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GIES Case Study on Guangfeng Majia Pomelo Subtropical Low Mountains and Hills

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Abstract: The cultivation history of Guangfeng Majia Pomelo can be traced back to the Chenghua period of the Ming Dynasty, named after the mother tree located in Majia village, Danan Town, Guangfeng District, Jiangxi Province of China. Majia Pomelo is a local excellent variety that has evolved over a long period of time in the specific geographical environment of Guangfeng. It has the characteristics of being sweet and juicy, with tender flesh, rich in lycopene and trace elements. This article summarizes and analyzes Geographical Indications Environment & Sustainability (GIES) model of Guangfeng Majia Pomelo from the geographical location and ecological environment of the Majia Pomelo planting area, the characteristics and quality, as well as the development and management of Majia Pomelo industry, through detailed scientific data. This case dataset consists of boundary of the study area, data of physical geography and ecological environment, Majia Pomelo quality characteristic detection data, socio-economic data, etc. The dataset is archived in .shp, .xlsx, .tif formats, and consists of 166 data files with data size of 141 MB (Compressed into one file with 57.8 MB).

Keywords: Guangfeng District; Majia Pomelo; geographical indications; ecological environment protection; sustainable development; Case 18

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[2] Zhu, Y. Q., Gong, Z. Z., Yao, H., *et al*. GIES case dataset on Guangfeng Majia Pomelo subtropical low mountains and hills [J/DB/OL]. *Digital Journal of Global Change Data Repository*, 2024. https://doi.org/10.3974/geodb.2024.05.07.V1. https://cstr.escience.org.cn/CSTR:20146.11.2024.05.07.V1.

1 Introduction

Guangfeng District, administrated by the Shangrao City, Jiangxi Province, is located in the northeast of Jiangxi Province, at the junction of three provinces of Jiangxi, Zhejiang and Fujian. It is adjacent to Yushan County, Shangrao City in the north, Guangxin District and Xinzhou District, Shangrao City in the west, Jiangshan City, Zhejiang Province in the east, and Wuyishan City and Pucheng County, Fujian Province in the south. It belongs to subtropical monsoon climate, and is located in the low mountains and hills at the northern foot of Mount Wuyi, which belongs to half hills and half mountains. The soil types of Guangfeng District are mainly red soil, paddy soil, and purple soil, with the pH between 5.5–7.0, indicating acidic soil[1–3].

Majia Pomelo [*Citrus maxima* (L.) Osbeck cv. "Majiayou"] is a local excellent variety formed through long-term adaptation and evolution in the specific geographical environment of Guangfeng area. Its quality characteristics are sweet, juicy, tender flesh, rich in lycopene and trace elements. The National Citrus Breeding Center of China has verified that Majia Pomelo is a new variety originating from Guangfeng and its genes are distinct from other Pomelo varieties in the country. Guangfeng Majia Pomelo began planting during the Chenghua period of the Ming Dynasty (about 1472 A.D.), named after the mother tree in Majia natural village, Gucun administrative village, Danan Town, Guangfeng District, Shangrao City, Jiangxi Province. Guangfeng Majia Pomelo has successively been rated as the "first sour Pomelo" in Jiangxi Province and a famous fruit in China. It has been recognized as a "Geographical Indication of the People's Republic of China" and a "Geographical Indication of China's Agricultural Products". It also has been selected as the third batch of advantageous areas for Chinese characteristic agricultural products[4–7]. In 2023, the planting area of Majia Pomelo was 13,333 ha, with 13 planting bases over 66.67 ha and 315 bases over 6.67 ha. The average yield of Majia Pomelo per ha reached 15,000 kg, with a total output of 205 million kg. The comprehensive output value of the entire industry of Majia Pomelo exceeded 3 billion CNY, driving more than 50,000 households and an average annual income increase of 28,000 CNY[1]. Majia Pomelo has become the leading industry for rural revitalization of Guangfeng District. Guangfeng District is transforming the resource advantages of Majia Pomelo into the advantages of rural revitalization industry, promoting the integrated development of rural "First (agriculture), Second (industry), and Third (service)" industries, deepening and solidifying the "local specialties", and building Majia Pomelo into a major industry.

Scholars and industry departments have conducted a series of studies on the identification of genetic sources and genomic characteristics, variety characteristics and fruit quality, seedling planting and cultivation techniques, meteorological disaster impact and prevention, Pomelo product development and industrial development, as well as comparison with other Pomelo fruit quality[4–5,9–31]. These existing studies are of great significance for promoting the planting and industrial development of Guangfeng Majia Pomelo. However, less systematical studies on the physical geographical conditions, ecological environment, quality characteristics, management, and industrial development of the Guangfeng Majia Pomelo planting area. There is a lack of complete and available open shared data, making it difficult to trace the habitat conditions and management of Guangfeng Majia Pomelo.

Under the guidance of the GIES 2021–2030 decade action plan[32], this article conducted a case study on GIES of Guangfeng Majia Pomelo using multi-modal data, remote sensing, and geographic information technologies. The aims of this study are to elucidate and analyze the suitable physical geographical conditions and excellent ecological environment of the Majia Pomelo planting area, the unique quality characteristics of Majia Pomelo, long-standing cul-

[1] Guangfeng District People's Government. Development of the entire industry chain of Guangfeng Majiayou. 2023.

tural inheritance, modern management mode, as well as sustainable development situation of Majia Pomelo. It utilizes the Global Change Research Data Publishing & Repository to publicly disclose the systematic and correlated datasets mentioned above, providing scientific data support for consumers, industry investors, and managers of Majia Pomelo. On the basis of protecting the ecological environment, it may promote the sustainable development of the modern industry of Guangfeng Majia Pomelo, and provide a reference model for the development of other Pomelo industries in China.

2 Metadata of the Dataset

The metadata of the GIES case dataset on Guangfeng Majia Pomelo subtropical low mountains and hills is summarized in Table 1[33].

3 Case Datasets

3.1 Geographic Location and Transportation Data

Guangfeng District, under the jurisdiction of Shangrao City, Jiangxi Province, its geographical coordinate range (as shown in Figure 1) is located at 118º1′18″–118°29′15″E and 28°3′30″–28°37′23″ N, with a length of 62.5 km from north to south and a width of 45 km from east to west, covering an area of 1,377 km^2[1–3].

Guangfeng District governs 23 sub-districts and townships (including 5 sub-districts including Yongfeng, Fengxi, Lulin, Dashi, and Xiaxi, as well as 15 towns including Wudu, Yangkou, Hengshan, Tongfan, Hufeng, Danan, Paishan, Maocun, Jiandi, Quanbo, Huqiao, Xiafeng, Wucun, Shatian, and Tongboshan, and 3 townships including Dongyang, Songfeng, and Shaoyang) and Tongbashan Reclamation Farm[1–3].

In terms of transportation network, the Shanghai-Kunming Railway and the Shanghai-Kunming (Beijing-Fuzhou) high speed Railway pass through the territory of Guangfeng. There is currently one transit expressway (Shanghai-Kunming expressway), one national level road (320 national road), two provincial level roads (Ershang road and Yuguang road), and 11 county level roads in this area, with a total length of 1,791.39 km. The administrative divisions and transportation network distribution of Guangfeng District are shown in Figure 2.

3.2 Physical Geographical Data

3.2.1 Terrain and Landform Data

Guangfeng is located at the northern foot of Mount Wuyi, which is a hilly and low mountainnous area. The whole terrain gradually inclines from southeast to northwest, forming the topographic characteristics of semi mountainous and semi hilly areas. In the southeast, there are continuous mountains with overlapping peaks, with 102 peaks above an altitude of 1,000 m, and the main peak of Tongbo mountain has an altitude of 1,534.6 m. The central, northern, and western regions all belong to undulating hills with gentle terrain, and the county town has an altitude of 95 m. The lowest point in Guangfeng is the western and northern, both at an altitude of 72 m. In terms of landform types, the main rock layers in Guangfeng are quartz sandstones from the late Devonian to early Lower Carboniferous. The area is divided into landform types including erosive structures from low to medium mountains, erosive hills, weathered and eroded hills, and eroded and deposited river valleys and plains, etc. Tongbo mountain, located in the south of Guangfeng, is the largest national forest park of Danxia landform in China, accounting for about a quarter of the whole Guangfeng District[1–3]. The spatial distribution of altitude and slope in Guangfeng District are shown in Figure 3, 4 using DSM (AW3D30) data.

Table 1 Metadata summary of the dataset

Items	Description
Dataset full name	GIES case dataset on Guangfeng Majia Pomelo subtropical low mountains and hills
Dataset short name	GuangfengMajiayouCase18
Authors	Zhu, Y. Q., Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, zhuyq@igsnrr.ac.cn Gong, Z. Z., District Committee of Guangfeng, gfqwbmsk@163.com Yao, H., People's Government of Guangfeng District, gfqwbmsk@163.com Chen, J. L., District Committee of Guangfeng, gfqwbmsk@163.com Liu, X. F., District Committee of Guangfeng, gfqwbmsk@163.com Wang, X. W., People's Government of Guangfeng District, 1491288852@qq.com Ning, X. H., Development and Reform Commission of Guangfeng District, gfqfgwbgs@163.com Hong, H. H., Education and Sports Bureau of Guangfeng District, gfjys@126.com Wang, Z. F., Agriculture and Rural Bureau of Guangfeng District, jxgfxnyj@163.com Ruan, X. F., Agricultural, Cultural and Tourism Development Group Co.,Ltd. in Guangfeng District, 447390034@qq.com Wu, F. F., Majia Pomelo Science and Technology Research Center, Guangfeng District, wff_pomelo@163.com Zhu, H. Z., Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, zhuhz@igsnrr.ac.cn Xu, Q., Huazhong Agricultural University, xuqiang@mail.hzau.edu.cn Zhou, S. Y., Guangfeng Majia Pomelo Industry Association, 364169936@qq.com Zhong, H. P., Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, zhonghp@igsnrr.ac.cn Huang, M., Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, wangm@igsnrr.ac.cn
Geographical region	Guangfeng District, Shangrao City, Jiangxi Province, 118º1′18″E–118°29′15″E and 28°3′30″N–28°37′23″N
Year	1980–2021 (temperature data), 1980–2020 (precipitation data), 2022 (statistical data), 2023 (testing data for water and soil environmental data, as well as Majia Pomelo)
Spatial resolution	10 m, 30 m
Data format	.shp, .tif, .xlsx
Data size	141 MB
Data files	Geographical location and scope of the case area, spatial data of physical geographical conditions (topography, climate, soil, vegetation, etc.), ecological environment testing data (water quality, soil data, etc.), quality testing data of pomelo (biological characteristics and nutritional components, etc.), socio-economic and industrial development data of pomelo in the case area
Foundations	Ministry of Science and Technology of P. R. China (2021YFE0117300-4); Chinese Academy of Sciences (XDA23100100); Agricultural, Cultural and Tourism Development Group Co., Ltd. in Guangfeng District, Shangrao City, Jiangxi Province (2023)
Data publisher	Global Change Research Data Publishing & Repository, https://www.geodoi.ac.cn
Address	No. 11A, Datun Road, Chaoyang District, Beijing 100101, China
Data sharing policy	(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[34]
Communication and searchable system	DOI, CSTR, Crossref, DCI, CSCD, CNKI, SciEngine, WDS, GEOSS, PubScholar, CKRSC

3.2.2 Climate and Air Quality Data

Guangfeng District is covered by typical subtropical monsoon humid climate. According to the statistical data of Guangfeng District Meteorological Bureau, the average temperature over the years in Guangfeng is 17.9 °C, with a historical minimum temperature of –9.6 °C and a historical maximum temperature of 41.4 °C. The average annual precipitation of this area is 1,661.1 mm, with significant seasonal changes in rainfall throughout the year, with more in spring and summer but less in autumn and winter. The spatial distribution of precipitation varies significantly, with plains increasing towards mountainous areas. The end of spring and early summer are the "plum rain" seasons. Its average annual sunshine hours are

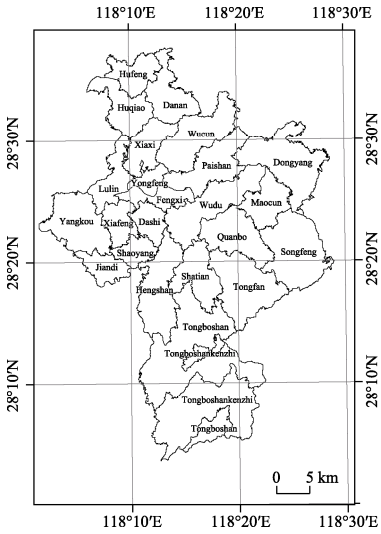

Figure 1 Geographical administrative divisions map of Guangfeng District

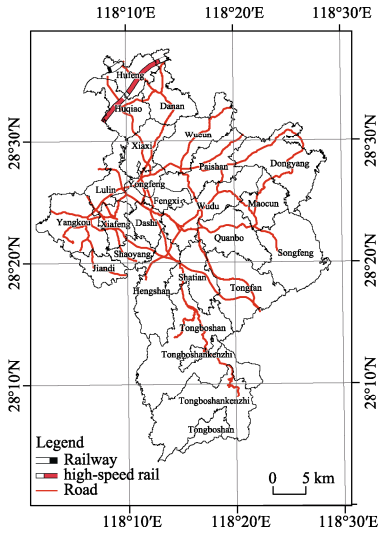

Figure 2 Transportation network map of Guangfeng District

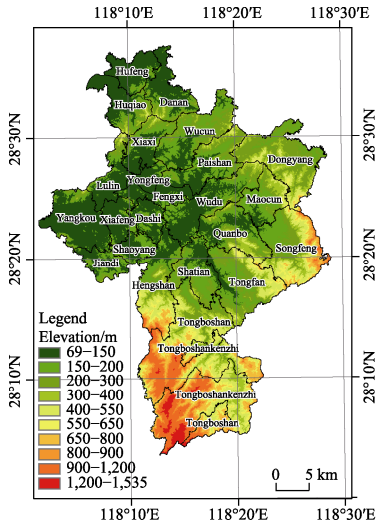

Figure 3 Map of land elevation classification of Guangfeng District (30 m resolution)

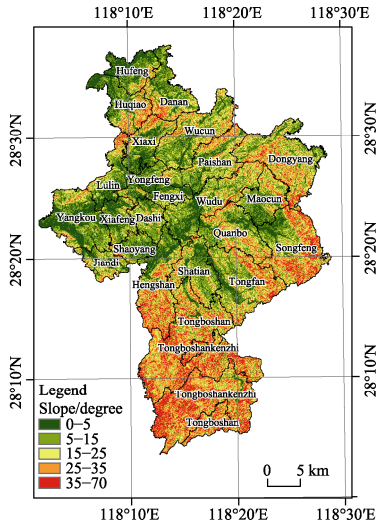

Figure 4 Map of land slope of Guangfeng District (30 m resolution)

1,733.82 hours, and the distribution of light is relatively uniform. The total annual radiation is about 108.7 kcal/cm^2. According to meteorological data from 1980 to 2021 (Figures 5, 6, 7, 8), the average temperature in January of the coldest month in this area is 5.2 °C, and the average temperature in July of the hottest month is 28.59 °C. Over the past 40 years, its annual average temperature has shown an increasing trend (17.37 °C in 1980, 18.13 °C in 2000, and 19.69 °C in 2021)[1–3] .

According to Ambient Air Quality Standards (GB 3095—2012)[35], and Environmental Quality Standards for Surface Water (GB 3838—2002)[36], the excellent air quality rate in Guangfeng was 95.2%, and the river section compliance rate of water quality was 100% in 2020. Since the 12th Five Year Plan, the excellent air quality rate in the urban area of Gua-

ngfeng has increased from 85.4% to 95.2%, and the average concentration of $PM_{2.5}$ has decreased from 44 μg /m^3 to 27 μg /m^3 [2].

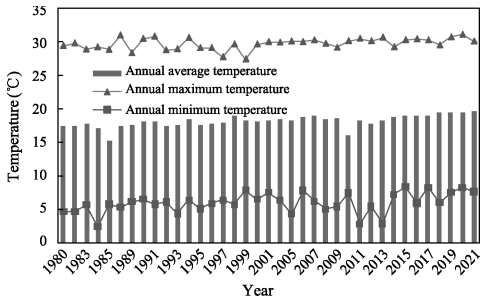

Figure 5 Temperature changes in Guangfeng District (yearly, 1980–2018)

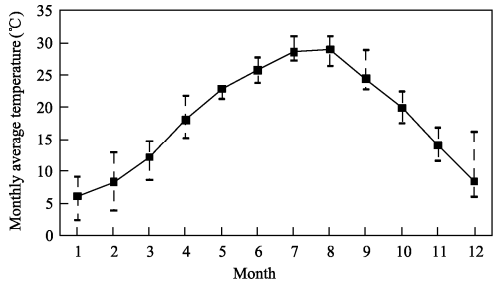

Figure 6 Temperature changes in Guangfeng District (monthly, 1980–2021)

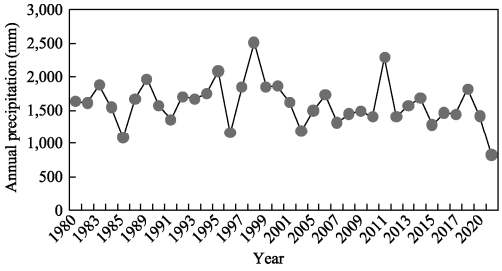

Figure 7 Precipitation changes in Guangfeng District (yearly, 1980–2020)

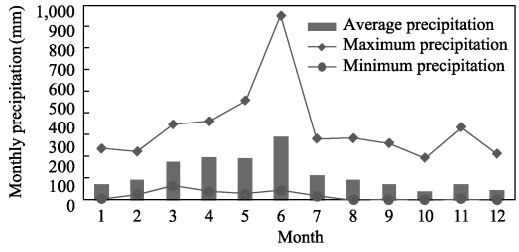

Figure 8 Precipitation changes in Guangfeng District (monthly, 1980–2020)

3.2.3 Land Use and Vegetation Index Data

The land use types in Guangfeng District in 2023 are mainly forest and cultivated land. Among them, the forest area is 85,361.46 hm^2, accounting for 60%; the cultivated land area is 27,209.57 hm^2, accounting for 19.76%; the garden area is 2,771.56 hm^2, accounting for 2.01%. Among them, the garden areas of Danan, Wudu, Dongyan, Tongboshan, Paishan, Huqiao, Yangkou, Tongfan, Wuchun, Lulin, Yandi and Hufeng Town are all greater than 100 ha. Majia Pomelo is also mainly planted in the above mentioned towns.

In 2020, the forest coverage rate in Guangfeng reached 62.05%; the inversion results based on Sentinel satellite remote sensing images (date: November 2, 2023; spatial resolution: 10 m) show that over 80% of Guangfeng having a vegetation index (NDVI) greater than 0.25 (as shown in Figure 9). Guangfeng has successively been awarded the titles of "Provincial level Forest City" and "Provincial level Green and Low Carbon Pilot County". Tongboshan National Forest Park and Guangfeng Modern Agriculture Demonstration Park have respectively been awarded the title of Provincial level Low Carbon Tourism Demonstration Scenic Area and Jiangxi Province level Low Carbon Agriculture Pilot Industrial Park.

3.3 Ecological Environment Data

3.3.1 Soil Environmental Quality Data

The soil in Guangfeng District is mainly acidic, and its soil types mainly include red soil, paddy soil, tidal soil, and lithological soil. Taking into account factors such as the uniformity of spatial distribution of sampling points, the diversity of landform types covered, and the

[2] Guangfeng District People's Government. The 14th Five Year (2021–2025) Plan for land space ecological restoration of Guangfeng District, December 2022.

scale level and management type of the Majia Pomelo planting bases, 15 bases were selected from over 300 hundred mu bases as sampling sites for testing soil quality, water quality, and Majia Pomelo fruit quality in planting area over Guangfeng District. The spatial distribution and specific information of the sample plots and main hundred acre bases are respectively shown in Figure 10 and Table 2.

Among the above 15 bases, each base selects 3 sampling points with uniform spatial distribution for sampling of different soil layers (Figure 11). The Physical and Chemical Analysis Center of Institute of Geographic Sciences and Resources, Chinese Academy of Sciences (IGSNRR-CAS) conducts pH, total nitrogen, total phosphorus, organic carbon content and soil heavy metals detection and analysis of these 45 soil samples. The soil pH of 15 sampling points is 4.21–7.11 (the soil parent material of A10 sampling point in Maocun Town is purple shale, so the soil pH is 7.11); the total nitrogen content are 0.31%–2.09%; the total phosphorus content are 170.80–1,875.33 mg/kg; and the organic matter content are 0.98%–1.53%. The specific test results are shown in Table 3.

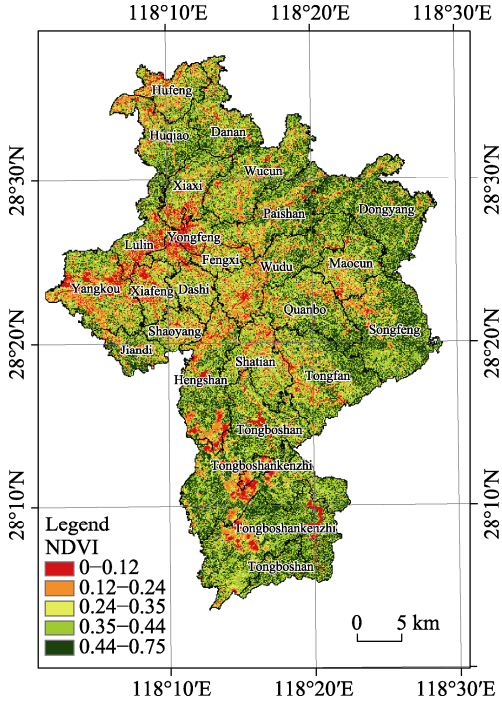

Figure 9 Spatial distribution of vegetation index (NDVI) in Guangfeng District

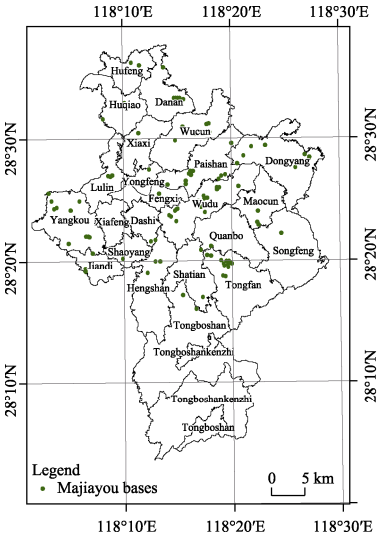

Figure 10 Map of Majia Pomelo planting bases

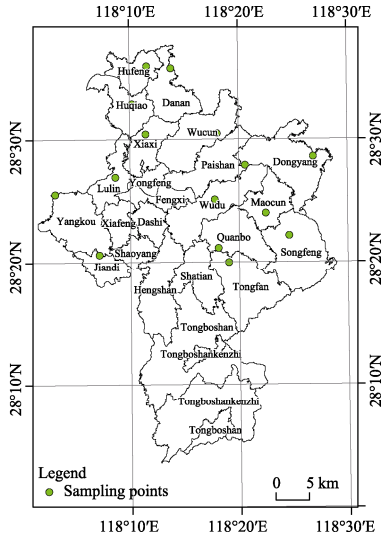

Figure 11 Sampling points map of the case area

The average content of heavy metals such as cadmium (Cd), chromium (Cr), nickel (Ni), lead (Pb), zinc (Zn), copper (Cu), mercury (Hg), and arsenic (As) in the soil of these 15 sampling points respectively is 0.12, 55.07, 21.85, 24.28, 86.73, 19.05, 0.08, and 3.29 mg/kg, which is much lower than the soil pollution risk screening value specified in the national

Table 2 Detailed information of soil, water and Majia Pomelo fruit sampling points in the case area

No.	Base location	Sample points			Map of sampling base
		Longitude (°)	Latitude (°)	Elevation (m)	
A1	Tongshan Village, Jiandi Town	118.118 E	28.343N	153	
A2	Xitan Village, Xiaxi sub District	118.191E	28.507N	164	
A3	Zhuyeshan Village, Huqiao Town	118.167 E	28.550N	152	
A4	Qiaotou Village, Hufeng Town	118.193E	28.600N	113	
A5	Jiaotang Village, Danan Town	118.230E	28.596N	129	
A6	Lutingshan Village, Wucun Town	118.298E	28.508N	214	
A7	Zhujiawu Village, Paishan Town	118.343 E	28.465N	283	
A8	Longxi Village, Dongyang Town	118.447E	28.476N	196	
A9	Shiyidu Village, Songfeng Town	118.414E	28.369N	210	
A10	Maocun Village, Maocun Town	118.375E	28.399N	174	
A11	Wutongwu Village, Quanbo Town	118.300E	28.352N	161	
A12	Maoxi Village, Tongfan Town	118.316E	28.333N	287	
A13	Wangjiaban Village, Wudu Town	118.299E	28.414N	133	
A14	Fushan Village, Yangkou Town	118.051E	28.425N	134	
A15	Xitan Village, Lulin sub District	118.134E	28.448N	146	

Table 3 Testing data of Total N, Total P, and organic matter of soil sample points in the case area

No.	pH	Total nitrogen (%)	Total phosphorus (mg/kg)	Soil organic matter content (%)
A1	4.26	0.48	560.40	1.53
A2	4.34	0.71	550.50	1.51
A3	4.21	2.09	562.80	1.03
A4	4.94	1.39	1,875.33	1.30
A5	4.92	0.31	267.00	1.41
A6	5.22	0.43	984.57	1.41
A7	4.59	1.40	555.10	1.51
A8	4.51	1.04	264.00	1.53
A9	4.92	0.50	170.80	1.36
A10	7.11*	0.86	395.60	1.17
A11	4.81	0.85	175.00	1.18
A12	4.68	1.34	1,339.67	0.98
A13	4.79	1.09	568.10	1.36
A14	4.38	1.89	414.00	1.13
A15	4.41	1.84	616.77	1.29

* The soil parent material of A10 sampling point in Maocun Town is purple shale, so the soil pH is 7.11.

Soil Environmental Quality Risk Control Standard for Soil Contamination of Agricultural

Land (GB 15618—2018)[37]. The testing results indicate good soil environmental quality in the case area. The heavy metal testing data of 15 soil sampling points in the base are shown in Table 4.

Table 4 Testing data of chemical elements (heavy metals) of soil sample points in the case area

No.	Heavy metal content (mg/kg)							
	As	Hg	Cu	Zn	Pb	Cd	Cr	Ni
A1	3.79	0.08	9.07	63.35	25.71	0.10	53.21	24.17
A2	3.63	0.09	35.09	129.20	30.74	0.07	73.25	35.47
A3	2.04	0.10	4.80	54.24	25.36	0.07	64.19	19.31
A4	2.91	0.08	19.24	104.85	26.72	0.25	30.47	11.75
A5	4.28	0.09	2.05	57.86	13.28	0.05	14.48	6.44
A6	2.82	0.09	89.15	91.75	12.19	0.11	34.38	19.30
A7	2.44	0.06	1.97	91.25	28.73	0.16	25.72	10.80
A8	2.62	0.07	3.48	75.55	30.67	0.11	34.94	13.61
A9	2.71	0.11	4.46	60.42	19.13	0.09	38.96	12.27
A10	4.08	0.07	5.85	79.12	20.67	0.21	60.85	28.95
A11	3.61	0.09	4.95	66.42	23.14	0.07	26.36	9.28
A12	3.91	0.09	8.68	123.67	28.19	0.12	92.50	25.58
A13	3.66	0.07	23.72	96.61	26.28	0.11	94.07	36.16
A14	3.49	0.06	46.72	100.90	26.23	0.18	75.36	39.51
A15	3.46	0.06	26.50	105.82	27.18	0.18	107.35	35.17
Filter values[37]	40	1.3	50	200	70	0.3	150	60

3.3.2 Water Resources and Environment Quality Data

Guangfeng District has abundant water resources, with a total water resources of 2.055 billion m^3 in which the surface water resources amount is 1.678 billion m^3 and groundwater resources amount is 377 million m^3. The total length of surface rivers is 1,956 km. Rivers belonging to the Xinjiang river basin mainly include Fengxi river, Xixi river, Jianxi river, Shidu river, Tangling river, and Shiwudu river. While rivers belonging to the Qiantang river basin include Longxi river in the southern part of Dongyang Township. Among them, Fengxi river, which originates from Xianxia mountain at the northern foot of Mount Wuyi in Fujian Province, is the "mother river" of Guangfeng District. The total length of the river in the area is 88 km, and the drainage area is 2,233 km^2. There are 159 reservoirs in Guangfeng District. There are no polluting factories and enterprises in the entire area. Rivers, reservoirs, and ponds within the area are the main irrigation sources for Majia Pomelo.

In this case, 15 surface water and 5 groundwater sampling points were selected for quality sampling in the above 15 bases, and the physical and chemical analysis center of IGSNRR-CAS tested the sampling water quality. The dissolved organic carbon (DOC) range for water samples is 1.266–4.504 mg/L, total nitrogen (TN) range is 1.111–5.918 mg/L, nitrate nitrogen (NO_3^-–N) range is 1.033–3.032 mg/L, ammonia nitrogen (NH_4^+–N) range is 0.089–0.393 mg/L, and total phosphorus (TP) range is 0.002–0.135 mg/L. The specific detection results are shown in Table 5; The content of heavy metal elements arsenic (As), mercury (Hg), copper (Cu), zinc (Zn), lead (Pb), cadmium (Cd), chromium (Cr), and nickel (Ni) detected in water samples is far lower than the national water environmental quality standards. The specific detection results are shown in Table 6. According to the Green Food-Environmental Quality for Production Area (NY/T 391—2021)[38], the irrigation water in the Guangfeng Majia Pomelo planting area meets the current national and industry standards. Meanwhile, the water sample test results showed that the irrigation water in the Majia Pomelo planting area is weakly alkaline, with strong surface activity, good permeability, and strong solubility. It is easy to participate in the biochemical activities of crops and enhance the ability to solidify nitrogen. Therefore, irrigation water is conducive to

the green growth of Majia Pomelo.

Table 5 Water quality testing data in the case area

Type	No.	DOC (mg/L)	TN (mg/L)	NO_3^-–N (mg/L)	NH_4^+–N (mg/L)	TP (mg/L)
Surface water	A1	3.811	1.948	1.987	0.200	0.003
	A2	3.962	2.419	2.361	0.236	0.014
	A3	2.641	1.613	1.574	0.158	0.016
	A4	2.425	1.240	1.265	0.127	0.143
	A5	3.077	1.894	2.099	0.180	0.051
	A6	2.311	1.411	1.377	0.138	0.009
	A7	4.484	3.220	3.032	0.260	0.002
	A8	3.761	5.918	2.566	0.220	0.031
	A9	4.303	1.240	1.077	0.393	0.040
	A10	4.102	2.526	2.799	0.240	0.011
	A11	4.292	2.620	2.558	0.256	0.135
	A12	2.735	1.684	1.866	0.160	0.003
	A13	4.504	1.303	2.349	0.237	0.004
	A14	3.077	1.894	2.099	0.180	0.127
	A15	2.666	1.521	1.578	0.104	Not detected
Ground water	A6	1.425	1.238	1.265	0.097	0.017
	A9	2.093	1.173	1.033	0.140	0.005
	A11	1.266	1.293	1.142	0.089	Not detected
	A13	1.771	1.417	1.245	0.146	Not detected
	A15	1.311	1.111	1.077	0.108	0.007

Table 6 Testing data of heavy metal element content in surface water and groundwater in the case area

Item	Surface water detection value (μg/L)	Groundwater detection value (μg/L)	National standard limit values for surface/groundwater environmental quality (μg/L)*		
			Class I water limit	Class II water limit	Class III water limit
As	1.26	1.05	50/1	50/1	50/10
Hg	0.01	0.01	0.05/0.1	0.05/0.1	0.1/1
Cu	0.52	0.99	10/10	1,000/50	1,000/1,000
Zn	3.08	9.88	50/50	1,000/500	1,000/1,000
Pb	0.01	0.03	10/5	10/5	50/10
Cd	0.01	0.04	1/0.1	5/1	5/5
Cr	0.89	0.97	10/5	50/10	50/50
Ni	0.73	0.96	20/2	20/2	20/20
Se	Not detected	Not detected	10/10	10/10	10/10

*Environmental Quality Standards for Surface Water (GB 3838—2002)[36] and Standard for Groundwater Quality (GB/T 14848—2017)[39]

3.4 Majia Pomelo Morphological and Quality Data

3.4.1 Morphological Characteristics of Majia Pomelo

Majia Pomelo belongs to the Rutaceae and Citrus trees. Its tender branches, flower stalks, sepals, and ovaries are all covered with soft hairs. Its tender branches are flat and have edges, and the leaves are quite thick, with a strong green color and wide oval or oval shape. Its leaves of Lianji are usually 9–16 cm long and 4–8 cm wide. Majia Pomelo flowers are racemes, sometimes accompanied by axillary single flowers. The flower buds are milky white and the calyx is irregular which usually has 5–3 lobeds. Its petals is about 1.5–2 cm, with 25–35 stamens, and sometimes some stamens are sterile[14,19].

Majia Pomelo has a high and flat round shape, with a flowering period from April to May and a maturity period in mid to late November. The weight of a single fruit of Majia Pomelo ranges from 1,200 to 1,850 g. After maturity, the skin of the fruit is yellow; the shoulder of the fruit is raised; and the top of the fruit is sunken. The fruit surface has large and prominent oil cells, resulting in a thicker texture, and the fruit peel is thick, with a light pink sponge texture and an average thickness of 2.0–3.2 cm. The fruit has cracked petals, with 10–15 or more to 19 petals, and the skin is pink. Juice cells of Majia Pomelo are rose red or pink in color, with rich juice and a sweet and refreshing flavor[14,19]. There are many or no seeds, usually in the shape of an approximate rectangle, with a single embryo. The morphology of the Majia Pomelo tree, fruit, and sac is shown in Figure 12, and the specific morphological feature testing data is shown in Table 7.

Figure 12 Morphology of Majia Pomelo trees, fruits, and sacs

Table 7 Testing data of morphological features of Majia Pomelo fruit

No.	Fruit shape	Fruit surface color	Longitudinal diameter of fruit (mm)	Horizontal diameter of fruit (mm)	Peel thickness (mm)	Fresh weight of single fruit (g)	Fresh weight of petal (g)	Petal count	Juice cell color
A1	High flat, round shaped	Fruit surface is yellow and smooth, with a uniform color	179	181	26	1,795	1,081	16	Light red
A2			183	180	27	1,762	1,071	15	
A3			178	185	25	1,824	1,110	16	
A4			186	178	27	1,752	1,075	15	
A5			186	173	28	1,727	1,055	15	
A6			182	177	27	1,767	1,080	15	
A7			180	177	27	1,766	1,078	15	
A8			182	179	27	1,789	1,092	16	
A9			177	175	26	1,742	1,064	15	
A10			192	189	27	1,887	1,151	16	
A11			187	185	27	1,841	1,123	16	
A12			183	184	27	1,818	1,109	16	
A13			179	171	25	1,707	1,042	15	
A14			186	183	25	1,825	1,114	16	
A15			189	185	25	1,796	1,122	16	
Average			183	180	27	1,787	1,091	16	

3.4.2 Majia Pomelo Quality Characteristics Data

From the aforementioned 15 bases, according to the soil sampling selecting method, 5 Majia Pomelo were harvested from each base. The quality characteristics of the sampled Majia Pomelo were tested by the Agricultural Product Quality Supervision and Inspection Testing Center of Jiangxi Agricultural University (December 2023). The test results showed that the

average values of nutritional components such as juice percentage, soluble solids, titratable acid, vitamin C, and Pomelo peel pectin were 48.04%, 10.75%, 0.69%, 61.74 mg/100g, and 20.69%, respectively, as shown in Table 8. The average content of the fruit sugars such as fructose, glucose, sucrose, soluble sugar, starch, cellulose, and total sugar is 2.39%, 2.50%, 3.85%, 6.98%, 1.03%, 10.33%, and 9.24%, respectively, as shown in Table 9. The average content of the fruit acids such as malic acid, citric acid, lactic acid, quinic acid, palmitic acid, stearic acid, and total acid is 0.83%, 6.08%, 0.16%, 0.41%, 0.28%, 0.20%, and 8.52%, respectively, as shown in Table 10. The average dry weight content of Lycopene, β carotene and other carotenoids, Naringin, Naringenin, and other flavonoids is 23.51 μg/g, 5.29 μg/g, 7.86 mg/g, 1.49 mg/g, 1.82 mg/g, respectively, as shown in Table 11. And 17 different amino acids were measured, including 7 essential amino acids which are essential elements for the human body, as shown in Table 12. Majia Pomelo contains 18 types of mineral elements, as shown in Table 13.

Table 8 Testing data of nutrient composition in Majia Pomelo fruit

No.	Juice percentage (%)	Soluble solids (%)	Titrable acid (%)	Vitamin C (mg/100g)	Pectin (pomelo peel) (%)
A1-B	46.89	11.54	0.83	58.61	21.88
A4-B	50.12	12.13	0.76	47.36	17.47
A6-B	47.34	10.58	0.59	56.73	18.22
A12-B	48.21	9.87	0.65	67.35	26.33
A15-B	47.65	9.65	0.63	78.64	19.56
Average	48.04	10.75	0.69	61.74	20.69

Table 9 Testing data of sugar in Majia Pomelo fruit

No.	Fructose (%)	Glucose (%)	Sucrose (%)	Soluble sugar (%)	Starch (%)	Cellulose (%)	Total sugar (%)
A1	2.15	2.56	3.28	6.57	1.05	10.69	8.56
A4	1.98	2.13	3.65	6.32	0.84	9.02	8.02
A6	2.34	2.49	3.34	7.02	1.07	9.88	8.72
A12	2.67	2.86	4.13	7.35	1.22	11.63	10.12
A15	2.83	2.47	4.87	7.62	0.97	10.45	10.76
Average	2.39	2.50	3.85	6.98	1.03	10.33	9.24

Table 10 Testing data of fruit acids in Majia Pomelo fruit

No.	Malic acid (%)	Citric acid (%)	Lactic acid (%)	Quinic acid (%)	Palmitic acid (%)	Stearic acid (%)	Total acid (%)
A1	0.79	5.55	0.14	0.34	0.32	0.28	7.94
A4	0.98	7.39	0.16	0.35	0.36	0.16	9.76
A6	1.03	5.97	0.18	0.56	0.26	0.14	8.85
A12	0.86	6.78	0.21	0.47	0.28	0.15	9.12
A15	0.47	4.72	0.13	0.31	0.19	0.25	6.94
Average	0.83	6.08	0.16	0.41	0.28	0.20	8.52

Table 11 Testing data of carotenoids and flavonoids in Majia Pomelo fruit

No.	Carotenoids (μg/g·DW)*		Flavonoids (pomelo peel) (mg/g·DW)*		
	Lycopene	β-Carotene	Naringin	Naringenin	Other
A1	25.98	5.56	7.24	1.37	1.43
A4	20.57	3.13	6.78	1.23	1.52
A6	18.35	4.87	8.36	1.64	1.78
A12	21.64	5.39	9.24	1.85	2.51
A15	31.02	7.49	7.68	1.34	1.87
Average	23.51	5.29	7.86	1.49	1.82

*DW represents dry weight.

Table 12 Testing data of amino acid in Majia Pomelo fruit (Unit: mg/kg·FW)

No. / Amino acid	A1	A4	A6	A12	A15	Average
Met	0.096	0.106	0.095	0.097	0.109	0.101
Cys	0.016	0.018	0.015	0.017	0.019	0.017
His	0.024	0.029	0.022	0.026	0.029	0.026
Tyr	0.057	0.063	0.056	0.058	0.065	0.060
Phe	0.022	0.026	0.020	0.023	0.026	0.023
Ile	0.039	0.045	0.037	0.041	0.045	0.041
Thr	0.015	0.019	0.013	0.017	0.018	0.016
Gly	0.023	0.028	0.021	0.025	0.028	0.025
Val	0.014	0.018	0.012	0.016	0.017	0.015
Ser	0.024	0.030	0.021	0.027	0.030	0.027
Arg	0.032	0.039	0.029	0.035	0.039	0.035
Leu	0.029	0.036	0.025	0.032	0.036	0.031
Lys	0.024	0.030	0.021	0.026	0.030	0.026
ALa	0.039	0.047	0.035	0.043	0.048	0.042
Pro	0.051	0.067	0.042	0.059	0.066	0.057
Glu	0.062	0.079	0.053	0.070	0.078	0.069
Asp	0.098	0.123	0.085	0.110	0.123	0.108
DL-Pyroglutamic acid	0.385	0.426	0.378	0.391	0.439	0.404
Essential amino acids	0.320	0.340	0.320	0.320	0.350	0.330
Total protein hydrolyzed amino acid	0.704	0.748	0.704	0.704	0.770	0.726

* FW represents fresh weight (the same below).

Table 13 Testing data of mineral content in Majia Pomelo juice (Unit: mg/kg·FW)

No. / Mineral elements	A1	A4	A6	A12	A15	Average
K	412.390	412.390	530.061	422.659	425.601	440.620
Ca	8.225	5.563	7.443	7.043	7.090	7.073
Mg	20.209	21.048	23.741	20.304	20.371	21.134
Na	3.564	4.219	3.513	3.511	3.494	3.660
Mn	0.029	0.031	0.017	0.025	0.024	0.025
Zn	0.171	0.115	0.114	0.136	0.136	0.134
Fe	0.181	0.145	0.063	0.134	0.132	0.131
B	0.111	0.264	0.066	0.126	0.121	0.138
Mo	0.002	0.002	0.002	0.002	0.002	0.002
Sr	0.024	0.011	0.029	0.022	0.022	0.022
Co	0.002	0.002	0.002	0.002	0.002	0.002
As	0.005	0.003	0.003	0.004	0.004	0.004
Cu	0.050	0.086	0.025	0.049	0.047	0.051
Ni	0.017	0.003	0.002	0.009	0.009	0.008
Al	0.529	0.068	0.094	0.290	0.291	0.254
Ba	0.014	Not detected	0.009	0.012	0.011	0.011
P	38.040	41.790	37.227	36.721	36.607	38.077
Se	Not detected	0.151	0.091	0.134	0.116	0.123

3.5 Majia Pomelo Business Management and Industrial Development

3.5.1 Population and Socioeconomic Development in Guangfeng District

According to statistics[3], the total population of Guangfeng District in 2022 was 980,072,

[3] Guangfeng District Bureau of Statistics. 2022 Guangfeng District national economic and social development statistical communiqué. May 24, 2023.

including 559,856 urban residents, accounting for 57.12% of the total population of the district, and 420,216 rural population, accounting for 42.88%. Compared with 2016, the total population of Guangfeng increased 9,005 people, of which the urban population increased 293,589 people, accounting for an increase of 29.7%, while the rural population decreased 284,584 people, accounting for a decrease of 29.7%. In 2022, the GDP of Guangfeng was 62.902 billion CNY, ranking among the top ten in Jiangxi Province. Calculated at comparable prices, the GDP in 2022 increased by 5.7% year-on-year, nearly double the GDP in 2016, and the ratio of the three industries was 4.8:51.8:43.4. Among them, the added value of the first industry was 3.037 billion CNY, a year-on-year increase of 3.9%; the added value of the second industry was 32.506 billion CNY, a year-on-year increase of 7.0%; the added value of the third industry was 27.358 billion CNY, a year-on-year increase of 4.3%.

3.5.2 Inheritance and Management of Majia Pomelo Culture

Guangfeng Majia Pomelo has a long history and development culture, and has formed a modern management system through "technology research center, local standard specifications, demonstration base, information platform, agricultural technology services and training", etc., supporting the large-scale and standardized planting management of Majia Pomelo in the entire region.

In order to improve the quality of Majia Pomelo from the source, Guangfeng District Government has established the Majia Pomelo science and technology research center, invited a team of academicians as technical support for the development of Majia Pomelo industry, and established scientific and technological cooperation with Huazhong Agricultural University, the Citrus Research Institute of the Chinese Academy of Agricultural Sciences, and the Jiangxi Academy of Agricultural Sciences. The Majia Pomelo Digital Intelligence Cockpit, the *Pomelo* Germplasm Resources Protection and Innovation Base, and the Jiangxi Pomelo Resources Conservation Nursery have been established. The government also established the first national Pomelo germplasm experimental base which has introduced 200 domestic and foreign Pomelo germplasm resources, and discovered 3 excellent varieties[4]. Especially, the "3361 Project" for improving the quality of Majia Pomelo has been launched, that is through a 3 years period (2023–2025), it will implement 3 major plans (Strong Foundation Plan, Quality Improvement Plan, and Excellent Plant Plan), establish 1 standardized cultivation technology system, strengthen 1 research and development team, cultivate 1 local professional technical service, protect 1 mother tree of Majia Pomelo, build 1 Majia Pomelo seedling breeding base, construct 6 high-quality demonstration bases, and achieve 1 comprehensive upgrading of the Majia Pomelo industry in Guangfeng.

In 2018, the local standard Geographical Indication Product Guangfeng Majia Pomelo (DB36/T 1057—2018)[40]in Jiangxi Province was released and implemented[34], which stipulated the protection scope of geographical indication products, cultivation technology requirements (seedling cultivation, planting, shaping and pruning, flower and fruit management, water management, reasonable fertilization, disease and pest control, and prevention of frost damage), harvesting, fruit quality requirements, inspection methods, inspection rules, marking labels, packaging, transportation, storage, and other technical content for Guangfeng Majia Pomelo, providing solid technical support for the protection and planting management of geographical indication products of Guangfeng Majia Pomelo.

The government also established a Xitan standard orchard that integrates germplasm innovation, standard planting, digital intelligence, and cultural tourism. Xitan orchard has established a science and technology small courtyard led by academician Deng Xiuxin, which has developed information platforms such as disease and pest monitoring systems, soil moisture monitoring systems, automatic weather stations, integrated water and fertilizer

[4] Guangfeng District People's Government. Development of the entire industry chain of Guangfeng Majiayou. 2023.

machines, 360° seamless camera monitoring, and online e-commerce selection systems. Through technological empowerment and information technology, it provides a demonstration base for standardized production, production and sales coordination, quality improvement, and integration of agriculture and tourism of Majia Pomelo. It has become a provincial level modern agriculture demonstration park and a green and low-carbon demonstration base in Jiangxi Province.

In order to promote the cultivation of Majia Pomelo, Guangfeng government has published popular science materials such as 100 Questions on Cultivation Techniques of Guangfeng Majia Pomelo, Illustrated High Quality Cultivation Techniques of Guangfeng Majia Pomelo, Handbook of Cultivation and Management Techniques of Guangfeng Majia Pomelo, and Biological Characteristics of Guangfeng Majia Pomelo. Relying on the expert database of universities such as Huazhong Agricultural University and China Agricultural University, the government has opened a "Online clinic" to provide timely online "pulse diagnosis" for the management of Majia Pomelo farmers. Using the "S&T Small Courtyard" as a platform, experts are invited to conduct consultations and training for major growers and technical backbone, breaking geographical restrictions, achieving the sharing of high-quality resources at any time, and providing high-quality technical guidance services for fruit farmers in all aspects and at multiple levels. At the same time, more than 10 experimental demonstration bases will be established in different areas to cultivate agricultural technology talents. A comprehensive and multi-level technical service system will be established, with expert teams in the district, assistance teams in the town, and technicians in the village. This will help farmers update and upgrade their planting techniques, and ensure that farmers increase production and income from a technical perspective. In recent years, training courses on the cultivation techniques of Majia Pomelo have been held, cultivating more than 30,000 fruit farmers and new agricultural operators.

3.5.3 Development of Majia Pomelo Industry

In the past thirty years, Guangfeng District has been deeply cultivating the leading industry of Majia Pomelo, focusing on the entire industrial chain of production, processing, circulation, supply, and sales, optimizing and strengthening the brand of Guangfeng Majia Pomelo, and promoting high-quality development of agricultural industrialization.

In the year of 2009, after undergoing scientific genetic identification and quality testing by the National Citrus Breeding Center, Guangfeng government took Majia Pomelo as the "No.1 Project" of agricultural industry, and an important industry to promote farmers' income growth. Majia Pomelo began the process of large-scale production. The government has successively issued policy documents such as "Implementation Opinions on Promoting the Development of Majia Pomelo Industry", "Development Plan for Majia Pomelo Industry in Guangfeng", "Implementation Plan for Accelerating the Optimization of Majia Pomelo Industry Structure in Guangfeng" and "Implementation Plan for Creating Excellent Majia Pomelo Orchard in Guangfeng". And through these policy documents, the government had vigorously promoted the high-quality development of Majia Pomelo industry.

In 2010, Guangfeng established the Majia Pomelo Planting Command Headquarters, integrating more than 60 million CNY of funds from nine departments including agriculture, water conservancy, transportation, and power supply, and promoting the hardening of the main roads in orchards, improving the renovation of the orchard power grid, promoting the installation of drip irrigation and sprinkler irrigation technologies, strengthening the improvement of orchard infrastructure, cultivating leading enterprises and large growers, and gradually achieving large-scale and standardized planting. A series of supporting policies have been established, such as planting rewards and subsidies for large scale planters based on planting area, and subsidies for participating farmers based on seedlings and annual survival rate.

Since 2023, the decision makers of Guangfeng District has been promoting the construction of boutique orchards, with an annual investment of 30 million CNY to implement the boutique orchard creation project, focusing on creating a number of high standard smart orchards. The government also promotes to strengthen the production capacity of socialized services and establish the Majia Pomelo Industry Association. The association takes the lead in the implementation of socialized services that has established a pruning team of more than 50 people, and carryed out fruit tree pruning services, with nearly 80 service bases covering an area of over 2,000 ha. It has purchased 4 drones to implement socialization of plant protection and harvesting, and served more than 40 bases. The Guangfeng supply and marketing company has provided deep services to agriculture, built plant hospitals, created demonstration bases, and served more than 10 bases. The government has introduced Jiangxi Nongyuan Biotechnology Co., Ltd., with an investment of 40 million CNY, to build a 40 mu Majia Pomelo organic fertilizer and formula fertilizer production base. There are nearly 10 socialized service institutions for guiding and nurturing production services in Guangfeng.

4 Conclusion and Discussion

The unique geographical location (junction of three provinces) with hilly and mountainous terrain, acidic soil, warm and humid subtropical monsoon climate, and the unique ecological environment of Guangfeng District have nurtured the regional characteristics of the Majia Pomelo variety. Majia Pomelo has a long history of cultivation and culture of which since the early 1990s, it has gradually entered a process of large-scale development by optimizing the “production”, refining the “processing”, smoothing the “circulation”, strengthening the “supply”, and expanding the “sales”. Nowadays, Majia Pomelo has become the leading industry of modern agriculture in Guangfeng and an advantageous industry for rural revitalization. This article elucidates the physical geographical conditions and ecological environment of the Majia Pomelo planting area through systematic scientific data, as well as the quality characteristics, management models, and industrial development of Majia Pomelo. In the future, on the basis of protecting the excellent ecological environment of the Majia Pomelo planting area, further improve and enhance from the following aspects:

(1) Inheriting history and enhancing brand: on the basis of protecting the mother tree of Majia Pomelo, it can further strengthen the construction of Majia Pomelo town, germplasm resource theme museum, and industry theme museum, as well as vigorously promote the “planting+greening” model of small orchards in front of courtyards and houses, integrate the traditional culture. Therefore Guangfeng can further strengthen the inheritance of Majia Pomelo history and culture, and promote the construction of Majia Pomelo brand culture.

(2) Technology empowerment and high quality production: based on the existing Majia Pomelo Science and Technology Research Center, Science and Technology Academy, and *Pomelo* Germplasm Resource Innovation Base, it can further strengthen innovative research on Majia Pomelo germplasm preservation, quality optimization, and new variety research and development, and strengthen the formulation and application promotion of relevant standards and specifications for Majia Pomelo, scientifically investigate and plan the advantages of Majia Pomelo cultivation. At the same time, it can further accelerate the construction of high standard smart orchards, and promote the large-scale and standardized production of Majia Pomelo in the entire region. By utilizing modern information technologies such as geographic information, big data, and artificial intelligence, it can further strengthen the construction of the Majia Pomelo big data intelligent supervision and service platform. Through one code, one database, and one map, it will achieve scientific management and quality traceability of the full lifecycle of Majia Pomelo germplasm seedlings, planting production, product processing, market sales, and all stakeholders.

(3) Taking multiple measures to promote agricultural income growth: on the basis of

planting and production, it can further strengthen the construction of field warehouses, modern warehousing and logistics systems for Majia Pomelo, and regional agricultural product trading centers. It may accelerate the establishment of a quality grading sales mechanism, and adhere to the dual driven development of "external introduction and internal training". Additionally, it can further strengthen the deep processing industry chain of Majia Pomelo, and cultivate a group of leading enterprises. And also it need continuously strengthen existing online and offline marketing activities, establish a direct sales and procurement system, increase the cultivation of a broker team, smooth the two-way feedback channels between the market, fruit merchants, and fruit farmers, ensure that Majia Pomelo can "grown well" and more importantly "sold well". So, it can promote increasing the income and wealth of Majia Pomelo planting farmers. Taking this GIES case as an opportunity, we recommend increasing the support for the habitat protection and sustainable development of high-quality geographical products of Majia Pomelo. Based on this case, it will be published and disseminated by the association between the unique quality of Majia Pomelo products and the excellent ecological environment. And it will be encouraged to actively participate in the international trade, and expand the international sales channels of Majia Pomelo.

(4) Improving mechanisms and sustainable development: the government need further improve the guiding policies and incentive mechanisms for the development of the Majia Pomelo industry. It is necessary to establish a risk fund for Majia Pomelo specialty agricultural products to effectively prevent natural disasters and market price risks, and provide a foundation for Majia Pomelo planting farmers. By leveraging the geographical advantage of the junction of three provinces and using the Majia Pomelo as a carrier, it can further enrich folk cultural activities such as the Majia Pomelo picking festival and rural tourism, promote the integrated development of the "first, second, and third" industries, and activate new momentum for rural revitalization. Importantly, it is necessary to exploratively conduct carbon sink capacity accounting of the full life cycle Majia Pomelo. Preliminary research shows that 1 mu of Majia Pomelo can absorb about 200 kg of carbon dioxide. Currently, the annual carbon sink of 13,333 ha of Majia Pomelo in Guangfeng District can reach 10.92 million kg of carbon by using the conversion factor of 0.272,9[5]. Moreover, it can explore the ecological value of Majia Pomelo, promote green finance of agricultural products, and thus help Guangfeng District achieving the "double carbon" goal, and form a model of ecological environment protection and sustainable development of Majia Pomelo with Guangfeng characteristics.

Author Contributions

Zhu, Y. Q. made overall design for the case study and data collection work, and written and revised the paper; Gong, Z. Z., Yao, H., Chen, J. L., Liu, X. F. and Wang, X. W. organized and coordinated the construction of the case, and guided the overall design of the case; Ning, X. H., Hong, H. H. and Wang Z. F. participated in the overall case design discussion, case research, coordination of relevant data, and revision of this data paper; Ruan, X. F. participated in the case study and coordinated the support resources for the case construction; Wu, F. F. participated in the overall design and data collection work of the case study and data collection work; Zhu, H. Z. collected and processed data, and participated in the writing of the paper; Xu, Q. participated in the review of quality characteristic testing data of Majia Pomelo and the data paper; Zhou S. Y. participated in the discussion and paper review related to the development of the Majia industry; Zhong, H. P. participated in data collection and processing; Huang, M. participated in the research and data collection of the case, as

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well as responsible for carbon sequestration accounting work.

Conflicts of Interest

The authors declare no conflicts of interest.

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