginger industry plays an important role in eliminating poverty among rural area, creating jobs for vulnerable groups, and carrying forward traditional rural culture. It functions as a vital cornerstone for local rural revitalization.

3.3 Historical Origin and Evolution

3.3.1 The System's History of Development and Evolution

Tongling White Ginger Plantation System in Anhui Province has a long history of over 2,000 years. On that basis, white ginger culture, which is full of ups and downs, is long-standing and well-established. From the perspective of historical development, the evolution of Tongling White Ginger Plantation System in Anhui Province is mainly comprised of following periods (see Figure 9):

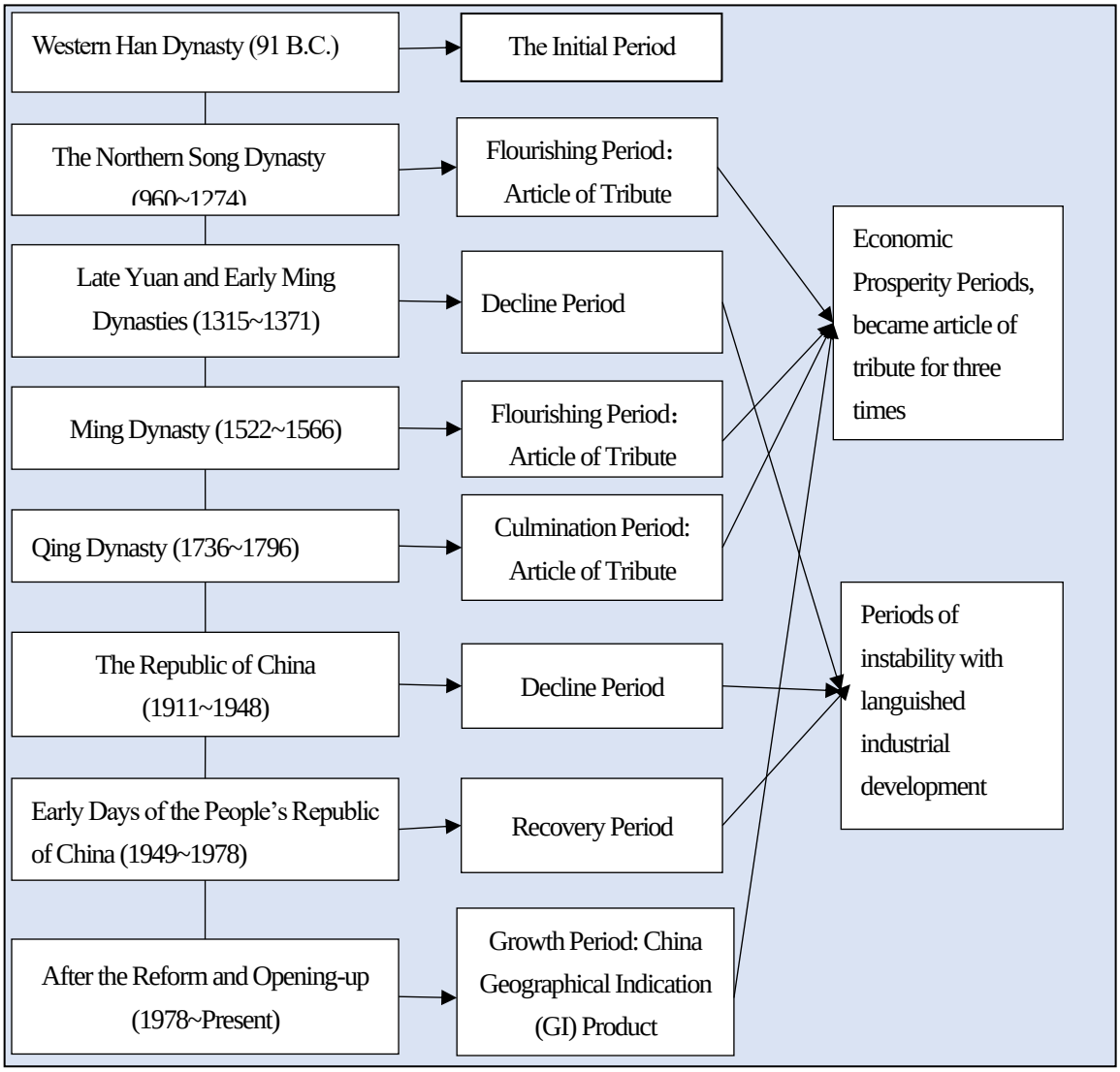


Figure 9: Historical Evolution of Tongling White Ginger Plantation System in Anhui Province

The origin of Tongling White Ginger Plantation System in Anhui Province dates back to the Western Han Dynasty. According to the Collected Biographies of Businessmen in Shǐjì (Records of the Grand Historian, Chinese: 史记·货殖列传) (91 B.C.), "JiāngNán (literally River South, refer to the vast area that lies to the south of the Yangtze River) abounds in nanmu, catalpa, ginger, cassia, copper, tin, lead, cinnabar…" (see Figure 10). During Western Han Dynasty, Tongling belonged to the JiāngNán region. Above-mentioned records show that the Tongling White Ginger Plantation System was in the bud at that time.

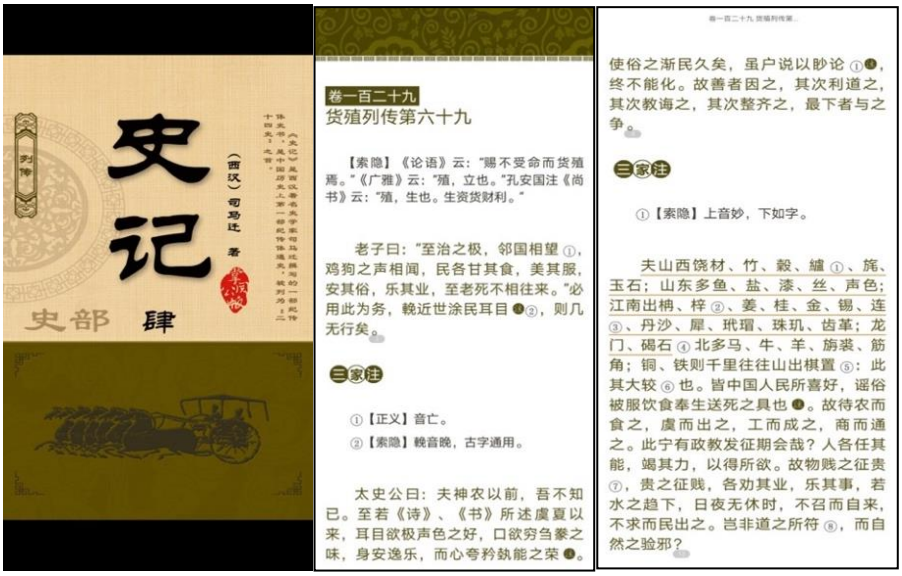


Figure 10: Record of Tongling White Ginger in *Shǐjì*

Flourishing in Northern Song Dynasty. During Northern Song Dynasty, Tongling was part of Chizhou Prefecture. Northern Song pharmacologist, Mr. Su Song (1020~1101) indicated in TúJīng BěnCǎo (Illustrated Classic of Materia Medica, Chinese: 图经本草): "Ginger can be seen everywhere. Gingers produced in Hanzhou (in Sichuan Province), Wenzhou (in Zhejiang Province), and Chizhou (the Site in Anhui Province) are better than others." It means that Tongling white ginger had been famous for its outstanding quality as early as in Northern Song Dynasty, and the industry reached considerable scale and output back then. SòngShǐ (the History of Song Dynasty, Chinese: 宋史) (960~1274) records that "Red and white ginger, articles of tribute from Chizhou" (see Figure 11). Red and white ginger refer to red or white Candied Ice Gingers that are made of Tongling white ginger after being processed with brown sugar or honey. It is evident that, during Song Dynasty, Chizhou Prefecture contributed Tongling white ginger to the emperors as articles of tribute. It also means that the planting skill, processing techniques, and food culture of Tongling white ginger had been rather developed in Song Dynasty. Accordingly, we can say that, during Northern Song Dynasty, Tongling White Ginger Plantation System also tended towards maturity at that time.

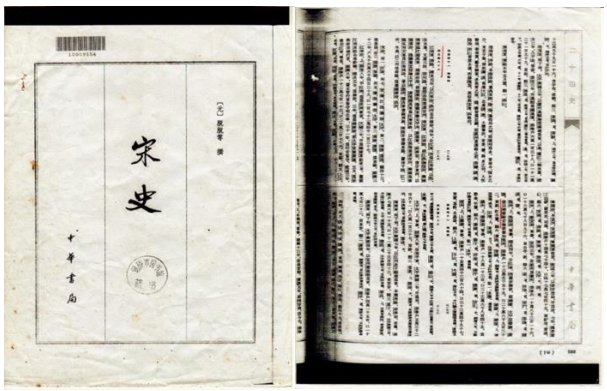


Figure 11: Records in *SòngShǐ* (The History of Song Dynasty, Chinese: 宋史) About Tongling White Ginger Being the "Article of Tribute"

Techniques of "Ginger Pavilion for Seed-Preserving and Germination- Accelerating" Emerged in Yuan Dynasty. Mr. Wang Zhen, agronomist in Yuan Dynasty (one of the Four Greatest Agronomists in Ancient China) wrote in Băigŭpŭ (literally Chart of One Hundred Crops, Chinese: 百谷谱，part of The Book of Agriculture by Wang Zhen, Chinese: 王祯农书) (1271~1368), "Nowadays, southern China is so warm that people need no cellars. Before the Slight Snow (the 20th Solar Term), select (gingers seeds) that are intact without frost injury. Sun-cure on the very day of plucking without removing the mud. Put them into bamboo crate, and put the crates up. Fire set below the crates, for 3 days and 3 nights. After the humidity is completely removed, keep the crates sealed and place them further higher. Constant fire shall be made to keep them warm and avoid cold bite. When the next spring comes, select those with longer sprouts, sow them in the same fashion" (see Figure 12). This record is a real portrayal for the process of traditional Tongling ginger pavilion for seed-preserving and germination-acceleration. Mr. Shen Mi, a poet of Qing Dynasty, wrote in his Ginger-Planting Song: "For ginger seeds that can't survive the coldness, seal them in crates and keep them warm. The Waking of Insects (the 3rd Solar Term) is a good day of sales. The Fire Ginger are best known for their strong resilience. Sow them in fertile fields and keep the humidity balanced. House them with pine-needle sheds for shading." This poem specifically described Tongling white ginger's unique techniques, i.e., "Ginger-pavilion for Seed-Preserving and Germination-acceleration" and "Bamao Shed for Shading".

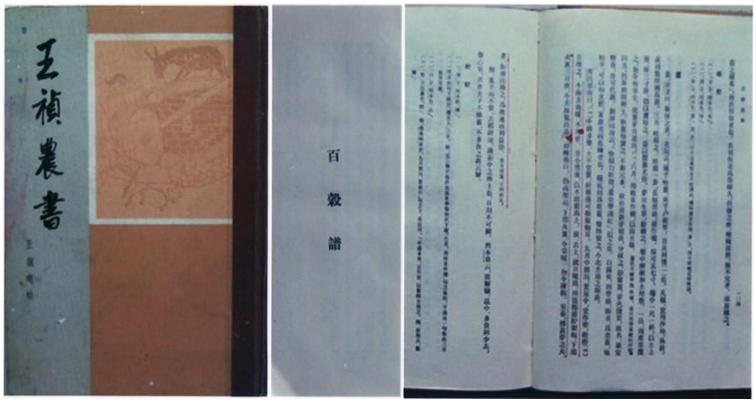


Figure 12: Description of "Ginger-pavilion for Seed-preserving and Germination-acceleration" techniques in the *Băigŭpŭ* Section from the *Book of Agriculture by Wang Zhen*

Declined in late Yuan Dynasty and Early Ming Dynasty. During late Yuan Dynasty, wars and turmoil greatly destroyed the social economic development and agricultural production. It was a dark time for Tongling white ginger, too. Mr. Tao An (1315~1368), grand secretary in Ming Dynasty, was deeply saddened by the situation when he visited Tongling. In his poem *Going by Tongling*, Tao wrote: "Ginger buds can be hardly seen in the war-torn land. Nothing left but rocks and new arrow bamboo." It depicted the decline of ginger planting during the hard times.

Recovery in Ming Dynasty. During the reign of Emperor Jiajing in Ming Dynasty (1522~1566), The *Shé* brothers (Mr. Shé Jingzhong and Mr. Shé Yizhong) rose from "The Shé's Grand Courtyard" (now Dayuan Village, Datong Town, Jiaoqu District, Tongling Prefecture) and became officials in the government. They contributed the local ice ginger to the royal court. Hence,

Tongling white ginger became (again) "Ginger as Article of Tribute". Attracted by the good reputation of "article of tribute", people scrambled for it. Tongling white ginger became a "hot" specialty and bulk commodity that "drew so many traders from faraway". We can see such records as "Tongling produces ginger" in the *Chronicles Chizhou Prefecture* that was written during the reign of Emperor Jiajing (1522~1566) in Ming Dynasty (see Figure 13).

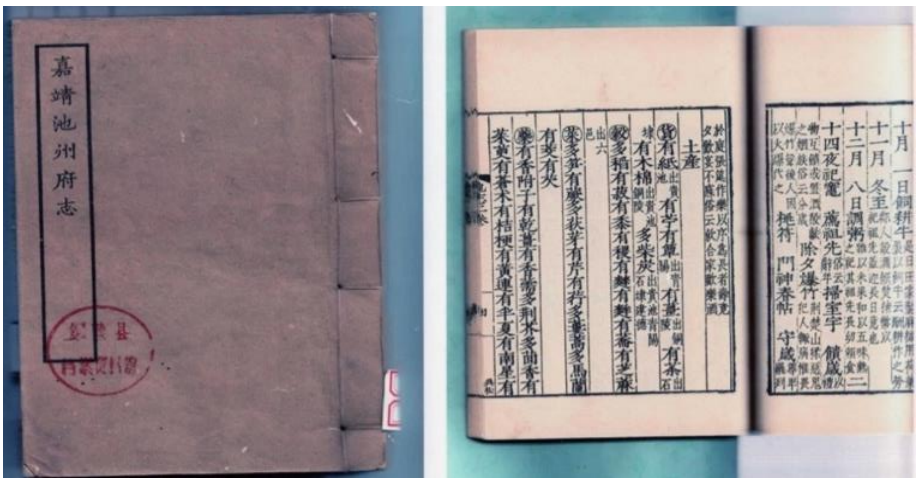


Figure 13: Record about Tongling White Ginger in the *Chronicles Chizhou Prefecture* (Reign of Emperor Jiajing (1522~1566), Ming Dynasty)

Planting and Sales of Tongling Ginger in Heyday during Qing Dynasty. Datong Town had been the traditional producing area of Tongling white ginger. Enjoying convenient water and land transportation and advanced commerce, Datong had been well known as one of the "Four Famous Ports in Anhui Province". It was also the only gateway to the Mount Jiuhua, a Buddhist shrine that "attracts most pilgrims in China". Datong Ginger, which is the product from Datong Town with excellent quality and a shape like "Buddha's Hand", plus the transportation advantage, had gone wild among Buddhists and pilgrims at home and abroad. Its fame spread throughout the world. It is recorded that there were six or seven well-known white ginger merchants in Datong Town, for example, *Bìróngxīng* (literally *Bì Family's Co., Ltd., Prosperous and Glorious*), *Bìzhèngfā* (literally *Bì Family Co., Ltd, Just and Rich*), and *Yuánchángfā* (literally *Yuán Family's Co., Ltd., Eternally Wealthy*), etc. Annual sales volume from these traders was impressive: no less than 100,000 *shi* (Appx. 5,000 tonnes). In the twelfth year during Emperor Qianlong's Reign, Qing Dynasty (1747), the *Chronicles of Tongling County* (in the Chapter of *Products*) recorded that "according to the *Compendium of Materia Medica*, Chizhou ginger is better than others. Currently, it goes wild at most markets and fairs throughout Datong Town. It is commonly known as Datong Ginger, of which the annual sales volume is no less than 100,000 *shi* (or *dan*)" (see Figure 14). Monks from Mount Jiuhua have the customs of making Candied Ice Ginger from Tongling white ginger; it's known as "Jiuhua Ice Ginger". The Jiuhua Ice Ginger was not only offered to the Buddha as sacrifice, but also given to pilgrims as gifts. In addition, thanks to the gingers' outstanding quality, Tongling has been the ginger materials source of famous, century-old sauce shops, for example, *Huyumei Sauce Shop* in Anqing City (1830~Present), *Simei Sauce Shop* in Yangzhou (1817~Present), and *Hengshun Sauce Shop* in Zhenjiang City (1840~Present), etc. Candy, vinegar, sauce, salt, and other related products that made of Tongling white ginger have

various colors and flavors. These ginger products are popular in China and Southeast Asian countries.

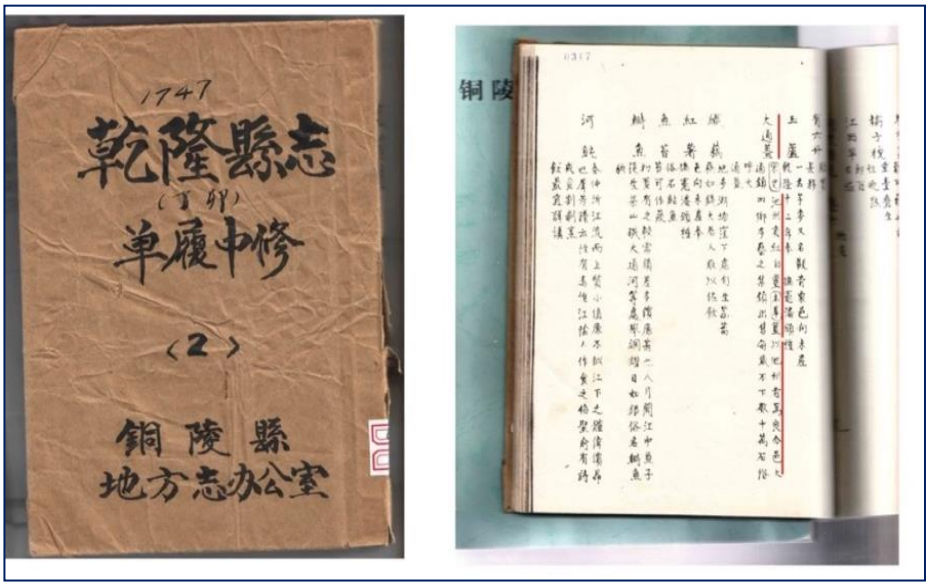


Figure 14: Record about Tongling White Ginger's Unprecedented Hot Sales from the *Chronicles of Tongling County* during Emperor Qianlong's Reign, Qing Dynasty

Tongling White Ginger was at a Low Ebb in the Period of the Republic of China. Ravaged by years of wars and turmoil, the production and sales of Tongling white ginger were in a downturn. For example, in 1948, the ginger-planting area in Tongling was merely 300 *mu* (Appx. 20 hectares), with a meagre output of 100 tonnes. In short, white ginger industry in Tongling was devastated.

Revitalized and Developed After the Founding of the People's Republic of China. During the late 1950s and early 1960s, in order to feed people, agricultural production in Tongling strictly followed the guideline of "take the grain as the key links". Ginger planting consequently gave way to rice planting. From 1964 to 1990, the maximum ginger procurement by Tongling Supply and Marketing Department was 60,800kg in 1966, minimum 350kg in 1978.

Tongling White Ginger Plantation System in the Fast Lane after the Reform and Opening-Up. Since 1980s, under the guidance of active development of diversified economy, planting area and output of Tongling white ginger have been constantly increasing. 1980 saw ginger-planting area 315 *mu* (Appx. 21 hectares), output 324.3 tonnes, then 1,362 *mu* (Appx. 90.8 hectares) and 1,516 tonnes in 1990; 4,497 *mu* (Appx. 299.8 hectares) and 5,725 tonnes in 2001. With the increasing market demand, the price of white ginger continued to rise, which drove local farmers to expand ginger planting area. In 2006, white ginger-planting area increased to 6,500 *mu* (Appx. 433.3 hectares) and 12,000 tonnes. However, the white ginger-planting area and output had fell sharply after 2006 due to supply exceeding demand by led blind expansion of planting area. They decreased to 6,500 *mu* (Appx. 301 hectares) and 6,248 tonnes in 2013; Since then, the planting area and output has maintained a small fluctuation state; 4,159 *mu* and 6,746 tonnes in 2020 (see Figure 15). As the white ginger industry grows and advances, a host of leading

enterprises came forth in Tongling. White ginger products hit the shelves of supermarkets in large and medium- sized cities. They are also exported to EU and other overseas markets. This is a new development opportunity for Tongling White Ginger Plantation System. As one of "Eight Treasures of Tongling Prefecture", white ginger becomes a major source of income for local farmers.

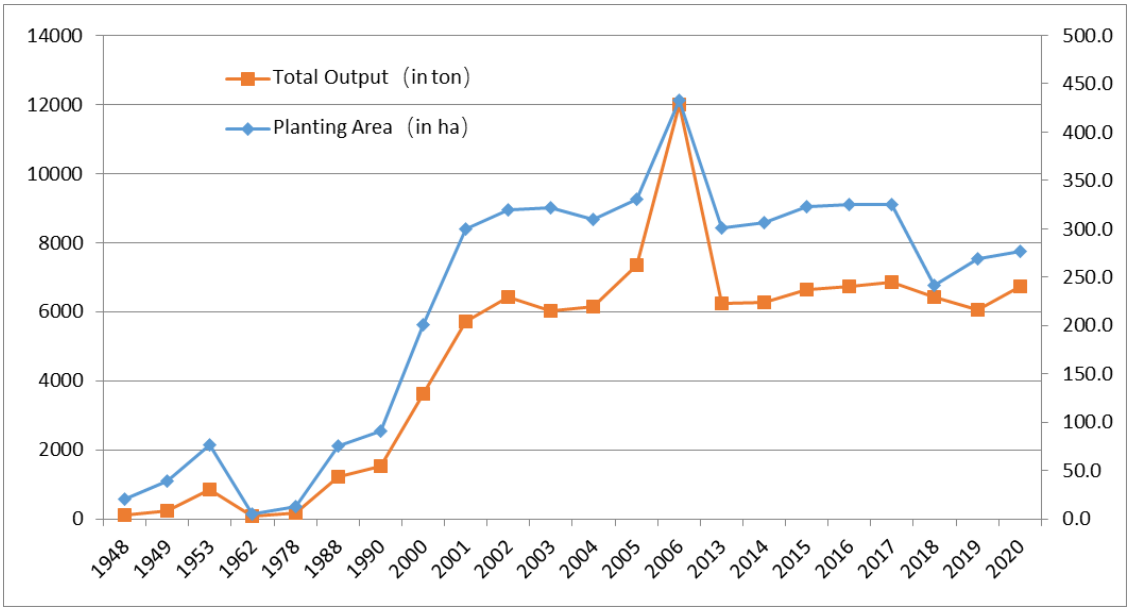


Figure 15: Production Area and Output of Tongling White Ginger, 1948~2020

In 2009, Tongling white ginger was awarded "Product from Place of Origin under National Protection" (now GI product, i.e., Geographical Indication of China). In the same year, "manufacturing techniques of Tongling white ginger" was included into the category of Anhui Province's Intangible Cultural Heritage. In 2012, it was certified and granted China GI label and trademark. In 2017, Tongling White Ginger Planting System was identified China's Nationally Important Agricultural Heritage Systems (China-NIAHS). Tongling white ginger is going into a new development era. As an important symbol of Tongling Prefecture, the white ginger, once again, is becoming popular in the country and the world.

Figure 16: Titles of Honor for Tongling White Ginger

3.3.2 Heritage Value and its Significance in Agricultural History

(1) Tongling Ginger-Rice Paddy-Upland Rotation is a Typical Farming Method along the Yangtze River Valley

Early in the Western Han Dynasty (202 B.C.~8 A.D.), Chinese people had adopted farming systems of crop rotation. For a long time, on upland, Chinese people mainly cultivate cereals, or adopt cereal/cash crops-legume crops rotation, or rotation with green manure crops. In some areas, paddy-upland crops rotation is practiced. Tongling White Ginger Plantation system typically belongs to paddy-upland rotation between cereal crops and cash crops. It is the suitable farming method that was developed by people who live in the middle and lower reaches of Yangtze River on the basis of local environmental and climatic conditions.

(2) From the Perspectives of Economics and Society, Tongling White Ginger Plantation System is a Sustainable Compound Agriculture Model that Balances Food Security and Economic Benefits

On the one hand, rice produced by the System can guarantee local people's food and nutrition security, on the other hand, as cash crops, white ginger produced by the System can increase the locals' income to a large extent. It also creates jobs for a number of women and the elderly. In this way, the System can lift local farmers out of poverty, prompt farmers to invest in agricultural infrastructure, and realize a sustainable and circular development of local agriculture.

(3) As a Typical Representative of Ecological Farming along the Yangtze River Valley, Tongling White Ginger Plantation System Implies the Chinese Philosophical Thinking of Harmony Between Use and Care

The implementation of ginger-rice rotation is beneficial for prevention against plant disease, insect pests, and harmful weeds. Moreover, the paddy-upland rotation can also help balance the ecological environment of the soil, prompt soil aeration and the decomposition of organic substances, and accelerate the reproduction of beneficial microorganism in the soil. In realizing proper use of local farmland, the System shows high ecological values. Early in ancient times, Chinese people already knew that "the secret of growing rice is changing the field once a year." It pointed out that rotation is an effective measure that combines land utilization with its maintenance. Tongling White Ginger Plantation System balances land utilization and maintenance, and reflects the Chinese philosophical thinking of "harmony between use and care". It is good for the sustainability of the environment and crops systems.

IV. Characteristics of the System

4.1 Food and Livelihood Security

4.1.1 The System Provides Rich Varieties of Foods

(1) Types and Scopes of Primary Agricultural Products

The most important agricultural products of Tongling White Ginger Plantation System in Anhui Province are fresh white ginger and rice. Additionally, it also produces crops that rotated or interplanted, self-sown plants and natural animals, and livestock that depend on these plants and crops, etc. (see Figure 17). Within the System, the compound cultivation, which comprises ginger, grain and oil crops, and other crops (cereal, sugar crops, oil plants, vegetables, and edible fungi, etc.), yields agricultural, forest, fruit, livestock, and aquatic products of various kinds.

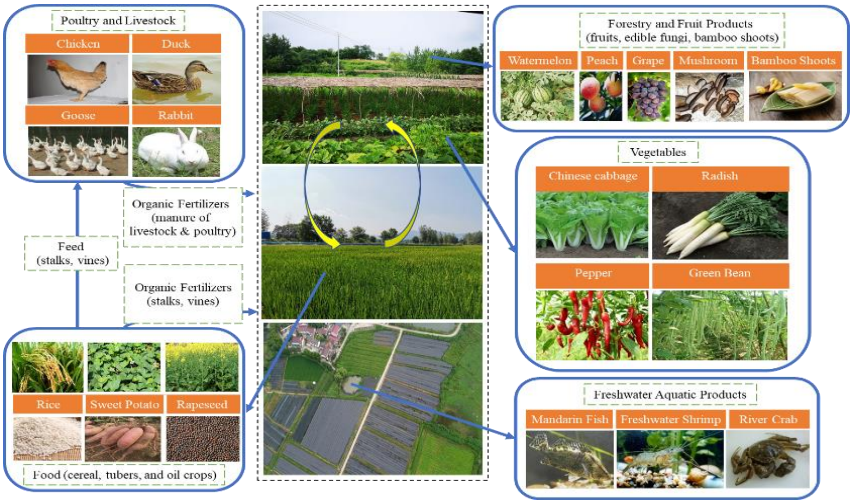


Figure 17: Foods Provided by White Tongling Rotation System

1) Rice and Other Foods

Besides grains like rice, wheat and corn, there are tubers like potato and sweet potato, and oil crops like rapeseed, sesame and peanuts. After harvesting and processing, these crops provide local people with important staple foods and edible vegetable oil. They are also important sources of starch, vegetable protein, vitamins, and fats for local people.

2) Fruits

More than 10 varieties of fruits are planted around Tongling white ginger fields, on hilltops, wind gaps, or hillsides. For example, watermelon, peach, grape, pear, orange, persimmon, and red dates, etc. These fruits are rich in multiple nutrients. Thanks to these fruits, local needs for various vitamins, sugar, minerals and microelements, carbohydrate, pectin, and amino acid, etc. are satisfied.

3) Vegetables

In different seasons, local farmers grow Chinese cabbages, radish, pepper, eggplant, tomato, cucumber, oilseed rape, spinach, cowpea, and garlic, etc. Totally over ten varieties of vegetables that are rich in nutrients. These vegetables can basically satisfy the needs of local farmers throughout the year.

4) Livestock and Poultry

Local farmers use sweet potato leaves, stalks, and vines, which are harvested from and around the ginger fields, as feeds for poultry and livestock, such as chicken, duck, goose, and rabbits. These poultry and livestock are main sources of animal protein for local people.

5) Fungi

Edible fungi, such as mushroom, black fungus and shii-take, are grown in and around Tongling white ginger fields. These fungi contain various protein, amino acid, vitamins, minerals, microelements and other nutrients. The fungi are not only fresh and tasty, but also helpful in lowering blood cholesterol and curing high blood pressure. They enrich local people's nutritional supplies.

6) Others

In Tongling white ginger fields, and the ponds around the fields, freshwater aquatic products like silver carp, bighead carp, ricefield eel, mandarin fish, and freshwater shrimp, etc. are cultured artificially. Fresh leaves of Tongling white ginger are important bait for cultured fishes. In the river courses and canals of the ginger fields, there are lots of wild river crabs. Every year in spring and winter, local people dig bamboo shoots in ginger fields and the moso bamboo forests around the fields.

(2) Processed Products

1) Ginger Series

Fresh Tongling white ginger and its processed products are the most important products from the Tongling White Ginger Plantation System in Anhui Province, with extraordinary commodity rate and economic values. Traditional processed products of Tongling white ginger are Candied Ice Ginger, Sweet-and-Sour Ginger, and Sauced Ginger, etc. (see Figure 18).

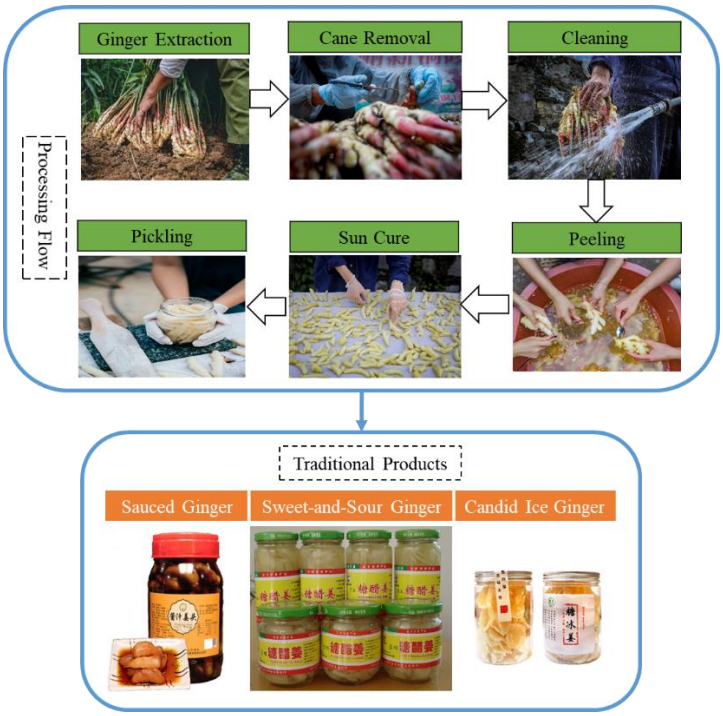


Figure 18: Processing Chain of Ginger Products

2) Rice Series

Rice serves as staple food in Tongling. Throughout the long history, local people have developed a lot of manual food-making methods. Rice products made in these ways are of various types and distinct local characteristics. For example, glue pudding, ZòngZi (rice dumpling), and rice cake that are made of glutinous rice; rice crackers, baba (mochi), crunchy candy, and square cakes that are made of non-glutinous rice.

Figure 19: Processed Rice Foods

3) Vegetable Series

Vegetables are highly seasonal. Fresh vegetables don't last long. In order to adjust the imbalanced seasonal consumption of vegetables, local people explored and invented many traditional ways of vegetable pickling and curing. Characteristic preserved vegetables are basically pickled products, such as pickled Chinese cabbage, pickled radish, pickled green bean and garlics, etc.

Figure 20: Processed Vegetables

4.1.2 Food Security and Livelihood Security

(1) High-level Self-sufficiency of Agricultural Products Guarantees Local Food Security

Agricultural products, such as rice, white ginger, oilseed rape, and other vegetables, produced by Tongling White Ginger Plantation System provide the locals with abundant and diversified food and nutrients, and guarantee food security of this region. Statistics and on-site surveys show (see Table 2) that, generally speaking, food production of the Site precedes its consumption (100% self-sufficient). Except self-needs, there is still 30.79% surplus food that is sold to other regions as commodity. White ginger is the most typical product of the System with the highest economic value. Production of the ginger is far more than its consumption by local people (100% self-sufficient). 86.1% white-ginger products are sold to other regions as commodity. Thus, it becomes the largest source of income for local farmers.

Table 2: Self-Sufficiency and Commodity Rate of Major Agricultural Products throughout the Heritage Site in 2020

		Rice				White Ginger			
Area	Population	Output	Consumption per capita	Self-sufficiency	Sales Ratio	Output	Consumption per capita	Self-sufficiency	Sales Ratio
Unit		Ton	Kg/Person	%	%	Ton	kg/Person	%	%
Tianmen Town	39081	11581	169.2	100	42.9	5153	10	100	89.7
Datong Town	15519	2747	169.2	82.6	-21	1593	10	100	52.9
In Total	54600	14328	169.2	100	30.7	6746	10	100	86.1

Data Source: Statistical Yearbooks of Yi'an District and Jiaoqu District, Tongling Prefecture

(2) Medical and Health-Care Functions of Tongling White Ginger Safeguard Local People's Nutrition and Health

1) Tongling White Ginger is Rich in Various Microelements and Organic Ingredients

In terms of microelements, Tongling white ginger contains: crude fiber (0.9%), total phosphorus (0.02%), calcium (0.06%), iron (14.2mg/kg), carbohydrate (2.3%), crude protein (1.3%), crude fat (0.3%), as well as essential nutrient contents, for example, selenium, carotene, thiamine, riboflavin, nicotinic acid, ascorbic acid, and inorganic salt, etc.

Regarding to organic components, test and analysis show that, major effective components in Tongling white ginger are: gingerol (45%~55%), zingerone (2%~10%), cineole (2%~7%), methyl heptanone (2%), aromatic alcohol (1.5%), geranic acid (1.5%), citric acid (5%), and borneol (3%~11%).

According to the comparative analysis research results on the chemical compositions of essential oils from Tongling white ginger and yellow ginger by Kunming Institute of Botany, Chinese Academy of Sciences, extraction rate of yellow ginger is 0.12%, while 0.16% for Tongling white ginger, 30% higher than the former. In terms of Zingiberol, ginger aldehyde, and ginger esters, main components that affect ginger's quality, contents in Tongling white ginger are higher than yellow ginger by 7.49%, 27.2%, and 32.34% respectively (see Table 3).

Table 3: Chemical Component Comparison between Essential Oils of Tongling White Ginger and Yellow Ginger (Fresh Ginger)

Chemical Components	In Tongling White Ginger (%)	In Yellow Ginger (%)	+/- (%)
Zingiberol	17.06	15.87	+7.49
Ginger aldehyde	16.13	12.68	+27.20
Ginger esters	8.96	6.77	+32.34
Ginger acids	11.95	5.74	+108.18
Shogaol	1.89	1.96	-3.57
Ginger geraniol	6.11	3.72	+64.24
Ginger geranial	14.05	8.55	+64.32

Data Source: Pharmacopoeia of the People's Republic of China

2) Tongling White Ginger with High Medicinal Value and Health-Care Functions

White ginger is a typical example of the "homology of medicine and food". It means that it is not only an ordinary food and condiment, but also an indispensable medicinal material. Used as condiment vegetable, ginger can deodorize fishy taste and mutton-like taints. It serves as dim-sum and cuisine. Moreover, ginger is also recommended by many health-preserving experts and clinicians as a healthy drink. Mature ginger has effects like stomachic, hemostasis, chi (literally currents of energy, air, or vitality within human body)-guiding, cold-dispelling, phlegm resolving, detoxication, diaphoresis, heat relieving, and appetite-improving, etc. Gingerol is the major functional component in fresh Tongling white ginger. It has functions like antioxidation, anti-inflammation, and anti-cancerization, etc. (Zhang et al., 2017). In addition, Zingiberol substances (6-Zingiberol) in fresh Tongling white ginger also has antioxidation, anti-inflammation, and anti-tumor effects. For example, Kunming Institute of Botany, Chinese Academy of Sciences

successfully separated and obtained 42 chemical compounds from the ethanol extracts of Tongling white ginger, 4 of which are newly-founded chemical substances, including 2 zingerone dimers with novel structures. These new chemical substances showed weak inhibited activity during extracorporeal tumor cytotoxicity test and HIV-1 activity test. What's more, it also has 3 active ingredients during the diabetes-related 11β-HSD model screening (Feng et al., 2011).

(3) Multifunctional Agricultural Development Promotes Local Economic Development and Increases Farmers' Income

1) Contributions to Regional Economic Development Made by the White Ginger Plantation System

Industries of Tongling white ginger, rice, and oilseed rape, etc. have been the pillars of agricultural economy in the region of the Site, and the cornerstone industries that help farmers increase income and achieve prosperity in ginger-producing area. In 2020, the heritage site achieved RMB 36.73 million (Appx. USD 5.74 million) for total value of rice output, RMB 14.86 million (Appx. USD 2.32 million) for oilseed rape, and RMB 177 million (Appx. USD 27.65 million) for ginger. Total output value of white ginger, rice, and oilseed rape accounted for 56.9% of the Site's total agricultural production value.

2) Contribution of White Ginger Plantation System to Farmers' Income-Generation

The development of Tongling white ginger and rice industries has not only solved local farmers' bread-and-butter problem, but also brought prosperity into local community. It has been a major source of income for local farmers (see Figure 21). The on-site random sampling survey indicates that, within the scope of 8 villages in Tianmen Town and 2 villages in Datong Town, average per capita income of farming household is RMB 42,867.7 (Appx. USD 6,698), among which, per capita income from white ginger planting is RMB 25,708.9 (Appx. USD 4,017), RMB 2,229.6 (Appx. USD 349) from rice planting, totally 65.2% of per capita household income.

Figure 21: White Ginger Market

(3) White Ginger Plantation System Creates Employment for Local People

On the one hand, the development of Tongling white ginger industry and rice planting industry creates direct employment opportunities for local farmers. They can participate ginger-related work during slack season for extra income. Current income for local farmers who are employed for Ginger-Ridge Treading is RMB 100~300 per day, or RMB 100~200 per day for rice harvesting. On the other hand, it drives the development of supporting industries, for example, food processing for local ginger, rice, and vegetables, transportations and logistics, and cultural creativity, etc. It creates jobs for local people, prompts entrepreneurship, and increases farmers' income.

Figure 22: Ginger Sowing

Tongling white ginger industry accelerates local women's employment. According to surveys, by the end of 2020, average size of farmer household is 3.8 people, among which, 1.8 women (49.2%). Quantity of labor force per farmer household is 3.2, among which, 1.6 women (48.3%). Quantity of labor force that is involved in white ginger production is 1.8, accounting for 56% of the household labor force that participate the white ginger industry. Local women mainly engage in work like ginger-ridge treading, white ginger sowing, shed building, intertillage hilling, ginger field fertilization, ginger field weeding, insect pest prevention and treatment, white ginger harvesting, etc., especially white ginger sowing, ginger shed building, and white ginger harvesting, etc.

Figure 23: Women are Sowing and Processing White Ginger

4.1.3 The contribution to farmers' livelihood sustainability and resilience

(1) Diversified production such as ginger-other crops rotation ensures the sustainability of farmers' livelihood

Tongling white ginger has high economic benefits. Farmers in the heritage site obtain the main source of livelihood by planting white ginger. However, as the population of the heritage site continues to grow, the local population faces a huge demand for food rations, which is costly and risky to obtain from outside. Therefore, through diversified production methods such as ginger-rice crop rotation and ginger-vegetable intercropping, farmers not only gain economic income from the Tongling white ginger plantation system, but also meet their own food demand such as rice and corn, maintaining the sustainability of farmers' livelihoods. Especially, it avoids the monotonic structure of agricultural planting in ginger producing areas, promotes the diversified development of agriculture, and benefits to balance soil fertility through diversified production.

(2) The system provides a variety of livelihood ways for farmers engaged in ginger other crops rotation

1) The production cycle characteristics of ginger-other crops rotation are conducive to promoting the diversification of farmers' livelihood sources

The production cycle of Tongling white ginger in a year is "planted in April, harvested in September", which is a short production cycle, and rice and vegetables cultivation does not require much labor to manage. Therefore, except for the growing season when farmers mainly stay at home to do farm work, they can go out to work nearby in the district and the city at other times, and the working time is mainly 3 months. This increases the wage income of farmers' families, promotes the diversification of farmers' income sources, and disperses income risks.

2) The development of local white ginger processing enterprises provides new employment opportunities for left-behind laborers

As the economic value of Tongling white ginger continues to rise, the number of processing enterprises producing mainly Tongling white ginger has gradually increased, and in recent years, enterprises have gradually developed a number of further processing products. At present, there are 26 white ginger processing enterprises in Tongling, with a total ginger processing volume of 6.364 million jin and an annual output value of about 200 million yuan. White ginger processing enterprises are located in heritage sites, and the labor required for processing mainly comes from local left-behind laborers, who are often too old to go out to work and live apart from their children all year round, but often have experience in processing white ginger. Thus, these left-behind laborers not only gain economic income by being employed in white ginger processing enterprises, but also increase the acquaintance among different residents within the village. White ginger processing enterprises provide new employment opportunities and enhance the well-being of the elderly rural workforce.

4.2 Agrobiodiversity

4.2.1 Biodiversity in Agricultural System

(1) Diversity of Ginger Varieties

Southern China is the principal ginger-planting area, while Tongling is an important part of southern planting area. There are 17 varieties of ginger in Tongling White Ginger Plantation System (see Table 4, and Figure 24), mainly white ginger.

Table 4: Major Ginger Varieties

S/N	Ginger Variety	S/N	Ginger Variety
1	Tongling White Ginger	10	Laiwu Small Ginger
2	Fuyang Small Yellow Ginger	11	Zingiber kawagoi
3	Guangdong Blue Ginger	12	Shandong Ginger
4	Maoming Sand Ginger	13	Sichuan Small Yellow Ginger
5	Guangdong Curcuma	14	Sichuan Bamboo-Root Ginger
6	Guangxi Small Turmeric	15	Anqiu Ginger

7	Guizhou Zingiber striolatum	16	Detoxified Tissue-cultured Ginger
8	Hubei Laifeng Ginger	17	Yunnan Small Yellow Ginger
9	Curcuma longa		

White Ginger

Yellow Ginger

Zingiber striolatum

Sand Ginger

Figure 24: Some Varieties of Ginger

(2) Rice Variety Diversities

Other than early-season rice or late rice, what dominates Tongling rice-planting is semilate rice. There are 31 major rice varieties here (see Table 5, Figure 25). 75% of these varieties are suitable for semilate rice cultivation. Varieties that cover the largest area are Zhennuo 19, Guangmingnuo 1, Taihunuo, Fengliangyou 4, and Jingliangyou 534, etc.

Table 5: Major Rice Varieties

S/N	Rice Variety	Suitable Season	S/N	Rice Variety	Suitable Season
1	*Wankennuo* 1	Semilate	17	*Y Liangyou* 990	Semilate
2	*Guangmingnuo* 1	Semilate	18	*Y Liangyou* 1928	Semilate
3	*Taihunuo*	Semilate	19	*Liangyou* 6326	Semilate
4	*C Liangyou Huazhan*	Semilate	20	*Yang Liangyou* 6	Semilate
5	*Yigengnuo* 1	Semilate	21	*Hui Liangyou* 996	Semilate
6	*Xinrongyou Huazhan*	Semilate	22	*Xin Liangyou* 6	Semilate
7	*Zhefengnuo* 188	Semilate	23	*Shen Liangyou* 581	Semilate
8	*Wankennuo* 2	Semilate	24	*Zhennuo* 11	Late
9	*Dangyugeng* 10	Semilate	25	*Jia'nuo* 65	Late
10	*Jing Liangyou* 534	Semilate	26	*Zhennuo* 15	Late

11	*Wandao* 68	Semilate	27	*Zhennuo* 19	Late
12	*Wandao* 153	Semilate	28	*Quanyou* 822	Late
13	*Liangyou* 688	Semilate	29	*Quanyou Simiao*	Early
14	*II You* 838	Semilate	30	*Tianyou Huazhan*	Early
15	*Y Liangyou* 2	Semilate	31	*Zhongzao* 35	Early
16	*Feng Liangyou* 4	Semilate			

Zhennuo 19

Yang Liangyou 6

Guangmingnuo 1

Hui Liangyou 996

Figure 25: Some Varieties of Rice

(3) Diversity of other Agricultural Species

A large number of agricultural species in Tongling (see Table 6) can be categorized into 3 groups: agricultural crops, animals, and microorganism. Besides white ginger and rice, there are 9 varieties of agricultural crops, 10 varieties of grain crops, 5 oil-bearing crops, 20 vegetables, 2 sugar-yielding crops, 2 spice crops, 3 fiber crops, 3 medicinal crops, 9 fruit crops, and 7 other cash crops. Agricultural animals can be categorized into 2 groups: livestock (8 varieties) and aquatic products (24 varieties). Agricultural microorganism mainly refers to edible fungi (6 varieties) (see Table 6). The maintenance of ecological and agrobiodiversity of the heritage site has fundamental significance for the protection of local species and germplasm resources.

Table 6: Diversity of other Agricultural Species

Class of Germplasm Resource	Sub-Class	Specific Species
Plant	Grain Crops	Wheat (*Sumai* 188, *Yangfumai* 5, *Yangmai* 18, *Yangfumai* 4, *Zhenmai* 9, etc.), maize (*Longping* 206, *Jidan* 7, *Zhengdan* 958, *Denghai* 605, *Denghai* 11, etc.), millet,

		sorghum, barley, oat, buckwheat, soybean, potato, sweet potato
	Oil-bearing Crops	Peanut, oilseed rape (*Fengyou* 737, *Zheza* 903, *Qinyou* 10, *Dehe Zayou* 8, *Huihaoyou* 12, etc.), sesame, flax, sunflower
	Vegetables	Celery, oilseed rape, spinach, Chinese cabbage, cabbage, white radish, carrot, mustard, cucumber, pumpkin, wax gourd, cowpea, string bean, eggplant, ginger, pepper, tomato, green Chinese onion, garlic, lotus root
	Sugar-yielding Crops	Sugarcane, sugar beet
	Spice Crops	Chinese prickly ash, star anise
	Fiber Crops	Jute, ramie, flax
	Medicinal Crops	Ginseng, liquorice, wolfberry
	Fruit Crops	Watermelon, muskmelon, strawberry, pear, orange, peach, grape, red date, persimmon
	Other Cash Crops	Tobacco, cotton, tung oil tree, tea tree, walnut, chestnut, pine nut
	Livestock	Beef cattle, dairy cow, sheep, pig, chicken, mulberry silkworm, bee, rabbit
Animal	Aquatic Products	Black carp, grass carp, yellow silver-carp, silver carp, carp, bream, blunt-snout bream, ricefield eel, loach, Coilia ectenes, whitebait, sturgeon, mandarin fish, hilsa herring, eel, soft-shelled turtle, tortoise, freshwater mussel, spiral shell, shrimp, crab, finless porpoise, Yangtze alligator
Microorganism	Edible Fungi	Oyster mushroom, straw mushroom, needle mushroom, shii-take, black fungus, mushroom

4.2.2 Biodiversity of Related Systems

Vegetation of the Site belongs to the northern subtropics and deciduous broad-leaf mingled forest area within subtropical evergreen broad-leaf forest region. It has a climate that belongs to monsoon climate type in eastern China, with distinct transitional characteristics. Either structure and distribution of vegetation or community characteristics shows both subtropical features and transitional features between subtropical zone and warm temperate zone. It enjoys advantageous geographical conditions, which foster a wide range of plant and animal populations, and maintain the stability of the ecosystem and the functional diversity of the Site.

(1) Plant Diversity

Statistics shows that there are 600 species of plants in 88 families that are scientifically named in Tongling (see Annexed Table 1). They include ornamental plants, garden arbors for garden and sidewalk greening (totally 36 varieties), shrub (33 varieties), bamboo for greening and ornament

(17 varieties), fern (over 60 varieties), grass & tree (34 varieties), and hydrophyte (more than 10 varieties). Since it is rich in paulownia resources, Tongling is also known as "A Land of Paulownia". In total, there are 1,233 varieties of naturally-growing plants and 553 varieties of cultivated plants. These plants account for 54% of the 3,200 varieties in Anhui Province. Thanks to these advantageous natural conditions, Tongling is an excellent place for plants to grow.

The zonality of the vegetation is interpenetration between floristic elements of subtropic zone and warm temperate zone. In this region, the subtropical evergreen trees are mainly Cyclobalanopsis glauca (of Fagaceae), which scattered with evergreen varieties like Theaceae, Lauraceae (Machilus Leptophylla, Phoebe sheareri), and Aquifoliaceae, etc. Deciduous forests are basically comprised of varieties that belong to Ulmaceae, Juglandaceae, Leguminosae, and Meliaceae, for example, chinaberry, Chinese hackberry, Pistacia chinensis, Platycarya strobilacea, Pterocarya stenoptera, Dalbergia hupeana, and Chinese sweet gum, etc. Regarding to the secondary shrub forests, dominant varieties are Platycarya strobilacea, Lindera, and Rubus; they belong to the ancient plant distribution in Luyuan, for example, Lauraceae, Symplocaceae, and Meliaceae, etc. (see Figure 26).


Cyclobalanopsis glauca


Paulownia


Chinese sweet gum


Emmenopterys henryi


White Ginger


Cinnamomum pedunculatum


Moso bamboo


Cedarwood


Nyssa sinensis

Figure 26: Some Varieties of Plants on the Site

(2) Animal Diversity

The complex terrain and widely-extending vegetation in Tongling benefit the growth of reproduction of animals. Statistics indicates that there are totally 267 species of terrestrial

vertebrates, among which, 166 species of birds, beasts (26 species), amphibian wildlife (9 species), and reptiles (22 species). Animals under national protection include sika deer, Panthera pardus, owl, finless porpoise, pangolin, and serow, etc. Preliminary survey shows that, in Tongling waters, there are fishes of 15 families and 44 species (see Annexed Table 2). Rare aquatic animals include Acipenser sinensis, Yangtze finless porpoise, Yangtze alligator, etc. Tongling has 7 species of wildlife under Class-1 Key Protection, for example, sika deer, pangolin, and Panthera pardus; 20 species under Class-2 Protection, such as wolf, serow, river deer, and otter, etc.; and 21 endangered species on the IUCN (The International Union for Conservation of Nature) Red List (see Figure 27).

Sika Deer | Pangolin | Otter

Serow | Yangtze finless porpoise | Egret

Figure 27: Some Wildlife of the Site under Key Protection

(3) Microorganism Diversity

There are abundant kinds of soil micro-organisms (see Table 7, Annexed Table 3, and Annexed Table 4), among which, the average value of Shannon Index, which represents the diversity of microbes, is 6.17. The average value of ACE Index, which represents the richness of microflora, is 3,190. Dominant bacterial phyla are Actinobacteriota, Proteobacteria, Chloroflexi, Acidobacteriota, and Firmicutes (see Figure 28). Prevailing bacterial genuses are Arthrobacter, Gemmatimonas, Bacillus, Nocardioides, and Acidothermus (see Figure 29). The average value of Shannon Index that represents the diversity level of fungus microbes is 3.34, while the average value of ACE Index that indicates the richness of microflora. Dominant fungal phyla are Ascomycota, Mortierellomycota, Unclassified K Fungi, Basidiomycota, and Rozellomycota (see Figure 30). Prevailing fungal genuses are Mortierella, Fusarium, Fusicolla, Podospora, and Peziza (see Figure 31). The diversity of microflora structure maintains the soil functions and remains the soil healthy and stable.

Table 7: Indices of Soil Microbe Diversity

Type	Bacterial Diversity Index		Fungal Diversity Index	
	ACE Index	Shannon Index	ACE Index	Shannon Index
Vegetable Plot 1	2869	6.12	509	3.53
Vegetable Plot 2	2233	5.93	493	3.35
Vegetable Plot 3	2272	5.77	425	3.77
Ginger-Vegetable Rotation 1	1898	5.66	222	3.57
Ginger-Vegetable Rotation 2	2877	5.72	344	3.57
Ginger-Vegetable Rotation 3	2689	6.02	419	3.30
Rice field 1	4586	6.98	705	4.42
Rice field 2	3411	6.59	543	3.89
Rice field 3	3746	6.58	891	4.30
Ginger-Rice Rotation 1	3396	5.35	552	3.21
Ginger-Rice Rotation 2	3931	6.63	465	2.14
Ginger-Rice Rotation 3	4372	6.74	429	1.67

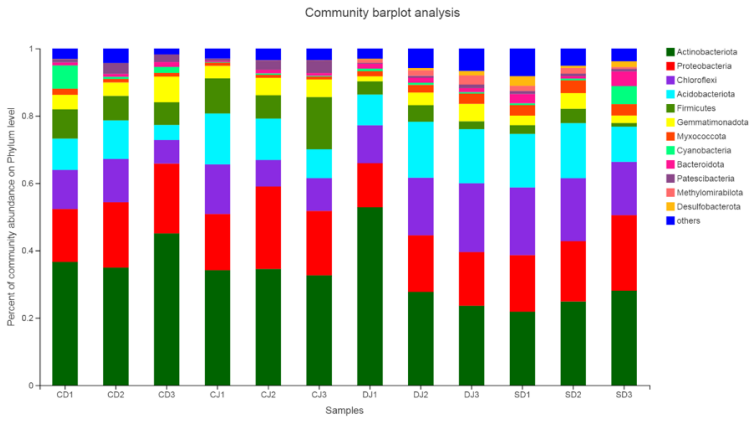


Figure 28: Structure and Composition of Bacterial Community on Phylum Level

(Note: CD, CJ, SD, DJ refers to planting model of vegetable, white ginger-vegetable rotation, rice, and white ginger-rice rotation individually; 1, 2, 3 represents different sampling locations. Hereinafter the same.)

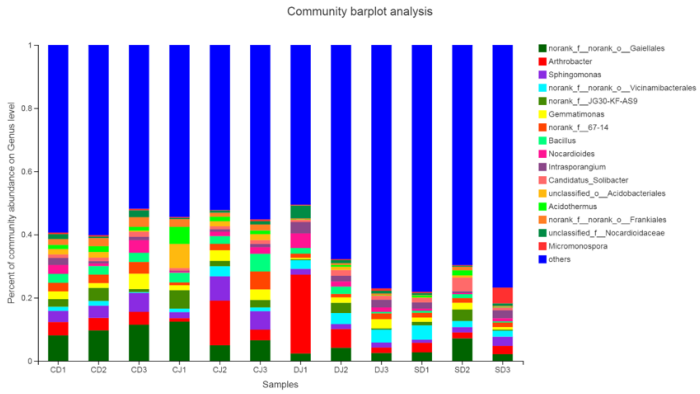


Figure 29: Structure and Composition of Bacterial Community on Genus Level

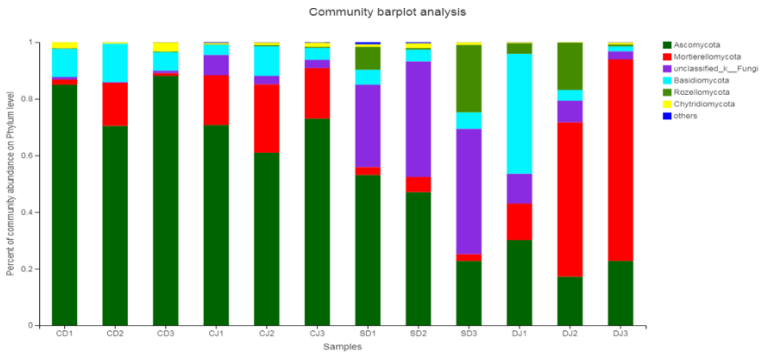


Figure 30: Structure and Composition of Fungi Community on Phylum Level

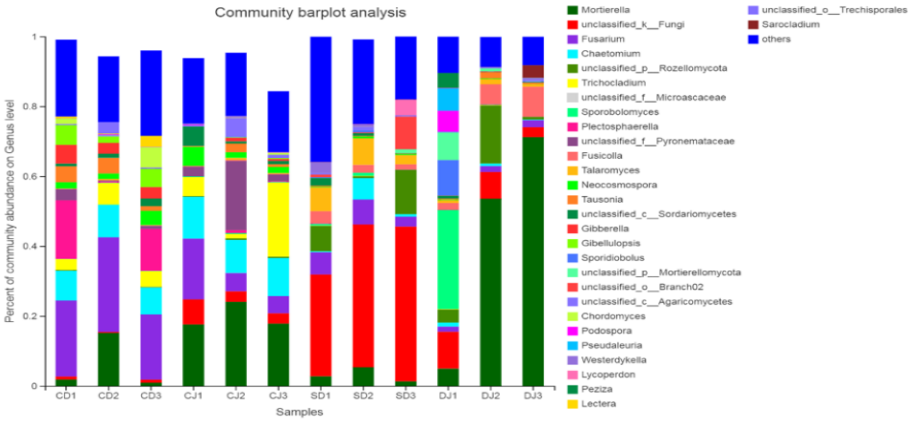


Figure 31: Structure and Composition of Fungi Community on Genus Level

4.2.3 Ecological Service Functions of the System

Tongling White Ginger Plantation System is a natural complex that consists of plants, animals, microflora, and abiotic environment. It realizes various ecological functions through circulation of matter and energy flow between internal elements, and between the System and ambient environment.

(1) Biodiversity Conservation

Tongling Ginger-Rice Rotation System adopts traditional methods that are natural and ecological. In terms of spatial pattern, it features an arbor-crops-waters horizontal distribution,

which harmonizes supporting habitats with growing habitats, and, moreover, determines the diversity of the ecological pattern. The System possesses rather strong regulating capabilities for the ecosystem's balance and stability. Especially the landscape of ginger-rice/vegetables rotation/intercropping and the ginger-rice rotation model, which creates rich habitat diversity within the System. With little application of fertilizers or pesticides, the System has been an important habitat for both plant, animals, and microorganism. The intricate symbiotic relationships among various species in the System form a biological system with stable and diversified structures. It is the biological system that maintains and protects the biodiversity of Tongling White Ginger Plantation System in Anhui Province.

(2) Diseases and Insect Pests Control Function

Ginger Wilt is the disease that happens commonly in the production of white ginger (see Figure 32). Pathogen of ginger wilt is Pseudomonas solanacearum, which belongs to the Proteobacteria phylum (Xinzheng Ren, et al., 1987). Local farmers' practice proves that white ginger rotation/intercropping is an important method for ginger wilt prevention. The white ginger-rice rotation pattern is especially effective in ginger wilt control. Long-time waterlogging is required in the rice plantation period management during the rotation. It increases the soil pH to a level that is higher than white ginger-vegetable rotation model (see Figure 33). It prompts the growth of bacteriophage against Pseudomonas solanacearum [1], lowers the richness of Pseudomonas solanacearum, and, therefore decreases the occurrence of ginger wilt.

Figure 32: Ginger Wilt

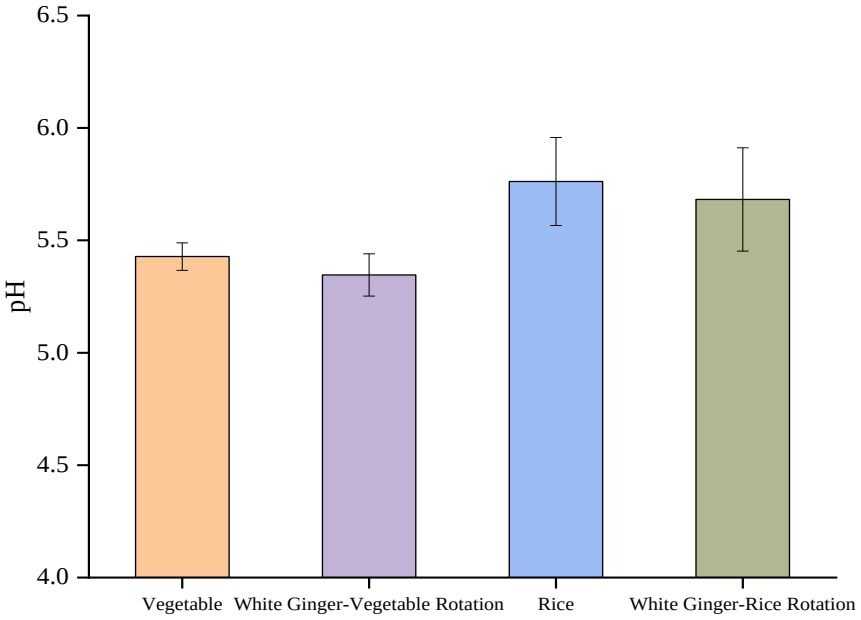


Figure 33: Soil pH Under Different Rotation Models

(3) Water Resources Conservation

Ginger sheds are built during the planting process of white ginger. These sheds resist and retain part of the precipitation, decelerate the speed of rainfall dropping into the soil. Combined with the existence of crops and field-surface herbaceous layer, it forms an orderly vertical structure, which prolongs the residence time of precipitation. As a result, litters in themselves, root systems, and soil can protect more water resource and realize the function of water resource conservation. The maximum water holding capacity of the field is a good example. It represents soil's maximum water holding capability. After rotation of white ginger with other crops, especially with rice, the maximum water holding capacity is 25.7% higher than any other type of soil with single-planted vegetation (see Figure 34) (Yang et al., 2022).

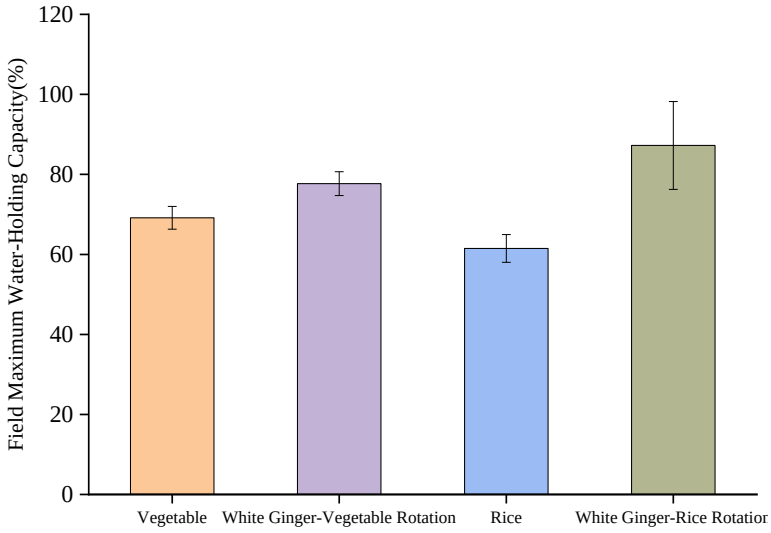


Figure 34: Maximum Water-Holding Capacity of Field Soil in Different Rotation Models

(4) Climate Regulation and Adaptation

Climate Regulating Function: building of ginger shed (see Figure 35), and the management model of combining crops with different heights, can provide shading and lower the air temperature by 1 to 2°C, and decrease the soil temperature (surface soil within 5cm) by 3 to 7°C. At the same time, it also reduces the daily range of environment temperature, keeps suitable humidity within the microenvironment, improves the effect of photosynthesis, and releases more oxygen. Moreover, the diversified plants in the System can absorb air pollutants, for example, SO2 and HF. They retard dusts, reduce noises, and produce negative oxygen ions that brings good physiological effect for all living things.

Carbon Sequestration and Emission Reduction functions: regarding to the function of greenhouse gas emission regulating, the soil's potential of methane release under white ginger-rice rotation model is apparently lower than that of white ginger-vegetable rotation model (see Figure 36). The difference between white ginger-rice rotation period and rice planting period in terms of carbon storage is relatively small, however, it is higher than that of white ginger-vegetable rotation. It performs better in maintaining the ecosystem's function of carbon sink (see Figure 37).

Figure 35: Ginger Sheds that Are Built with Black Gauze and With Bamao Thatch

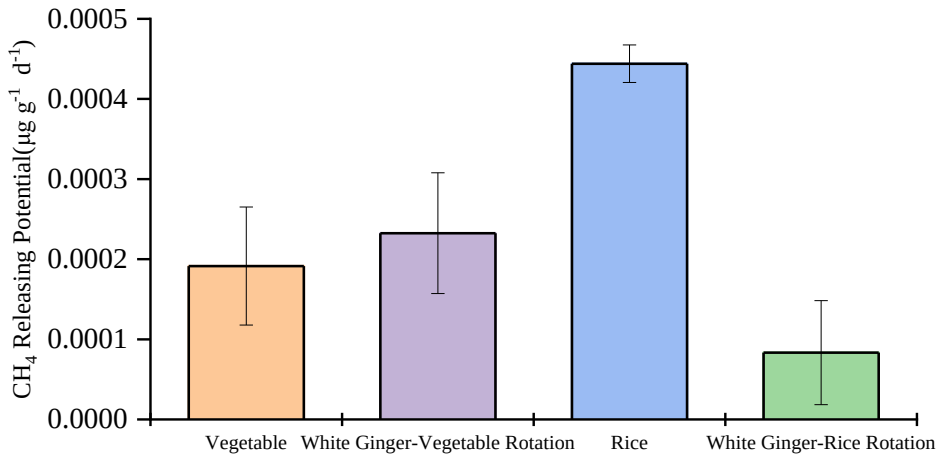


Figure 36: Methane Production Rate of Soil under Different Rotation Systems

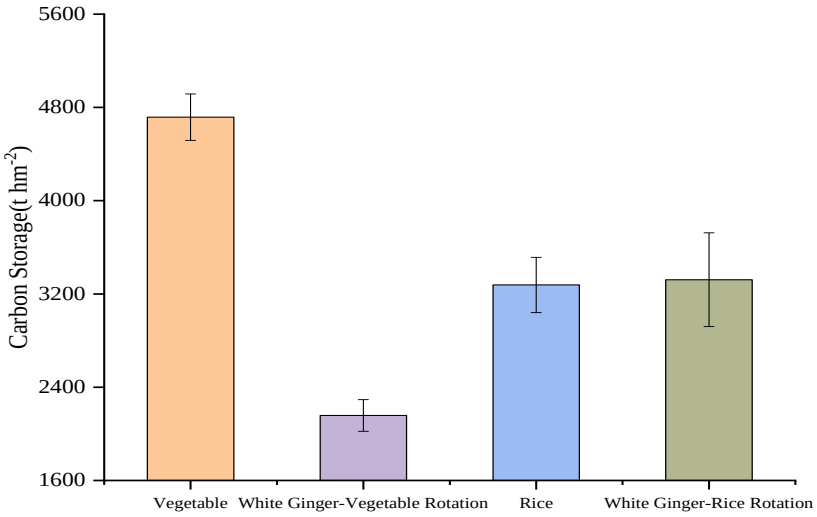


Figure 37: Soil Carbon Storage under Different Rotation Models

(5) Nutrient Immobilization and Circulation

Nutrient immobilization function: plant biomass is high in white ginger fields within the Tongling White Ginger Plantation System. It retains nutrients in itself. At the same time, the plant residue, which drops during late growing period, covers the surface of the soil. This mitigates the nutrient loss caused by the washing and erosion of rainfall, and captures more nutrients from irrigation water. From the perspective of soil nutrients, under the model of white ginger-rice rotation, the contents of soil organic matter, total nitrogen, rapidly available nitrogen, rapidly available phosphorus, and rapidly available potassium are, without exceptions, higher than those under white ginger-vegetable rotation model (see Figure 38, Table 8). The former performs better in immobilizing soil nutrients.

Nutrient circulation and efficient utilization: because of the differences between the depth of crop root systems and needs for nutrients, the rotations of white ginger with rice and vegetables can improve the balanced utilization and orderly transmission of nutrients along the soil's profile dimension, and realize the maximum production potential of the fields. Efficient circulation of nutrients is realized through process like regulating the mineralization and supply of soil nutrient, plant absorption, and nutrient returns of litters, etc. Under white ginger-rice rotation model, soil C:N is lower than that of vegetable planting, white ginger-vegetable rotation, and rice planting models (see Figure 38). Lower C:N ratio is beneficial for the decomposition of soil organic matter and the circulation of nutrients (Wang et al., 2015).

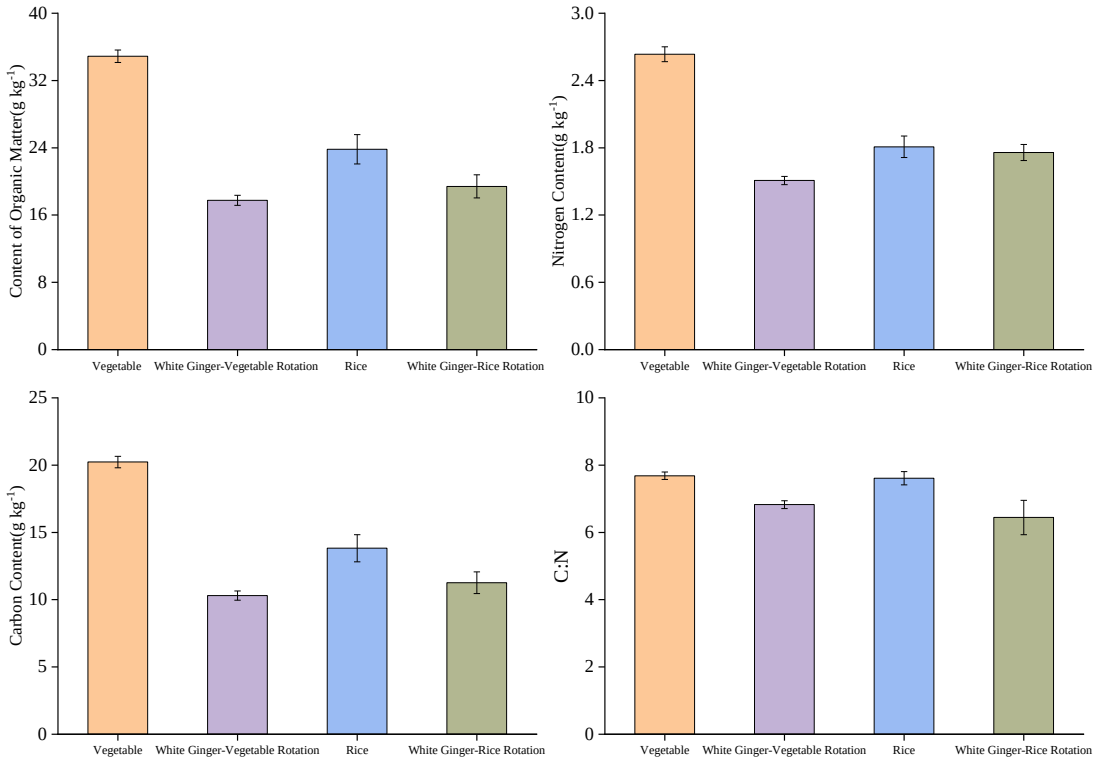


Figure 38: Soil Nutrient Contents under Different Rotation Models

Table 8: Effective Nutrient Contents in the Soil under Different Rotation Models

Cropping Pattern	Rapidly Available Nitrogen (mg/kg)	Rapidly available phosphorus (mg/kg)	Rapidly available potassium (mg/kg)
Vegetable	22.02±2.57	29.58±3.21	120.74±16.26
White Ginger-Vegetable Rotation	24.18±4.97	35.41±2.55	130.64±6.16
Rice	20.30±3.06	25.75±1.82	107.62±6.45
White Ginger-Rice Rotation	41.17±2.27	50.71±2.79	150.44±12.09

4.2.4 The contribution to the sustainability and resilience of heritage systems

Tongling agrobiodiversity is an important factor in maintaining ecological balance and resisting socio-economic fluctuations, and plays a huge role in stabilizing and improving the environment. Specifically:

(1) The suppressive effect between different organisms can reduce the occurrence of pests and diseases

In the Tongling, ginger-related crops rotation agroecosystem can enrich species diversity, such as ginger-rice rotation, mosaic distribution of ginger fields and rice fields, and intercropping of different crops. Mutual biocontainment, the suppressive effect of natural enemies on pests, and changes in the soil microbial environment under different crop rotations can improve the soil structure and health situation, and reduce the incidence of plant diseases and pests, especially for the original ginger blast and rice blast, etc. Meanwhile, the rotation can enhance the utilization efficiency of local land and water and raise the ability of the heritage system to adapt to environmental changes, and thus increase the yield of white ginger and rice per unit land area.

(2) Rich biodiversity that enhances regional soil and water conservation

In Tongling ginger rice rotation system, rich agrobiodiversity improves the vegetation coverage and ecosystem complexity of the heritage site: On the one hand, the increase of vegetation layer can effectively prevent the direct scouring of rainwater on the surface, so as to effectively prevent the surface soil from splashing erosion and improve the soil and water conservation capacity; On the other hand, the net bag effect between different plant rhizosphere can enhance the cohesion between plant roots and soil and enhance the erosion resistance of soil.

(3) Crop diversity is grown to withstand socio-economic risks

Farmers in the heritage site usually plant a variety of crops such as white ginger, rice, corn and vegetables at the same time, which can meet their diversified food and nutrition needs on the one hand, and avoid the economic risks that may be encountered by growing a single crop on the other hand. For example, a significant drop in market prices and a reduction in yields due to pests and diseases can cause business risks of farmers.

4.3 Local Traditional Knowledge and Technique System

4.3.1 Farming Schedule for White Ginger Plantation System

On the heritage site, ginger and rice grow in the same season, normally starting with breeding and field preparation around the *Qingming* Festival (literally clear and bright, i.e., Tomb-Sweeping Day, around 5 April per year). Sowing starts after the breeding. In south China, rice can be divided into three varieties, early-rice, semilate -rice and late-rice, according to their planting time. Semilate -rice and late-rice are suitable for planting in the heritage site. The growing period of middle-rice is from late May to late September. Late-rice grows from late July to middle November. Thus, sowing time for ginger is earlier than rice. However, its harvest time is later than early-rice and semilate-rice, earlier than late-rice.

(1) Farming schedule for ginger planting

Farming schedule goes throughout the year, with different farming activities in different seasons (see Figure 39). Generally speaking, it consists of five periods as following: sowing, building sheds for shading, field management, harvesting, ginger-pavilion for seed-preserving and germination-accelerating.

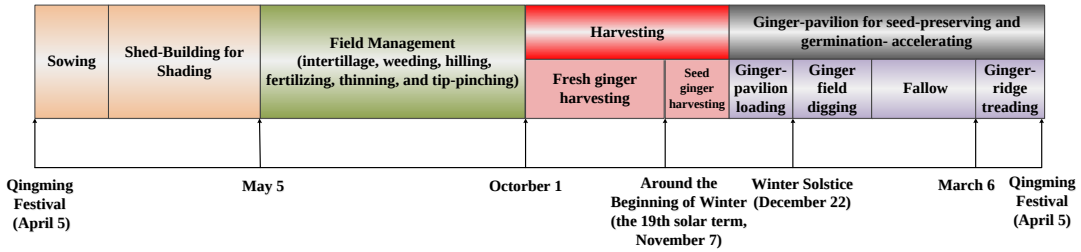


Figure 39: Farming Schedule for Tongling White Ginger

Ginger-ridge Treading. One month prior to the Qingming Festival (April 5), ginger farmers plough and level the field plots that were chosen in previous year for ginger planting. Then dig furrows and ditches. Ready ginger field has furrows and ridges interlacing with each other.

Sowing. White ginger sowing begins on the Qingming Festival. Farmers take out the sprouted ginger seeds from the ginger pavilion. Then come the seed selection, air-cure, and slicing (with sprout(s) on each piece). Sow the seed ginger (pieces with sprout) together with organic fertilizers into the prepared ginger field. Window for sowing is usually a week or so.

Shed-building for shading. Right after sowing, farmers cut woods and Bamao grass on the mountains. They set up piles around the borders of the ginger field, and build shade ceiling with Bamao grass. The shed-building needs to be finished within 30 days after sowing.

Field management. After the building of field facilities, during the gradual growth of ginger shoots, field management needs to be done in right timing. It includes 2 to 3 intertillage and weeding, 5 to 6 hilling, watering, and 3 to 4 topdressings.

Harvesting. Products of traditional Tongling white ginger include fresh ginger and seed ginger. Fresh ginger is mainly used for food. Its harvest starts from early and middle September. Selling goes on parallel with harvesting. Harvest of fresh ginger lasts for about 1 month. Seed ginger is mainly kept as seeds for the coming year. In usual, seed ginger is harvested in the week before or after the Beginning of Winter (19th solar term). Farmer's proverb says "If the winter begins in September, harvest in winter. If it beings in October, harvest before winter." It means that, if winter starts in the ninth lunar month of the year, seed ginger needs to be harvested after the Beginning of Winter. Do so before that if winter comes in the tenth lunar month of the year.

Ginger pavilion for seed-preserving and germination-accelerating, and ginger field arrangement. After ginger harvest, seed ginger shall be selected, sun-cured, and put into the ginger pavilion. Making fire below and removing extra moisture from the ginger are useful for warmth preserving and germination accelerating. At the same time, farmers need to determine field plots for next year's ginger cropping. These fields shall be deeply ploughed, dug, and made into rectangle, higher plots before or after Winter Solstice (around December 22). After digging, these plots shall be fallow until next year's ginger sowing.

(2) Farming schedule for rice planting

Paddy field leveling. Normally 10 to 15 days before rice transplanting.

Raising rice seedings and transplanting. The Site mainly grows late rice and semilate rice. Seedings of semilate rice is normally raised after *Gǔyǔ* (literally Grain Rain, the 6th solar term, around 21 April). And it's usually transplanted in late May or early June. Late rice is usually raised around Summer Solstice (around 21 June) and transplanted in late July.

Field management. It lasts from middle and later June, when rice is transplanted, until middle November, when late rice is harvested. Field management for rice cropping mainly refers to water conditioning, and the prevention and treatment of disease, insect pests, and weeds.

Harvesting. In terms of harvest time, it is usually late August till late September for semilate rice, and late October to middle November for late rice.

4.3.2 Key techniques for White Ginger Plantation System

(1) Ginger pavilion for seed-preserving and germination-accelerating

Traditional way of ginger pavilion for seed-preserving and germination-accelerating is divided into 6 stages:

Stage 1: select ginger seeds that are robust, strong and intact. Sun cure and remove part of its moisture.

Stage 2: ginger-pavilion workers climb to the upper floor through the ladder in central passageway. Orderly, they put the sun-cured ginger seeds onto layers of bamboo mats (see Figure 40).

Figure 40: Ginger Pavilion

Stage 3 (Sweating): after arranging the seeds into ginger pavilion, make fire on a daily basis. Within the first 40 to 50 days, use Bamao grass as fuel. In the first 2 days, make fire on the first floor to the maximum extent. It consumes 20kg to 23kg Bamao grass and lasts for 40 to 60 minutes each time. This is for warming the pavilion up. From the third day, make fire each morning and night. This compels moisture out of ginger seeds and keeps them from rotting. Ginger farmers call it "sweating". Average temperature for sweating shall be 18.2°C.

Stage 4 (Heat Preservation): about 90 days. Fuel shall be changed into firewood. The fire shall be made in the fire-pit that is dug at the center of the first floor, twice a day (in the morning and the evening individually), with 15kg to 20kg of hard firewood each time. The temperature inside the pavilion should be kept around 20.1°C (see Figure 41).

Figure 41: Making Fire in Ginger Pavilion in Winter for Seed-Preserving and Germination-Accelerating

Stage 5 (Germination Acceleration): for 20 to 25 days. That is to say, it shall be changed into mild fire from middle March to early April. Increase the volume of firewood properly. However, because the air temperature is getting higher, the intensity of fire need to be carefully controlled according to weather conditions. In order to accelerate germination, the temperature in the pavilion shall be kept around 22 to 25°C. In this way, the ginger seeds will grow sprouts (about 1cm long) before *Qingming* Festival.

Stage 6 (Ginger Seeds Leave the Pavilion. Slicing into Pieces): Due to water loss and nutrient consumption, ginger seeds will lose weight by 20% when they leave the pavilion. The sprouted seeds that are covered by black surface, which comes from long-time smoke curing. Cut them into pieces according to the distribution of ginger sprouts. Then, they are ready to be sown into the ginger field.

(2) White ginger planting techniques

Site-selection for ginger field. Ginger doesn't have an advanced root system, so it can resist neither drought nor waterlogging. Generally speaking, optimal choice for ginger field should be higher and sunward plots that are with convenient irrigation and drainage, deep soil layer, rich

humus, good water-holding and fertilizer-holding capacities. Choose fields with neutral soil or sandy loam soil (locally called *Băntián*, literally Board Field). Paddy field for 2 or 3 years is the best choice.

Ginger field leveling. Once chosen, after the harvest of previous crop, the field shall be ploughed, normally around the Winter Solstice. It is known as Ginger Field Digging. Traditionally, ploughing requires purpose-made ginger hoe and shovel. Depth of ploughing is about 40 to 50cm. Ginger plots, which are as long as the field and as wide as 4.5 to 5m, should be made after ploughing. The ditch between plots is about 40~50cm wide and 50~60cm deep; the gutter going around the field is 60~70cm wide and 50~60cm deep.

Farrow. It begins right after the ploughing. After the frost-thaw cycle, the soil structure of the ploughed field is improved with better permeability. The soil has more nutrient effectiveness but less pest eggs and pathogenic bacteria.

Ginger-Ridge Treading. About 10 days before ginger sowing in the next spring, subtly plough and harrow the ginger field, once or twice. Apply sufficient decomposed farmyard manure (for example, 3000~3500kg of poultry manure, cattle manure, plant ash, or stable manure, plus 100kg of rapeseed cakes). This serves as base fertilizer, among which, decomposed cattle manure and plant ash are the most common choices. It is followed by ginger-ridge making. Dig row-ridges on the surface of the plot every 55~60cm. Between the ridges are sowing furrows that are 30~35cm deep. Furrow slopes are usually abrupt on the south side and gentle on the north side (at an incline of 60~70 degrees). Northern slopes need to be compacted by treading.

Figure 42: Ginger-Ridge Treading

Sowing. Perfect timing for sowing Tongling white ginger is usually the 5~7 days around *Qingming* Festival. Take the sprouted ginger seeds from the ginger pavilion, select, cover them with dried lotus leaves, air-cure indoor for 2~3 days. Remove the thin and weak sprouts and lateral sprouts with black spots. Slice the selected ginger seeds into smaller pieces. Make sure that each piece has a sprout. Weight of each piece is about 50g~60g. Seeding rate is 1875 kg~2250 kg per hectares. With a row spacing of 55cm~65cm, and a plant spacing of 20cm, about 60,000~67,500 seeds are planted each hectares. Adopt thin planting in fertile earth, while close planting on infertile

land. During sowing, keep the apical bud downwards and place the seed on the northern slope of the sowing furrow (5cm higher than furrow bottom). Keep certain distance between each seed. Cover the seeds with a layer of ash manure and mixed fertilizer (3cm~4cm deep), then apply decomposed cake fertilizer (750kg/hectares), proper amount of compound fertilizer, then finish it with a layer of stable fertilizer (30000kg/hectares). After fertilization, cast a layer of rotten straw on the ridge surface. It can prevent the ridges from being washed down by rainstorm.

Ginger-Shed Building. The sheds can be built right after sowing. Traditional materials of ginger shed are ginger-stick (wooden stick, 3cm~4cm in diameter), bamboo poles, and Bamao grass. About 3000~3750 ginger-sticks, 2100kg~2250kg of bamboo poles, and 5250kg~6000kg of dried Bamao grass are needed for each hectares. Building method: erect a row of ginger-sticks every three ginger ridges. Each row consists of 3 ginger-sticks, leaving a spacing of 1m~1.2m. Bind the bamboo poles, as horizontal rails, onto the ginger sticks at the height of 1.5m above the plot surface. Form a horizontal net rack with the rails. Pave the rack with Bamao grass. Then put bamboo poles onto the grass and tie them tight. The poles can keep the grass from being blown away by strong wind. Grass paving follows the scanty-sunlight principle of "30% sunshine, 70% shade". In short, the shed results in scattered sunlight.

Intertillage and weeding. Ginger is a shallow-rooted crop. Its root system mainly distributes in the topsoil. Intertillage, which scarifies and soil and improve its permeability, is critically important for the growth of ginger. After seedlings emergence, soil scarification, weeding, and watering are required for the growth of root system. 2~3 rounds are needed, depending on different soil properties.

Hilling (Growth in furrow, harvest on ridge). Hilling means covering the root part of ginger plant with soil. It is needed for 5~6 times during the growth period of white ginger. First hilling happens when the ginger grows 2~3 tender stems. Shovel up the organic manure (such as cattle stable manure, etc.) and weed, pave the sowing furrow with them. Then shovel a thin layer of soil from the ridge to cover them. It is followed by the second hilling in half a month. It mainly refers to intertillage and weeding. Cover the furrows with weeds and small amount of soil. The third hilling follows 20 days later. It is basically new digging and hilling all over again, and it is combined with topdressing. Level up the ridge and furrow by filling the furrow with the soil of ridge. This step is called "leveling the ginger ridges". The 4^{th} and 5^{th} hilling shall be carried out based on weather conditions, normally 3~4 days after raining. Dig and hill up the ginger field when it is still moist. Dig up the soil between the ginger rows and earth them up on both sides of the ginger plants. Thus, former furrow become ridges; former ridges become furrows. In the end, stem of the ginger is hilled by 15cm~20cm. Normally, the higher, the better. This can ensure longer internode length of the secondary ginger body, i.e., long-fingered and tender ginger.

Watering. There is plentiful rain during the growth period of Tongling white ginger. Keep the furrows deep and unblocked. Make sure that water cannot be seen as soon as it stops raining. Watering is usually not needed for ginger cropping. In case it does not rain in summer or fall for a long time, people need to flood the ditches around the ginger field with well water. A few hours after the flooding, drain them dry immediately after the water is absorbed by the soil.

Fertilization. Traditional way of fertilization for Tongling white ginger: base fertilizer is applied when sowing, 3 or 4 topdressings during its growth period. The first topdressing is applied 15~20 days after emergence (normally middle or late May). It, also known as the Seedlings-raising Fertilizer, is applied when the seedlings are 10~15cm high, i.e., applying decomposed farmyard manure water, 7500kg~11250kg per hectares. The second topdressing happens in early or middle June. Also being called "Seedlings-Strengthening Fertilizer", it mainly consists of cake fertilizer and compound fertilizers: 750kg~1,125kg of cake fertilizer per hectares, 1,200kg~1,350kg of compound fertilizer per hectares, plus decomposed farmyard manure water (9,000kg~12,000kg per *mu*) and mixed ash manure (12,000kg per hectares). The third topdressing is applied in early or middle July. It is the tillering phase of underground rhizome, when secondary ginger body, as well as the overground part, grows fast. It is a stage that consume a good deal of fertilizer. Apply the "Ginger-Strengthening Fertilizer", which is combined with hilling: cake fertilizer (1,200kg~1,500kg per hectares), mixed ash manure (37,500kg per hectares), decomposed farmyard manure (45,000kg per hectares), and compound fertilizer (750kg per hectares). Apply the fourth topdressing in early or middle August, together with hilling during the Ginger Furrow Digging. Application rate depends on the growth status of the ginger. Apply less if it grows vigorous, apply more otherwise. It is mainly decomposed farmyard manure that is applied this time.

Thinning. It refers to removing excess sprouts. Usually, when the young ginger plant is 20cm high, remove the smaller sprouts or weaker sprouts that come out from latent buds. In order to save nutrient, leave only one strongest sprout.

Tip-Pinching. Pinch off the tip of fully-grown ginger stem to restrain the growth of overground part of the stem and reduce nutrient consumption. In this way, the growth of secondary body of the ginger is prompted. It is usually done after *Lìqiū* (literally the Beginning of Autumn) when the ground is still covered by the tears of Eos. The stem is more fragile in early morning. It makes the pinching easier. Tip-pinching is needed for 2 or 3 times in a row, with an interval of 5 to 7 days.

Harvesting. The harvest of tender ginger begins in middle September. Water the ginger ridges to be harvested the day before. The field need to be fully drenched with moist and loose soil. Hold the ginger stem and pull the whole plant out. Get rid of the mud. Remove its root system. Then cut off the stem from the point that is 2cm~3cm higher than its base.

(3) Farming Instruments

For White Ginger. From the long history of ginger plantation, Tongling ginger farmers has come to learn the special living habits of white ginger and devised purpose-made farming instruments, which are an important part of white ginger farming. As Figure 44 shows, main purpose-made instruments are (from left to right): (1) Ginger Shovel: for leveling ginger field, building ginger ridges, ginger digging, and fertilization, etc.; (2) Ginger Hoe: with a depth of 30cm, (20cm deeper than regular hoe), mainly for making ginger ridges; (3) Ginger Pry: for ginger sowing and old ginger prying; (4) Sun Curtain: for ginger sun-cure; (5) Dustpan: for carrying

HuǒFèn (mixture of plant ash and soil); (6) Ginger Sifter: for ginger sun-curing, and for pressing the vat when pickling the ginger; (7) Ginger Basket: for harvesting and carrying ginger; (8) Bamboo Knife: for opening ginger, and tearing ginger to eat; (9) BàngChuí (wooden club): for spanking the ginger.

Ginger Shovel: For ginger field leveling

Ginger Shovel: for ginger ridge making

Ginger Shovel: for fertilization

Ginger Hoe: for digging ginger ridge

Ginger Pry: for ginger sowing and prying old ginger

Ginger Shovel: for ginger harvesting

Sun Curtain: for ginger sun-curing

Dustpan: for carrying manure

Ginger Sifter: for ginger sun-curing	Ginger Basket: for harvesting and carrying ginger	Bamboo Knife: for tearing ginger	*BàngChuí*: for spanking the ginger

Figure 43: Special Imstruments for White Ginger Planting

(4) Rice planting techniques

Seed selection. Choose the rice that fits local natural conditions, production conditions, and cultivation systems. Select those of strong plant, higher disease resistance, and plump seeds. Seed rice should be of extraordinary stability, yielding capabilities, and stress tolerance.

Rice Shoots Raising. Sun-cure the seeds in sunny days, 2 or 3 days prior to seeding. Select the seeds by winnowing, sieving, and yellow muddy water selection, etc. Soak the seeds in limewash (1:100) for 1 to 2 days. Then rinse and accelerate germination. Ensure 100% cleaving of the seeds. Then choose short sprouts that are 0.1cm~0.2cm. Tongling people mostly adopt the method of wet open-field for shoot raising. Prepare the shoot-raising field before sowing: apply enough base fertilizer, level the bed surface, make it paste-like. Then cast the sprouts evenly. Sowing is following by *TāGǔ* (gently pat the bed surface with wood board). In order to prompt its emergence and rooting, keep the field moist before the third leave comes out. Manage water usage during the whole course of raising. Keep it moist, but avoid excessive growth.

Field arrangement. Apply organic fertilizers, for example, stable fertilizer, before ploughing. Normally 2 ploughing, 2 harrowing, and 1 leveling. Use plough, harrow and *Chào* (a harrow-like tool for pulverizing soil and leveling field) to clear stubbles, straw, and weed, make the field ground neat and levelled.

Transplanting. It is done when the seedlings are 30 to 35 days old. Transplant the rice shoots into shallow water, ensure the transplanting shallow, straight, and evenly. Depth of the transplanting is around 1 *cun* (1/3 decimetre). Row spacing and plant spacing are 3~4 *cun* and 6~8 *cun* individually. Plug 4~6 rice shoots in each pit.

Fertilization. After being changed from ginger field into paddy field, it should be fertilized as following: in the 1st year, use decomposed stable manure, like animal manure or poultry manure, as base fertilizer. Apply plant ash and oilseed cakes for topdressing; 2nd year: plant green manure crops like milk vetch, which will become base fertilizer after ploughing. Use decomposed animal

or poultry manure, plant ash or oilseed cakes for topdressing; 3rd year: green manure crops and decomposed animal or poultry manure as base fertilizer, plant ash and oilseed cake for topdressing.

Water management. From transplanting to tillering stage: transplant in shallow water, keep the water 1-*cun* deep and revive the shoots in it, shoots take root in moist field, tilling happens in shallow water, in order to eliminate ineffective tillering, when there are enough seedlings, drain water and roast the paddy field with sunlight. At the booting stage, keep the water as deep as 1.5~2 *cun*. During heading and flowering stages, irrigate with shallow water and keep the water layer. As for grain filling stage, alternate "dry" with "wet" (mainly "wet"). Normally, the water is completely cut off 5 to 7 days before harvesting.

Harvesting. Harvest when the stem, leaves, and the upper part of the spike stalk turn yellow, when there are no green kernels, or there are just a few green-ish kernels.

Storage. Rice seed storage: sun-cure for 2~3 days in sunny time after harvesting, then pack them with cloth bags or sacks. Put them in dry places with good ventilation. To avoid damages from worms or rats, check them regularly during the storage period. Regular rice storage: after husking, winnower for clearing abortive grains and impurities, and sun cure in a timely fashion when it is sunny. After that, store the rice in barns. Keep away rats, insects, and mould.

4.3.3 Traditional knowledge and techniques on water and soil management

(1) Ginger-Rice Rotation

The growth of Tongling white ginger's tuber is highly fertility-consuming. And it is apt to be damaged by plant diseases. Based on the commonality and complementarity characteristics between the growth habits of ginger and rice, Tongling farmers have developed, from long-time practice, an interannual ginger-rice rotation pattern: 1 year for ginger, 1-3 years for rice or vegetables. That is to say, rice shall be planted in three consecutive years before ginger is planted in its place on the same plot of field.

(2) Ginger-Vegetable Intercropping

Tongling ginger farmers have the habit of intercropping vegetables in ginger field. This habit can make full use of the space of ginger shed, and the resources of water and soil of the ginger field. Common intercropping models are ginger with taro, amaranth, green bean, hyacinth bean, gourd and other vine crops. Avoid maize that can bring ginger worms. Local farmers usually intercrop taro around the ginger field. Or, based on the difference of growth periods of ginger and amaranth, cast amaranth seeds on the surface of ginger ridges after ginger sowing. The amaranth will be harvested right before the ridge hilling. Intercropping of ginger and vegetable dose not interfere ginger sowing.

4.3.4 Traditional knowledge and techniques on disease and insect pest prevention

(1) Prevention and treatment of ginger disease, insect pest, and weed

Common diseases and insect pest of Tongling white ginger are ginger wilt, ginger worm, and Prodenia litura. Ginger farmers have developed a series of methods for prevention and treatment.

Against ginger wilt. Ginger wilt is caused by Pseudomonas solanacearum, which is strongly infectious. It transmits via ginger seed, soil, and water stream. Prevention is a preferred way. Ginger farmers invented the prevention method of White Ginger Plantation system (1 year for ginger, 1-3 years for rice or vegetables). What's more, they also carefully select ginger seeds to improve their resistance against disease. Disinfect soil with quick lime and plant ash, apply clean fertilizers and clean water. In order to cut off the source of infection, once ginger wilt is identified, eliminate the infected plants and their neighboring plants immediately.

Against ginger worm. Mainly by clearing the field after ginger harvest, burning ginger stem, ploughing the field deeply, erasing weeds in field edges, and wiping out overwintering pests. When worms attack, manually hunt them, or spray quick lime in early morning when the dew is not yet dried.

Against Prodenia litura. Trap and kill them with the help of black-light lamp or sugar-vinegar pot.

(2) Prevention and treatment of rice disease, insect pest, and weed

Manual weeding. With the help of weeding harrow, rake the field after the rice shoots survive. Do it again when field sun-cure ends by the late tillering phase. After that, whenever aged weeds are seen, pull them by hand.

Burn straws. In autumn and winter, after rice harvest, burn straw in the middle of the field. This can eliminate residual insect and pathogenic bacteria, and alleviate the influence of plant disease and insect pest in the next year.

Home-made pesticide against plant diseases and insect pest. Use 150kg of plant ash, 225kg of grass seed cake, 15kg of sulphur powder, and 225kg of lime per hectare. Mix them up and evenly spread on the rice shoots. It can effectively prevent rice bacterial leaf blight.

Manual worm-hunting. When insect pest occurs in large scale, for example, rice leaf roller or striped rice borer, hunt them manually.

Raising ducks in paddy field. After rice shoots survive, raise petite local shelducks in the paddy field. The ducks can mitigate the damage of pest and weeds by eating them.

4.3.5 Preservation and Food Manufacturing Techniques for Ginger

There are a large number of processing techniques, which are inherited for nearly 1,000 years, for Tongling white ginger. Representative processing techniques include Salt-pickled Ginger, Sauced Ginger, Sweet-and-Sour Ginger, and Sugared Ginger.

Making of Salt-pickled Ginger. In conditions of hyperosmosis, high-concentration salt can physiologically dehydrate the cells of microorganism, inhibit their growth, and even kill them. This

is how it prevents corrosion and preserve quality. Main processing steps of this technique: fresh ginger→selection→cleaning→airing→pickling→packing→finished product.

Making of Sauced Ginger. Soak ginger pieces (or slices) in sauce, to absorb the nutrients and flavor substances from the sauce. It gives special color and tasty flavor to the product. Producing flow: fresh sauce→pre-treatment→sauce pickling→packing→finished products.

Making of Sweet-and-Sour Ginger. It makes use of the non-corrosibility of acetic acid, and the seasoning and color-toning effects of sugar, and processes white ginger into sweet and sour, tender and crisp products with delicate fragrance. Processing flow: fresh ginger→peeling and cutting→salt pickling→slicing→desalination→vinegar soaking→sugar pickling→boiling→filling and sealing→sterilization→cooling→checking and packing→finished products.

Making of Sugared Ginger (Candied Ice Ginger). It is made by increasing ginger products' sugar content and relatively reducing the moisture content. In order to be bacteriostatic, sugar content of the Sugared Ginger has to be kept above 80%. Specific processing flow: fresh ginger→cutting and peeling→boiling→sugar pickling→drying and packing→finished products.

At present, newly-developed and preserved products that are made from Tongling white ginger include: Antioxidant preservative, white ginger juice, breath freshener with ginger juice, ginger tea beverage, anti-sickness chewing gum, and ginger tea anti-influenza granule, etc.

4.3.6 The contribution to the sustainability and resilience of heritage systems

(1) Traditional crop rotation and intercropping techniques contribute to balance of soil fertility and reduce operational risk

The tuber growth of Tongling white ginger is extremely ground intensive and requires a lot of fertilizer when growing white ginger. If white ginger is planted continuously for many years, the soil fertility is not available and diseases are easy to occur. The fertilizer consumption of rice growth is less than that of white ginger. Planting white ginger for one year and rice for one to three years can improve soil structure and make full use of soil nutrients. In general, the first year after the ginger field is converted to rice, 20%-30% less fertilizer is needed than conventional rice paddy. The traditional technique of inter-annual crop rotation of ginger and rice reduces the incidence of ginger blight and rice pests and reduces the business risk for farmers by changing the soil structure and microorganism environment of the farmland.

(2) Traditional planting management technology can realize the circulation of material and energy and effectively prevent the occurrence of diseases and pests

The traditional white ginger plantation system is a complex system in which all aspects of white ginger are interrelated with other crop cultivation, livestock farming and farmers' livelihoods. In this system, resources are recycled to meet the nutritional requirements for the growth of various types of animals and plants, while in the flow of material cycles, checks and balances between

organisms are formed to maintain the stability and sustainability of agro-ecosystems, thus achieving stability in agricultural production.

The contribution of traditional planting management technology to the sustainability of ginger-rice rotation planting system is shown in three aspects:

First, the technology with ginger planting as the core: ① Manpower and cattle power provide power for white ginger planting; ②White ginger grown in rice fields and fertilized with grass ash, rapeseed cake and well-rotted cow manure can effectively reduce the incidence of ginger plague and stabilize ginger production. ③Wooden sticks, bamboo and barberry shade ensure proper ginger growth.

Second, the technology centred on ginger pavilion preservation and germination: ① Ginger pavilion provides a place for ginger seed storage and germination; ② The abandoned Bambusa and bamboos removed from the shade shed are used as fuel for burning ginger pavilion; ③ The plant ash produced by burning ginger pavilion is used as fertilizer and insecticide to ensure the high quality and stable yield of ginger planting.

The third is the technology with rice planting as the core: ① Rotation of rice and white ginger for mutual benefit, ensuring excellent growing conditions for both white ginger and rice. ② Cattle provide power for rice cultivation, and cow dung produced after straw feeding provides fertilizer for rice and white ginger planting; ③ Manure from humans, poultry and domestic animals as fertilizer for rice. ④ The products produced by rice planting provide food for mankind, and its straw provides feed for cattle and other livestock and poultry.

The above three together constitute a material and energy cycle system, which ensures the ecological stability and sustainable production of white ginger plantation system.

4.4 Culture, Value System, and Social Organizations

4.4.1 White Ginger Culture

Tongling White Ginger Plantation System has played a significant role in the evolution of agricultural society of Tongling area and in many aspects like regional culture, religious belief, life style and habits, and literature and art, etc. "White Ginger Culture" is the core of regional culture in Tongling area. Tongling white ginger was article of tribute as early as over 1,000 years ago. It is a bestselling product in domestic and international markets. It has witnessed the rise and fall of history. And it is a shining pearl of traditional Chinese regional culture.

(1) Customs during Production

Ginger-related Custom. For example, the custom of BiānPào ZhàChūn (Wake up Spring with Firecrackers). The day before or in the early morning of LìChūn (the Beginning of Spring), ginger farmers set off firecrackers to greet the advent of spring, offering their prayers for peacefulness. From this day on, ginger farmers start to prepare ginger fields. A new round of ginger-producing cycle hence beings. Around Qingming Festival, when ginger seeds go out of ginger pavilion, ceremony of ancestor worshipping is held, to pray for good harvest. From June to July each year, when pests run rampant, Tongling ginger farmers have the custom of "Pest Exorcising": for example, by "Burning the Straw Hill", ginger farmers pile a small hill of straw

beside their ginger field and set fire on it. This is for pest exorcising. Another example is "Frying the Bean". It means that some farmers fry beans at home. Implied meaning of this act is that insects in their field have been all "fired".

In addition, local farmers have developed special production collaborating method and accords. The custom of "Field Exchange" is popular in Tongling White Ginger Plantation System. In a given plot of field, white ginger can be grown for just 1 year before being rotated by rice. It will cause ginger wilt otherwise. However, average area of field that the farmers own is pretty small. Apparently, self-owned field cannot satisfy the needs of rotation. For this reason, local farmers devised the idea of "Field Exchange" as a solution. By exchanging fields, every family can grow white ginger every year. Moreover, ginger farmers and ginger pavilion operators agree that, in case the germination acceleration fails in the pavilion, the operators don't have to compensate the losses.

(2) Food Culture

Tongling region has over 2,000 years' history of white ginger. It creates a unique white ginger food culture that features the homology of medicine and food.

In terms of white ginger, relative foods can be classified into 3 types. Firstly, there is medicinal foods. Local people believe that white ginger has extraordinary medicinal effects. As the sayings go "A cup of tea and a cup of ginger, good prescription for keeping your stomach strong and your body warm", "Three pieces of ginger a day keep the doctor away", and "Three slices of ginger are better than a cup of ginseng soup". Then condiments: white ginger serves as spice for cooking cuisine and making ginger porridge. It is especially indispensable for cooking fish. Tongling people believe that fish cooked with local white ginger has better flavor. Thirdly, ginger is used for making pastries, tea, and beverages. For example, Candied Ice Ginger (used to be article of tribute), Sweet-and-Sour Ginger, Sauced Ginger, Salt-Pickled Ginger, Ginger Sugar Tablet, Five-Colored Ginger, and Ginger Tea are all representative ginger products. They are essential foods for local people. Every family is busy with pickling white ginger in Tongling every year in ginger harvest season. Behind every door, there is a secret recipe for white ginger pickling.

Tongling Specialty: Sweet-and-Sour Ginger

Tongling Specialty: Sauced Tender Ginger

White Candied Ginger

Sauced and Salted Dry Ginger

Figure 44: White Ginger Foods

Figure 45: Ginger Pickling

Tongling people has unique white ginger food culture as following. (1) Eating ginger in the morning: every morning after getting up, have a sip of tea, and have a bite of ginger. It makes you feel energized when you engage in work optimistically and positively. Surveys show that, averagely, every household consume 35kg of white ginger each year. (2) Must-have side dishes:

restaurants in Tongling routinely serve side dishes before serving main courses. There must be a dish of white ginger, or sauced ginger or candied ice ginger. It is Tongling people's appetizer. (3) Refreshing and energizing food: Tongling people get used to carry a bottle of "salted ginger" in travel. They chew shredded ginger when they feel tired or sleepy. It allays fatigue and spices you up. (4) Hospitality food: as important guests arrive, Tongling people greet them with white ginger. When the guests leave, Home-made Sweet-and-Sour Ginger or Candied Ice Ginger will be given as parting gift. Every year around the Mid-Autumn Festival and National Day Holiday, when is also ginger harvest season, Tongling people invite their relatives and friends who live in other places. They show the guests around Tongling and present white ginger food. According to the customs of the Chinese New Year in the region of Yangtze River and Huai River, Candied Ice Ginger is an important food for greeting guests. White ginger is also local people's first choice for gift.

Figure 46: Making Process of Tongling White Ginger

Figure 47: Ginger Tasting and Tea Drinking in Sidewalk Café

(3) Ginger-related Ceremonial Customs

In Tongling, white ginger plays an important role in ceremonies like weddings and funerals. Skill of "Ginger-Ridge Treading" as a spouse-choosing standard: parents will give the blessing to the future son-in-law only after he can pass the skill test of Ginger-Ridge Treading. Since this job is very laborious, local ginger farmers believe that, only if a man can master the skills of Ginger-Ridge Treading, he is a trustworthy guy to marry. Ginger-Giving: after engagement, before wedding, the fiancé needs to pay visits to the relatives of the fiancée, and give them gifts: liquor, tea, bride cake, Candied Ice Ginger, or vinegar-pickled ginger. It is commonly seen when Tongling people marry non-Tongling people. Besides, white ginger is also offered as sacrifice when Tongling people "sweep tombs" (pay respect to people at their grave with sacrifices).

Figure 48: Ginger Ridge Treading

(4) Broadcasting of Ginger Zen Culture

In history, Tongling white ginger has risen to fame as the Buddhist culture spread all over China. Datong Town in Tongling is the only path to Mount Jiuhua, the famous Buddhist shrine (see Figure 51). Therefore, the Dashi Temple in Datong Town is known as "the First Celestial Gate of Mount Jiuhua" (see Figure 52, Figure 53). It has been the first place to visit for pilgrims from all over China and those from Southeast Asian countries. When pilgrims go ashore at Datong Town, they must buy Candied Ginger as a vegetarian food, before going on to the Shrine. Hence, Tongling white ginger spreads to everywhere with the pilgrims. The best-known White Candied Ginger is Buddha's-Hand Ginger. Because of the high altitude and low temperature, monks on Mount Jiuhua get used to eat Tongling white ginger to compel coldness and prevent diseases. The White Candied Ginger, also known as Jiuhua Ice Ginger, is not only offering to the Buddha, gift to the pilgrims, but also vegetarian pastries for leisure time. Local Buddhists highly praise Tongling white ginger. It is widely known that "Master Yangqi's lamp is bright for a thousand years. Master Baoshou's ginger is still spicy 10,000 years later". So, there is the "Ginger Buddhist Dharma". Every year around Qingming Festival, in the ancestral ceremony for "Ginger Pavilion Opening", monks from Jiuhua are invited for chanting. This essential part of the ceremony proves that the Zen Buddhism culture and white ginger culture have been blended perfectly like milk and water.

Figure 49: Zen Master Fanghui in Mount Yangqi

Figure 50: Dashi Temple in Datong Town

Figure 51: The First Celestial Gate of Mount Jiuhua

4.4.2 Value System

Tongling region has a ginger-planting history that is as long as over 2,000 years. It has given birth to special belief and sacrifice culture. Tongling people believe that white ginger is the symbol of good health and wealth. It is said that "ginger protects people against all evils," and "the profit made by planting ginger is as much as raising sheep".

(1) Belief of White Ginger

Ginger farmers worship Yanju, the god of ginger. They believe that Yanju can bring them good harvest, and keep them from disease. Worshipping ceremonies are held in different seasons.

Ginger Pavilion Opening Ceremony. Around every Qingming Festival, ginger farmers will hold grand ceremony to greet the ginger seed. It's also known as "Greeting the Ginger God". Usually, it is hosted by the elderlies who are most prestigious in the village. A few days before the ceremony, ginger farmers raise funds for purchasing the offerings and sacrifices for the ceremony. On the day, farmers gather at appointed place, put the memorial tablet of Ginger God, the Three Sacrifices (cattle, sheep, pig), and incense burner squarely on the alter table. After a volley of firecrackers, pavilion gates are opened. The elderly host will lead a chorus of Pavilion Opening Chant: "The celestial gate opens on Qingming Festival, and the Queen of Heaven descends with ginger. Ginger is the king of all spices. It is necessary for every meal; The Gate of Earth opens in March, and the Bodhisattva of Medicine presents with ginger. Ginger is originally planted by Him. It cures all diseases and remove ill fortune; The Gate of Pavilion opens on an auspicious day, and the God of Land appears with ginger. Here comes good weather for crops this year. Gold ingots torrent into everyone's house." As the chant goes, all ginger farmers put palms together devoutly, make deep bow, then kowtow, say their prayers to the Ginger God: please safeguard their ginger field from ginger wilt and insect pest; please bless with a good harvest. After greeting the Ginger God, the opening ceremony comes to an end. Ginger farmers take out their ginger seeds in sequence. So begins a new cycle of ginger planting.

Figure 52: Worshipping *Yanju*, the Ginger God, during the Ginger Pavilion Opening Ceremony

Figure 53: Ginger Farmers Take Away Own Ginger Seeds after Ginger Pavilion Opening

Sacrifice-offering Before Ginger Harvesting. On the eve of ginger harvesting, similar to the idea of Ginger God Greeting, local ginger farmers hold sacrifice offering ceremonies to "brief" the God of Land and the Ginger God about the gains of the year. And express their gratitude for the gods' blessings. White ginger harvesting cannot start before the ceremony is finished.

Worshipping Yanju, the Ginger God. A small number of ginger farmers, during their everyday life, when they or their family members are ill, choose to worship Yanju for his blessing. They pray that Yanju can descend and cure the diseases. The worshipping customs during production vividly depict farmers' ideas about "gratitude and returning the favor". It also deeply reflects ginger farmers' philosophies of "Lǐ" (rite) and "Jìng" (esteem).

Figure 54: Worshipping Yanju, the Ginger God

(2) Material Culture Value and Spiritual Culture Value

The history of white ginger in Tongling is long stand and well established. No matter in material terms or spiritual, emotional, cultural, or artistic terms, white ginger has been an indispensable part of local life. It represents people's yearning and pursuit of wealth, good health, and fairness. The longing is on everybody's lips in the form of poetry, proverb, and drama.

Poetry. Tongling white ginger is closely linked with local way of life. Since Song Dynasty (960～1279), there have been poetry about ginger. Mr. Su Shi wrote "tender ginger, purple vinegar, broiled silver-fish…the flavor is even better than stewed perch with water shield leaves". It indicated that ginger can effectively remove fishy taste, enhance the flavor, and improve good taste. He also wrote "the ginger shoot is as tender as meat". It means that the newly-arrived tender ginger is more delicious than meat. Mr. Mei Yaochen, poet in Northern Song Dynasty (960～1127), mentioned, in his poem "Reply to Mr. Liu Yuanfu on the ZāoJiāng (ginger that is pickled with distillers' grains) That He Sent", that "In a famous city of 10,000 households, the owner of 1,000 *mu* (Appr. 66.7 hectares) of ginger field is as wealthy as a duke. The ginger needs to be cut before the swallows return. It is very distillers'-grains-consuming for making ZāoJiāng. Emperor Yan in Kingdom Xu must be happily smiling, because the ginger has no hard fibers. Its fantastic flavor is far beyond what Mr. Qu Yuan can possibly imagined. It is sent to the tables of the Imperial

Academy. So the emperor acclaimed 'Thou shall keep that on my table'. It is sent to humble houses, ordinary people cannot stop praising it". The author thought that the owner of 1,000 mu of ginger field is as rich as a duke. It means that planting ginger is very profitable. And it was equally popular among both nobles and ordinary people. Mr. Liu Zihui, a poet in Song Dynasty, wrote in his "Ode to Ginger" that, "new ginger shoot has delicate texture. It seems transparent in sunlight. Look at its rosy, tender tips. Doesn't it remind you of a fair lady's well-manicured hands?". It vividly described Tongling white ginger's feature of "white skin with rosy tips, in a shape of Buddha hand". In The Dream in Red Mansions (one of China's Four Greatest Classic Novels), the author described that "The alcohol is as good as chrysanthemum in eliminating fishy flavor; It is ginger that you must choose for preventing the accumulation of coldness in your body". It pointed out that people should eat white ginger when they eat fresh-water crabs. The ginger can prevent the cold Chi, which is hidden in the crab, from doing harms to the stomach. Mr. Shen Mi, poet of Qing Dynasty (1644~1911), wrote in his "Ballad of Ginger Planting" that "(The ginger) cannot resist coldness. It shall be kept in sealed containers. Sell ginger on JīngZhé (the 3rd solar term, meaning the Waking of Insects). At this moment, the ginger becomes Fire Ginger, so it doesn't rot easily. Fertilize the field before sowing, and keep the humidity balanced afterwards. Use pine needles to provide the growing ginger with shade." It narrates the special, non-material cultivating techniques of Tongling white ginger, such as Ginger Pavilion for Seed-Preserving, Cultivation on High Ridges, and Shed for Shading, etc.

Proverbs That Reflect the Growth Habits of Ginger. From the long-time practice, Tongling people have summarized many proverbs about the growth of white ginger. For example, "Keep the arrows (newly-grown ginger leaves) out of sunlight", "At seedling stage, 30% of sunlight, 70% of shade; the other way around at later stage." They point out ginger's different needs for sunlight at different stages. It is also where "Shed for Shading" comes from. More examples. "Enter the Pavilion on LìDōng (19th solar term, meaning the Beginning of Winter), Leave the Pavilion in Qingming Festival; Capping on the Dragon Boat Festival. De-capping on the Double Ninth Festival (the ninth day of the ninth lunar month); Grow in furrow, harvest on ridge." It says that ginger cultivation must be in season. "A cup of ginger soup can keep the elderly and the young safe. A bit of ginger in the morning is better than a bowl of ginseng soup." It summarizes the ginger's medicinal values: keep people fit. "Bamao house, adobe walls, mother goes out after giving birth to son." It reveals the growth habit of ginger, i.e., parent ginger can be harvested and sold after new ginger sprouts come out. There is also a popular two-part allegorical saying amongst the locals: The Grand Courtyard of Family Shé---Good Ginger (Good Future). It underlines the extraordinary quality of "Ginger as an Article of Tribute" that planted by the Shé family: the very origin of Tongling white ginger plantation.

Literature and Arts. People of the heritage site produced Huangmei Operas around ginger, for example, "A Romantic Story of Ginger Pavilion", "Buddha's-Hand Ginger", and "Emperor Qianlong and Ms. Ginger", etc. The Huangmei Opera lively expresses the cultural connotation of Tongling white ginger. Hence, it is widely loved by Tongling people and domestic and international tourists. Tongling White Ginger Institute edited and published an anthology of historical accounts about Tongling white ginger: Tongling White Ginger in Ink. It

comprehensively introduced the historical stories, literary quotations, folklores, literature works, Cultural Park of Chinese White Ginger, cooking and cuisine, health care, and technological innovation, etc. The Institute also produced a 3-episode radio drama: Tale of White Ginger and promoted it. This drama has been played on central radio stations and some of provincial and municipal radio stations. It won national silver award for radio drama.

Figure 55: Shows and Performance about White Ginger

4.4.3 Social Organizations and System Management

(1) Organizing White Ginger Worshipping

In usual, white ginger worshipping is loosely organized by villages. In old times, hoping for good harvests, Tongling ginger farmers held grand ceremonies of pavilion opening to greet the Ginger God. So, the ceremony was also known as "Greeting the Ginger God". In this way, the farmers believed, that they would have a good harvest of ginger in autumn. The events are usually held in front of ginger pavilions, hosted by prestigious elderlies. A few days before the ceremony, farmers collectively raise fund for purchasing offerings for the ceremony. On the day of the event, ginger farmers in the village gather in front of the pavilion. Place the memorial tablet of Ginger God, Three Sacrifices, and incense burner. After a volley of firecrackers, the pavilion gates are opened. At the same time, the elderly host leads the chorus: "The celestial gate opens on Qingming Festival, and the Queen of Heaven descends with ginger. Ginger is the king of all spices. It is necessary for every meal…Here comes good weather for crops this year. Gold ingots torrent into everyone's house." Ginger farmers would take away their own ginger weeds after the chant singing. So begins a new cycle of white ginger production. It still goes on at present, and every year over the past thousand years.

(2) Organizing and Management of Ginger Pavilion Seeding

Non-governmental activities of white ginger seed keeping. Tongling ginger farmers use local seeds. They are selected from gingers of the year with outstanding quality. They are chosen, during the ginger harvest season, from the best ginger of the year in the village, instead of farmer's self-grown ginger. Seeds are booked on the demand of the next year, paid in average market price, and kept by the seller. Harvest season for seed ginger is one month later than the fresh ginger and ginger for processed foods. Around November, seed gingers are harvested and put into pavilions within 1 week.

Non-governmental organizations for ginger pavilion seeding. The seeding of ginger is not conducted by farmer themselves. Seeding experts who run ginger pavilions are entrusted by farmers for seed preserving and germination accelerating. The seeding experts are mainly old people with over 50 years old, young people just accounting for 10%. The process includes: (1) Farmers warp their ginger seeds with dried lotus leaves, put them in bamboo baskets, and place them into ginger pavilion in order. Seeds of different farmers are separated by fences. Seeding expert registers the location and quantity by order. The expense for pavilion seeding is paid at market price. It basically comprises seeding cost and fuel cost. Farmers can bring their own Bamao grass or firewood to deduct the fuel cost. Since the pavilion needs a large quantity of firewood, the pavilion owners usually purchase them from farmers, too. Old-fashioned ginger pavilion can keep 9,000kg~10,000kg of ginger seeds. Each pavilion keeper has 5 to 8 pavilions, which can serve 400 to 600 families in nearby neighborhoods. (2) About a week prior to ginger sowing, choose auspicious day to worship the Ginger God, open the pavilions, take away the seeds. According to the sequence that the keeper recorded but in reverse, farmers take own seeds from the pavilion, then sow the seeds in their own ginger fields. This is how a new cycle of ginger production begins.

(3) Ginger Merchant (JiāngHáng)--Traditional Ginger Trading Organization and Its Management

In traditional agricultural times, Tongling white ginger was "best-selling" specialty and bulk commodity. It was sold all over China and overseas by JiāngHáng, ginger merchants. Traditional JiāngHáng normally took the format of "Shop (in front) and Factory (in behind)". Fresh ginger and processed ginger products are for sale in the shop (fresh ginger cannot last long, so the shops mainly sell processed products). What the ginger farmers sell is basically fresh ginger. Every year, before ginger hits the shelves, farmers and the merchants come to an agreement on price, quantity and conditions (deduct certain weight based on the humidness, dirt attachment, and the length of ginger stem). After harvesting, farmers ship the fresh ginger directly to the merchants. They can request the merchant to purchase from the field, if the quantity is large enough. The way of shipment depends on quantity of the ginger. Donkey cart, horse coach, or ox cart will be used if the quantity is large; carrying pole or wheel barrow is used if it's small. Merchant pays in cash if the quantity is not large; or the merchant can finalize the payment, if the quantity is large, before Chinese New Year, or after selling out the ginger. The Ginger Merchants based in the market of Datong Town, from where they sell white ginger through the Yangtze River.

4.4.4 The contribution to the sustainability and resilience of heritage systems

(1) Traditional farming culture and value systems become intangible forces that sustain the ginger-rice crop rotation system

Some farming cultures formed during the development of Tongling ginger rice rotation system, including traditional rice planting and white ginger planting related customs, festival culture, beliefs and taboos, and unique farming tools, are the basis of local farmers' cultural identity and social communication. These farming cultures and value systems sustain the people of the heritage site in their continued agricultural production and provide the conditions for the transmission of the heritage system.

(2) The local characteristic food culture lays a stable market foundation for the sustainable development of ginger-rice system

The staple food of the farmers in the heritage site has been rice since ancient times, and the local people have explored the edible and medicinal effects of white ginger, invented various rice products and white ginger foods, and formed a unique culture of eating white ginger. The demand for rice and white ginger by the local people has motivated the local farmers to grow white ginger and rice on a continuous basis, thus maintaining the sustainability of the system. The higher market price of ecological white ginger products has also made farmers willing to adopt traditional production methods, leading to increasing sustainability and resilience of the system.

(3) The traditional social organization and system management are the institutional carrier of system survival

The traditional sacrificial organization maintained the belief of local farmers in planting, while the traditional ginger pavilion breeding organization ensured the survival and uniqueness of the white ginger variety in the Tongling White Ginger Plantation system, allowing the variety to be passed down through millennia of heritage. Traditional ginger merchants ensured the trade and circulation of white ginger, which made the market demand expand continuously, thus promoting farmers to plant white ginger and maintaining the development of White Ginger Plantation system.

4.5 Characteristics of Landscape

4.5.1 Landscape Pattern Characteristics of the Heritage Site’s Land Usage

The difference between landscape characteristics of the heritage site is mainly subject to the Yangtze River drainage and various mountainous and hilly landforms within its borders. It creates diverse landscapes from usages like forest field, paddy field, upland field, grassland, and waters. Forest is the principal land usage type of landscape in the natural ecosystem, while paddy filed the key type of landscape of usage under human influences (see Figure 58). It is closely related to many factors, for example, favorable climate, land that is suitable for farming, and the landforms that transit from mountain and hill region to river-side flatlands, etc.

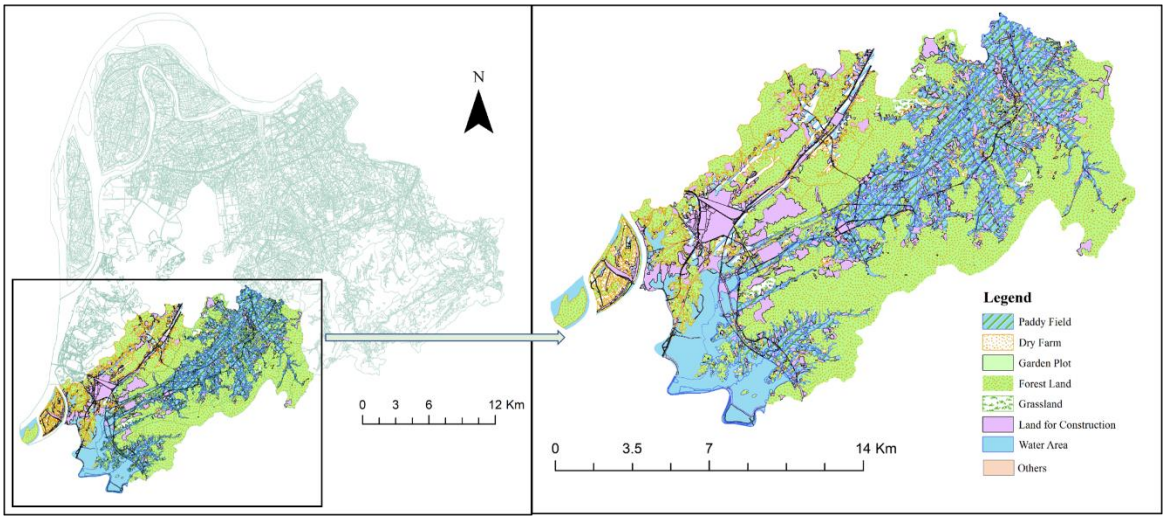


Figure 56: Landscape of Land Usage at the Heritage Site

In term of the landscape structure of whiter ginger, the proposed heritage system has a better irrigation system consisting of reservoirs (Figure 57a), dāngjiā ponds (community ponds) (Figure 57b), riverways (Figure 57c), and ditches (Figure 57d, e, f), benefiting for intercropping between white ginger and other crops (Figure 57). Main functions of the reservoirs are flood detention, flood regulation, and irrigation. The dāngjiā ponds are used for retaining water and irrigation, while riverways and ditches for flood discharging and irrigation. The Site has 22 reservoirs with a total storage capacity of around 6.551 million cubic meters and 243 dāngjiā ponds whose individual capacity is over 10 thousand cubic meters (total capacity: around 6.075 million cubic meters). Overall length of its 4 major riverways is more than 30 kilometers in the site. The functions of irrigation system are shown in two aspects. Firstly, as a dry crop, white ginger is vulnerable to waterlogging; the irrigation system can timely drain water to keep white ginger healthy growth during because the growing season of white ginger (from April to Octorber) nearly concides the rainy season in Tongling Perfecture (from March to Augest); Secondly, in the years of rice and other crops rotation, the irrigation system can meet the irrigation and drainage needs of rice and other crops, fully demonstrating the relationship between supply and demand of white ginger and related crops and water bodies. In case of drought, the reservoirs and dāngjiā ponds are usually under centralized management of the towns or villages. In order to ensure a reasonable use of water, the water resources are put under unified distribution. Besides, white ginger usually rotates with rice (from late April to mid-November) and rape (from October to the next May), at the same time, it forms a Mosaic distribution with them in some time. Such a management mode plays an important role in the utilization of soil nutrients, the mitigation of diseases and pests, and the improvement of soil structure. The intercropping pattern with other crops or Mosaic distribution from a regional perspective can jointly form a good ecological environment and realize efficient utilization of light, heat, water and soil resources.

a. Reservoir

b. Dāngjiā pond

c. Riverway

d. Trunk ditch

e. Ditch in the ginger field

f. Ditch around the ginger field

Figure 57: Ditch system in Tongling White Ginger Plantation System

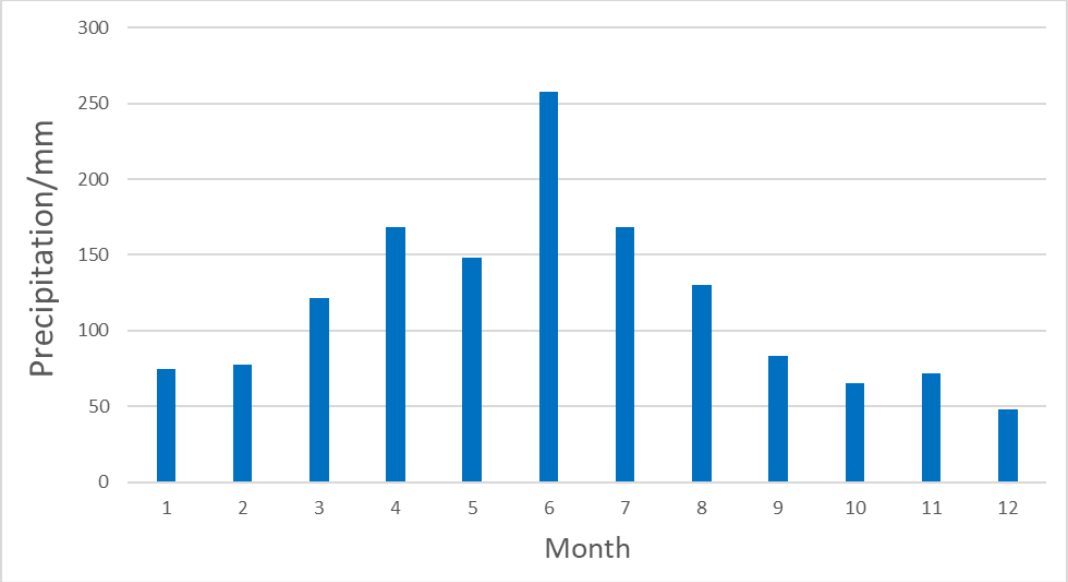


Figure 58: Distribution characteristics of monthly average precipitation in Tongling Perfecture

4.5.2 Landscape of White Ginger Plantation

(1) Landscape of Interannual Rotation between Ginger and Rice or Other Crops

The landscape of White Ginger Plantation is commonplace at the Site (see Figure 59). It means that, in the same plot of field, plant ginger for a year, then plant rice or oilseed rape for the next consecutive years. At the same time, ginger can also rotate with other crops with economic values, for example, maize or pepper, etc.

Figure 59: Rotation Landscape

(2) Specially-Distributed Landscape of Ginger, Rice, and other Crops in the Same Season

In the first place, the microtopography features of ginger ridge on high plot, in Tongling white ginger plantation, constitutes a unique landscape of ginger field. Secondly, Tongling white ginger can endure neither high temperature nor strong sunlight, especially new ginger sprouts. To keep the high temperature and sunlight in summer time from hurting the ginger plants, farmers build shed with Bamao grass for shading. This is a very special landscape in Tongling white ginger production system. What's more, ginger inlays with rice, vegetables, and rivers like in a mosaic picture. Together, they form an amazing hill-field landscape with ginger field (paddy field). The riverside white ginger (paddy) planting area, with waters and fields inlaid with each other, has a special glamor of waterside scenery (see Figure 60).

Figure 60: Landscape of Spatial Differentiation

(3) Sequential Change of the Landscape of White Ginger System in Different Seasons

In terms of time, Tongling ginger fields show obvious differences (see Figure 61). In spring, when the ginger is sown, ridges line up the field. In summer, when ginger plants are rapidly growing, the fields present a landscape of ginger sheds. In autumn, when ginger is ripe, farmers are busy harvesting in the field. A picture of ginger airing can be seen around farmers' houses. The seasonal scenery changes that are linked with farming activities present unique landscapes to Tongling ginger-planting area in different seasons.

Figure 61: Sequential Landscapes of White Ginger

4.5.3 Landscape of Rice Intercropping with other Crops

Through rotation and intercropping of ginger-rice, ginger-vegetables, ginger- protection forest, etc. (see Figure 63), Tongling White Ginger Plantation System in Anhui Province optimizes the landscapes, and realizes the compound agricultural model that organically combines tree, grass, fertilizer, and water.

In addition, when intercropped or rotated with crops that are of ornamental value, the utilization of ginger field will present a compound, biological landscape with well-arranged gradations. What's more, ginger field and surrounding waters, forests, and fields form an unsophisticated, amazing, compound landscape of biodiversity. All in all, Tongling agricultural production system is, in itself, an excellent compound agricultural landscape of biodiversity.

Figure 62: Landscapes of Ecological Farming Model

4.5.4 Community, Buildings, and Human Landscapes

Various, unique cultural landscapes came into being throughout the cultural customs of ginger-planting, ginger-eating, and ginger-worshipping during the longtime history of Tongling's ginger plantation. Ancient ginger pavilion, for example, is a special type of landscape (see Figure 64). The special structure of the pavilions can meet the demands of ginger seed keeping. It is usually built in places that are higher and drier. In order to keep the seeds dry, the pavilion also need to be sheltered from wind and exposed to sunlight. To keep the cold wind out, clay walls or brick walls need to be built around the pavilion. And seal the wall (both internal side and outer side) with puddle. Within the pavilion, construct wood ceiling (1.5m high above the floor, in a shape of steamer bottom). Open a small skylight on the south side of the roof. It can discharge moisture (see Figure 64). Pave the roof with tiles. Seal it with puddle, which is a mixture of water, clay, grass, and straw, underneath the tiles. It can effectively keep the warmth. This internal and external pattern and landscape structure becomes a beautiful scenery. Generation after generation, it has been inherited in Tongling ginger-producing areas. And it has been an attraction for so many tourists, to see, and to feel.

Figure 63: Ancient Ginger Pavilions

In busy farming seasons, diligent farmers, wearing local dress and carrying bamboo or rattan baskets, go to ginger field or waterside to harvest white ginger or wash the ginger. It is a harmonious picture scroll of white ginger landscape (see Figure 65). During rice rotation period, the farming of paddy field is also distinctively unique (see Figure 66).

Figure 64: Pictures of White Ginger Harvesting and Ginger Washing

Figure 65: Picture of Rice Transplanting and Harvesting

Moreover, during the long history of Tongling white ginger production system, a special landscape of buildings took shape. It features special ginger workshops and ginger-culture-related ancient buildings. For example, the Ginger Trading Street in Ancient Datong Town, Dashi Temple in Datong Town, etc. (see Figure 67). The buildings witnessed Tongling ginger farmers' arduous journey of ginger planting, making, and ginger business running for hundreds of years. They also recorded the inheritance and development of ginger culture. Ancient Datong Town was one of "Top Four Trading Ports of Anhui Province" in Qing Dynasty (1644~1911). Tongling white ginger went from this important port to other areas (see Figure 68). The Anhui architecture, Anhui businessmen's shops, piers, facilities of ancient town collectively constitute a complete white ginger ancient building and human landscape in the low hilly region.

Figure 66: Ginger Trading Street in Ancient Datong Town

Figure 67: Pier of Ancient Datong Town

4.5.5 The contribution to the sustainability and resilience of heritage systems

The contribution of ginger-rice agricultural landscape management practices to the sustainability of heritage systems is reflected in the following.

(1) Landscape management of ginger-rice crop rotation helps in full utilization of soil and water resources and reduce waterlogging

For the traditional ginger-rice crop rotation system, a field is usually planted with "white ginger for one year and rice for three years", with the ginger field and paddy field are alternately distributed. This landscape management method can improve the utilization efficiency of farmland soil, reduce the incidence of diseases and pests, and achieve the purpose of increasing production and income. Secondly, the white ginger planting landscape is characterized by the "shade trellis" and "raised bed and high ridge" agricultural landscapes, with the "shade trellis" meeting the light needs of white ginger at different stages of growth. And the "raised bed and high ridge" is conducive to the drainage of rainy summer ginger field in the heritage site and plays a role in preventing waterlogging. The management of these traditional landscapes enhances the natural and socio-economic resilience of the heritage system and promotes its sustainability.

(2) Landscape management practices help support heritage site systems to mitigate adverse impacts associated with environmental pressures

Protecting and optimizing landscape patterns is an important aspect of landscape management practices, such as the protection of water-conserving forest landscapes can reduce soil erosion and

the occurrence of geological hazards while providing a supply of water and nutrient resources for agricultural production. The mosaic layout of agricultural landscapes such as ginger fields and rice fields, as well as the composite landscape of villages and water systems, on the one hand, facilitates the arrangement of agricultural activities, such as the diversion of water for irrigation in years of drought, and the timely drainage of water in years of high precipitation, and is a mutual unification of ecological, economic and social benefits, promoting heritage sites to better cope with future climate change and natural disasters and contribute to the sustainability of the system.

(3) The ginger pavilion operating subsidy policy promotes the protection of ginger pavilion landscape and the protection and inheritance of the whole heritage system

Due to the lack of effective protection and repair, ginger pavilions will be damaged, but considering the cost, ginger farmers' willingess to repair is not strong. In recent years, the government has developed a policy of subsidizing the operation of ginger pavilions to economically relieve the pressure of ginger pavilion maintenance and to stimulate the initiative of ginger farmers for ginger pavilion repair and conservation, while the conservation of ginger pavilions has increased the effectiveness of storing and passing on ginger seeds. In addition, the restoration, conservation and preservation of the ginger pavilion landscape incentivized by the subsidy policy will also help to safeguard the integrity of the cultural landscape of the entire heritage system.

V. Action Plan of Dynamic Conservation

5.1 Threats and challenges

5.1.1 Decreasing food and livelihood security role reduce the economic sustainability of the system

(1) Smaller scale cultivation, increase in part-time family labor and reduced security of livelihoods from ginger and rice

At present, the cultivated land of ginger rice rotation in the heritage site is still dominated by small-scale decentralized planting and management by families. The average household planting of white ginger is less than 0.13 ha, and rice is only 0.3 ha. Moreover, the driving capacity of ginger rice industry is limited, and the number of farmers involved is not large. The share of ginger and rice income in household income generally decreased in most areas, except for some villages where the white ginger brand has been developed, where the share of ginger and rice income in household income increased. Due to the migrant workers of young families, the income from migrant workers in the family income gradually increases, while the proportion of income from planting white ginger and rice continues to decline, which weakens the importance of ensuring the livelihood security of farmers.

(2) Higher production costs and increased business risks for Tongling white ginger threaten farmers' sustainable livelihoods

Tongling white ginger, as a local characteristic cash crop variety in Tongling, has different cultivation techniques and storage methods from ordinary ginger. Most links are completed manually, and the planting cost is high, especially the labor cost is more than 75000 yuan per ha. In recent years, affected by many factors, the market price of Tongling white ginger has fluctuated greatly, and ginger farmers are facing great production and operation risks. In addition, the extreme weather has increased in recent years, and the incidence rate of ginger blast has increased, resulting in halved yield and even crop failure. This has seriously affected the farmers' benefit from planting white ginger, and the enthusiasm of farmers in white ginger has been reduced, making the planting area of white ginger hard to expand.

5.1.2 Declining diversity of crop germplasm resources and biodiversity in the heritage site

In some places, the use of chemical fertilizers, pesticides and herbicides for field management during cultivation on adjacent farmland outside the White Ginger Plantation system poses a certain threat to maintaining biodiversity in the White Ginger Plantation system.

For example, some ginger species are experiencing low yields and susceptibility to disease, and the area planted with traditional varieties of rice is decreasing. In addition, the germplasm resources of heritage sites are also facing some problems, such as scattered distribution and poor ability to resist the impact of the external environment.

5.1.3 The sustainable utilization of traditional knowledge and technology faces multiple impacts

(1) The traditional core planting technology of ginger and rice faces the risk of being replaced by modern agricultural science and technology

The traditional knowledge and technology included in the Tongling White ginger Plantation system (such as building ginger huts) requires a lot of labor and the work is labor-intensive. More and more farmers are adopting plastic shade nets in place of barberry to save costs, and these labor-intensive traditional techniques are being replaced by modern technologies, increasing the risk that core elements of heritage systems will disappear.

(2) Changes in agricultural production and rural lifestyles challenge the sustainable recycling mechanism of heritage

In the traditional White ginger Plantation system, cow dung and plant ash are important fertilizers, of which grass ash is also a major pesticide. It is not only the nutrient for the growth of white ginger and rice, but also plays a role in preventing diseases and pests. However, the circular mechanism of the heritage system is being challenged by the widespread use of agricultural mechanization, electricity and natural gas, the substitution of chemical fertilizers and factory-produced organic fertilizers, and the increased difficulty in obtaining traditional fertilizers such as grass ash and cow dung, while pesticide and fertilizer use can reduce labor costs.

(3) The young generation is less willing to adopt the traditional ginger rice planting method, and the inheritance of traditional knowledge and technology is facing challenges

As urbanization continues to accelerate, a significant proportion of young people go to school or work in cities and have less and less access to traditional ginger-rice crop rotation techniques, such as the traditional roasted ginger pavilion technique and white ginger cultivation techniques with which fewer and fewer young people are familiar. In addition, most young people are unwilling to engage in the cultivation of white ginger, rice, wheat, oilseed rape, etc. and the protection and inheritance of traditional farming technologies are facing a major test.

5.1.4 The protection and inheritance mechanism of traditional farming culture faces the impact of modern civilization

(1) Challenges to the inheritance of traditional farming culture

Due to the influence of modern production technology and the aging of the agricultural labor force in the context of population urbanization, some traditional production customs included in the Tongling White Ginger Plantation system are gradually disappearing (such customs as "firecrackers blowing up the spring" and "burning straw bales" in the production of white ginger), and some traditional farming tools (such as waterwheel, sickle, dustpan, mallet, etc.) are being replaced by mechanized tools, and the traditional farming culture of the heritage site is at risk of being lost.

(2) The traditional value system has been impacted

Traditional white ginger sacrifice beliefs in heritage sites are mainly performed by older ginger farmers from local clans and villages leading younger generations of ginger farmers, but the sacrifice activities in the village are rare now. Traditional festivals such as the Dragon Boat Festival and the Mid Autumn Festival are the days for family members to get together and celebrate. However, at present, there is a large outflow of labor force in the heritage site. Due to the limitation of working hours and the increase of transportation costs, there is less return to the hometown for festivals, which also has an impact on the traditional lifestyle, festival and sacrificial culture derived from traditional production and labor.

(3) Difficulties in the development of traditional social organizations and systems management

Fewer and older people have mastered the ginger pavilion breeding technology in Tongling White Ginger Plantation system. Because of the hard work and low income associated with the management of the ginger pavilion business, the younger generation is less inclined to take up the job and its family-style heritage is at risk of disruption. The traditional trade distribution organization, the ginger merchants, is also at risk of disappearing due to modern transportation methods (from water to land-based) and sales methods (e-commerce, live streaming, etc.).

5.1.5 Traditional agricultural landscape is challenged by many factors such as environmental change and management

(1) The traditional cultural landscape of the heritage site is in a state of disrepair

In some areas, the walls of the ancient ginger pavilion are peeling, the roof cover tiles are falling off, and the internal wooden structure is aging, etc. The old town of Datong, in terms of the overall landscape, has been affected by age and disrepair as well as flood disasters, and although some ancient buildings have been restored, individual cultural landscapes are still in disrepair.

(2) The White Ginger Plantation landscape in the plains is threatened by extreme weather in individual years

For example, in recent years, extreme weather disasters such as extreme high temperature, drought and continuous heavy rainfall have occurred from time to time, threatening the landscape elements of ginger rice rotation system such as crops, ridges, ditches, roads and shelter forests to varying degrees.

(3) The landscape of local water conservation forest in mountainous and hilly areas is degraded

For example, in the distribution area of water conservation forest landscape, with the growth of tree age and natural decline of forest, the community landscape degenerates. The occurrence of natural disasters such as pests and diseases or droughts in some years further increases the risk of degradation of water-conserving forest landscapes.

5.2 Action Plan That Have Been Taken

5.2.1 Organizational construction

The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, the administrative institution for the protection and development of agricultural heritages, was established. The Office of Steering Group for Rural Affairs in Tongling Municipal Party Committee was founded, too. It's responsible for the implementation and management of agricultural heritage protection.

5.2.2 Management system construction

(1) The Plan of Conservation and Development for Tongling White Ginger Plantation System (Tongling White Ginger Planting System) in Anhui Province, a China-NIAHS was complied. The White Ginger Plantation system was taken into the Industrial Plan for Food Production in Tongling Prefecture.

(2) The government enacted the Measures for Tongling White Ginger Conservation and Implementation Suggestions on Promoting the Development of Tongling White Ginger Industry. The Conservation and development of Tongling white ginger becomes part of the 14th Five-Year Plan of Tongling Prefecture.

(3) Standardized the producing and processing of Tongling white ginger and rice. Specifications and quality standards for processed products have been drafted, revised, and vigorously promoted. For example, Technical Specification of Tongling White Ginger Producing

Techniques, Specification of Seeding Techniques for Tongling White Ginger, Harvesting and Storing Techniques of Ginger, Pickling Tongling White Ginger, and The Proposal of Demonstration and Popularization for the Ecological and Efficient Models of Rice Planting in Tongling Prefecture.

(4) Regulations on the Use of Special Images of the Geographic Indication for Tongling White Ginger and Regulations on the Use of Certificates and Trademarks of Tongling White Ginger are put into effect.

5.2.3 Conservation Measures

(1) Protecting the germplasm resources of Tongling white ginger

a. Superior seeding system for Tongling white ginger was established.

b. Promote the construction of demonstrative planting bases for the superior seeding and experimentation of Tongling white ginger. Build the germplasm resource circle for Tongling white ginger, which has included 47 ginger varieties.

c. Special incentive policies for ginger pavilion operation: give RMB 2,000 to the operator of every working ginger pavilion. Protect the unique seed-preserving techniques of Ginger-Pavilion for Seeding-Preserving and Germination- Accelerating.

(2) Protecting the Ecosystem of White Ginger Plantation

a. Monitoring ginger field soil and fresh ginger. Adopt various scientific methods like "bio-organic fertilizers plus biochar (ash)". Restore and improve the soil of the ginger field during the dormancy period (October to December, after ginger harvest).

b. Support the construction of environment-friendly bases of ginger-rice rotation production, for example, the green production base of Tongling white ginger, etc. Tongling white ginger has won the title of Protected Product of China Geographic Indication and China Geographic Indication Certification trademark. At present, 4 Tongling white ginger brands have achieved the certification of China Green Food, while 2 Tongling white ginger brand won the certificates of pollution-free agricultural product.

c. Replace chemical fertilizer with organic fertilizer. Allocate special funds for organic fertilizer subsidy. This fund is used for purchasing highly-effective organic fertilizers, and distribute them to ginger farmers for free. Appropriately promote ecological fertilizing techniques and methods, for example, Organic Fertilizer plus Farmyard Manure, or Organic Fertilizer plus Formula Fertilizer, etc.

d. Combine with the implementation of initiatives like Zero Growth of Chemical Fertilizer and Pesticides, vigorously prompt the Rice+ technologies of biological prevention and treatment of insect pest and plant diseases, fertilizer saving, and fertility improvement. Promote biological prevention and treatment technologies like biocides, sexual inducing, and lamp luring, etc.

e. Tongling has been certified among the first batch of predominant regions with special agricultural products in Anhui province.

(3) Protecting traditional knowledge and techniques of ginger-rice rotation.

a. Tongling Institute of Agricultural Sciences and Tongling White Ginger Institute jointly present knowledge and skill training, push the inheriting of traditional cultivating techniques of ginger-rice rotation, and promote the traditional ginger making and processing techniques and white ginger culture.

b. Since 2012, "Tongling Ginger King" Contest has been held every year from September to October. The "Ginger King" will be awarded, so as to encourage non-governmental white ginger contests.

c. Serial research projects, such as protective mechanism of agricultural heritages, biodiversity Conservation on heritage site, the value of service functions of the ginger-rice rotation ecosystem and its improvement, etc., are carried out with collaboration of institutions like Chinese Academy of Agricultural Sciences, and Fujian Agriculture and Forestry University, etc. The collaboration can continuously improve the scientific supporting capabilities.

d. Host public events like "Initiative of Ginger Firms and Farms: Protect Our Geographic Indication Products". Ginger farmers promise to adopt unique traditional cultivating techniques, during planting Tongling white ginger, without using restricted (or limited) pesticides. Ginger firms promise to manufacture white ginger products strictly in accordance with standards and processes.

e. Proactively apply the certification of non-material cultural heritage for ginger and rice systems at the municipal level. In 2011, "Making Techniques of Tongling White Ginger" was certified Intangible Cultural Heritage of Anhui province. Multiple people were certified inheritors of white ginger making skills at the municipal level.

5.2.4 Risk-reduction Measures

(1) Operating the ginger-rice rotation on an appropriate scale

Given the fact that there are few scaled operations of ginger-rice rotation, but risks are rather high, Tongling Prefecture are pushing, by various means shown below, the rotation on an appropriate scale.

a. Promote models like "Cooperatives + Ginger farmers" or "Family farms + Ginger farmers". Turn modern agricultural business entities like cooperatives and family farms into basic units of the modern organization of Tongling Ginger-Rice Rotation industry.

b. Encourage appropriately-scaled operation. Rationally promote orderly transition from small ginger/rice field to modern agriculture business entities, like cooperatives or family farms. Lower the market risks.

c. Support leading enterprises to build ginger-rice rotation bases. Promote the management model of Tongling ginger-rice rotation system in Anhui Province, i.e., "Leader Enterprises +

Cooperatives + Bases + Family Farms + Ginger Farmers". Establish, step by step, a community of industrial stakeholders that share both interests and risks. Subsidize leading enterprises that construct scaled demonstration bases, which are contiguous and over 200 mu, within the Tongling White Ginger Plantation System. The lump-sum subsidy for the company equals to 50% of its newly invested money for the base.

d. Interest subsidy (lump-sum, 50% off, based on the benchmark interest rate of the year) for the business entities' loan for producing, processing, and trading Tonging white ginger.

e. Liquidate the financial functions of rural lands' contract for the managerial right. Give more property rights to the planting entities of Tongling white ginger and rice. Entities that pass assessments can get loans from financial institutions by mortgaging their contractual right of land.

(2) Tongling white ginger market oversight

a. In the selling season of Tongling white ginger, establish special direct-selling markets in major farmers' markets and big markets. This can effectively solve farmers' difficulties in ginger selling, and safeguard farmers' interests.

b. Give free packing bags, with the logo of place of origin for Tongling white ginger, to those companies that testify trademark rights or geographic indication. Strengthen market oversight. Effectively tackle with counterfeit Tongling white ginger and restore the order of local market. Stabilize Tongling white ginger's market prices.

(3) Insurance for planting Tongling white ginger and the prevention of ginger wilt

a. Set up insurance system for planting Tongling white ginger. The premium is RMB 6000 per hectares (RMB 1200 from planting entity, RMB 2400 from municipal government, RMB 2400 from city government). Insured amount is RMB 6,0000 per mu. Promote policy-backed agricultural insurance system for rice planting. Premium is RMB 645 per hactares (RMB 129 from planting entity, RMB 516 from central, provincial, municipal, and city governments respectively). Insured amount is RMB 7200 per hactares. This effectively improves planting entities' capability to fight against risks from natural disasters, plant diseases, and insect pest.

b. Collaborate with universities and scientific & research institutions, for example, Nanjing Agricultural University, Anhui Agricultural University, etc. Carry out joint research on ginger wilt prevention and treatment.

5.2.5 Publicity Measures

Proactive publicity for Tongling white ginger and rice has apparently improved the brand influence. The publicity measures include:

a. Broadcast Tongling White Ginger Plantation System in Anhui Province in many forms, for example, serial treatise of Research on the History and Culture of Tongling White Ginger, performance arts about ginger, such as Hymn to Tongling White Ginger (song and dance), and A Romantic Story of Ginger Pavilion (Huangmei Drama), etc.

b. Organize events like exhibitions about white ginger culture, ginger pavilion opening ceremonies, ceremony of ginger market opening, etc., in venues like Cultural Park of Chinese White Ginger in Tongling, Tongling Prefecture Cultural Center, etc. The Cultural Park of Chinese White Ginger in Tongling has been identified "The Youth's Base for Practice and Science Popularization in Tongling".

c. Brand promotion by hosting events like Tongling white ginger culture and tourism fiesta. Organize ginger companies to participate in domestic and international fairs like Shanghai Expo, China International Agricultural Trade Fair, China Anhui Famous-High Quality Agricultural Products & Agricultural Industrialization Trade Fair (Hefei), etc. Positively push forward the establishment of brands, highlighting serial dedicated brands for round-grained glutinous rice, like "Fengyao" (Chinese: 枫瑶) and "Wanyaohu" (Chinese: 皖瑶湖), etc., and organic rice bands like "Quanjing" (Chinese: 泉井), etc.

d. Encourage and subsidize business entities for producing, processing, and selling Tongling white ginger to promote and advertise autonomously.

e. Tongling white ginger successfully entered the first product list of homologies of medicine and food issued by National Health Commission of China. Tongling Prefecture was successfully listed in the first batch of pilot cities for national cultural and tourism consumption.

5.3 Action Plans To Be Taken

Based on the threats and challenges that are confronted with Tongling White Ginger Plantation System in Anhui Province, 5 comprehensive action plans, 4 initiatives for the ecological conservation of ginger and rice fields, 5 conservation plans for traditional culture, 2 conservation plans for agricultural landscape, 3 initiatives for ecological agricultural product development, 3 initiatives for the development of ecological tourism, and 4 action plans of capability building have been made.

Table 9 Outline of Action Plans

Categroy	Action plans	Time and Place	Targets	Panticipants	Fund and Sources
Comprehensive Action Plans	Design the LOGO of Tongling White Ginger Plantation System in Anhui Province as an important agricultural heritage, and put it into service	2022-2023；the heritage site	Heritage brand of TonglingWhite Ginger Plantation System recognized by all residents of Tongling Prefecture	Heritage brand of Tongling Ginger-Rice RotationWhite Ginger Plantation System recognized by all residents of Tongling Prefecture	RMB 400,000/year；The Special Fund for the Conservation and Development of Agricultural Heritages
	Proactively Promote the Conservation of GIAHS	2022-2026；the Site, via TV stations of all levels, and Internet.	Over 95% of residents of the heritage site know of GIAHS	Publicity Department of the Municipal Party Committee in Tongling Prefecture, The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, The Bureau of Culture and Tourism of Tongling Prefecture, The Bureau of Agriculture and Rural Affairs of Yi'an District, The Bureau of Agriculture and Rural Affairs of Jiaoqu District.	RMB 800,000/year；The Special Fund for the Conservation and Development of Agricultural Heritages
	Keep Organizing the Contest of "Tongling Ginger King", and Further Improve the Competition Rules	2022-2026；the heritage site	Encourage ginger-related practitioners in Tongling to study and research the technology and skills of traditional ginger-rice rotation and processing. Inspire young and middle-aged people to learn and inherit the knowledge and techniques of ginger-rice rotation, processing of white ginger, and knowledge and skills of white ginger.	The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, Organization Department of the Municipal Party Committee in Tongling Prefecture, White Ginger Institute, The Bureau of Agriculture and Rural Affairs of Yi'an District, The Bureau of Agriculture and Rural Affairs of Jiaoqu District.	RMB 800,000/year；Annual budget of Tongling Prefecture Government
	Strengthen Farmer's Training on Traditional Ginger-Rice Rotation	2022-2023；the heritage site	All residents know of the heritage brand of Tongling White Ginger Plantation	The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, White Ginger Institute, The	RMB 800,000/year；The Special Fund for the

	Techniques		System in Anhui Province	Bureau of Agriculture and Rural Affairs of Yi'an District, The Bureau of Agriculture and Rural Affairs of Jiaoqu District, Town Governments within the heritage site.	Conservation and Development of Agricultural Heritages
	Enhance the Exchange between Agricultural Heritages in Terms of Conservation and Development	2022-2026; the heritage site	Administrators, representative enterprises, and outstanding farmers can fully understand the conservation elements of Tongling White Ginger Plantation System and main approaches of heritage conservation and development.	The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, White Ginger Institute, The Bureau of Agriculture and Rural Affairs of Yi'an District, The Bureau of Agriculture and Rural Affairs of Jiaoqu District, white ginger processing enterprises, cooperatives, and ginger farmers.	RMB 500,000/year; The Special Fund for the Conservation and Development of Agricultural Heritages
Protecting Farmland Ecosystem	Survey of and Scientific Research on the Germplasm Resources of Tongling White Ginger. Strengthen Germplasm Resource Conservation	2022-2023; the heritage site	Identify the distribution of the germplasm resource of Tongling white ginger. Protect the germplasm resource of Tongling white ginger.	The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, White Ginger Institute, Institute of Agricultural Sciences, The Bureau of Agriculture and Rural Affairs of Yi'an District, The Bureau of Agriculture and Rural Affairs of Jiaoqu District, relative enterprises, and ginger farmers	RMB 400,000/year ; special government funds of all levels, funds raised by enterprises
	Implement the Ecological Construction Projects for Ginger Fields and Paddy Fields	2022-2026; the heritage site	Complete ecological construction in more than 80% of the ginger fields and rice fields. Surrounding ecosystem being significantly improved.	The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, The Bureau of Ecology and Environment of Tongling Prefecture, Institute of Agricultural Sciences, The Bureau of Agriculture and Rural Affairs of Yi'an District, The Bureau of Agriculture and Rural Affairs of Jiaoqu District, Town Governments within the heritage site.	RMB 800,000/year ; special government funds of all levels
	Promote Ecological Ginger-rice	2022-2026; the	Content of organic matter of the	The Bureau of Agriculture and Rural Affairs of	RMB 2,000,000/year;

	Rotation Approach. Improve the Stability of Ecosystems in Ginger Fields and Rice Fields	heritage site	ginger/rice field soil being significantly improved. Soil fertility being effectively increased. Traditional and biological methods of disease/insect pest prevention and treatment being widely popularized.	Tongling Prefecture, Tongling Institute of Agricultural Sciences, The Bureau of Agriculture and Rural Affairs of Yi'an District, The Bureau of Agriculture and Rural Affairs of Jiaoqu District, Town Governments within the heritage site, relative enterprises, ginger farmers	special government funds of all levels; funds raised by enterprises
	Broaden the Area of Ginger Field That Passes the Green Certification and Organic Certification	2022-2026; the heritage site	All ginger fields within GIAHS core conservation area have green and organic certifications.	The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, Tongling Institute of Agricultural Sciences, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, Town Governments within the heritage site, relative enterprises, and ginger farmers	RMB 1,000,000/year; special government funds of all levels; funds raised by enterprises
	Continue the Scientific Research on the Prevention and Treatment of Ginger Wilt	2022-2026; the heritage site	Ginger wilt in Tongling white ginger under effective control. Occurrence rate being significantly reduced	The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, Tongling Institute of Agricultural Sciences, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District.	RMB 800,000/year; The Special Fund for the Conservation and Development of Agricultural Heritages
Protecting Traditional Culture	Culture Survey and Data Compilation about Tongling White Ginger	2022-2023; the heritage site	Tongling's cultural elements that are relative to Tongling white ginger being systematically reviewed and complied into volumes.	The Bureau of Culture and Tourism of Tongling Prefecture, The Literature and Art Federation of Tongling Prefecture.	RMB 250,000/year; The Special Fund for the Conservation and Development of Agricultural Heritages
	Tongling White Ginger Literature Prize	2022-2026; the heritage site	Explore and expand the white ginger culture in Tongling. Cultivate a group of	The Literature and Art Federation of Tongling Prefecture, Tongling citizens	RMB 250,000/year; The Special Fund for the

			ginger-loving writers		Conservation and Development of Agricultural Heritages
	Encourage Non-governmental Inheritance of Traditional White Ginger Culture	2022-2026; the heritage site	Triple the number of young people who know of the traditional culture of Tongling white ginger.	The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, The Bureau of Culture and Tourism of Tongling Prefecture, The Bureau of Human Resources and Social Security of Tongling Prefecture, Institute of Agricultural Sciences, The Bureau of Agriculture and Rural Affairs of Yi'an District, The Bureau of Agriculture and Rural Affairs of Jiaoqu District.	RMB 800,000/year; Annual budget of Tongling Prefecture, The Special Fund for the Conservation and Development of Agricultural Heritages.
	Encourage Private Investments in Constructing Public Facilities for Tongling White Ginger Culture	2022-2026	Traditional Tongling white ginger culture being widely spread	The Bureau of Natural Resources of Tongling Prefecture, The Bureau of Culture and Tourism of Tongling Prefecture, The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, White Ginger Institute.	private investments
	Traditional Culture Exchange and Broadcast for Tongling White Ginger Plantation System in Anhui Province through multiple approaches	2022-2026	Awareness of Tongling White Ginger Plantation System in Anhui Province being significantly improved, home and abroad	The people's Government of Tongling Prefecture, The enterprises, The households	RMB 2,000,000/year; annual budget of Tongling Prefecture, international organizations, funds raised by enterprises
Protecting Agricultural Landscape	Push forward compound ecological landscape model	2022-2026; the heritage site	80% of Tongling ginger fields become ecological	The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of	RMB 1,000,000/year; annual government budget of Tongling

				Agriculture and Rural Affairs of Jiaoqu District, relative enterprises and farmers.	Prefecture, funds raised by enterprises
	Strengthen Infrastructure Building for Ginger Fields and Paddy Fields	2022-2026; the heritage site	Reduce the loss ratio of the ginger fields and paddy fields caused by extreme weather by 70% or above	The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, relative enterprises and farmers.	RMB 1,000,000/year; annual government budget of Tongling Prefecture, funds raised by enterprises
Development of Ecological Products	Promote Deep Processing of Tongling White Ginger	2022-2026; the heritage site	Build up stable, long-term collaborative relationship with universities, institutes, and relative leading enterprises. Double the diversity of processed product of Tongling white ginger. Significantly increase its added value.	The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, The Bureau of Science and Technology of Tongling Prefecture, The Bureau of Economy and Information Technology of Tongling Prefecture, The Bureau of Commerce of Tongling Prefecture, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, Town Governments within the heritage site, leading enterprises, and scientific and research institutions.	RMB 2 million/year; special fund of Tongling Prefecture, funds raised by enterprises
	Deep Processing and Branding of Relative Agricultural Products in the System	2022-2026; the heritage site	Diversity of deep-processed agricultural products increased by 50%. Added value being significantly improved.	The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, Town Governments within the heritage site, leading enterprises	RMB 1 million/year; special fund of Tongling Prefecture Government, funds raised by enterprises
	Broaden the Selling Channels for Tongling White Ginger and Related	2022-2023; the heritage site	Establish stable online and offline selling networks and channels for Tongling	The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, the Bureau of Agriculture and	special fund of Tongling Prefecture Government,

	Processed Products		white ginger and its processed products. Increase the sales volume steadily.	Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, Town Governments within the Site, Leading enterprises.	funds raised by enterprises
Developing Multifunctionality of Agriculture	Develop Ecological Tourism (Ecotourism) Model in Various Forms	2022-2026; the heritage site	Basic framework of ecotourism in the Site established. Rapid growth of the ginger-rice rotation tourism industry as an important point of economic growth	The Bureau of Culture and Tourism of Tongling Prefecture, the Bureau of Agriculture and Rural Affairs of Tongling Prefecture, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, Town Governments within the Site	RMB 800,000/year; private investments, rural construction fund of Tongling Prefecture Government
	Build Teaching and Research Centers. Regularly Conduct Research and Study Activities about Tongling White Ginger Plantation System in Anhui Province	2022-2026; the heritage site	Orderly operation of teaching and research bases and collaboration centers on the Site. Research and study tourism activities being an important form of talent cultivation, regarding to the Tongling White Ginger Plantation System in Anhui Province	The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, the Bureau of Culture and Tourism of Tongling Prefecture, the Bureau of Education of Tonging City, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, towns and villages within the heritage site, universities and scientific & research institutions (e.g., Tongling University), teachers and students in Tongling primary schools and middle schools	RMB 400,000/year; The special fund of Tongling Prefecture Government
	Develop Tourism Souvenir of Tongling White Ginger Plantation System in Anhui Province	2022-2026; the heritage site	Tourism souvenir of Tongling White Ginger Plantation System in Anhui Province being an important industrial form of Tongling tourism	The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, relative enterprises	private investments

Capability Building	Special Lectures for Heritage Managers on Agricultural Heritage	2022-2026; the heritage site	Administrators can basically grasp the connotation of agricultural heritage and main methods and measures of its conservation and development	leaders of Tongling Prefecture Government, and leaders of relative departments	RMB 150,000/year; The Special Fund for the Conservation and Development of Agricultural Heritages
	Training Sessions by Experts of Agricultural Heritage, for Enterprises and Farmers	2022-2026; the heritage site	Enterprises and farmers' awareness of the conservation and development of agricultural heritage being apparently improved	The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, white ginger enterprises, and ginger farmers	RMB 150,000/year; The Special Fund for the Conservation and Development of Agricultural Heritages
	Compile Popular Science Readings for Tongling White Ginger Plantation System in Anhui Province	2022-2026; the heritage site	The administrators and enterprises have further and deeper understanding about the agricultural heritage system	science researchers, and the Bureau of Agriculture and Rural Affairs of Tongling Prefecture	RMB 150,000/year; The Special Fund for the Conservation and Development of Agricultural Heritages
	Build the Industry-Academia-Research Collaboration Platform on the Conservation and Utilization of Agricultural Heritage	2022-2026; the heritage site	protecting entities of Tongling White Ginger Plantation System in Anhui Province can organically integrate the conservation of heritage with proper utilization, with evident protective effects and obvious industrial added values.	The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, relative universities and science & research institutions.	RMB 250,000/year; The Special Fund for the Conservation and Development of Agricultural Heritages

5.3.1 Comprehensive Action Plans

(1) Design the LOGO of Tongling White Ginger Plantation System in Anhui Province as an important agricultural heritage, and put it into service

Action Plan: call for LOGO. Nationwide recruitment for LOGO proposals of Tongling White Ginger Plantation System in Anhui Province. The LOGO needs to be of profound connotation, be highly recognizable, and be of artistic appeal. It will improve the popularity of the System, and prompt the development of Tongling ginger and rice industries and relative cultural conservation.

Implementation Time and Location: 2022~2023, the heritage Site.

Expected Target: heritage brand of Tongling White Ginger Plantation System recognized by all residents of Tongling Prefecture

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, The Bureau of Agriculture and Rural Affairs of Yi'an District, The Bureau of Agriculture and Rural Affairs of Jiaoqu District.

Budget Fund: RMB 400,000/year

Source of Funding: The Special Fund for the Conservation and Development of Agricultural Heritages

(2) Proactively Promote the Conservation of GIAHS

Action Plan: disseminate and popularize GIAHS knowledge and the significance in protecting Tongling White Ginger Plantation System in Anhui Province by means of TV stations, portal websites, social media (like WeChat, Weibo, and Tik-Tok, etc.), and print media (billboard, posters, etc.). It can improve people's awareness of GIAHS and willing in conservation; and it can urge the conciseness and enthusiasm of conservation in all communities of the society.

Implementation Time and Location: 2022~2026, the Site, via TV stations of all levels, and Internet.

Expected Target: Over 95% of residents of the heritage site know of GIAHS

Participants Involved: Publicity Department of the Municipal Party Committee in Tongling Prefecture, The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, The Bureau of Culture and Tourism of Tongling Prefecture, The Bureau of Agriculture and Rural Affairs of Yi'an District, The Bureau of Agriculture and Rural Affairs of Jiaoqu District.

Budget Fund: RMB 800,000/year

Source of Funding: The Special Fund for the Conservation and Development of Agricultural Heritages

(3) Keep Organizing the Contest of "Tongling Ginger King", and Further Improve the Competition Rules

Action plan: on the basis of existing selection standards of "Ginger King" Contest, keep on improving the assessment criteria in the spirit of GIAHS conservation principles and goals. Cover all key parts with assessment criteria from ginger-rice rotation to processing of white ginger

products. Let the Contest of Ginger King practically drive the whole society's concern, conservation, and inheritance of the heritage.

Implementation Time and Location: 2022~2026, the heritage Site

Expected Target: Encourage ginger-related practitioners in Tongling to study and research the technology and skills of traditional ginger-rice rotation and processing. Inspire young and middle-aged people to learn and inherit the knowledge and techniques of ginger-rice rotation, processing of white ginger, and knowledge and skills of white ginger.

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, Organization Department of the Municipal Party Committee in Tongling Prefecture, White Ginger Institute, The Bureau of Agriculture and Rural Affairs of Yi'an District, The Bureau of Agriculture and Rural Affairs of Jiaoqu District.

Budget Fund: RMB 800,000/year

Source of Funding: Annual budget of Tongling Prefecture Government

(4) Strengthen Farmer's Training on Traditional Ginger-Rice Rotation Techniques

Action Plan: compile the *Pamphlet about Targets of Tongling Ginger-Rice Rotation and Its Management*. Distribute the pamphlets to ginger farmers. Further implement the 1,000-people training project for Tongling white ginger industry. Train 100 ginger farmers in rotation each year.

Implementation Time and Location: 2022~2023, the heritage Site

Expected Target: All residents know of the heritage brand of Tongling White Ginger Plantation System in Anhui Province

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, White Ginger Institute, The Bureau of Agriculture and Rural Affairs of Yi'an District, The Bureau of Agriculture and Rural Affairs of Jiaoqu District, Town Governments within the heritage site.

Budget Fund: RMB 800,000/year

Source of Funding: The Special Fund for the Conservation and Development of Agricultural Heritages

(5) Enhance the Exchange between Agricultural Heritages in Terms of Conservation and Development

Action Plan: actively participate the Seminar of National Agricultural Heritage (organized by Chinese Association of Agricultural Science Societies), Exchange Meeting on China's GIAHS Work, and agricultural heritage seminars in Eastern Asian region. Organize administrators, enterprises, and farmers to visit similar agricultural heritage sites for experience exchange in terms of conservation and development.

Implementation Time and Location: 2022~2026, the heritage Site

Expected Target: administrators, representative enterprises, and outstanding farmers can fully understand the conservation elements of Tongling White Ginger Plantation System and main approaches of heritage conservation and development.

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, White Ginger Institute, The Bureau of Agriculture and Rural Affairs of Yi'an District, The Bureau

of Agriculture and Rural Affairs of Jiaoqu District, white ginger processing enterprises, cooperatives, and ginger farmers.

Budget Fund: RMB 500,000/year

Source of Funding: The Special Fund for the Conservation and Development of Agricultural Heritages

5.3.2 Protecting Farmland Ecosystem

(1) Survey of and Scientific Research on the Germplasm Resources of Tongling White Ginger. Strengthen Germplasm Resource Conservation.

Action Plan: carry out city-wide survey for the germplasm resource of Tongling white ginger. Establish post-doctoral scientific research workstations. Initiate the research plan of "DNA fingerprint database for the germplasm resources of Tongling white ginger". Build breeding base (100 *mu*) for the germplasm resource of Tongling white ginger.

Implementation Time and Location: 2022~2023, the heritage Site

Expected Target: identify the distribution of the germplasm resource of Tongling white ginger. Protect the germplasm resource of Tongling white ginger.

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, White Ginger Institute, Institute of Agricultural Sciences, The Bureau of Agriculture and Rural Affairs of Yi'an District, The Bureau of Agriculture and Rural Affairs of Jiaoqu District, relative enterprises, and ginger farmers

Budget Fund: RMB 400,000/year

Source of Funding: special government funds of all levels, funds raised by enterprises

(2) Implement the Ecological Construction Projects for Ginger Fields and Paddy Fields

Action Plan: afforestation in the hilly region alongside the ginger fields and rice fields. Afforest the open space, valleys, and roadsides around the ginger fields and rice fields. Optimize the ecosystem of ginger and rice fields by increasing vegetation communities. Recommend grass-keeping on the balks of ginger and rice fields. Make the balks covered by green grass all year around.

Implementation Time and Location: 2022~2026, the heritage Site

Expected Target: complete ecological construction in more than 80% of the ginger fields and rice fields. Surrounding ecosystem being significantly improved.

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, The Bureau of Ecology and Environment of Tongling Prefecture, Institute of Agricultural Sciences, The Bureau of Agriculture and Rural Affairs of Yi'an District, The Bureau of Agriculture and Rural Affairs of Jiaoqu District, Town Governments within the heritage site.

Budget Fund: RMB 800,000/year

Source of Funding: special government funds of all levels

(3) Promote Ecological Ginger-rice Rotation Approach. Improve the Stability of Ecosystems in Ginger Fields and Rice Fields

Action Plan: by means of green manure planting, adopt ecological fertilization methods like "Organic Fertilizer + Farmyard Manure", or "Organic Fertilizer + Formula Fertilizer", and realize comprehensive management of nutrient resources. Encourage traditional and biological methods against plant diseases and insect pest: including manually hunting, infected plant removal, bait alluring and killing, etc. Plant legume trees, whose flowers and attract insect pests and lower their influence upon the fields, around ginger fields and rice fields.

Implementation Time and Location: 2022~2026, the heritage Site

Expected Target: content of organic matter of the ginger/rice field soil being significantly improved. Soil fertility being effectively increased. Traditional and biological methods of disease/insect pest prevention and treatment being widely popularized.

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, Tongling Institute of Agricultural Sciences, The Bureau of Agriculture and Rural Affairs of Yi'an District, The Bureau of Agriculture and Rural Affairs of Jiaoqu District, Town Governments within the heritage site, relative enterprises, ginger farmers

Budget Fund: RMB 2 million/year

Source of Funding: special government funds of all levels; funds raised by enterprises

(4) Broaden the Area of Ginger Field That Passes the Green Certification and Organic Certification

Action Plan: develop and apply special organic fertilizers that are dedicated to ginger fields. Deepen the implementation of plans that replace chemical fertilizers with organic ones. Push forward the green and organic certifications for Tongling white ginger in line with the standards of Chinese and international green and organic certifications.

Implementation Time and Location: 2022~2026, the heritage Site

Expected Target: all ginger fields within GIAHS core conservation area have green and organic certifications.

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, Tongling Institute of Agricultural Sciences, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, Town Governments within the heritage site, relative enterprises, and ginger farmers

Budget Fund: RMB 1 million/year

Source of Funding: special government funds of all levels; funds raised by enterprises

(5) Continue the Scientific Research on the Prevention and Treatment of Ginger Wilt

Action Plan: continue the collaboration with industrial-important universities and institutes, initiate and implement joint problem-solving research projects against ginger wilt. Explore for more scientific and effective ways, such as green technological approaches and biological agent products, to prevent and treat ginger wilt. Promote and popularize these methods in a timely fashion.

Implementation Time and Location: 2022~2026, the heritage Site

Expected Target: ginger wilt in Tongling white ginger under effective control. Occurrence rate being significantly reduced.

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, Tongling Institute of Agricultural Sciences, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District.

Budget Fund: RMB 800,000/year

Source of Funding: The Special Fund for the Conservation and Development of Agricultural Heritages

5.3.3 Protecting Traditional Culture

(1) Culture Survey and Data Compilation about Tongling White Ginger

Action Plan: conduct a comprehensive, city-wide survey on cultural elements, such as folklore, celebrities' stories, poetry, *DuìLián* (poetic couplet), ginger-related customs and etiquette, ginger-related festival culture, and ginger-related ancient buildings, etc. Establish cultural archives for Tongling white ginger. Compile books about the culture of Tongling white ginger.

Implementation Time and Location: 2022~2023, the heritage Site

Expected Target: Tongling's cultural elements that are relative to Tongling white ginger being systematically reviewed and complied into volumes.

Participants Involved: The Bureau of Culture and Tourism of Tongling Prefecture, The Literature and Art Federation of Tongling Prefecture.

Budget Fund: RMB 250,000/year

Source of Funding: The Special Fund for the Conservation and Development of Agricultural Heritages

(2) Tongling White Ginger Literature Prize

Action Plan: Tongling White Ginger Literature Prize, organized biennially

Implementation Time and Location: 2022~2026, the heritage Site

Expected Target: Explore and expand the white ginger culture in Tongling. Cultivate a group of ginger-loving writers

Participants Involved: The Literature and Art Federation of Tongling Prefecture, Tongling citizens

Budget Fund: RMB 250,000

Source of Funding: The Special Fund for the Conservation and Development of Agricultural Heritages

(3) Encourage Non-governmental Inheritance of Traditional White Ginger Culture

Action Plan: establish the working mechanism of Tongling white ginger culture inheritance through the contest of "Ginger King". Empower people with more responsibilities and duties of inheriting traditional culture.

Implementation Time and Location: 2022~2026, the heritage Site

Expected Target: triple the number of young people who know of the traditional culture of Tongling white ginger

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, The Bureau of Culture and Tourism of Tongling Prefecture, The Bureau of Human Resources and Social Security of Tongling Prefecture, Institute of Agricultural Sciences, The Bureau of Agriculture and Rural Affairs of Yi'an District, The Bureau of Agriculture and Rural Affairs of Jiaoqu District.

Budget Fund: RMB 800,000/year

Source of Funding: Annual budget of Tongling Prefecture, The Special Fund for the Conservation and Development of Agricultural Heritages.

(4) Encourage Private Investments in Constructing Public Facilities for Tongling White Ginger Culture

Action Plan: in order to promote the traditional culture of Tongling white ginger, simplify the procedure of land use approval and enact preferential policies to encourage private investments in non-governmental cultural spaces like Tongling White Ginger Museum, etc.

Implementation Time and Location: 2022~2026

Expected Target: traditional Tongling white ginger culture being widely spread

Participants Involved: The Bureau of Natural Resources of Tongling Prefecture, The Bureau of Culture and Tourism of Tongling Prefecture, The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, White Ginger Institute.

Source of Funding: private investments

(5) Traditional Culture Exchange and Broadcast for Tongling White Ginger Plantation System in Anhui Province through multiple approaches

Action Plan: support or organize enterprises and farmers to participate events like World Exposition, national/international agricultural product trade fairs, etc. Host serial cultural promotion and broadcast activities, such as "Diplomatic Envoys on the Heritage Site of Tongling White Ginger Plantation in Anhui Province" and "Ceremonies and Tourism Festival for Tongling Ginger-Pavilion Opening and Ginger God Worshipping", etc., to showcase and exchange the traditional culture of Tongling White Ginger Plantation System in Anhui Province, and promote the System.

Implementation Time and Location: 2022~2026

Expected Target: awareness of Tongling White Ginger Plantation System in Anhui Province being significantly improved, home and abroad

Budget Fund: RMB 2 million/year

Source of Funding: annual budget of Tongling Prefecture, international organizations, funds raised by enterprises

5.3.4 Protecting Agricultural Landscape

(1) Push forward compound ecological landscape model

Action Plan: demonstrate and promote traditional ecological landscape models like Ginger Pavilion for Seed-Preserving and Germination-Accelerating, Bamao Shed for Shading, White Ginger Plantation, and Ginger Field Villages, etc.

Implementation Time and Location: 2022~2026, the heritage Site

Expected Target: 80% of Tongling ginger fields become ecological

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, relative enterprises and farmers.

Budget Fund: RMB 1 million/year

Source of Funding: annual government budget of Tongling Prefecture, funds raised by enterprises

(2) Strengthen Infrastructure Building for Ginger Fields and Paddy Fields

Action Plan: in order to improve the capabilities of ginger field and paddy field in enduring extreme weather, construct and restore infrastructures surrounding ginger fields and paddy fields City-wide, such as roads, channels, and balks.

Implementation Time and Location: 2022~2026, the heritage Site

Expected Target: reduce the loss ratio of the ginger fields and paddy fields caused by extreme weather by 70% or above

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, relative enterprises and farmers.

Budget Fund: RMB 1 million/year

Source of Funding: annual government budget of Tongling Prefecture, funds raised by enterprises

5.3.5 Development of Ecological Products

(1) Promote Deep Processing of Tongling White Ginger

Main points: properly strengthen the R&D for deep processing and reprocessing of Tongling white ginger. Research on the applications of Tongling white ginger extract in food, daily necessities, cosmetics, and health-care products. Develop serial products to extend industrial chain, and improve added value of Tongling white ginger.

Implementation Time and Location: 2022~2026, the heritage Site

Expected Target: build up stable, long-term collaborative relationship with universities, institutes, and relative leading enterprises. Double the diversity of processed product of Tongling white ginger. Significantly increase its added value.

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, The Bureau of Science and Technology of Tongling Prefecture, The Bureau of Economy and Information Technology of Tongling Prefecture, The Bureau of Commerce of Tongling Prefecture, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural

Affairs of Jiaoqu District, Town Governments within the heritage site, leading enterprises, and scientific and research institutions.

Budget Fund: RMB 2 million/year

Source of Funding: special fund of Tongling Prefecture, funds raised by enterprises

(2) Deep Processing and Branding of Relative Agricultural Products in the System

Main points: strengthen the R&D of deep-processed products for crops from the Site, for example, rice, tubers, mushroom, bamboo shoot, and oilseed, etc. Develop foods and subsidiary foodstuffs with local characteristics. Improve the added value of related agricultural products.

Implementation Time and Location: 2022~2026, the heritage Site

Expected Target: diversity of deep-processed agricultural products increased by 50%. Added value being significantly improved.

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, Town Governments within the heritage site, leading enterprises

Budget Fund: RMB 1 million/year

Source of Funding: special fund of Tongling Prefecture Government, funds raised by enterprises

(3) Broaden the Selling Channels for Tongling White Ginger and Related Processed Products

Main points: strengthen the promotion and selling of Tongling white ginger and its deep processed products. Extend off-line sales network. Develop online selling platform Apps. Build traceability system within the Apps for organic white ginger and its processed products. Good price for good quality. Excellent price of excellent quality.

Implementation Time and Location: 2022~2023, the heritage Site

Expected Target: establish stable online and offline selling networks and channels for Tongling white ginger and its processed products. Increase the sales volume steadily.

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, Town Governments within the Site, Leading enterprises.

Source of Funding: special fund of Tongling Prefecture Government, funds raised by enterprises

5.3.6 Developing Multifunctionality of Agriculture

(1) Develop Ecological Tourism (Ecotourism) Model in Various Forms

Main Points: develop leisure ecotourism in core villages of the Site. Promote experience tourism products about the planting, harvesting, and processing in ginger-rice rotation. Sell related processed products.

Implementation Time and Location: 2022~2026, the heritage Site

Expected Target: basic framework of ecotourism in the Site established. Rapid growth of the ginger-rice rotation tourism industry as an important point of economic growth

Participants Involved: The Bureau of Culture and Tourism of Tongling Prefecture, the Bureau of Agriculture and Rural Affairs of Tongling Prefecture, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, Town Governments within the Site

Budget Fund: RMB 800,000/year

Source of Funding: private investments, rural construction fund of Tongling Prefecture Government

(2) Build Teaching and Research Centers. Regularly Conduct Research and Study Activities about Tongling White Ginger Plantation System in Anhui Province

Main Points: organize research and study tourism activities about Tongling White Ginger Plantation System for groups like primary school and middle schools, universities and scientific & research institutions. Co-found teaching & research bases and collaboration centers. Recruit university students for volunteer conservation activities. Host lectures, outdoor activities, and participatory projects. Improve the inheritance and conservation of Tongling White Ginger Plantation System in Anhui Province.

Implementation Time and Location: 2022~2026, the heritage Site

Expected Target: orderly operation of teaching and research bases and collaboration centers on the Site. Research and study tourism activities being an important form of talent cultivation, regarding to the Tongling White Ginger Plantation System in Anhui Province

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, the Bureau of Culture and Tourism of Tongling Prefecture, the Bureau of Education of Tonging City, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, towns and villages within the heritage site, universities and scientific & research institutions (e.g., Tongling University), teachers and students in Tongling primary schools and middle schools

Budget Fund: RMB 400,000/year

Source of Funding: The Special Fund for the Conservation and Development of Agricultural Heritages

(3) Develop Tourism Souvenir of Tongling White Ginger Plantation System in Anhui Province

Main Points: deeply explore the traditional cultural connotation and agricultural landscapes, integrate them with current market consumption trends and habits, develop tourism souvenirs of Tongling White Ginger Plantation System in Anhui Province, for example, clothing, stationery, specialty food, tourism album, cooper artwares, etc. Build tourism souvenir stores on the heritage site.

Implementation Time and Location: 2022~2026, the heritage Site

Expected Target: tourism souvenir of Tongling White Ginger Plantation System in Anhui Province being an important industrial form of Tongling tourism

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, relative enterprises

Source of Funding: private investments

5.3.7 Capability Building

(1) Special Lectures for Heritage Managers on Agricultural Heritage

Action Plan: organize seminars on the conservation and management of agricultural heritage for all relative administrative departments of the City, with presence of important City-level leaders, at least twice a year. Improve the awareness and managerial capabilities of the administrators of the agricultural heritage.

Implementation Time and Location: 2022~2026, the heritage Site

Participants Involved: leaders of Tongling Prefecture Government, and leaders of relative departments

Expected Target: administrators can basically grasp the connotation of agricultural heritage and main methods and measures of its conservation and development

Budget Fund: RMB 150,000/year

Source of Funding: The Special Fund for the Conservation and Development of Agricultural Heritages

(2) Training Sessions by Experts of Agricultural Heritage, for Enterprises and Farmers

Action Plan: organize training sessions about the conservation and industrial development of agricultural heritage, for enterprises and farmers, 2 to 3 times a year: how to protect the heritage; how to develop new products based on the resources of heritage site, etc.

Implementation Time and Location: 2022~2026, the heritage Site

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, white ginger enterprises, and ginger farmers

Expected Target: enterprises and farmers' awareness of the conservation and development of agricultural heritage being apparently improved

Budget Fund: RMB 150,000/year

Source of Funding: The Special Fund for the Conservation and Development of Agricultural Heritages

(3) Compile Popular Science Readings for Tongling White Ginger Plantation System in Anhui Province

Action Plan: compile and publish Tongling White Ginger Plantation System in Anhui Province, China-NIAHS series. Distribute to the administrators and related protecting entities of the agricultural heritage. Improve their awareness of Tongling White Ginger Plantation System in Anhui Province

Implementation Time and Location: 2022~2026, the heritage Site

Participants Involved: science researchers, and the Bureau of Agriculture and Rural Affairs of Tongling Prefecture

Expected Target: the administrators and enterprises have further and deeper understanding about the agricultural heritage system

Budget Fund: RMB 150,000

Source of Funding: The Special Fund for the Conservation and Development of Agricultural Heritages

(4) Build the Industry-Academia-Research Collaboration Platform on the Conservation and Utilization of Agricultural Heritage

Action Plan: collaborate with institutions like Institute of Agricultural Economics and Development, Chinese Academy of Agricultural Sciences (CAAS), and Fujian Normal University. Establish integrated industry-academia-research platform for heritage conservation and utilization. Provide technical support for the conservation and industrial development of Tongling White Ginger Plantation System in Anhui Province.

Implementation Time and Location: 2022~2026, the heritage Site

Participants Involved: The Bureau of Agriculture and Rural Affairs of Tongling Prefecture, the Bureau of Agriculture and Rural Affairs of Yi'an District, the Bureau of Agriculture and Rural Affairs of Jiaoqu District, relative universities and science & research institutions.

Expected Target: protecting entities of Tongling White Ginger Plantation System in Anhui Province can organically integrate the conservation of heritage with proper utilization, with evident protective effects and obvious industrial added values.

Budget Fund: RMB 250,000/year

Source of Funding: The Special Fund for the Conservation and Development of Agricultural Heritages

5.4 Conservation Measures

5.4.1 Organizational Assurance

Based on existing NIAHS management organizations in Tongling Prefecture, further improve the work of agricultural heritage applications, the organization structure, personnel structure, and leading structure for the conservation and development.

a. Raise management level. Establish steering group for GIAHS application with principal leaders of the City Government as the group head. The Group is responsible for the organizing, leading, and decision-making of important and urgent GIAHS events.

b. Expand the strength of administrative organization for important agricultural heritage. Add dedicated heritage managers. Build an "echelon" team that consists of young personnel, middle-aged and elder personnel. Ensure the stability and sustainability of heritage management.

c. Dedicated personnel in district and town governments for the conservation and development of important agricultural heritage. Implement relative training, guiding, inspecting, and overseeing for the conservation and management of the heritage.

5.4.2 System Assurance

Establish and improve relative systems and rules for the conservation and development of important agricultural heritage. Make sure there are laws for the conservation and development of GIAHS to follow; and there are systems and rules as their assurance. Especially strengthen the construction of following systems:

a. In the spirit of FAO GIAHS selection principles and conservation requirements, and based on existing *Plan of Conservation and Development for Tongling White Ginger Plantation System in Anhui Province (Tongling White Ginger Planting System), a Nationally Important Agricultural Heritage System in China*, introduce the *Management Measures for Tongling White Ginger Plantation System in Anhui Province, an Important Agricultural Heritage*.

b. After completing the LOGO contest for Tongling White Ginger Plantation System in Anhui Province as an important agricultural heritage, introduce the *Management Measures and Detailed Implementing Rules for the use of LOGO of Tongling White Ginger Plantation System in Anhui Province* as an important agricultural heritage. Guarantee users' rights.

c. Write NIAHS/GIAHS into the *Fourteenth Five-Year Plan of Tongling Prefecture*. Establish special funds for the conservation and development of important agricultural heritages.

5.4.3 Fund-Raising and Financial Supports

Raise project funds from all levels, such international, national, and local organizations and governments, to support the conservation of the heritage. Found non-governmental funds and raise private capital. Financially support the conservation and development of the agricultural heritages.

a. Set up special fund for the conservation and development of Tongling White Ginger Plantation System in Anhui Province. It has a yearly budget of RMB 10 million to support the implementation of all protective projects for Tongling White Ginger Plantation System in Anhui Province.

b. Actively apply for the support from special funds for Anhui provincial agricultural projects, for example, the Industrialization and Comprehensive Development of Anhui Agricultural Industry, Rural Revitalization Project at the Provincial Level, and Rural Complex at the Provincial Level, etc. Use them to support the implementation of initiatives of conservation and development for Tongling White Ginger Plantation System in Anhui Province.

c. Apply for national agricultural and rural development projects, for example, Pioneer District for the Integrated Development of the Primary Industry, the Secondary Industry, and the tertiary industry in Rural Area, Demonstration Park for the Development of Industrial Integration for Rural Area, etc. Pursue supports of relative funds. Put project-related action plans for the conservation and development of agricultural heritage into effect.

d. Apply relative projects of international organizations (for example, Global Environment Facility (GEF), The Food and Agriculture Organization of the United Nations (FAO), and World Bank, etc.). Work for the support of international funds.

e. Mobilize non-governmental strengths. Raise funds from enterprises and individuals to support the non-profit activities and public-welfare projects that protect and develop Tongling White Ginger Plantation System in Anhui Province.

f. Apply to be a National Model County for Green Prevention and Control against Plant Diseases and Insect Pests. Urge the governments at municipal, district, and town levels to put emphasis on green prevention and control. Improve the awareness of all communities and farmers about the ecological and social benefits of green prevention and control. Accelerate the establishment of "excellent price for excellent quality" mechanism for agricultural products. Push forward the green prevention and control effectively and sustainably.

5.4.4 Multi-Stakeholder Participation Mechanism

Establish multi-stakeholder participation mechanism for Tongling White Ginger Plantation System in Anhui Province. Involve various strengths in the conservation and development of agricultural heritage, for example, governments, enterprises, communities, famers, non-governmental groups, and scientific and research institutions, etc. Support the effective implementation of action plans for the conservation and development of the heritages.

a. Government level. In order to push forward the GIAHS conservation in the institutional aspect, the Ministry of Agriculture and Rural Affairs of the People's Republic of China has been continuously improved the management measures of GIAHS. It works on the establishment of nation-level GIAHS conservation funds and the GIAHS monitoring and assessment system. Set up dedicated administrative organization and personnel for agricultural heritage in governments of all levels, for example, provincial, municipal, and district governments. These organizations and personnel are responsible for implementing national GIAHS regulatory measures, organizing GIAHS applications, managing relative conservation, development, and inspection, and providing GIAHS with dedicated project funding and policy supports.

b. Enterprise level. In line with GIAHS conservation measures and regulations, enterprises explore the potential of agricultural heritage resources, develop relative products, carry out GIAHS branding, promotion, and marketing activities, drive the economic development of the Site and the increase of farmers' income, and establish the "enterprises + farmers" model of sustainable development model for Tongling White Ginger Plantation System in Anhui Province.

c. Community level. Community managers organize and coordinate residents' production and business activities, plan and develop collective economy, strive for the benefits of farmers, explore sustainable model for farmers' livelihood development. They also oversee and regulate farmers' production and business operation, and put GIAHS conservation measures and relative regulations into effect.

d. Farmer's level. Under the guidance of GIAHS conservation measures, work on ginger-rice rotation production and business, maintain the ecological landscape of ginger fields and rice fields, inherit traditional knowledge and techniques of ginger-rice rotation and the processing of its

products, protect local traditional customs and culture, and, at the same time, enjoy the benefits and policy-backed subsidy that come with agricultural heritages.

e. Non-governmental organization level. Non-governmental organizations, like Tongling White Ginger Institute, will organize and carry out related seminar, discussion, and popular science lectures. These trainings improve local farmers' ability in professional skills and use of modern information technologies, strengthen their capabilities in protecting the heritages. Science & research institutions and universities are also involved in agricultural heritage work, from perspectives like economics, ecosystem, culture, and society, etc., especially the prevention and treatment of ginger wilt. They provide technical supports to the agricultural heritages.

5.4.5 Construction of Monitoring and Assessment Mechanism

Over the past few years, the Ministry of Agriculture and Rural Affairs of People's Republic of China (MARA) has established a dynamic monitoring system for GIAHS in China. MARA also organized members of expert committees to inspect and evaluate GIAHS heritage sites, one after another. Meanwhile, entrusted by MARA, science & research institutions are exploring indicator system and assessment methods for quantitative monitoring and assessments. This provides system and mechanism assurance and data platform and method support for the implementation of projects that protect and develop Tongling White Ginger Plantation System in Anhui Province.

The monitoring and assessment of action plans for the conservation and development of Tongling White Ginger Plantation System in Anhui Province will be carried out according to the following frameworks:

a. Following the regulation of Plan of Conservation and Development for Tongling White Ginger Plantation System in Anhui Province (Tongling White Ginger Planting System), a Nationally Important Agricultural Heritage System in China, the Bureau of Agriculture and Rural Affairs of Tongling Prefecture dynamically monitors the ecological conditions of ginger fields and paddy fields, construction of infrastructure, and farmers' producing and operating behaviors on the heritage site.

b. During the implementation of the action plans, assess their progresses by the end of the year, write self-assessment reports, bring forward revision comments and suggestions on issues that practically exist.

c. Meticulously collect and report the annual data for the dynamic monitoring system of MARA Globally Important Agricultural Heritage. Accept the inspections, monitoring, and assessments of MARA.

d. Cooperate with MARA for random on-site monitoring, inspections, and assessments, take in comments from the assessment experts, practically put the action plans for conservation and development into effect.

VI. Appendix

Annex 1 List of Major Plants in the Heritage Site

Family	Genus	Species	Category
Herbertaceae	Herbertus Gray	Herbertus aduncus (Dicks.) Gray	Bryophyte
Herbertaceae	Herbertus Gray	H.longifissus Steph	Bryophyte
Trichocoleaceae	Trichocolea	Trichocolea tomentella (Ehrh.) Dumort.	Bryophyte
Lepidoziaceae	Bazzania Gray	Bazzania japonica (S. Lac.) Lindb	Bryophyte
Lepidoziaceae	Bazzania Gray	Bazzania Tridens	Bryophyte
Lepidoziaceae	Bazzania Gray	Bazzania trilobata (L.) S. Gray	Bryophyte
Cephaloziaceae	Nowellia Mitt	Nowellia curvifolia (Dicks.) Mitt	Bryophyte
Geocalycaceae	Heteroscyphus	Heteroscyphus argutus (Reinw. et al.) Schiffn	Bryophyte
Geocalycaceae	Heteroscyphus	Heteroscyphus coalitus (Hook.) Schiffn	Bryophyte
Geocalycaceae	Heteroscyphus	Heteroscyphus planus (Mitt.) Schiffn.	Bryophyte
Geocalycaceae	Heteroscyphus	H.saccogynoides Herz.	Bryophyte
Plagiochilaceae	Plagiochila (Dum.) Dum.	Plagiochila flexuosa Mitt	Bryophyte
Plagiochilaceae	Plagiochila (Dum.) Dum.	Plagiochila ovalifolia Mitt	Bryophyte
Radulaceae	Radula Dum.	Radula japonica Gott. ex Steph.	Bryophyte
Radulaceae	Radula Dum.	Radula kojana Steph.	Bryophyte
Porellaceae	Porella pinnata L	Porella chinensis (Steph.) Hatt.	Bryophyte
Porellaceae	Porella pinnata L	Porella vernicosa Lindb	Bryophyte
Porellaceae	Porella pinnata L	Porella perrottetiana (Mont.) Trevis.	Bryophyte
Porellaceae	Porella pinnata L	Porella pinnata L	Bryophyte
Porellaceae	Porella pinnata L	Porella campylophylla (Lehm.et Lindb.) Trev.	Bryophyte
Frullaniaceae	Frullania Raddi	Frullania apiculata (Reinw. et al.) Dum.	Bryophyte
Frullaniaceae	Frullania Raddi	Frullania ericoides (Nees) Nees et Mont.	Bryophyte
Frullaniaceae	Frullania Raddi	Frullania moniliata (Reinwardt, Blume et Nees) Montagne	Bryophyte
Marchantiaceae	Marchantia L.	Marchantia emarginata subsp. tosana (Steph.) Bischl.	Bryophyte
Marchantiaceae	Marchantia L.	Marchantia polymorpha L.	Bryophyte
Sphagnaceae	Sphagnum L.	Sphagnum palustre L.	Musci
Sphagnaceae	Sphagnum L.	Sphagnum magellanicum Brid	Musci
Dicranaceae	Campylopus Brid.	Campylopus atro–virens de not.	Musci

Dicranaceae	Campylopus Brid.	Campylopus coreensis Card.	Musci
Dicranaceae	Campylopus Brid.	Campylopus ericoides (Griff.) Jaeg.	Musci
Dicranaceae	Campylopus Brid.	Campylopus flexuosus	Musci
Dicranaceae	Campylopus Brid.	Campylopus involutus (C. Muell.) Jaeg.	Musci
Dicranaceae	Campylopus Brid.	Campylopus gracilentus card.	Musci
Dicranaceae	Campylopus Brid.	Campylopus umbellatus (Arnoth.) Par.	Musci
Dicranaceae	Dicranodontium	Dicranodontium blindioides (Besch.) Broth.	Musci
Dicranaceae	Dicranodontium	Dicranodontium asperulum (Mitt.) Broth.	Musci
Dicranaceae	Dicranodontium	D.uncinatum (Harv.)Jaeg.	Musci
Dicranaceae	Dicranum Hedw.	Dicranum delavayi Besch.	Musci
Dicranaceae	Dicranum Hedw.	Dicranum japonicum Mitt.	Musci
Dicranaceae	Dicranum Hedw.	Dicranum nipponense Besch.	Musci
Fissidentaceae	Fissidens Hedw.,1801	Fissidens adelphinus	Musci
Fissidentaceae	Fissidens Hedw.,1801	Fissidens cristatus	Musci
Fissidentaceae	Fissidens Hedw.,1801	Fissidens grandifrons	Musci
Fissidentaceae	Fissidens Hedw.,1801	Fissidens geminiflorus	Musci
Pottiaceae	Anoectangium Schwaegr.	Anoectangium euchloron	Musci
Pottiaceae	Anoectangium Schwaegr.	Anoectangium stracheyanum	Musci
Pottiaceae	Anoectangium Schwaegr.	Anoectangium thomsonii mitt.	Musci
suoyexianke	Ptychomitrium	Ptychomitrium dentatum (Mitt.) Jaeg.	Musci
suoyexianke	Ptychomitrium	Ptychomitrium fauriei Besch.	Musci
suoyexianke	Ptychomitrium	Ptychomitrium linearifolium	Musci
suoyexianke	Ptychomitrium	Ptychomitrium wilsonii	Musci
Bryaceae	Bryum Hedw.	Bryum argenteum Hedw.	Musci
Bryaceae	Bryum Hedw.	Bryum capillare.	Musci
Bryaceae	Bryum Hedw.	Bryum pallens Sw.	Musci
Bryaceae	Bryum Hedw.	Bryum paradoxum Schwaegr.	Musci
Bryaceae	Bryum Hedw.	Bryum pseudotriquetrum.	Musci
Bryaceae	Bryum Hedw.	Bryum recurvulum Mitt.	Musci
Bryaceae	Bryum Hedw.	Bryum cyelophyllum (Schwaegr.) B.S.G.	Musci
Bryaceae	Bryum Hedw.	Bryum truncorum (Brid.) Brid.	Musci
Bartramiaceae	Philonotis	Philonotis lancifolia Mitt.	Musci
Bartramiaceae	Philonotis	Philonotisturneriana.	Musci
Leucodontaceae	Leucodon Schwaegr.	Leucodon sciuroides (hedw.) schwaegr	Musci
Leucodontaceae	Leucodon Schwaegr.	Leucodon secundus（Harv.）Mitt	Musci

Leucodontaceae	Leucodon Schwaegr.	Leucodon sinensis Ther.	Musci
Thuidiaceae	Thuidium B. S. G.	Thuidium cymbifolium (Dozy et Molk.) Dozy et Molk.	Musci
Thuidiaceae	Thuidium B. S. G.	Thuidium delicatulum (Hedw.) Mitt.	Musci
Thuidiaceae	Thuidium B. S. G.	Thuidium glaucinoides Broth.	Musci
Thuidiaceae	Thuidium B. S. G.	Thuidium pristocalyx (C. Muell.) Jaeg.	Musci
Thuidiaceae	Thuidium B. S. G.	Thuidium kanedae Sak.	Musci
Thuidiaceae	Thuidium B. S. G.	Thuidium assimile (Mitt.) Jaeg.	Musci
Thuidiaceae	Thuidium B. S. G.	Thuidium subglaucinum Card.	Musci
Thuidiaceae	Thuidium B. S. G.	Thuidium submicropteris Card	Musci
Thuidiaceae	Thuidium B. S. G.	Thuidium tamariscinum (Hedw.) Schimp.	Musci
Brachytheciaceae	Brachythecium B. S. G	Brachythecium albicans	Musci
Brachytheciaceae	Brachythecium B. S. G	Brachythecium buchananii (hook.) jaeg	Musci
Brachytheciaceae	Brachythecium B. S. G	Brachythecium campylothallum C. Muell	Musci
Brachytheciaceae	Brachythecium B. S. G	Brachythecium glaciale B. S. G	Musci
Brachytheciaceae	Brachythecium B. S. G	Brachythecium piligerum Card	Musci
Brachytheciaceae	Brachythecium B. S. G	Brachythecium plumosum (hedw.) b. s. g	Musci
Brachytheciaceae	Brachythecium B. S. G	Brachythecium populeum (hedw.) b. s. g	Musci
Brachytheciaceae	Brachythecium B. S. G	Brachythecium reflexum (stark.) b. s. g	Musci
Brachytheciaceae	Brachythecium B. S. G	Brachythecium albicans	Musci
Brachytheciaceae	Brachythecium B. S. G	Brachythecium rutabulum	Musci
Brachytheciaceae	Brachythecium B. S. G	Brachythecium velutinum	Musci
Brachytheciaceae	Brachythecium B. S. G	Brachythecium garovaglioides C. Muell	Musci
Entodontaceae	Entodon C. Mull	Entodon aeruginosus C. Muell	Musci
Entodontaceae	Entodon C. Mull	Entodon cladorrhizans (Hedw.) C. Muell	Musci
Entodontaceae	Entodon C. Mull	Entodon compressus （Hedw.）C. Muell	Musci
Entodontaceae	Entodon C. Mull	Entodon viridulus Card	Musci
Entodontaceae	Entodon C. Mull	Entodon concinnus (de not.) par	Musci
Entodontaceae	Entodon C. Mull	Entodon dolichocucullatus Sh. Okam	Musci
Entodontaceae	Entodon C. Mull	Entodon flavescens (Hook.) Jaeg	Musci
Entodontaceae	Entodon C. Mull	Entodon luridus	Musci
Entodontaceae	Entodon C. Mull	Entodon macropodus (Hedw.) C. Muell	Musci
Entodontaceae	Entodon C. Mull	Entodon micropodus Besch	Musci
Entodontaceae	Entodon C. Mull	Entodon plicatus C. Muell.	Musci
Entodontaceae	Entodon C. Mull	Entodon prorepens (Mitt.) Jaeg	Musci
Entodontaceae	Entodon C. Mull	Entodon smaragdinus Par. et Broth	Musci
Entodontaceae	Entodon C. Mull	Entodon acutifolius R. L. Hu	Musci
Selaginellaceae	Selaginella P. Beauv	Selaginella heterostachys Baker	Pteridophyta

Selaginellaceae	Selaginella P. Beauv	Selaginellalabordei Heron. ex Christ	Pteridophyta
Selaginellaceae	Selaginella P. Beauv	Selaginella heterostachys Baker	Pteridophyta
Selaginellaceae	Selaginella P. Beauv	Selaginella tamariscina (Beauv.)Spring	Pteridophyta
Selaginellaceae	Selaginella P. Beauv	Selaginella uncinata	Pteridophyta
Pteridaceae	Pteris L	Pteris dispar Kunze	Pteridophyta
Pteridaceae	Pteris L	Pteris cretica L. var. nervosa (Thunb.) Ching et S. H. Wu	Pteridophyta
Pteridaceae	Pteris L	Pteris cretica L. var. nervosa (Thunb.) Ching et S.H.Wu[P.nervosa Thunb	Pteridophyta
Athyriaceae	Athyrium	Athyrium clivicola Tagawa	Pteridophyta
Athyriaceae	Athyrium	Athyrium niponicum	Pteridophyta
Athyriaceae	Athyrium	Athyrium otophorum (Miq.) Koidz	Pteridophyta
Athyriaceae	Athyrium	Athyrium yokoscense	Pteridophyta
Asplenium trichomanes L	Asplenium trichomanes L	Asplenium austrochinense Ching	Pteridophyta
Asplenium trichomanes L	Asplenium trichomanes L	Asplenium incisum Thunb	Pteridophyta
Asplenium trichomanes L	Asplenium trichomanes L	Asplenium sarelii	Pteridophyta
Asplenium trichomanes L	Asplenium trichomanes L	Asplenium trichomanes L	Pteridophyta
Asplenium trichomanes L	Asplenium trichomanes L	Asplenium tripteropus Nakai	Pteridophyta
Dryopteridaceae	Dryopteris Adanson	Dryopteris setosa (Thunb.) Akasawa	Pteridophyta
Dryopteridaceae	Dryopteris Adanson	Dryopteris championii (Benth.) C. Chr	Pteridophyta
Dryopteridaceae	Dryopteris Adanson	Dryopteris chinensis (Baker) Koidz	Pteridophyta
Dryopteridaceae	Dryopteris Adanson	Dryopteris decipiens (Hook.) Kuntze	Pteridophyta
Dryopteridaceae	Dryopteris Adanson	Dryopteris fuscipes C. Chr	Pteridophyta
Dryopteridaceae	Dryopteris Adanson	Dryopteris gymnophylla (Bak.) C. Chr	Pteridophyta
Dryopteridaceae	Dryopteris Adanson	Dryopteris huangshanensis	Pteridophyta
Dryopteridaceae	Dryopteris Adanson	Dryopteris lacera (Thunb.) O. Ktze	Pteridophyta
Dryopteridaceae	Dryopteris Adanson	Dryopteris lepidorachis	Pteridophyta
Dryopteridaceae Herter	Polystichum Roth	Polystichum makinoi (Tagawa) Tagawa	Pteridophyta
Dryopteridaceae Herter	Polystichum Roth	Polystichum neolobatum Nakai	Pteridophyta
Dryopteridaceae Herter	Polystichum Roth	Polystichum tripteron	Pteridophyta
Dryopteridaceae	Polystichum Roth	Polystichum tsus-simense (Hook.)	Pteridophyta

Herter			
Polypodiaceae	Lepisorus (J. Sm.) Ching	Lepisorus asterolepis (Baker) Ching	Pteridophyta
Polypodiaceae	Lepisorus (J. Sm.) Ching	Lepisorus contortus	Pteridophyta
Polypodiaceae	Lepisorus (J. Sm.) Ching	Lepisorus thunbergianus （Kaulf.）	Pteridophyta
Polypodiaceae	Pyrrosia Mirbel	Pyrrosia calvata (Baker) Ching	Pteridophyta
Polypodiaceae	Pyrrosia Mirbel	Pyrrosia drakeana (Franch.) Ching in Bull	Pteridophyta
Polypodiaceae	Pyrrosia Mirbel	Pyrrosia lingua (Thunb.) Farwell	Pteridophyta
Ginkgoaceae	Ginkgo	Ginkgo biloba L.	Gymnosperm
Pinaceae	Pinus	Pinus massoniana Lamb.	Gymnosperm
Pinaceae	Pinus	Pinus taiwanensis Hayata	Gymnosperm
Pinaceae	Pseudolarix	Pseudolarix amabilis (J. Nelson) Rehder	Gymnosperm
Pinaceae	Pseudotsuga	Pseudotsuga sinensis Dode	Gymnosperm
Pinaceae	Tsuga	Tsuga chinensis (Franch.) Pritz.	Gymnosperm
Cupressaceae	Cunninghamia	Cunninghamia lanceolata (Lamb.) Hook.	Gymnosperm
Cupressaceae	Cupressus	Cupressus funebris Endl.	Gymnosperm
Cupressaceae	Juniperus	Juniperus formosana Hayata	Gymnosperm
Cupressaceae	Platycladus	Platycladus	Gymnosperm
Cupressaceae	Juniperus	Juniperus chinensis Linnaeus	Gymnosperm
Cupressaceae	Taxodium	Taxodium distichum var. imbricatum (Nuttall) Croom	Gymnosperm
Taxaceae	Cephalotaxus	Cephalotaxus sinensis (Rehder et E. H. Wilson) H. L.	Gymnosperm
Juglandaceae	Carya	Carya cathayensis Sarg.	Angiosperm
Juglandaceae	Cyclocarya	Cyclocarya paliurus (Batal.) Iljinsk.	Angiosperm
Juglandaceae	Platycarya	Platycarya strobilacea Sieb. et Zucc.	Angiosperm
Juglandaceae	Juglans	Juglans mandshurica Maxim.	Angiosperm
Juglandaceae	Pterocarya	Pterocarya stenoptera C. DC.	Angiosperm
Salicaceae	Populus	Populus adenopoda Maxim.	Angiosperm
Salicaceae	Populus	Populus × canadensis 'I-214'	Angiosperm
Salicaceae	Salix	Salix babylonica L.	Angiosperm
Salicaceae	Salix	Salix chaenomeloides Kimura	Angiosperm
Salicaceae	Salix	Salix wilsonii Seemen ex Diels	Angiosperm
Salicaceae	Salix	Salix chienii Cheng	Angiosperm
Betulaceae	Betula	Betula luminifera H. Winkl.	Angiosperm
Betulaceae	Carpinus	Carpinus turczaninowii Hance	Angiosperm

Betulaceae	Corylus	Corylus chinensis Franch.	Angiosperm
Betulaceae	Corylus	Corylus heterophylla var. sutchuenensi Franch.	Angiosperm
Fagaceae	Castanea	Castanea mollissima Blume	Angiosperm
Fagaceae	Castanopsis	Castanopsis eyrei (Champ. ex Benth.) Tutch.	Angiosperm
Fagaceae	Castanopsis	Castanopsis sclerophylla (Lindl. et Paxton) Schottky	Angiosperm
Fagaceae	Cyclobalanopsis	Cyclobalanopsis glauca (Thunberg) Oersted	Angiosperm
Fagaceae	Cyclobalanopsis	Cyclobalanopsis myrsinifolia (Blume) Oersted	Angiosperm
Fagaceae	Cyclobalanopsis	Cyclobalanopsis gracilis (Rehder et E. H. Wilson) W. C. Cheng et T. Hong	Angiosperm
Fagaceae	Lithocarpus	Lithocarpus glaber (Thunb.) Nakai	Angiosperm
Fagaceae	Quercus	Quercus acutissima Carr.	Angiosperm
Fagaceae	Quercus	Quercus stewardii Rehd.	Angiosperm
Fagaceae	Quercus	Quercus chenii Nakai	Angiosperm
Fagaceae	Quercus	Quercus fabri Hance	Angiosperm
Cannabaceae	Celtis	Celtis chekiangensis Cheng	Angiosperm
Paulowniaceae	Paulownia	Paulownia fortunei (Seem.) Hemsl.	Angiosperm
Cannabaceae	Trema	Trema cannabina var. dielsiana (Hand.-Mazz.)C.J.Chen	Angiosperm
Cannabaceae	Celtis	Celtis sinensis Pers.	Angiosperm
Meliaceae	Melia	Melia azedarach L.	Angiosperm
Ulmaceae	Hemiptelea	Hemiptelea davidii (Hance) Planch.	Angiosperm
Ulmaceae	Ulmus	Ulmus castaneifolia Hemsl.	Angiosperm
Ulmaceae	Ulmus	Ulmus changii Cheng	Angiosperm
Ulmaceae	Ulmus	Ulmus davidiana var. japonica (Rehd.)Nakai	Angiosperm
Ulmaceae	Ulmus	Ulmus macrocarpa Hance	Angiosperm
Ulmaceae	Ulmus	Ulmus szechuanica Fang	Angiosperm
Ulmaceae	Ulmus	Ulmus parvifolia Jacq.	Angiosperm
Ulmaceae	Zelkova	Zelkova serrata (Thunb.) Makino	Angiosperm
Moraceae	Broussonetia	Broussonetia papyrifera (Linnaeus) L'Heritier ex Ventenat	Angiosperm
Moraceae	Maclura	Maclura tricuspidata Carriere	Angiosperm
Moraceae	Fatoua	Fatoua pilosa Gaud.	Angiosperm
Moraceae	Ficus	Ficus sarmentosa var. impressa (Champ.)Corner	Angiosperm
Moraceae	Morus	Morus cathayana Hemsl.	Angiosperm
Moraceae	Morus	Morus australis Poir.	Angiosperm

Simaroubaceae	Ailanthus	Ailanthus altissima (Mill.) Swingle	Angiosperm
Eucommiaceae	Eucommia	Eucommia ulmoides Oliver	Angiosperm
Symplocaceae	Symplocos	Symplocos sumuntia Buch.-Ham. ex D. Don	Angiosperm
Urticaceae	Boehmeria	Boehmeria spicata (Thunb.) Thunb.	Angiosperm
Urticaceae	Boehmeria	Boehmeria nivea (L.) Gaudich.	Angiosperm
Urticaceae	Boehmeria	Boehmeria nivea var. tenacissima (Gaudich.) Miq.	Angiosperm
Linaceae	Linum	Linum usitatissimum L.	Angiosperm
Urticaceae	Elatostema	Elatostema involucratum Franch. et Sav.	Angiosperm
Urticaceae	Gonostegia	Gonostegia hirta (Bl.) Miq.	Angiosperm
Urticaceae	Laportea	Laportea bulbifera (Sieb. et Zucc.) Wedd.	Angiosperm
Urticaceae	Nanocnide	Nanocnide lobata Wedd.	Angiosperm
Urticaceae	Pellionia	Pellionia brevifolia Benth.	Angiosperm
Urticaceae	Pilea	Pilea notata C. H. Wright	Angiosperm
Urticaceae	Pilea	Pilea sinofasciata C. J. Chen	Angiosperm
Schoepfiaceae	Schoepfia	Schoepfia jasminodora Sieb. et Zucc.	Angiosperm
Nyssaceae	Nyssa	Nyssa sinensis Oliv.	Angiosperm
Santalaceae	Thesium	Thesium chinense Turcz.	Angiosperm
Santalaceae	Viscum	Viscum coloratum (Kom.) Nakai	Angiosperm
Fabaceae	Desmodium	Desmodium styracifolium (Osbeck.) Merr.	Angiosperm
Polygonaceae	Fagopyrum	Fagopyrum esculentum Moench	Angiosperm
Polygonaceae	Fagopyrum	Fagopyrum dibotrys (D. Don) Hara	Angiosperm
Polygonaceae	Polygonum	Polygonum bistorta L.	Angiosperm
Polygonaceae	Polygonum	Polygonum japonicum Meisn.	Angiosperm
Polygonaceae	Fallopia	Fallopia multiflora (Thunb.) Harald.	Angiosperm
Polygonaceae	Polygonum	Polygonum orientale L.	Angiosperm
Polygonaceae	Rumex	Rumex japonicus Houtt.	Angiosperm
Portulacaceae	Portulaca	Portulaca oleracea L.	Angiosperm
Amaranthaceae	Spinacia	Spinacia oleracea L.	Angiosperm
Asteraceae	Epaltes	Epaltes australis Less.	Angiosperm
Asteraceae	Helianthus	Helianthus annuus L.	Angiosperm
Asteraceae	Anaphalis	Anaphalis sinica Hance	Angiosperm
Caryophyllaceae	Silene	Silene baccifera (Linnaeus) Roth	Angiosperm
Caryophyllaceae	Myosoton	Myosoton aquaticum (L.) Moench	Angiosperm
Caryophyllaceae	Silene	Silene gallica L.	Angiosperm
Amaranthaceae	Achyranthes	Achyranthes bidentata Blume	Angiosperm
Amaranthaceae	Alternanthera	Alternanthera sessilis (L.) DC.	Angiosperm
Amaranthaceae	Beta	Beta vulgaris L.	Angiosperm

Magnoliaceae	Manglietia	Manglietia fordiana Oliv.	Angiosperm
Magnoliaceae	Yulania	Yulania denudata (Desrousseaux) D. L. Fu	Angiosperm
Schisandraceae	Kadsura	Kadsura longipedunculata Finet et Gagnep.	Angiosperm
Lauraceae	Cinnamomum	Cinnamomum camphora (L.) Presl	Angiosperm
Lauraceae	Cinnamomum	Cinnamomum japonicum Sieb.	Angiosperm
Lauraceae	Lindera	Lindera glauca (Sieb. et Zucc.) Bl.	Angiosperm
Lauraceae	Litsea	Litsea pungens Hemsl.	Angiosperm
Lauraceae	Phoebe	Phoebe chekiangensis C. B. Shang	Angiosperm
Lauraceae	Machilus	Machilus leptophylla Hand.-Mazz.	Angiosperm
Lauraceae	Sassafras	Sassafras tzumu (Hemsl.) Hemsl.	Angiosperm
Altingiaceae	Liquidambar	Liquidambar formosana Hance	Angiosperm
Ranunculaceae	Aconitum	Aconitum carmichaelii Debeaux	Angiosperm
Ranunculaceae	Clematis	Clematis florida Thunb.	Angiosperm
Ranunculaceae	Pulsatilla	Pulsatilla chinensis (Bunge) Regel	Angiosperm
Berberidaceae	Nandina	Nandina domestica Thunb.	Angiosperm
Berberidaceae	Dysosma	Dysosma pleiantha (Hance) Woodson	Angiosperm
Lardizabalaceae	Akebia	Akebia quinata (Houttuyn) Decaisne	Angiosperm
Lardizabalaceae	Holboellia	Holboellia coriacea Deils	Angiosperm
Actinidiaceae	Actinidia	Actinidia chinensis Planch.	Angiosperm
Theaceae	Camellia	Camellia oleifera Abel.	Angiosperm
Theaceae	Camellia	Camellia sinensis (L.) O. Ktze.	Angiosperm
Hypericaceae	Hypericum	Hypericum sampsonii Hance	Angiosperm
Brassicaceae	Sinalliaria	Sinalliaria limprichtiana (Pax) X.F.Jin, Y.Y.Zhou & H.W.Zhang	Angiosperm
Brassicaceae	Capsella	Capsella bursa-pastoris (L.) Medic.	Angiosperm
Brassicaceae	Brassica	Brassica rapa var. oleifera de Candolle	Angiosperm
Brassicaceae	Brassica	Brassica rapa var. glabra Regel	Angiosperm
Brassicaceae	Brassica	Brassica oleracea L.	Angiosperm
Brassicaceae	Brassica	Brassica juncea var. tumida Tsen & Lee	Angiosperm
Brassicaceae	Raphanus	Raphanus sativus L.	Angiosperm
Araliaceae	Panax	Panax ginseng C. A. Meyer	Angiosperm
Crassulaceae	Phedimus	Phedimus aizoon (Linnaeus) 't Hart	Angiosperm
Crassulaceae	Sedum	Sedum sarmentosum Bunge	Angiosperm
Saxifragaceae	Saxifraga	Saxifraga stolonifera Curt.	Angiosperm
Rosaceae	Amygdalus	Amygdalus persica L.	Angiosperm
Rosaceae	Armeniaca	Armeniaca mume Sieb.	Angiosperm
Rosaceae	Chaenomeles	Chaenomeles sinensis (Thouin) Koehne	Angiosperm
Rosaceae	Crataegus	Crataegus cuneata Sieb. et Zucc.	Angiosperm

Rosaceae	Eriobotrya	Eriobotrya japonica (Thunb.) Lindl.	Angiosperm
Rosaceae	Photinia	Photinia beauverdiana Schneid.	Angiosperm
Rosaceae	Prunus	Prunus salicina Lindl.	Angiosperm
Rosaceae	Rosa	Rosa cymosa Tratt.	Angiosperm
Rosaceae	Rubus	Rubus corchorifolius L. f.	Angiosperm
Rosaceae	Fragaria	Fragaria × ananassa Duch.	Angiosperm
Rosaceae	Pyrus	Pyrus bretschneideri Rehd.	Angiosperm
Rhamnaceae	Ziziphus	Ziziphus jujuba var. inermis (Bunge) Rehder	Angiosperm
Fabaceae	Albizia	Albizia kalkora (Roxb.) Prain	Angiosperm
Fabaceae	Dalbergia	Dalbergia hupeana Hance	Angiosperm
Fabaceae	Cercis	Cercis chinensis Bunge	Angiosperm
Fabaceae	Gleditsia	Gleditsia sinensis Lam.	Angiosperm
Fabaceae	Amphicarpaea	Amphicarpaea edgeworthii Benth.	Angiosperm
Fabaceae	Glycine	Glycine soja Sieb. et Zucc.	Angiosperm
Fabaceae	Medicago	Medicago sativa L.	Angiosperm
Fabaceae	Styphnolobium	Styphnolobium japonicum (L.) Schott	Angiosperm
Fabaceae	Vicia	Vicia kulingana L. H. Bailey	Angiosperm
Fabaceae	Vigna	Vigna unguiculata (L.) Walp.	Angiosperm
Fabaceae	Phaseolus	Phaseolus vulgaris L.	Angiosperm
Fabaceae	Wisteria	Wisteria sinensis (Sims) Sweet	Angiosperm
Fabaceae	Arachis	Arachis hypogaea L.	Angiosperm
Fabaceae	Glycyrrhiza	Glycyrrhiza uralensis Fisch.	Angiosperm
Euphorbiaceae	Triadica	Triadica sebifera (Linnaeus) Small	Angiosperm
Euphorbiaceae	Vernicia	Vernicia fordii (Hemsl.) Airy Shaw	Angiosperm
Rutaceae	Zanthoxylum	Zanthoxylum simulans Hance	Angiosperm
Rutaceae	Citrus	Citrus reticulata Blanco	Angiosperm
Sapindaceae	Acer	Acer ceriferum Rehd.	Angiosperm
Sapindaceae	Sapindus	Sapindus saponaria Linnaeus	Angiosperm
Schisandraceae	Illicium	Illicium verum Hook. f.	Angiosperm
Balsaminaceae	Impatiens	Impatiens balsamina L.	Angiosperm
Paeoniaceae	Paeonia	Paeonia ostii T. Hong & J. X. Zhang	Angiosperm
Aquifoliaceae	Ilex	Ilex chinensis Sims	Angiosperm
Buxaceae	Buxus	Buxus sinica (Rehd. et Wils.) Cheng	Angiosperm
Saxifragaceae	Oresitrophe	Oresitrophe rupifraga Bunge	Angiosperm
Vitaceae	Vitis	Vitis vinifera L.	Angiosperm
Malvaceae	Corchorus	Corchorus capsularis L.	Angiosperm
Malvaceae	Firmiana	Firmiana simplex (Linnaeus) W. Wight	Angiosperm
Zingiberaceae	Zingiber	Zingiber officinale Roscoe	Angiosperm

Ebenaceae	Diospyros	Diospyros japonica Siebold & Zuccarini	Angiosperm
Poaceae	Phyllostachys	Phyllostachys edulis (Carriere) J. Houzeau	Angiosperm
Poaceae	Phyllostachys	Phyllostachys acuta Chu et Chao	Angiosperm
Poaceae	Phyllostachys	Phyllostachys angusta McClure	Angiosperm
Poaceae	Phyllostachys	Phyllostachys arcana McClure	Angiosperm
Poaceae	Phyllostachys	Phyllostachys reticulata (Ruprecht) K. Koch	Angiosperm
Poaceae	Phyllostachys	Phyllostachys nigra var. henonis (Mitford) Stapf ex Rendle	Angiosperm
Poaceae	Phyllostachys	Phyllostachys heteroclada Oliver	Angiosperm
Poaceae	Phyllostachys	Phyllostachys tianmuensis Wang et N. X. Ma	Angiosperm
Poaceae	Phyllostachys	Phyllostachys sulphurea var. viridis R. A. Young	Angiosperm
Poaceae	Pleioblastus	Pleioblastus amarus (Keng) Keng f.	Angiosperm
Poaceae	Indocalamus	Indocalamus latifolius (Keng) McClure	Angiosperm
Poaceae	Lophatherum	Lophatherum gracile Brongn.	Angiosperm
Poaceae	Phragmites	Phragmites australis (Cav.) Trin. ex Steud.	Angiosperm
Poaceae	Pennisetum	Pennisetum alopecuroides (L.) Spreng.	Angiosperm
Poaceae	Oryza	Oryza sativa L.	Angiosperm
Poaceae	Oryza	11Zhendao11	Angiosperm
Poaceae	Oryza	19Zhennuo19hao	Angiosperm
Poaceae	Oryza	Taihunuo	Angiosperm
Poaceae	Oryza	65Jianuo65	Angiosperm
Poaceae	Oryza	35Zhongzao35	Angiosperm
Poaceae	Oryza	10Dangyujing10hao	Angiosperm
Poaceae	Oryza	188Zhefengnuo188	Angiosperm
Poaceae	Oryza	1Xuanjingnuo1hao	Angiosperm
Poaceae	Oryza	1Guangmingnuo1hao	Angiosperm
Poaceae	Oryza	1Wankennuo1hao	Angiosperm
Poaceae	Oryza	68Wandao68	Angiosperm
Poaceae	Oryza	153Wandao153	Angiosperm
Poaceae	Oryza	6Yangliangyou6hao	Angiosperm
Poaceae	Oryza	6326Liangyou6326	Angiosperm
Poaceae	Oryza	996Huiliangyou996	Angiosperm
Poaceae	Oryza	688Liangyou688	Angiosperm
Poaceae	Oryza	Tianyouhuazhan	Angiosperm
Poaceae	Oryza	6Xinliangyou6hao	Angiosperm
Poaceae	Oryza	Y2YLiangyou2hao	Angiosperm
Poaceae	Oryza	II838IIYou838	Angiosperm

Poaceae	Oryza	Y990YLiangyou990	Angiosperm
Poaceae	Oryza	Y1928YLiangyou1928	Angiosperm
Poaceae	Oryza	581Shenliangyou581	Angiosperm
Poaceae	Oryza	CCLiangyouhuazhan	Angiosperm
Poaceae	Oryza	Xinrongyouhuazhan	Angiosperm
Poaceae	Oryza	Quanyousimiao	Angiosperm
Poaceae	Oryza	822Quanyou822	Angiosperm
Poaceae	Triticum	Triticum aestivum L.	Angiosperm
Poaceae	Zea	Zea mays L.	Angiosperm
Poaceae	Setaria	Setaria italica var. germanica (Mill.) Schred.	Angiosperm
Poaceae	Setaria	Setaria viridis (L.) Beauv.	Angiosperm
Poaceae	Sorghum	Sorghum 'Bicolor'	Angiosperm
Poaceae	Hordeum	Hordeum vulgare L.	Angiosperm
Poaceae	Avena	Avena sativa L.	Angiosperm
Poaceae	Saccharum	Saccharum officinarum L.	Angiosperm
Potamogetonaceae	Potamogeton	Potamogeton wrightii Morong	Angiosperm
Dioscoreaceae	Dioscorea	Dioscorea esculenta (Lour.) Burkill	Angiosperm
Pedaliaceae	Sesamum	Sesamum indicum L.	Angiosperm
Apiaceae	Apium	Apium graveolens L.	Angiosperm
Apiaceae	Daucus	Daucus carota var. sativa Hoffm.	Angiosperm
Cucurbitaceae	Cucumis	Cucumis sativus L.	Angiosperm
Cucurbitaceae	Cucumis	Cucumis melo var. makuwa Makino	Angiosperm
Cucurbitaceae	Cucurbita	Cucurbita moschata (Duch. ex Lam.) Duch. ex Poiret	Angiosperm
Cucurbitaceae	Benincasa	Benincasa hispida (Thunb.) Cogn.	Angiosperm
Cucurbitaceae	Citrullus	Citrullus lanatus (Thunb.) Matsum. et Nakai	Angiosperm
Solanaceae	Solanum	Solanum melongena L.	Angiosperm
Solanaceae	Capsicum	Capsicum annuum L.	Angiosperm
Solanaceae	Lycopersicon	Lycopersicon esculentum Miller	Angiosperm
Solanaceae	Lycium	Lycium chinense Miller	Angiosperm
Solanaceae	Nicotiana	Nicotiana tabacum L.	Angiosperm
Solanaceae	Solanum	Solanum tuberosum L.	Angiosperm
Nelumbonaceae	Nelumbo	Nelumbo nucifera Gaertn.	Angiosperm
Nymphaeaceae	Euryale	Euryale ferox Salisb. ex DC	Angiosperm
Lythraceae	Trapa	Trapa natans	Angiosperm
Salviniaceae	Azolla	Azolla pinnata subsp. asiatica R. M. K. Saunders & K. Fowler	Angiosperm
Asparagaceae	Hyacinthus	Hyacinthus orientalis L. Sp. Pl.	Angiosperm

Typhaceae	Typha	Typha orientalis Presl	Angiosperm
Ceratophyllaceae	Ceratophyllum	Ceratophyllum demersum L.	Angiosperm
Araceae	Lemna	Lemna minor L.	Angiosperm
Hydrocharitaceae	Vallisneria	Vallisneria natans (Lour.) Hara	Angiosperm
Oleaceae	Osmanthus	Osmanthus fragrans (Thunb.) Loureiro	Angiosperm
Convolvulaceae	Cuscuta	Cuscuta chinensis Lam.	Angiosperm
Lamiaceae	Salvia	Salvia japonica Thunb.	Angiosperm
Amaryllidaceae	Allium	Allium macrostemon Bunge	Angiosperm
Amaryllidaceae	Allium	Allium sativum L.	Angiosperm
Asphodelaceae	Hemerocallis	Hemerocallis citrina Baroni	Angiosperm
Iridaceae	Iris	Iris tectorum Maxim.	Angiosperm
Rubiaceae	Emmenopterys	Emmenopterys henryi Oliv.	Angiosperm

Annex 2 List of Major Animals in the Heritage Site

Family	Species
Corvidae.	Cyanopica cyana (Pallas).
Corvidae.	Pica pica (Linnaeus).
Corvidae.	Corvus sp.
Corvidae.	Corvus pectoralis.
Corvidae.	Urocissa erythrorhyncha.
Corvidae.	Garrulus glandarius
Corvidae.	Dendrocitta formosae
Corvidae.	Corvus frugilegus
Corvidae.	Corvus dauuricus
Corvidae.	Corvus macrorhynchos
Oriolidae.	Oriolus chinensis.
Dicruridae.	Dicrurus macrocercus.
Dicruridae.	Dicrurus leucophaeus
Dicruridae.	Dicrurus hottentottus.
Accipitridae.	Accipiter nisus
Accipitridae.	Accipiter gularis
Accipitridae.	Circus cyaneus
Accipitridae.	Accipiter gentilis
Accipitridae.	Milvus migrans
Accipitridae.	Accipiter soloensis.
Accipitridae.	Milvus Korschun.
Paridae	Aegithalos caudatus
Paridae	Aegithalos concinnus
Paridae	Parus major
Paridae	Parus venustulus
Paridae	Periparus ater
Paridae.	parus major.
Tytonidae.	Strigiformes.
Turnicidae.	Turnix tanki.
Rallidae.	Amaurornis phoenicurus.
Scolopacidae.	Tringa ochropus.
Scolopacidae.	Scolopacidae sp.
Scolopacidae.	Gallinago stenura
Podicipedidae	Podiceps ruficollis
Columbidae.	Streptopelia orientalis.
Streptopelia turtur.	Columbidae.
Alcedinidae.	Alcedinidae.
Alcedinidae.	Alcedo azurea.
Alcedinidae.	Alcedo atthis
Alcedinidae.	Megaceryle lugubris

Alcedinidae.	Ceryle rudis
Alcedinidae.	Halcyon smyrnensis
Alcedinidae.	Halcyon pileata
Picidae.	Picidae.
Picidae.	Dendrocoposmajor(Linnaeus).
Picidae.	Picus canus.
Picidae.	Jynx torquilla
Picidae.	Picumnus innominatus
Picidae.	Picus canus
Picidae.	Dendrocopos canicapillus
Picidae.	Dendrocopos hyperythrus
Cuculidae.	Cuculus canorus bakeri.
Cuculidae.	Cuculus poliocephalus.
Cuculidae.	Cuculus micropterus.
Cuculidae.	Cuculus sparverioides.
Cuculidae.	Clamator coromandus
Cuculidae.	Cuculus saturatus
Ardeidae.	Ardeola bacchus.
Ardeidae.	Nycticorax nycticorax.
Ardeidae.	Bubulcus ibis.
Ardeidae.	Ardea cinerea.
Ardeidae	Egretta garzetta.
Ardeidae	Egretta alba.
Ardeidae	Ardea intermedia
Ardeidae	Butorides striata
Ardeidae	Ixobrychus flavicollis
Hirundinidae.	Hirundo daurica.
Hirundinidae.	Hirundo rustica.
Gruidae.	Grus monacha.
Gruidae.	Grus vipio
Gruidae	Grus leucogeranus
Motacillidae	Motacilla alba
Laniidae.	Lanius cristatus.
Laniidae.	Lanius bucephalus.
Laniidae.	Lanius tigrinus.
Laniidae.	Lanius schach
Sturnidae.	Sturnus sericeus.
Muscicapidae.	Terpsiphone paradisi (Lihnaeus).
Muscicapidae.	Lusciniamegarhynchos.
Muscicapidae.	Acrocephalus arundiaceus.
Turdidae.	Rhinomyias brunneatus
Turdidae.	Ficedula zanthopygia
Turdidae.	Ficedula parva
Turdidae.	Cyanoptila cyanomelana

Turdidae.	Muscicapa sibirica
Turdidae.	Muscicapa dauurica
Turdidae.	Leiothrix lutea (Scopoli)
Turdidae.	Schoeniparus brunneus
Turdidae.	Alcippe morrisonia
Turdidae.	Paradoxornis webbianus
Turdidae.	Paradoxornis gularis
Turdidae.	Garrulax perspicillatus
Turdidae.	Garrulax vassali
Turdidae.	Garrulax poecilorhynchus
Turdidae.	Garrulax pectoralis
Turdidae.	Garrulax cineraceus
Turdidae.	Stachyris ruficeps
Turdidae.	Pomatorhinus erythrogenys
Turdidae.	Horornis diphone
Turdidae.	Horornis fortipes
Turdidae.	Phylloscopus inornatus
Turdidae.	Phylloscopus proregulus
Turdidae.	Phylloscopus reguloides
Turdidae.	Seicercus albogularis
Turdidae.	Cisticola juncidis
Turdidae.	Cisticola exilis
Turdidae.	Prinia superciliaris
Turdidae.	plnia prinia
Turdidae.	Turdus.
Turdidae.	Enicurus scouleri
Turdidae.	Enicurus leschenaulti
Turdidae.	Myophonus caeruleus
Turdidae.	Zoothera dauma
Turdidae.	Monticola solitarius
Turdidae.	Turdus merula
Turdidae.	Turdus pallidus
Turdidae.	Turdus naumanni
Turdidae.	Turdus hortulorum
Muscicapidae.	Garrulax canorus.
Timaliidae.	Garrulax perspicillatus.
Zosteropidae.	Zosterops japonicus.
Ploceidea.	Passer rutilans.
Ploceidea.	Passer montanus.
Ploceidea.	Lonchura striata
Ploceidea.	Lonchura punctulata
Passeridae.	Cocothraustes migratorlus.
Passeridae.	Fringilla montifringilla
Passeridae.	Carduelis sinica

Passeridae.	Eophona migratoria
Passeridae.	Coccothraustes coccothraustes
Passeridae.	Emberiza lathami
Passeridae.	Latoucheornis siemsseni
Passeridae.	Emberiza cioides
Passeridae.	Emberiza tristrami
Passeridae.	Emberiza fucata
Passeridae.	Emberiza pusilla
Passeridae.	Emberiza chrysophrys
Passeridae.	Emberiza elegans
Passeridae.	Emberiza aureola
Passeridae.	Emberiza rutila
Phylloscopidae.	Phylloscopus.
Sturnidae.	Acridotheres cristatellus.
Alaudidae.	Melanocorypha mongolica (Pallas).
Phasianidae.	Coturnix coturnix.
Phasianidae.	Lophura nycthemera
Gryllidae.	Cryllus testaceus wallker.
Anatidae.	Anser albifrons
Anatidae.	Cygnus columbianus
Anatidae.	Aix galericulata
Anatidae.	Anser cygnoides.
Anatidae.	sheldrake
Anatidae.	Anas platyrhynchos.
Anatidae.	Anas platyrhynchos domestica.
Anatidae.	Anser cygnoides
Anatidae.	Anser anser
Anatidae.	Anas strepera
Anatidae.	Anas formosa
Anatidae.	Anas crecca
Anatidae.	Anas zonorhyncha
Ciconiidae.	Ciconia boyciana
Ciconiidae.	Ciconia nigra
Ciconiidae.	Ciconia ciconia.
Threskiorothidae	Platalea leucorodia
Tyto longimembris	Tyto
Rallidae.	Gallicrex cinerea.
Phasianidae.	bamboo partridge
Platanistidae.	Lipotes vexillifer.
Phocoenidae.	Neophocaena phocaenoides.
Cervidae.	Cervus nippon.
Manidae.	Manis pentadactyla.
Bovidae.	Capricornis sumatraensis.
Cervidae.	*Hydropot.*

Cervidae.	Muntiacus.
Leporidae；hares.	Leporidae.
Felidae.	Panthera pardus.
Mustelidae.	Meles meles.
Canidae.	Vulpes.
Hystricidae.	Hystrix hodgsoni.
Suidae	Sus scrofa
Canidae.	*Canis lupus* Linnaeus.
Canidae.	dalmatian
Sciuridae.	Sciurus vulgaris Linneaeus.
Erinaceidae.	Erinaceinae
Mustelidae.	Mustela sibirica
Felidae.	*Felis silvestris*.
Viverridae	Paguma larvata
Mustelidae	Arctonyx collaris.
Mustelidae	Lutra lutra.
Muridae	Mus musculus
Vespertilionidae	Myotis chinensis
Vespertilionidae	Pipistrellus abramus
Bufonidae.	Bufo bufo Linnaeus.
Hylidae.	Hyla immaculata.
Ranidae.	Rana limnocharis Boie.
Ranidae.	Pelophylax nigromaculatus.
Ranidae.	Rana tientaiensis
Ranidae.	*Odorrana schmackeri*
Ranidae.	Rana temporaria.
Microhylidds.	Rana plancyi.
Cryptobranchidae	Andrias davidianus
Emydidae.	*Mauremys reevesii*.
Emydidae.	Mauremys mutica.
Platysternon megacephalum.	Platysternon megacephalum.
Emydidae.	Cuora trifasciata.
Emydidae.	Cuora
Gekkonidae.	Gekko japonicus.
Trionychidae	Pelodiscus sinensis
Scincidae.	Tiliqua scincoides.
Lacertian	Takydromus septentrionalis
Buthidae.	Scorpion.
Colubridae.	Dinodon.
Colubridae.	Natrix annularis(Hallowell).
Elapidae.	Bungarus fasciatus.
Elapidae.	Bungarus multicinctus.
Colubridae.	Zaocys dhumnades（Cantor）.

Viperidae.	Agkistrodon halys.
Viperidae.	Deinagkistrodon acutus
Viperidae.	Trimeresurus stejnegeri
Colubridae	Elaphe carinata Gunther
Boidae	*Python bivittatus*
Colubridae.	*Natrix annularis* Hallowell.
Clupeidae.	Tenualosa reevesii.
Engraulidae	Coilia ectenes Jordan
Anguillidae	eel
Percichthyidae.	Siniperca chuatsi.
Cyprinidae.	Cyprinus carpio.
Cyprinidae.	Procypris merus Lin
Cyprinidae.	Mylopharyngodon piceus.
Cyprinidae.	**Carassius auratus**.
Cyprinidae.	*Ctenopharyngodon idellus*.
Cyprinidae.	*Hypophthalmichthys molitrix*.
Cyprinidae.	Acrossocheilus fasciatus
Cyprinidae.	Acrossocheilus parallens
Cyprinidae.	Pseudorasbora parva
Cyprinidae.	Sarcocheilichthys kiangsiensis
Cyprinidae.	Sarcocheilichthys parvus
Cyprinidae.	Opsariichthys uncirostris bidens
Cyprinidae.	Abbottina rivularis
Cyprinidae.	Abbottina tafangensis
Cyprinidae.	Abbottina fukiensis (Nichols)
Cyprinidae.	Sarcocheilichthys nigripinnis(Gunther)
Cyprinidae.	Gnathopogon argentatus
Cyprinidae.	Gnathopogon taeniellus
Cyprinidae.	Gnathopogon wolterstorffi
Cyprinidae.	Pseudogobio vaillanti
Cyprinidae.	Elopichthys bambusa
Cyprinidae.	Hypophthalmichthys nobilis
Cyprinidae.	Coreius heterodon
Cyprinidae.	*Parabramis pekinensis*.
Percoidea.	Ephippus orbis.
Synbranchidae.	Monopterus albus.
Siluridae	Silurus asotus
Cobitidae.	Oriental weatherfish.
Siluridae	Paramisgurnus dabryanus (Sauvage)
Cobitidae.	Parabotia fasciata
Siluridae	Cobitis sinensis
Cobitidae.	Leptobotia tchangi
Cobitidae.	Leptobotia tientaiensis
Cyprinidae.	Aristichthysnobilis

Amblycipitidae	Liobagrus anguillicauda
Bagridae	Pelteobagrus fulvidraco
Mastacembelidae	Mastacembelus aculeatus
Acipenseridae	Acipenser sinensis
Alligatoridae	Alligator sinensis

Annex 3 Composition of the main soil bacterial communities

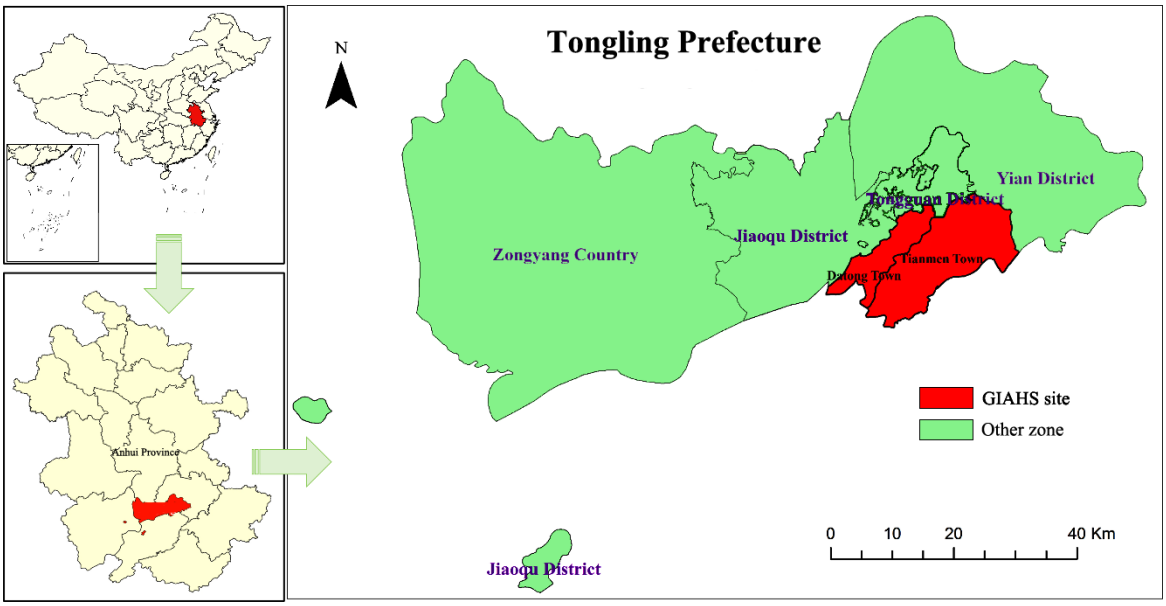
			norank_f__norank_o__Gaiellales
			Arthrobacter
			Sphingomonas
			norank_f__norank_o__Vicinamibacterales
	Actinobacteriota		*norank_f__JG30-KF-AS9*
	Proteobacteria		*Gemmatimonas*
	Chloroflexi		*norank_f__67-14*
	Acidobacteriota		*Bacillus*
	Firmicutes		*Nocardioides*
	Gemmatimonadota		*Intrasporangium*
	Myxococcota		*Candidatus_Solibacter*
	Cyanobacteria		*unclassified_o__Acidobacteriales*
	Bacteroidota		*norank_f__norank_o__norank_c__KD4-96*
Phylum	Patescibacteria	Genus	*Acidothermus*
status	Methylomirabilota	status	*norank_f__norank_o__Frankiales*
	Nitrospirota		*norank_f__norank_o__IMCC26256*
	Planctomycetota		*norank_f__Roseiflexaceae*
	Desulfobacterota		*unclassified_f__Nocardioidaceae*
	Verrucomicrobiota		*norank_f__norank_o__Subgroup_7*
	WPS-2		*unclassified_f__Xanthobacteraceae*
	MBNT15		*norank_f__norank_o__RBG-13-54-9*
			Ellin6067
			norank_f__Anaerolineaceae
			norank_f__norank_o__Rokubacteriales
			Micromonospora
			norank_f__norank_o__norank_c__JG30-KF-CM66
			norank_f__LWQ8
			Massilia
			unclassified_o__Cyanobacteriales

Annex 4 Composition of the main soil fungal communities

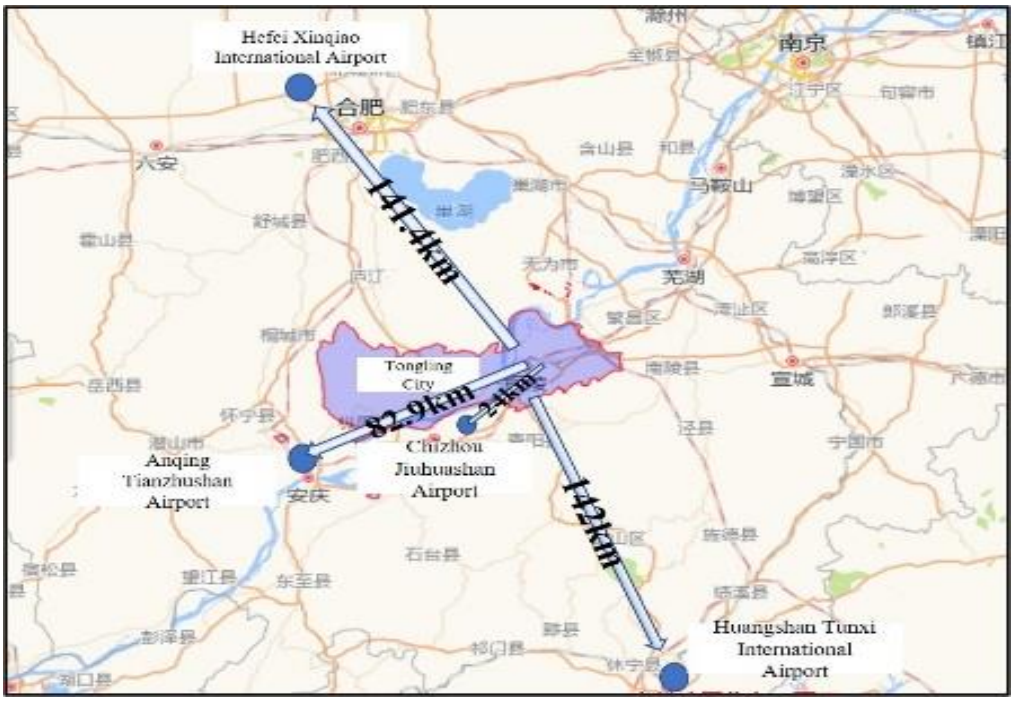
			Mortierella
			unclassified_k__Fungi
	Ascomycota		*Fusarium*
			Chaetomium
			unclassified_p__Rozellomycota
			Trichocladium
			unclassified_f__Microascaceae
	Mortierellomycota		*Sporobolomyces*
			Plectosphaerella
			unclassified_f__Pyronemataceae
			Fusicolla
			Talaromyces
	unclassified_k__Fungi		*Neocosmospora*
			Tausonia
Phylum status		Genus status	*unclassified_c__Sordariomycetes*
			Gibberella
			Gibellulopsis
	Basidiomycota		*Sporidiobolus*
			unclassified_p__Mortierellomycota
			unclassified_o__Branch02
			unclassified_c__Agaricomycetes
			Chordomyces
	Rozellomycota		*Podospora*
			Pseudaleuria
			Westerdykella
			Lycoperdon
			Peziza
	Chytridiomycota		*Lectera*
			unclassified_o__Trechisporales
			Sarocladium

Annex 5 Maps

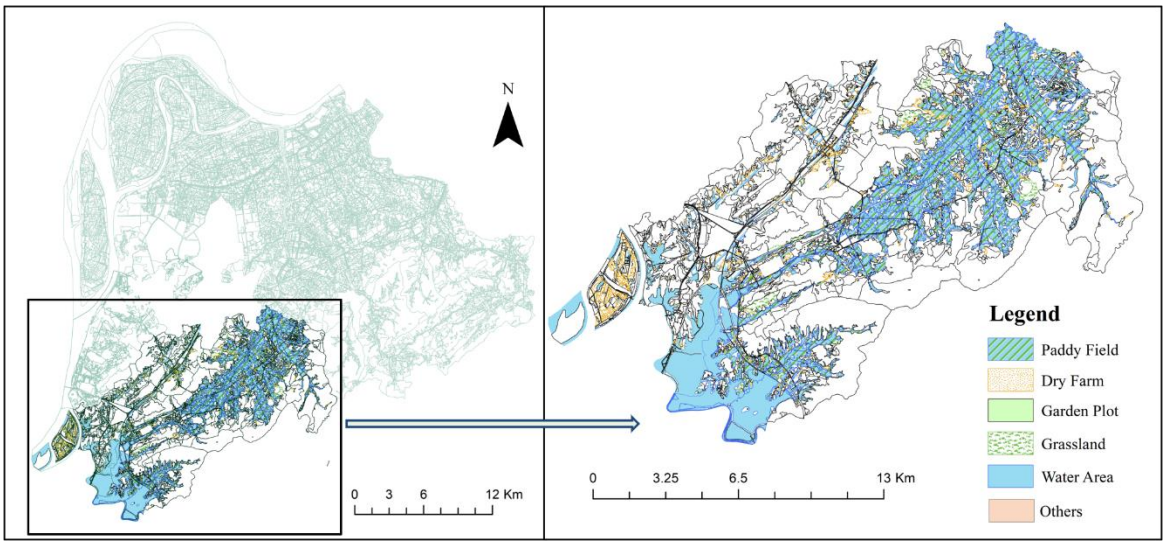
1 Location of the Heritage site



2 Transportation accessibility of Tongling Prefecture



3 Land use map of the heritage site



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