

Time-Space Coupling of Agriculture-Tourism in the Middle and Lower Reaches of the Yangtze

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Abstract. The coordinated development of agriculture and tourism is an effective way to promote rural tourism and agricultural economic upgrading. This paper takes the middle and lower reaches of the Yangtze River in the agricultural civilization area as the research object, constructs the theoretical model of agricultural tourism integration, and uses the entropy weight method and the coupled coordination evaluation method to analyze the spatial and temporal evolution trend and coupling and coordination relationship of agriculture and tourism development in 2013-2017. The results show that, at the time series, the comprehensive development level of agriculture in the study area is stable and the growth is slow, the comprehensive development of tourism is faster, and the development level is fluctuating. The agriculture and tourism are at a high level of coupling, and the coordination is in a moderate coordination stage. The overall progress of the integration of agricultural tourism has been slow. The integration of agriculture and tourism in China has a good environmental foundation and policy support, but the choice of integration mode is very important. It is necessary to develop a characteristic industrial chain, give play to the location advantage, and implement the integration strategy according to local conditions.

Keywords: Middle and lower reaches of the Yangtze River; Agriculture; Tourism; Coordination.

1. Introduction

As the primary industry in China, agriculture has always been the focus of the country. Its integration with the tourism industry is an important way to achieve rural revitalization. In 2012, “Beautiful China” was proposed at the 18th National Congress. “Beautiful China” first established a beautiful rural area, which brought down to the development of rural tourism. In 2018, the central government issued opinions on implementing rural revitalization strategies to solve the imbalance of rural development. Insufficient problems, in February 2019, the Central Document No. 1 once again emphasized the issue of “agriculture, rural areas and farmers” and placed its focus on rural tourism, which played a catalytic role in the integration of agricultural tourism. According to statistics, between 2013 and 2017, the average growth rate of rural tourism reception in China reached 33.6%, and the growth rate of rural tourism revenue reached 25.6%. In 2018, the number of rural tourism receptions exceeded 3 billion, and the operating income exceeded 800 billion yuan. It has become an important weapon for the rise of China's rural areas. Rural tourism is a new form of integration between agriculture and tourism. Studying the coupling and development of agriculture and tourism is of great significance for the further development of rural tourism.

The academic community has more experience in the research on the integrated development model and its path of agriculture and tourism. Yuan Zhongxu (2013) analyzed the stimulating effects of agricultural tourism integration [1]. Based on the theory of industrial integration, Lin Biao (2015) proposed the anti-feeding model of agricultural tourism integration and the urban-rural integration model [2]. Wang Lifang (2018) used Shanxi as an example to explore the mutual promotion method and path of the integration of agriculture and tourism [3]. Xu Bin (2019) divided the results of the integration of agriculture and tourism into three modes: science and education leisure, sightseeing agriculture and agricultural leisure, and pointed out the current shortage of agricultural tourism integration [4].

Quantitative measures on the integration of agriculture and tourism are currently lacking, and the main research involves the analysis of influencing factors. Liu Hong and Zhang Wei (2015) analyzed the tourism industry's role in agriculture by input-output method [5]. Xia Jiechang and Xu Jinhai (2016) used the VAR model to analyze the specific relationship between agriculture and tourism [6].

Su Fei (2017) used the econometric method to analyze the coupling relationship between agriculture and tourism [7]. Zhou Lei et al. (2016) determined the coupling mechanism between agriculture and tourism, selected the data of Sichuan agriculture and tourism from 2004 to 2014, and constructed a coupling model to empirically analyze the coupling relationship between agriculture and tourism from the perspective of industrial integration. [8].

It can be seen that in the past, the integration and development of agriculture and tourism mostly stayed in path selection and model innovation, objective quantitative analysis was lacking, and there were indicators such as imperfect indicator system and lack of typicality. Therefore, it is necessary to provide a customer-based observation of the degree of integration of agriculture and tourism through the establishment of an indicator system and the selection of representative samples, and provide a theoretical basis and practical basis for rural revitalization.

2. Evaluation Index System Construction and Evaluation Model

In order to better measure the integration and development of agriculture and tourism, it is necessary to grasp the basic mechanism of the integration of agricultural tourism and build a comprehensive evaluation index system. Tourism is a comprehensive industry, covering a wide range of factors, including food, housing, travel, tourism, shopping, and entertainment. Agriculture is the basis of food. Tourists in tourism activities cannot be separated from agricultural support. In addition, agriculture It also provides venues for tourism activities [9]. The mutual promotion effect between tourism and agriculture can simultaneously activate the vitality of agricultural production and tourism activities. The integration of agricultural tourism and tourism can buffer the supply and demand of agriculture and tourism, which is the requirement of agricultural modernization and tourism universality [10].

According to the relevant instructions of the State Council on Establishing and Improving the System and Policy System for the Development of Urban and Rural Integration, and referring to the analysis of the coupling mechanism between Liu Lijun and Liu Youjin on the two systems [11], this paper constructs the mechanism of the coupling between agriculture and tourism, as shown in Figure 1. Shown. Agriculture provides material support for tourism, and “food” and “purchase” in tourism activities are mostly derived from agricultural production. Local specialty snacks, as one of the tourist destinations, can effectively stimulate the growth of total tourism revenue; the increase in the number of rural tourists makes agriculture It is able to effectively transform and upgrade, and the sightseeing and experience-oriented agricultural projects are gradually emerging, and at the same time, the development of the local hotel industry is also promoted.

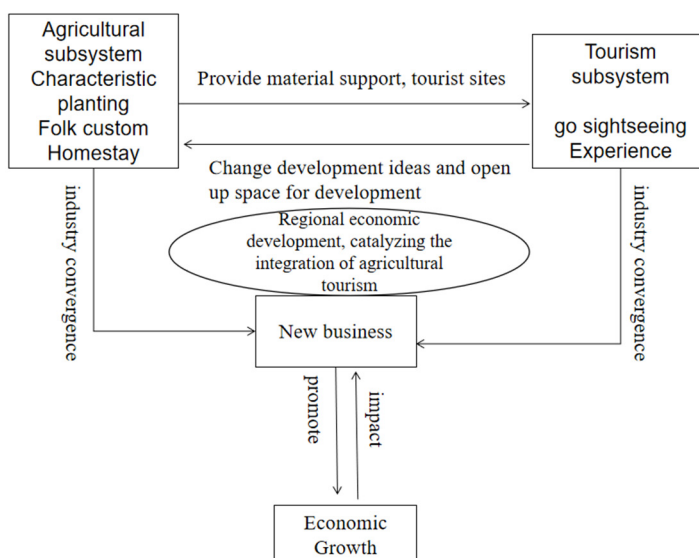


Figure 1. Agricultural and tourism integration mechanism map

2.1 Indicator Selection

On the basis of following the principles of science, system and operation of the indicator system, combined with the mechanism of agricultural tourism integration, and referring to the method of selecting the authoritative literature [3][4][5][12][13], the construction of the agricultural tourism The integrated indicator system is shown in Table 1.

Table 1. Agricultural-tourism coupling coordination evaluation index system

Criteria layer	Evaluation index layer	Indicator meaning	Indicator direction	Mark
Agricultural subsystem A	Agricultural machinery total power	Reflecting the level of agricultural development	Positive	A ₁
	Total agricultural income	Indicators for measuring agricultural economic benefits	Positive	A ₂
	Unit agricultural fertilizer application rate	Fertilizer application deficiencies effective irrigated area	Positive	A ₃
	Primary industry practitioners	Agricultural social benefits	Positive	A ₄
	Disposable income of rural residents	The impact of agriculture on people's lives	Positive	A ₅
	First industry share	The proportion of the tertiary industry to GDP	Positive	A ₆
Tourism subsystem T	Domestic tourism income	Tourism economic level	Positive	T ₁
	Foreign exchange income from tourism	Tourism economic level	Positive	T ₂
	Domestic tourists	Tourism economic benefit	Positive	T ₃
	Per capita consumption of tourism	Total tourism revenue / total number of visitors	Positive	T ₄
	Number of star hotels	Tourism infrastructure	Positive	T ₅
	Third industry ratio	The proportion of the tertiary industry to GDP	Positive	T ₆

2.2 Comprehensive Development Level Evaluation Model

The development of agriculture and tourism is the premise of the integration of the two. In order to explore the coupling and coordination between agriculture and tourism, it is first necessary to evaluate the development level of each subsystem. The specific steps are as follows:

Based on the above analysis, this paper puts forward hypothesis three: the improvement of digitalization level can indirectly promote the optimization of industrial structure by promoting the intermediary effect of high-tech industry opening to the outside world.

2.2.1 Method for Determining Index Weights——Improving Entropy Weight Method

(1) Original matrix:

$$M = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} \quad (1)$$

$$S_{ij} = \left\{ \begin{array}{l} \frac{x_{ij} - x_{ij}^{\min}}{x_{ij}^{\max} - x_{ij}^{\min}}, \\ \frac{x_{ij}^{\max} - x_{ij}}{x_{ij}^{\max} - x_{ij}^{\min}}, \end{array} \right\} \quad (2)$$

$$T = \begin{bmatrix} t_{11} & t_{12} & \dots & t_{1n} \\ t_{21} & t_{22} & \dots & t_{2n} \\ \dots & \dots & \dots & \dots \\ t_{m1} & t_{m2} & \dots & t_{mn} \end{bmatrix} \quad (3)$$

$$P_{ij} = \frac{t_{ij}}{\sum_{i=1}^m t_{ij}} \quad (i=1, 2, \dots, m; j=1, 2, \dots, n) \quad (4)$$

$$E_j = -k \sum_{i=1}^m (p_{ij} \cdot \ln p_{ij}) \quad (k=1/\ln m; j=1, 2, \dots, n) \quad (5)$$

$$(4) H_j = 1 - E_j \quad (j=1, 2, \dots, n, \quad E_j = -k \sum_{i=1}^m P_{ij} \ln P_{ij}) \quad (6)$$

$$W_j = H_j / \sum_{j=1}^n H_j \quad (j=1, 2, \dots, n) \quad (7)$$

2.2.2 Comprehensive Evaluation Value of Each System

$$U_i = \sum_{j=1}^n w_j x_j \quad (8)$$

2.3 Coupling Evaluation Model

Coupling originated from physics and was applied to the interaction between systems. The coupling of the two systems is mature in economics. The coupling process is the process of adapting the two systems gradually, synergistically, and toward the fusion process. It can reflect the strength of the interaction between systems [14], and its calculation formula is as follows:

$$C'' = 2 \left[\frac{U_1 U_2}{(U_1 + U_2) \times (U_1 + U_2)} \right]^{\frac{1}{2}} \quad (9)$$

2.4 Coupling Coordination Evaluation Model

The degree of coupling only reflects the relationship between the quantities of the system, which is not enough to explain the positive and negative effects of the system. Therefore, the coupling coordination degree model should be introduced. The coupling coordination degree model can reflect the strength of the positive influence between the systems. Can explain the state of integration and coordination between systems [13]. Referring to the related literature [14] [15], the degree of coupling and coupling coordination are graded, and the coupling and coordination of rural tourism is divided into four development stages for subsequent empirical analysis.

$$D = \sqrt{C \times T} \quad (10)$$

Moreover, in order to avoid the error caused by the regional difference as much as possible, both α and β take 0.5.

Table 2. Agricultural-tourism coupling coordination degree classification criteria

C	Type	D	Coupling coordination level	Coordinate development stage	D	Coupling coordination level	Coordinate development stage
C ₁ :0~0.3	Low level coupling	0.00~0.199	Extreme imbalance	Depression phase	0.60~0.699	Primary coordination	Moderate coordination
C ₂ :0.3~0.5	Adaptation phase	0.20~0.299	Serious disorder		0.70~0.799	Intermediate coordination	
C ₃ :0.5~0.8	Run-in phase	0.30~0.399	Mild disorder		0.80~0.899	Good coordination	
C ₄ :0.8~1	High level	0.40~0.499	On the verge of dys	Low coordination	0.90~1.00	Quality coordination	Highly coordinated
		0.50~0.599	Reluctant coordination				

3. Empirical Analysis

3.1 Data Collection

The farming culture originates from the areas with rich water resources. The development of agriculture mainly depends on the nourishment of the big rivers. The integration of agricultural tourism has begun in the areas with long agricultural civilization. Therefore, this paper selects 7 provinces and municipalities in the middle and lower reaches of the Yangtze River in China. As a research object, it analyzes the coupling status of agriculture and tourism, which is more representative. Through comparative analysis, it can more accurately find the problems existing in the process of agricultural tourism integration and provide corresponding experience for reference. The time dimension of the selected data is 2013-2017, which is a key period for the implementation of the rural revitalization strategy. It is of great practical significance to analyze the development of rural tourism integration at this stage. Selected data sources and China Statistical Yearbook, China Tourism Yearbook, statistical yearbooks and statistical bulletins of various provinces and cities.

3.2 Analysis of Agricultural Tourism Comprehensive Index in Research Area

This paper uses the entropy weight method combined with formula (8) to calculate the comprehensive evaluation value and ranking of agriculture and tourism in the middle and lower reaches of the Yangtze River as shown in Table 3. At the regional level, the level of agriculture in the coastal areas is slightly lower than that in the inland areas. From the perspective of each province (municipality), the comprehensive evaluation value of agriculture in Anhui and Zhejiang provinces is more obvious. The comprehensive evaluation value of agriculture in Jiangxi and Hubei provinces is relatively stable, and the comprehensive evaluation value of agriculture in other provinces shows a volatility growth trend. The overall evaluation value is generally on the rise, and the status of tourism is increasing. In terms of growth rate, the growth rate of tourism is generally higher than that of agriculture. Except for Shanghai, Jiangsu, and Jiangxi, the average annual growth rate is more than 50%. Tourism has developed rapidly in recent years; agricultural growth is relatively slow, and even negative growth occurs. The average annual growth rate is -0.1242, and the development of agriculture has already reached a stalemate. The integration of agriculture and other industries has become the focus of future agriculture. The tourism industry is a comprehensive and strong industry, and it is the best choice for the integration of agriculture and other industries.

Table 3. Measurement Results and Ranking of Comprehensive Evaluation Values of Agricultural Tourism in the Middle and Lower Reaches of the Yangtze River

area	Agricultural comprehensive evaluation value						Comprehensive evaluation value of tourism					
	2013	2014	2015	2016	2017	Ranking	2013	2014	2015	2016	2017	Ranking
Shanghai	0.560	0.555	0.641	0.446	0.446	4	0.229	0.177	0.264	0.547	0.888	4
Jiangsu	0.697	0.266	0.368	0.341	0.323	7	0.397	0.370	0.438	0.483	0.637	3
Zhejiang	0.652	0.557	0.551	0.535	0.368	3	0.133	0.231	0.370	0.518	0.710	5
Anhui	0.321	0.455	0.719	0.706	0.520	2	0.584	0.223	0.319	0.321	0.454	7
Jiangxi	0.474	0.536	0.681	0.608	0.546	1	0.185	0.306	0.462	0.647	0.835	1
Hubei	0.484	0.513	0.509	0.438	0.483	5	0.090	0.280	0.475	0.618	0.961	2
Hunan	0.608	0.405	0.387	0.357	0.412	6	0.079	0.131	0.282	0.506	0.935	6

3.3 Temporal and Spatial Evolution Characteristics of Coordination Degree of Rural Tourism

From the formula (9), (10) coupling coordination degree model, this paper calculates the relevant indicators of the coupling coordination degree of rural and rural areas in the middle and lower reaches of the Yangtze River in 2013-2017, see Table 4.

Table 4. Coordination degree of agricultural tourism in the middle and lower reaches of the Yangtze River

area	C					D				
	2013	2014	2015	2016	2017	2013	2014	2015	2016	2017
Shanghai	C ₄	C ₃	C ₄	C ₄	C ₄	On the verge of dys	On the verge of dys	Intermediate	Good	Good
	0.9081	0.8562	0.9088	0.9948	0.9436	0.5986	0.5596	0.6410	0.7030	0.7933
	C ₄	C ₄	C ₄	C ₄	C ₄	Reluctant	Reluctant	Primary	Intermediate	Intermediate
Jiangsu	0.9616	0.9867	0.9962	0.9850	0.9448	0.7253	0.5601	0.6337	0.6372	0.6734
	C ₄	C ₄	C ₄	C ₄	C ₄	Intermediate	Reluctant coordination	Primary coordination	Primary	Primary
	0.7500	0.9106	0.9804	0.9999	0.9485	0.5424	0.5989	0.6719	0.7255	0.7150
Zhejiang	C ₃	C ₄	C ₄	C ₄	C ₄	Reluctant	Reluctant	Primary	Intermediate	Intermediate
	0.9571	0.9398	0.9229	0.9273	0.9977	0.6580	0.5646	0.6924	0.6900	0.6971
	C ₄	C ₄	C ₄	C ₄	C ₄	Primary	Reluctant coordination	Primary	Primary	Primary
Jiangxi	0.8985	0.9620	0.9815	0.9995	0.9778	0.5442	0.6367	0.7486	0.7921	0.8216
	C ₄	C ₄	C ₄	C ₄	C ₄	Reluctant	Primary	Intermediate	Intermediate	Good
	0.7277	0.9560	0.9994	0.9853	0.9437	0.4569	0.6156	0.7014	0.7214	0.8255
Hubei	C ₃	C ₄	C ₄	C ₄	C ₄	On the verge of dys	Primary	Intermediate	Intermediate	Good
	0.6383	0.8601	0.9875	0.9850	0.9215	0.4683	0.4800	0.5748	0.6519	0.7878
	C ₃	C ₄	C ₄	C ₄	C ₄	On the verge of dys	On the verge of dys	Reluctant	Primary	Intermediate
Hunan	C ₄	C ₃	C ₄	C ₄	C ₄	Primary	Reluctant	Intermediate	Intermediate	Intermediate

3.3.1 Time Series Characteristics of Coordination Degree of Rural Tourism

This paper takes 2013-2017 as the time period for the research on the integration of agricultural tourism. During this period, China pays close attention to the issue of “agriculture, rural areas and farmers” and fully promotes the tourism poverty alleviation policy, which provides a favorable policy environment for the integrated development of agriculture and tourism.

It can be seen from Table 4 that during the study period, the coupling degree of the middle and lower reaches of the Yangtze River gradually increased, and the regional average increased from 0.8368 to 0.9362, an increase of 11.88%. In 2017, all provinces (municipalities) reached a high level of coupling. The coordination coefficient of the whole region increased from 0.5354 to 0.7793, an increase of 48.03%, which was at a moderate coordination level, and there was still a certain distance from the quality coordination. From the perspective of the trend of coordination in 2013-2017, the coordination degree of provinces (municipalities) in the study area generally showed an increasing trend, but the increase was not obvious, and the coupling and development of agriculture and tourism was hindered.

From the perspective of coupling coordination level, the coordination level of agricultural tourism in all provinces (municipalities) in the study area has risen rapidly. On the whole, the degree of coupling coordination has increased by more than three, among which the coupling of agriculture and tourism in Jiangxi and Hubei provinces. Coordinated development is the best and has achieved good coordination. In addition, the coordination degree of agricultural tourism in Anhui Province has risen slowly, and it is only in the primary coordination stage during the study period.

3.3.2 Spatial Differentiation Characteristics of Coordination Degree of Rural Tourism

From the perspective of regional differences, the coupling degree of agricultural tourism in inland areas is ahead of the spatial pattern of developed coastal areas. The coupling and coordination levels of Hubei and Jiangxi provinces have reached a good coordination stage, gradually moving closer to quality coordination, while coastal areas have been in a state of intermediate coordination fluctuations. This difference indicates that the agricultural environment of the inland provinces (municipalities) is more compatible with the integration of tourism, while the level of integration of coastal agriculture and tourism is less balanced, mainly due to the weak emphasis on agriculture and tourism.

From the perspective of inter-provincial differences, most provinces are in a moderate coordination stage, and the differences between provinces are gradually decreasing. The provinces with rich tourism resources have a relatively high degree of coupling between agriculture and tourism, indicating that the tourism environment plays an important role in the development of agricultural tourism.

4. Analysis of Factors Affecting the Development of Rural Tourism Integration

This In order to better explain the law of integration of agricultural tourism, this paper takes the coordination degree of agricultural tourism as the dependent variable (Y), the factors affecting the integration of agricultural tourism as the independent variable (X1-X12), and the use of the Yangtze River Economic Belt and the Yellow River Economic Belt 20 The agriculture and tourism data of the province (municipality), and the construction of the panel model to observe the impact factors of the rural tourism integration.

After unit root test and Hausman test on panel data, an individual fixed effect model was established and regression analysis was performed. The results are shown in Table 5.

From the regression results of the model, we can see that the coupling degree between agriculture and tourism has a long-term balanced relationship with the level of tourism and agricultural economic development, the status quo of development and the contribution to social and economic development. Among the factors affecting the integration of agricultural tourism, the total power of agricultural machinery (X1), agricultural labor (X4), per capita disposable income of farmers (X5), the proportion of primary industry (X6), per capita tourism consumption (X10), star rating The number of hotels (X11) and the proportion of the tertiary industry (X12) are significant at the 1% level and are positively correlated with the degree of coupling coordination. Among them, the tertiary industry has

the largest ratio of occupation, the per capita disposable income of farmers is the second, and the agricultural labor force is the smallest, indicating that the scale of tourism development and the effect of agricultural development play an important role in the integration of agriculture and tourism. The rapid growth of tourism scale provides a material basis for the tourism industry to extend the agricultural industry. In the process of tourism to the agricultural industry, it promotes the development of agricultural economy. Farmers feel the economic benefits brought by tourism and compete for the integration of agricultural tourism. Add bricks and tiles.

Table 5. panel model regression results

obs	coefficient	t	p
C	0.342929	13.03288	0.0000
X ₁	0.375572	5.237810	0.0000
X ₂	0.255139	2.473379	0.0153
X ₃	0.067577	0.688150	0.0493
X ₄	0.267028	2.982182	0.0037
X ₅	0.446579	2.467665	0.0016
X ₆	0.466282	3.891820	0.0002
X ₇	0.191019	0.561404	0.0576
X ₈	0.215118	2.568762	0.0119
X ₉	0.543387	1.590463	0.1154
X ₁₀	0.313770	3.186956	0.0020
X ₁₁	0.407796	2.890632	0.0049
X ₁₂	0.539062	4.731833	0.0000

5. Conclusions and Recommendations

5.1 Conclusion

This paper first analyzes the mechanism of the coupling development of agriculture and tourism, constructs a scientific index system of agricultural tourism integration, selects the 2013-2017 agricultural tourism integration data of the middle and lower reaches of the Yangtze River in the active farming culture area as a sample, and calculates the provinces (municipalities) of the study area. Coordination degree, study the coupling relationship between agriculture and tourism, and get the following conclusions:

(1) The changes in the comprehensive agricultural evaluation values of the provinces (municipalities directly under the central government) in the middle and lower reaches of the Yangtze River vary greatly, but the average value is basically above 0.45, while the comprehensive evaluation value of tourism has grown rapidly, with an average growth rate of 46.1%, indicating that tourism has been in recent years. The research area is developing rapidly, and the agricultural development has experienced a slow growth rate.

(2) During 2013-2017, the coupling degree of each province (municipality) in the study area was basically greater than 0.9, indicating that there is a close relationship between agriculture and tourism, and this relationship is gradually increasing in time series, but there is a certain Regional Differences. In general, agriculture and tourism are more closely linked in inland areas. The inland areas are relatively backward in overall economic level, mainly relying on the development of the primary industry and the tertiary industry; while the eastern coastal areas are relatively developed in economy, rich in industrial resources, and high-tech industries are intensive, and the emphasis on agriculture is not as high as in the Yellow River Economic Belt. .

(3) Agriculture and tourism have a strong relationship, and in a certain environment, the two can coordinate development. During the study period, the coordination degree of rural-urban tourism in the middle and lower reaches of the Yangtze River was generally fluctuating, and the average coupling degree of agricultural tourism was 0.9264. The average growth rate of coordination was 0.1219. The coupling effect of agriculture in tourism was relatively good.

5.2 Policy Implications

In order to further promote the positive interaction between agriculture and tourism in the middle and lower reaches of the Yangtze River, and promote the integration of rural tourism and tourism, and promote the efficient implementation of the rural revitalization strategy, this paper proposes the following aspects:

(1) Increase investment in rural tourism integration projects. The Yellow River Yangtze River Basin is the birthplace of farming culture and rich in agricultural resources. It is the epitome of China's agricultural development. At present, it faces the problem of low agricultural economic benefits and single development mode. The integration of agricultural tourism is a major boost to the transformation of agricultural development mode. Tourism integration projects can stimulate agricultural development and promote regional economic growth.

(2) Exerting the advantages of location and integrating farming and tourism according to local conditions. Characteristic agriculture and characteristic tourism will become the focus of the integration of agricultural tourism. According to the different characteristics of the provinces in the middle and lower reaches of the Yangtze River, the way of integration of agriculture and tourism development should be different. Different folk customs in different provinces should be combined with local agricultural development. Characteristic tourism activities, the construction of characteristic agricultural industrial bases in various provinces, and the introduction of a large number of high-quality talents for guidance.

(3) Optimize the industrial chain model of the integration of agriculture and tourism. Agriculture and tourism are both people's livelihood industries. We should vigorously develop rural tourism and form an industrial chain integrating production, processing, sales, service and sightseeing experience. Focus on the standardization and institutionalization of the management model, strengthen the unified training management of rural tourism practitioners, form a corporate management system; develop four-year farm tourism projects to solve the problem of seasonal visitor traffic differences.

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