

GIES Case Dataset on Conghua Litchi in Subtropical Hills in Jiangpu Town, Guangdong Province of China

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Abstract: The prosperity of litchi cultivation in Conghua district, Guangdong province began in the Ming and Qing dynasties. Conghua is located in the central part of Guangdong province and adjacent to the mountainous land in north and the Pearl River delta plain in south. The annual average precipitation is about 2,000 mm and the annual average sunshine is about 1,600 hours, with superior hydrothermal conditions. As one of the largest litchi producing areas in Guangdong province, Conghua has an annual yield of about 65,000 tons in 2021, with a value of two billion Yuan (RMB). Jingganghongnuo litchi, as a high-quality cultivated variety, retains its high-quality flavor while stabilizing production and resisting diseases. In June 2021, Jingganghongnuo litchi was assigned the international certification of the League Standard as a five-star brand. The case study area, Jiangpu town in Conghua, has 44.6 km² of litchi planting area, which is a pioneering demonstration area for the litchi standardization and digital industrial park. The dataset includes the administrative boundary data of the case study area, the physical geographic data, the litchi variety attribute data, the product growth environment monitoring data, the operation management data and related technical specifications. The dataset is archived in .shp, .tif, .pdf, .xlsx and .jpg data formats.

Keywords: Conghua; Jingganghongnuo litchi; sub-tropical; Hills; GIES Case 8

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1 Introduction

Litchis mainly grow between latitudes 17° to 23° both in south and north latitudes. Conghua district is located in the transition zone between the Nanling Mountains and the Pearl River delta plain. It is one of the main litchi growing areas in China. In 1981, Conghua was listed as one of the seven key litchi counties in the country¹. In 2009 and 2011, litchis fruit and litchi honey produced in Conghua were respectively designated as the Geographical Indication^{2,3}; since then, two varieties (Jingganghongnuo, Feizixiao) won the title of Guangdong Famous Agricultural Products^{4,5}; Conghua litchi won the certification trademark of national geographical indication in 2020 and was selected as an most suitable area for special agricultural products in Guangdong province⁶ in 2021, when over 65,000 tons of litchis were produced, with a total output value of about two billion RMB.

Jiangpu town of Conghua has a population of 87,000. It has 21 administrative villages and 12 neighborhood committees. It is located near to Liuxi river. The terrain is dominated by low mountains and hills within 100 m above sea level and area of 127 km², of which the litchi planting area is 44.63 km², accounting for about 35% of the area. In June 2020, the Litchi Expo Park was established in Jiangpu.

2 Metadata of the Dataset

The metadata summary of Congjiang litchi Jiangpu street subtropical low hills case dataset on ecosystem protection and sustainable development^[1] is listed at Table 1.

3 Methods

The Congjiang litchi Jiangpu town subtropical low hills case dataset was developed based on the following data: (1) vector data of Conghua district and Jiangpu town; (2) true color image of Jiangpu town from Sentinel-2 L2A; (3) 10-m NDVI of Jiangpu town based on Sentinel-2 L2A; (4) Jiangpu town land use based on Sentinel-1 GRD and Sentinel-2 L2A; (5) Soil Sub Center of National Earth System Science Data Center⁷; (6) 12.5-m DEM of the ALOS of Jiangpu town; (7) Conghua district annual average temperature, cumulative precipitation, annual sunshine hours data, from 2000–2020 Guangzhou Statistical Yearbook; temperature, precipitation data in 2020 and 2021, from National Basic Meteorological Station (Guangzhou, 59287); precipitation, soil moisture, and EC data from in situ observation. The flowchart of dataset development is shown in Figure 1.

¹ Conghua District People's Government. From the middle of June, litchis began to be listed intensively (2021.6) [OL]. http://www.conghua.gov.cn/zwgk/chyw/content/post_7199723.html.

² China National Intellectual Property Administration. Announcement on approving the implementation of geographical indication product protection for Qiangang glutinous rice fin, Tang Yuan leek yellow, Minle purple skin garlic, Yecheng walnut, Yingji Sha Semati dried apricot. (2009) [OL]. <https://dlbzl.hizhuanli.cn:8888/Product/Detail/333>.

³ China National Intellectual Property Administration. Announcement on approving the implementation of geographical indication product protection for Changping strawberries, Fugang apples, dianzi red dates, Conghua lychee honey and Liupao tea (2011) [OL]. <https://dlbzl.hizhuanli.cn:8888/Product/Detail/166>.

⁴ Guangdong famous brand product network. "Cantonese brand" agricultural brand catalog: Jinggang Hongnuo [OL]. <http://gdmpxt.org/mp/product/13319.html>.

⁵ Guangdong famous brand product network. "Cantonese brand" agricultural brand catalog: Feizixiao [OL]. <http://gdmpxt.org/mp/product/2624.html>.

⁶ Department of Agriculture and Rural Affairs of Guangdong Province. Notice on the Announcement of the list of advantageous zones for characteristic agricultural products in Guangdong province [OL]. http://dara.gd.gov.cn/tzgg2272/content/post_3456847.html.

⁷ Soil Sub Center, National Earth System Science Data Center, National Science & Technology Infrastructure of China. <http://soil.geodata.cn>.

4 Data Result

4.1 Dataset Composition

This dataset consists of three parts: boundary and physical geographic data; variety attribute and management data; and historical data.

4.2 Boundary and Physical Geographic Data

Jiangpu town is located in the east of Conghua district, central Guangdong province (Figure 2), between 113°17'E–114°04'E and 23°22'N–23°56'N. The area is 131 km².

Table 1 Metadata summary of Congjiang litchi Jiangpu street subtropical low hills case dataset on ecosystem protection and sustainable development

Items	Description
Dataset full name	Congjiang litchi Jiangpu street subtropical low hills case dataset on ecosystem protection and sustainable development
Dataset short name	ConghuaLitchiCase08
Authors	Wang, J. N., Guangzhou University, jnwang@gzhu.edu.cn Luo, Y. Y., Guangzhou University, 2112001073@e.gzhu.edu.cn Tan, Z. X., Guangzhou University, 2112001056@e.gzhu.edu.cn Ouyang, J. Z., Guangzhou Conghua Hualong Fruit and Vegetable Preservation Co., Ltd., 13902323212@163.com Liu, R. B., Guangzhou Conghua Hualong Fruit and Vegetable Preservation Co., Ltd., 13926146622@163.com Zhu, Z. W., Guangzhou University, 2112101056@e.gzhu.edu.cn Liu, H. D., Guangzhou Conghua Village Agriculture and Rural Bureau, 14290485@qq.com Jiang, J. F., Guangzhou University, 2112101060@e.gzhu.edu.cn
Geographical area	Jiangpu street, Conghua village, Guangzhou, Guangdong province
Year	2000–2021
Spatial resolution	10 m
Data format	.shp, .tif, .xlsx, .docx, .jpg
Data size	53.8 MB (after compression)
Data files	Regional boundaries, physical geographic data, product data, industrial development data
Data publisher	Global Change Research Data Publishing & Repository, http://www.geodoi.ac.cn
Address	No. 11A, Datun Road, Chaoyang District, Beijing 100101, China
Data sharing policy	Data from the Global Change Research Data Publishing & Repository includes metadata, datasets (in the <i>Digital Journal of Global Change Data Repository</i>), and publications (in the <i>Journal of Global Change Data & Discovery</i>). Data sharing policy includes: (1) Data are openly available and can be free downloaded via the Internet; (2) End users are encouraged to use Data subject to citation; (3) Users, who are by definition also value-added service providers, are welcome to redistribute Data subject to written permission from the GCdataPR Editorial Office and the issuance of a Data redistribution license; and (4) If Data are used to compile new datasets, the 'ten per cent principal' should be followed such that Data records utilized should not surpass 10% of the new dataset contents, while sources should be clearly noted in suitable places in the new dataset ^[2]
Communication and searchable system	DOI, CSTR, Crossref, DCI, CSCD, CNKI, SciEngine, WDS/ISC, GEOSS

4.2.1 Climate Data

The case area is located the transition area between middle sub-tropical and south sub-tropical zones, with the sub-tropical monsoon climate. The 20-year average precipitation from 2000 to 2020 was 1,992.7 mm, the annual average temperature was 21.5 °C, and the annual average sunshine was 1,588.1 hours (Figure 3).

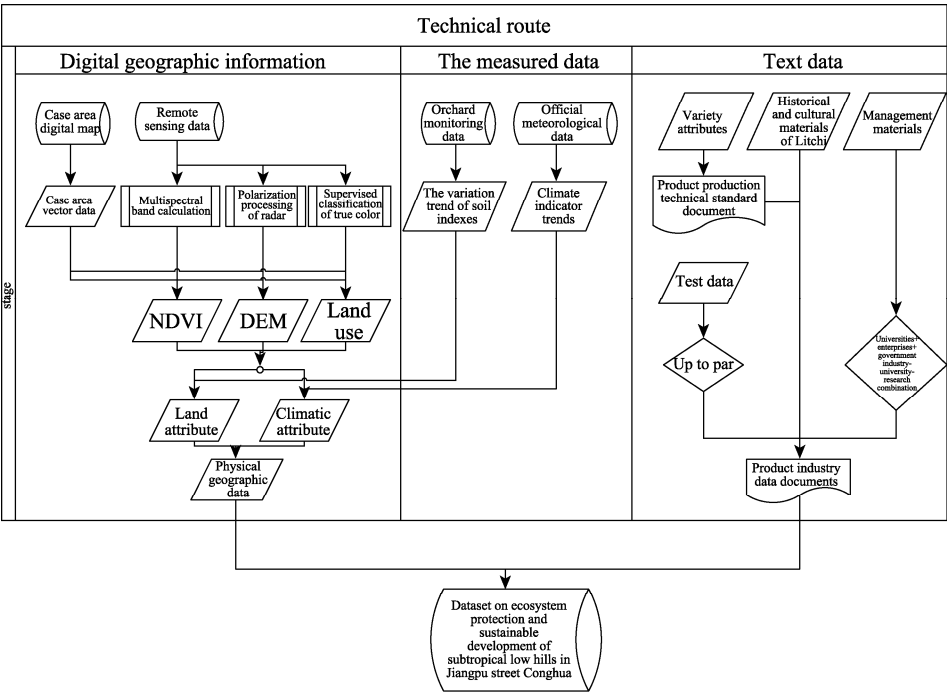


Figure 1 Flowchart of the dataset development

The suitable growth temperature for litchis is 23–29 °C, and litchi grows slowly when the temperature is 10–12 °C. There should be a period of low temperature in winter for litchi to hold down the vegetative growth and to promote the differentiation of flower buds. Litchi begins to bloom when the temperature is above 10 °C in spring, and the flowering is most prosperous when the temperature is 18–24 °C. If the temperature is low and rainy during the flowering period and the young fruit period, it will cause a large number of inferior flowers and fruits, or even lose all harvests^[3]. Based on the analysis of the annual precipitation and temperature observation data in 2000 (Figure 4), the temperature at the beginning of 2000 was stable and the flower buds differentiated smoothly.

4.2.2 Terrain, Soil and Land Use

Conghua district is connected to the mountainous area in the north and the Pearl River delta plain in the south. It belongs to the transition zone between mountainous area and plain.

According to the 12.5-m resolution DEM of ALOS satellite (Figure 5), the terrain in Jiangpu of Conghua is high in the southeast and low in the northwest, composed of low mountains, hills and alluvial plain. The main soil types in Jiangpu are acid lateritic red soil and fluvo aquic soil formed by rivers (Figure 6^[4]), both soils are suitable for litchi cultivation.

In addition to soil properties and fertility, soil temperature, humidity, pH and EC indicators (water-soluble salt indicators) also affect litchi growth. According to the monitoring station data (Figure 7), soil temperature, soil moisture, and water-soluble salt indicators for January–November 2021 were analyzed.

The analysis results of two soil samples from Litchi Expo Park ($23^{\circ}34'53''\text{N}$, $113^{\circ}37'7''\text{E}$) showed that these soil samples meet the national soil quality standard for agricultural land (GB15618—2018)^[5] (Table 2).

The potential land suitable for litchi planting in Jiangpu town (0–100 m a.s.l.) is 78.35 km² (Figure 8), accounting for 60% of the area; but the actual land for litchi planting is about 55 km², because 21.58 km² of the land is already built-up surface (Figure 9).

In addition, we developed NDVI using Sentinel-2 L2A data of Jiangpu town (Figure 10). The average NDVI of Jiangpu town is 0.633, higher than that of Guangdong province, which is 0.54. This suggests that the vegetation coverage in Jiangpu town is generally better than other places in Guangdong provinces.

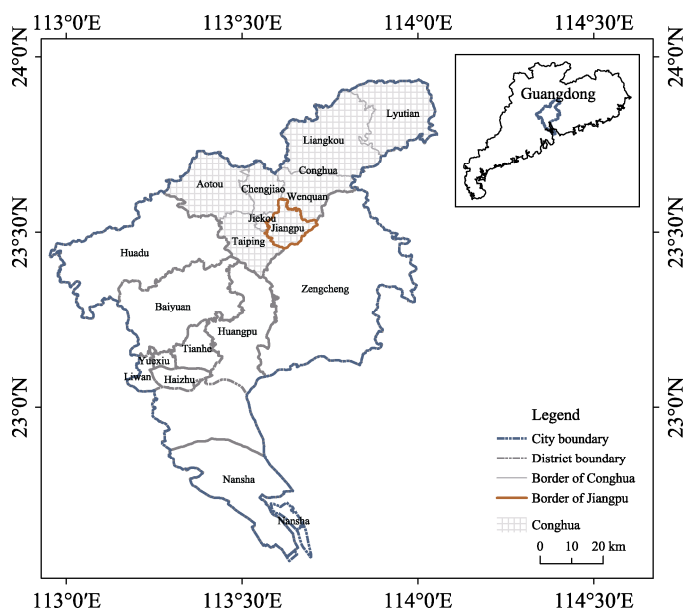


Figure 2 Map of geographical location of Jiangpu town

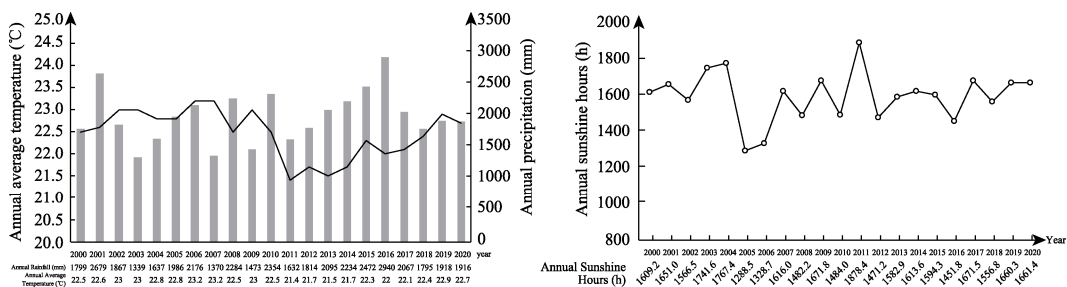


Figure 3 The annual average temperature, precipitation and sunshine of Jiangpu town in the past 20 years

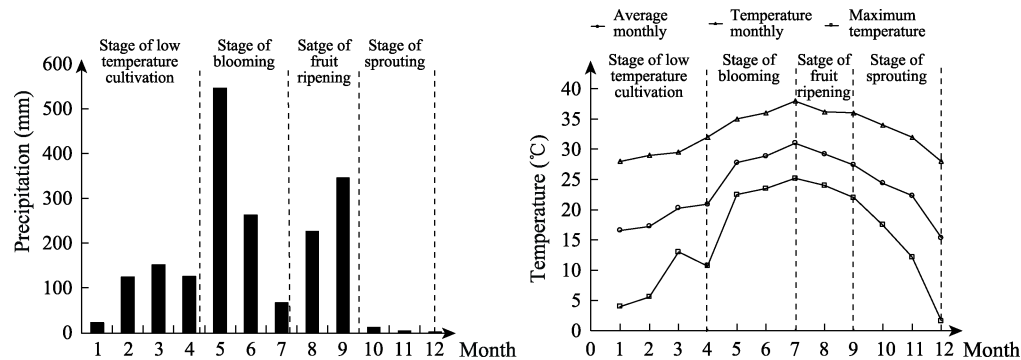


Figure 4 Average monthly temperature and precipitation in central Guangdong in 2020

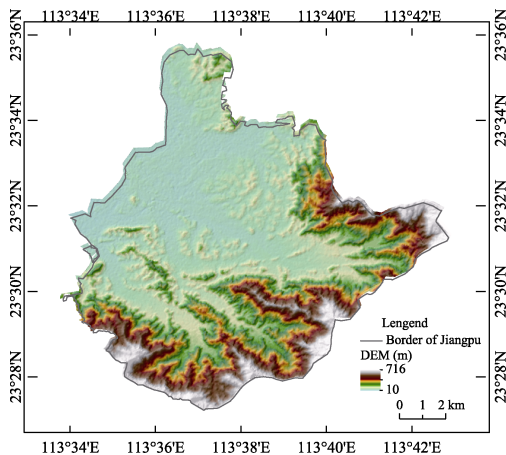


Figure 5 Map of altitude distribution

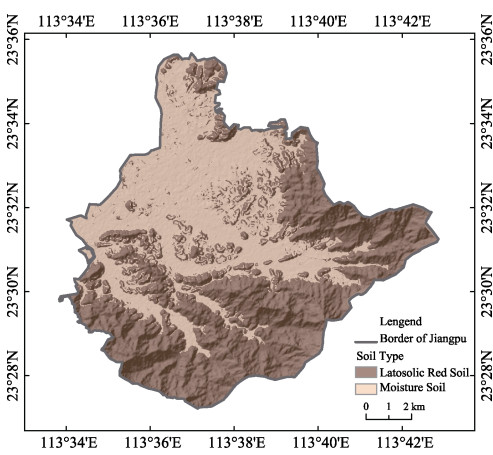


Figure 6 Distribution map of soil types: Fluvo aquic soil, Latosolic red soil

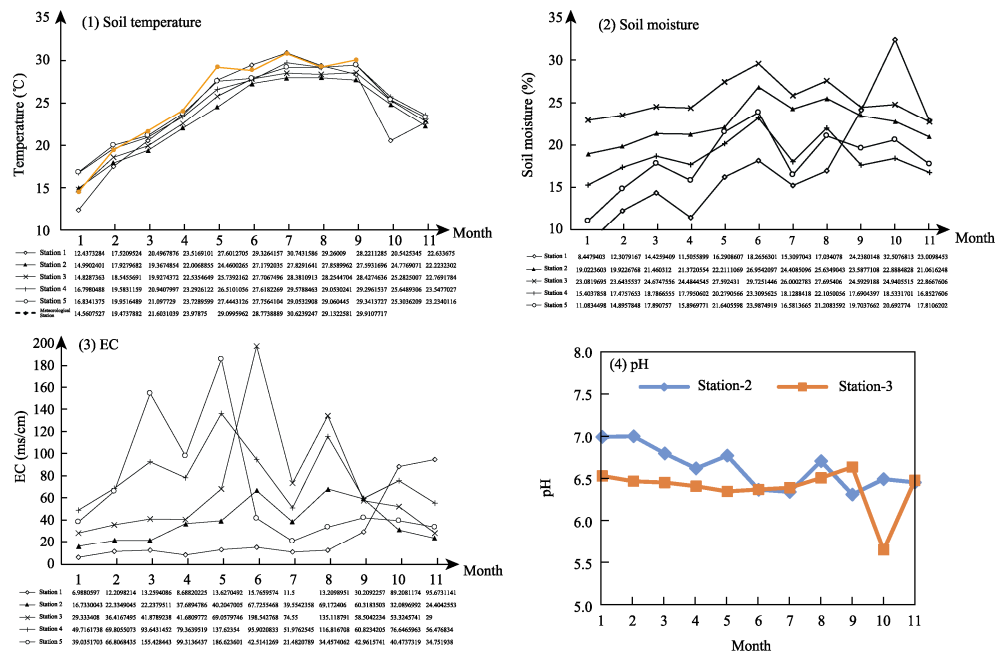


Figure 7 Jiangpu town monitoring station data in 2021

Table 2 Soil element composition in the case area

Test items	Test results	Unit	Test standard
Hg	0.036	mg/kg	GB/T 17136—1997
As	2.0	mg/kg	GB/T22105.2—2008
Pb	15.7	mg/kg	GB/T 17141—1997
Cd	0.048	mg/kg	GB/T 17141—1997
Cr	Not detected (lower limit of determination: 16)	mg/kg	HJ 491—2019
Cu	Not detected (lower limit of determination: 4)	mg/kg	HJ 491—2019
Ni	Not detected (lower limit of determination: 12)	mg/kg	HJ 491—2019
Zn	29	mg/kg	HJ 491—2019

4.3 Litchi Variety and Product

The litchi variety Jिंगganghongnuo belongs to sapindaceae and litchi is an evergreen tree. It is an excellent new litchi variety selected from excellent litchi seedlings by the School of Horticulture, South China Agricultural University^[6]. This variety is resistant to fruit cracking and litchi frost epidemic Mildew. It has thick pulp, rounded crown, vigorous tree vigor, average leaf length 8.98 cm, width 3.11 cm, petiole length 0.62 cm, prominent main vein, inconspicuous lateral veins, wavy leaf edge, green leaf. Male flowers open first and then female flowers, mostly in short inflorescences. The fruit is bright red and uniform in color, the fruit is heart-shaped with crooked shoulder. The average thickness of the peel is 1.62 mm, and the fruit is not dehiscent; the lobes are large and slightly prickly. The average fruit weight is 23.5 g. The coke nucleus rate is about 80%. The pulp is waxy, translucent, tender, refreshing, not juicy, with an average soluble solid content of 20.0%.

Litchi shoots four times a year: from the end of March to early April; mid and late May; mid and late July; and mid and late September respectively. The first flowering period is in early April, the full bloom period is in mid-April, the end flowering period is in the middle and late April, and the fruit matures in the middle and late July (Figure 11–14)^[7].

Litchi fresh fruit has a short shelf time so the litchi dried fruit is an important way to ensure income in the litchi industry^[8]. The main methods to dehydrate litchis are sun-drying, fire-roasting and hot-air drying. The main method used in Conghua (Figure 15) is sun-drying after fire-roasting. The dried fruit has a reddish-brown husk with a uniform color, a light

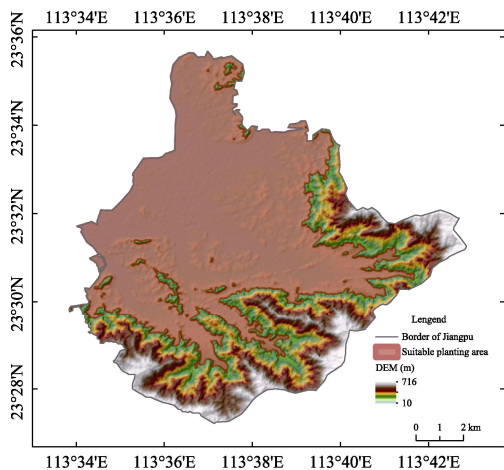


Figure 8 Distribution map of suitable planting sites

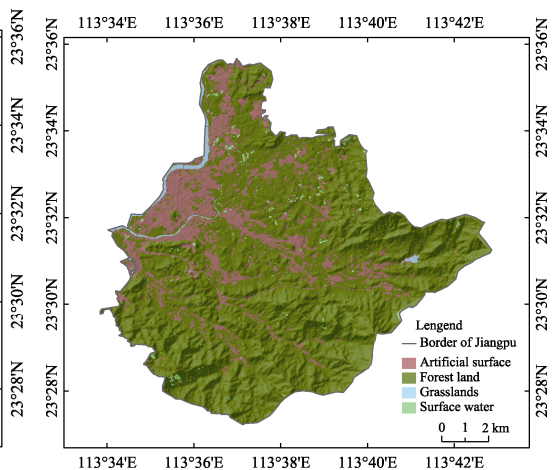


Figure 9 Distribution map of land use

brown and glossy pulp, and a complete and uniform fruit size; the water content is less than 25%, the sugar content is more than 50%, and the citric acid is less than 1.5%.

The wet habitat renders litchi very prone to some diseases. According to statistics, there are more than 140 kinds of common litchi diseases, insect pests and weeds in China^[9]. Therefore, pesticides, growth regulators and other chemicals are normally used in the cultivation of litchi. To ensure the litchi quality, the samples of Jinggang Hongnuo in the case area were set to the authoritative institution for testing. The test results showed that all the elements such as lead, fenamiphos, phosphatophos, and permethrin meet the national standard requirements. The main data and related national standards are shown in Table 3.

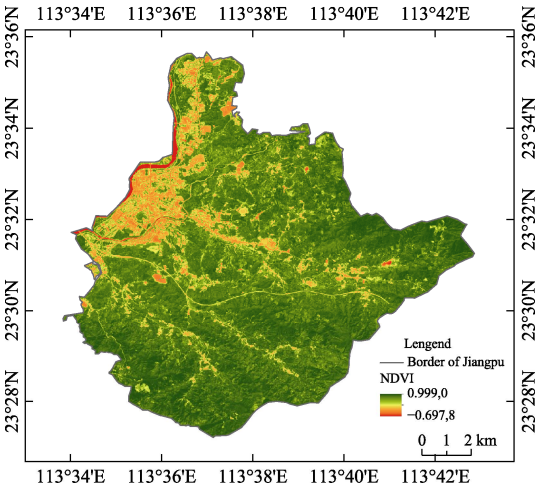


Figure 10 NDVI distribution map of Jiangpu town



Figure 11 Young fruit development period



Figure 12 Fruit development period



Figure 13 Premature drop period

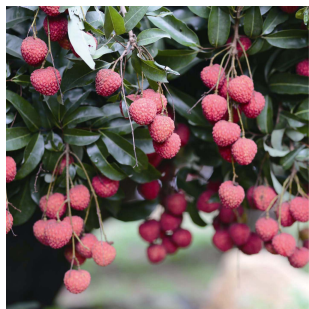


Figure 14 Fruit ripening period



Figure 15 Dried litchis from Conghua

4.4 Culture and History

Conghua is a well-known “hometown of litchis” in China. The records of litchi cultivation can be traced back to more than 200 years ago. According to Conghua County Records, Property Records in the eighth year of Yongzheng (1730): of the thirty-five major fruits in Conghua, litchi is the best, with a small core and plump pulp. Qu, Dajun, a writer in the late Ming and early Qing dynasties, in The Litchi Poems of Guangzhou, he described his missing

of not eating litchi for five years and the joy of sharing litchi with old friends after five years. Mao, Jike, a scholar in the Qing dynasty, wrote a well-known essay, The Story of Litchi in Guanlan Pavilion, which vividly described his experience of tasting litchis in Conghua. The essay Litchi Honey by Yang, Shuo, a famous contemporary prose master, even spread the fame of Conghua litchi to the whole country.

Table 3 Statistics of chemical residue detection in Jingganghongnuo samples

No.	Test items	Unit	Test results	The limit of quantitation	Standard requirement	Conclusion	Test standard
1	Pb	mg/kg	0	0.02	≤0.1	qualified	GB 5009.12—2017
2	phenophos	mg/kg	0	0.02	≤0.02	qualified	GB 23200.8—2016
3	phosphate	mg/kg	0	0.01	≤0.01	qualified	GB 23200.8—2016
4	perphos	mg/kg	0	0.025,0	≤0.05	qualified	GB 23200.8—2016
5	permethrin	mg/kg	0	0.012,6	≤2	qualified	GB 23200.8—2016
6	mycophos	mg/kg	0	0.05	≤0.05	qualified	GB 23200.8—2016
7	dichlorvos	mg/kg	0	0.075,0	≤0.2	qualified	GB 23200.8—2016

As early as before the founding of the People's Republic of China, there were more than 10,000 mu (about 666.67 ha) of litchi planting area in Conghua, which was an important source of income for local farmers. After decades of tepid development, the country began to shift its focus to economic development in 1978. Since then, Conghua has vigorously developed the litchi planting. By 1981, the planting area had grown to 24,100 mu (about 1,606.67 ha), ranking among the seven key litchi counties in China. The development upsurge of cultivating litchis in the mountains quickly set off. By 1996, the litchi planting area in the whole region had increased to 109,000 mu (about 7,266.67 ha), and the Ministry of Agriculture, Animal Husbandry and Fisheries of the State Council approved Conghua as a litchi production base county. Since then, litchi production has developed in the direction of scale, industrialization and standardization. In 2004, the litchi planting area in Conghua was 236,700 mu (15,780 ha). In 2020, this number rose to 300,000 mu (20,000 ha), with an annual output of 65,000 tons and a total value of two billion RMB.

4.5 Product Management

Guangzhou Conghua Hualong Fruit and Vegetable Preservation Co., Ltd. was established in 1998. It is a key agricultural enterprise in Guangdong province, a leading agricultural enterprise in Guangzhou, a national high-tech enterprise, a new R&D institution in Guangzhou and a demonstration enterprise of new technology, with an annual income of 80 M RMB. The company has deeply invested in the litchi planting industry, and organized more than 3,000 farmers to market their products to European and American markets, as well as domestic supermarkets. Its own 3,500 mu (about 233.33 ha), of standardized production bases and 8,000 mu (533 ha) of partnership base have obtained the certifications of export base and green food base. The main industrial models of Hualong company are as follows.

(1) Basic road map

The whole industry chain operation mode is to build an operation system of leading enterprises represented by Hualong + cold chain supply and marketing cooperatives + local wholesalers + 2,000 fruit farmers in the whole region⁸, and establish production + processing + technology + marketing (brand) litchi. In addition, build the secondary industrial chain of

⁸ http://www.conghua.gov.cn/zwgk/tpxw/content/post_7349905.html.

dried litchis, canned litchis, and litchi wine, and foster the largest litchi processing industry in Guangdong province.

(2) Variety upgrading

At present, the large area of Conghua is still dominated by old variety *Sophora japonica* with low yield and quality. In 2017, Conghua began to promote the high inoculation of *Jinggang Hongnuo* for variety update. According to the Guangdong Provincial Crop Variety Approval Committee (Tropical Product Approval No. 2015004), the new variety is of late maturity, excellent quality, crack resistance and storage resistance, high yield and stable yield, high coke core ratio, and a harvestable period of 25 days. By 2020, the updated area of the whole village will be 26,000 mu (about 1,733.33 ha), and it is expected that the updated area will reach 50,000 mu (about 3,333.33 ha) within 5 years. In the process of improving Jingganghongnuo by high seeding and replanting, the per-mu yield increased by 15,000 RMB, which has benefited 1,000 farmers with the average added income of 30,000 RMB per household. Once the update is completed, the region is expected to increase revenue by 500 million RMB.

(3) Application of new technology in litchi production

In June 2020, the Conghua Litchi Cultural Expo Park (referred to as Litchi Expo Park) was established. This Park and its Industrial Research Institute is a pioneer in agricultural technology innovation, where the advanced sensors, drones, internet of things and other high technologies (Figure 16, 17) were applied to the management of litchi growth cycle.

(4) Linking litchi industry to tourism

Litchi industry and agricultural tourism promote each other. It is important to fully tap the litchi cultural resources, tell a good litchi story, promote the development of culture and tourism through production, and use the litchi museum, characteristic orchard, and litchi cultural and creative base as the medium to showcase the application of advance techniques in agriculture. Conversely, leisure tourism, farming experience, and litchi culture promotion will promote the popularity of Conghua litchi.

5 Discussion and Conclusion

The unique eco-geographical environment of subtropical low mountains and hills in Conghua district, Guangzhou city, Guangdong province ensures the growth and development of high-quality litchis. As a national geographical indication product, litchis have been

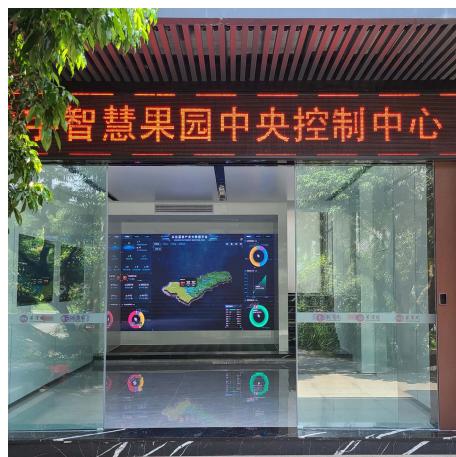


Figure 16 Litchi Expo Park Control Center



Figure 17 Monitoring station of Litchi Expo Park

inherited in Conghua for hundreds of years, and have accumulated several generations of production experiences. These experiences have long been integrated into the local life and culture. Farmers, enterprises and the government are confident to promote the further development of the litchi industrial culture. The Congjiang litchi Jiangpu street subtropical low hills case dataset on ecosystem protection and sustainable development developed by this case team collected the physical geography data, product attribute data and production and operation knowledge in the production and operation process of the litchi industry in Jiangpu street, Conghua, deeply excavated the local historical and cultural background of litchi, and analyzed the interdependence between the cultivation of litchi and the ecological environment. Through systematic interpretation, a healthy litchi industry development plan will be established to help farmers and enterprises improve their income levels, stimulate local economic development, and inherit local characteristic litchi culture.

Authors Contributions

Wang, J. N., made the overall design for the development of the dataset, Luo, Y. Y. made a data analysis to draw conclusions; Tan, Z. X. collected and processed physical geographic data and monitoring station data; Ouyang, J. Z. and Liu, R. B. collected litchi and orchard production management information; Liu, H. D. collected industry Development background data; Zhu, Z. W. and Jiang, J. F. collect and analyze geographic and humanistic data.

Conflict of Interest

The authors declare no conflicts of interest.

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