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GIES Case Dataset on Kolar Fragrant Pear in the Kongque River Oasis of the Xinjiang Uygur Autonomous Region of China

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Abstract: Awati town in Korla city is located on the northeast of the Tarim Basin in the Xinjiang Uygur autonomous region and is a desert-oasis ecosystem. Kolar fragrant pear (KFP), a primary product of the Xinjiang fruit industry, has been listed in the National Geographical Indication Products in 2004 and in the first protection list of the China-EU agreement on geographical indications in 2020. This case study compiles the data related to Kolar fragrant pear and the oasis environment, in order to support local sustainable development. The dataset includes: (1) the geographical boundary; (2) the physical geographic data (meteorology, DEM and slope, soil, surface water, groundwater, NDVI); (3) the pear variety attribute data, and (4) the management data. The dataset is archived in .shp, .xlsx, .tif, .jpg, and .docx formats.

Keywords: Geographic Indications; Kolar fragrant pear; Oasis; Habitat; Sustainability; China-EU; Case 14

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CSTR: https://cstr.escience.org.cn/CSTR:20146.14.2022.02.03

Dataset Availability Statement:

The dataset supporting this paper was published and is accessible the *Digital Journal of Global Change Data Repository* at: https://doi.org/10.3974/geodb.2022.05.10.V1 or https://cstr.escience.org.cn/CSTR:20146.11.2022.05.10.V1.

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[2] Gui, D. W., Fan, J. L., Shao, S. M., *et al*. Korla fragrant pear Kongque River oasis case dataset on ecosystem protection and sustainable development [J/DB/OL]. *Digital Journal of Global Change Data Repository*, 2022. https://doi.org/10.3974/geodb.2022.05.10.V1. https://cstr.escience.org.cn/CSTR:20146.11.2022.05.10.V1.

1 Introduction

High-quality agricultural products are not only an important requirement for life, but also a key to practice the development concept of Clear waters and lush mountains are invaluable assets. From the perspective of geography, Clear waters and lush mountains means protecting the original ecology of the environment[1] and identifying and protecting high-quality local agricultural products is the starting point to implement environmental protection while ensuring regional economic development[2]. Korla is located on the northeastern edge of the Tarim Basin in the Xinjiang Uygur autonomous region, in the upper and lower reaches of the Kaidu-Kongque River basin and in the middle of the Kongque River oasis. Korla has a typical warm temperate continental arid climate, characterized by rich light and heat, scarce precipitation and strong evaporation, which are ideal for special fruit. Kolar fragrant pear (KFP) is a native pear to Xinjiang, and mainly produced nearby Kolar[3], and it is known as the precious pear because of its sweet and smooth taste, rich aroma, thin skin and fine flesh[4]. KFP has been listed in the National Geographical Indication Products in 2004[5], the first protection list of the China-EU agreement on geographical indications in 2020[6,7]. Thanks to the Global Change Research Data Publishing & Repository[6,7], the output of this case, which is the No.14 case of Geographical Indications for Environment & Sustainability (GIES), can be published to aid the environmental protection and sustainable development of the Kongque River oasis.

2 Metadata of the Dataset

The metadata of GIES case dataset on KFP of Kongque River oasis[6,7] is shown in Table 1.

Table 1 Metadata summary of the dataset

Items	Description
Dataset full name	Kolar fragrant pear in the Kongque River oasis of the Xinjiang Uygur autonomous region of China case dataset on environment protection and sustainable development
Dataset short name	KorlaFragrantPearCase14
Authors	Gui, D. W., Xinjiang Institute of Ecological Geography, CAS, guidwei@ms.xjb.ac.cn
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Geographical area	Kongque river oasis, Xinjinag, China: 41°11′26″N–41°58′41″N, 85°20′42″E–86°46′15″E
Year	2022
Data format	.shp, .tif
Data size	631 MB
Data files	(1) Geo-location of Kongque River oasis; (2)Boundary of the core area of KFP; (3) NDVI of Kongque River oasis; (3) Climate data of Kolar city; (4) Soil and water of Awati, Kolar
Foundation	Xinjiang Uygur Autonomous Region (2020D14042)

(*To be continued on the next page*)

(*Continued*)

Items	Description
Data publisher	Global Change Research Data Publishing & Repository, htttp://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 *Digital Journal of Global Change Data Repository*), and publications (in the *Journal of Global Change Data & Discovery*). ***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 re-distribute ***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 [8]
Communication and searchable system	DOI, CSTR, Crossref, DCI, CSCD, CNKI, SciEngine, WDS/ISC, GEOSS

3 Geographical Scope of the Case Study Area

The case study area includes the Kongque (Peacock) river oasis and the core KFP area in the oasis. The Kongque river oasis is located in Kolar city, Tielmenguan city, Yuli county and Yanqi county of the Bayingoleng Mongol autonomous prefecture, in the Xinjiang Uygur autonomous region. The geographical location of the oasis is 41°11′26″N–41°58′41″N, 85°20′42″E–86°46′15″E, with an area of 4,019.30 km^2 a perimeter of 1,073.66 km[9]. The core KFP area is located in the Awati town of Kolar, within the geographical region of 41°36′40″N–41°42′00″N, 86°00′57″E–86°06′07″E (Figure 1, Figure 2). The area of KFP is about 50,000 mu (3,333.33 ha).

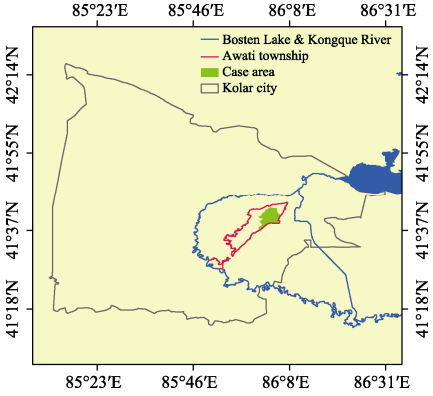

Figure 1 Geographical location of the case area

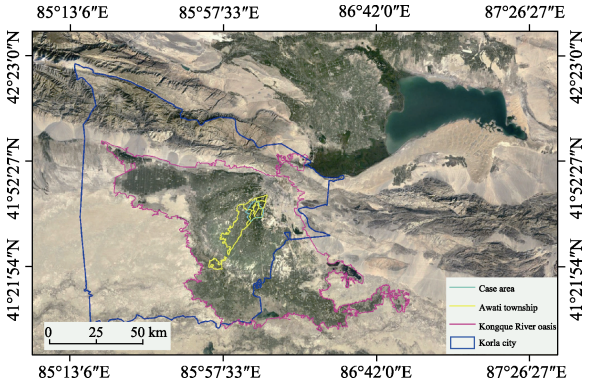

Figure 2 Landscape and Geographical location of the case area

4 Ecological and Geographical Environment

4.1 Topography and Climatic Conditions

The study area is located in the middle and lower reaches of the alluvial fan of the Kaidu-Kongchu river in the middle of the Kongchu river oasis, which has hot summer and cold winter, scarce precipitation, strong evaporation, large diurnal temperature amplitudes, abundant light and heat, prevailing easterly winds, and it is a typical warm temperate continental arid climate. According to the data from 2000–2020 at the Kullu meteorological station, the annual average temperature of the Peacock river oasis is 12.39 °C, and the accu-

mulated temperature of ≥10 °C is 4,640.22 °C. The average annual rainfall is 62.6 mm, with rainfall mainly concentrated during June-August. The annual hours of average sunshine is 2,891.82 h. The relative humidity varies steadily throughout the year at approximately 11%, with the lowest relative humidity in the spring and the highest from the end of the year to January (Figure 3–6).

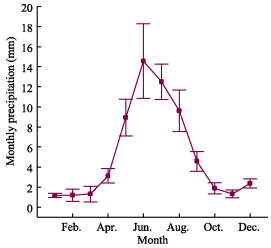

Figure 3 Monthly average annual precipitation

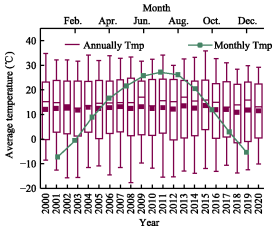

Figure 4 Annual temperature

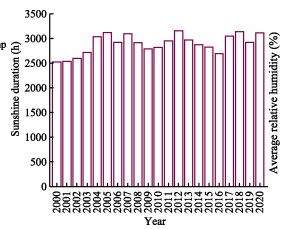

Figure 5 Annual sunshine duration

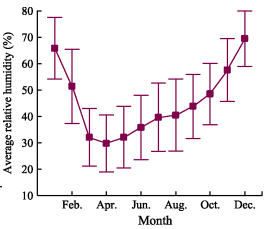

Figure 6 Monthly average air relative humidity

4.2 Soil Properties

Soil samples were collected in the core area of KFP in Awati town, Korla, and the soil chemical properties were analyzed. The soil sampling points were evenly distributed in the core area of KFP. The samples were taken with a soil auger in the stratification every 20 to 100 cm depth of the soil profile. The analysis was carried out by the Service Center of Public Technology at the Xinjiang Institution of Ecology and Geography, Chinese Academy of Sciences (CAS). The specific parameters analyzed included: soil pH, total carbon content (%), organic matter content (g/kg), total nitrogen content (g/kg), and 6 heavy metal ions content (mg/kg): cadmium (Cd), chromium (Cr), nickel (Ni), lead (Pb), zinc (Zn), and copper (Cu).

Figure 7 to Figure 10, Table 2 and Table 3 show that the soil in the KFP plantation is alkaline with an average pH of 8.71; the pH of the surface soil (0–20 cm and 20–40 cm) fluctuates less than that of the deep soil. The soil organic matter content, total nitrogen content, and total carbon content all decreased with soil depth. The mean value of the organic matter content in the surface soil (0–20 cm) was 26.00 g/kg, the total nitrogen content was 1.73 g/kg, and total carbon was 3.87%; All minimum values but total carbon content were found in the deepest soil layer (80–100 cm), with an organic matter of 7.47 g/kg, a total nitrogen of 0.51 g/kg, and a total carbon of 1.98%.

In order to appraise the soil environmental safety in the KFP plantation, we conducted a comparative analysis of the soil samples with the National Standard for Control Value of Soil Contamination Risk on Agricultural Land (GB15618—2018), which stipulates that for agricultural soils of pH>7.5, the cadmium (Cd) ion should be <0.6 mg/kg, the chromium (Cr) ion should be <250 mg/kg, the nickel (Ni) ion should be <190 mg/kg, the lead (Pb) ion should be <170 mg/kg, the zinc (Zn) ion should be <300 mg/kg, and the copper (Cu) ion should be <100 mg/kg. Because KFP is on the protection list of China-EU geographical indications agreement, the soil samples were also analyzed against the EU Soil Protection Standard for Agricultural Land (Council Directive 86/278/EEC of 12 June 1986)[10]. The results show that except for the Pb (lead) and Cu (copper) in the surface soil (0–20 cm) of sample site No. 4, which exceeded the standard values, the content of all six heavy metal ions in all soil layers of the remaining sample sites were within the safe values. It is likely that the contaminated soil samples were due to human activities, and the soil environment of KFP plantation in Awati town is not generally contaminated, and meets the EEC requirements of Council Directive 86/278/EEC of 12 June 1986[10] (Table 2, 3).

Table 2 Soil pH and main nutrient contents in KFP area of Awati town

Sites	Soil depth (cm)	pH	Organic matter (g/kg)	Total nitrogen (g/kg)	Total carbon (%)
No.1	0–20	8.72	33.6	2.09	4.70
	20–40	8.52	25.70	1.49	3.80
	40–60	8.77	15.70	0.86	2.42
	60–80	8.63	9.89	0.70	1.97
	80–100	8.70	9.56	0.70	2.84
No.2	0–20	8.57	29.30	1.83	4.22
	20–40	8.60	17.80	1.11	3.35
	40–60	8.83	8.33	0.54	2.75
	60–80	8.74	8.15	0.57	2.80
	80–100	8.67	4.59	0.42	3.07
N0.3	0–20	8.76	28.20	1.70	3.05
	20–40	8.75	16.90	0.961	2.35
	40–60	8.97	11.50	0.477	0.91
	60–80	9.08	6.170	0.30	0.74
	80–100	9.21	5.47	0.29	0.59
No.4	0–20	8.49	21.60	1.56	3.02
	20–40	8.54	12.50	0.89	2.37
	40–60	8.19	11.80	0.80	1.64
	60–80	8.22	9.66	0.69	1.74
	80–100	8.25	11.50	0.74	2.20
No.5	0–20	8.99	17.30	1.45	4.35
	20–40	8.79	14.00	1.04	3.76
	40–60	8.92	12.10	0.87	3.46
	60–80	8.87	7.17	0.36	1.79
	80–100	8.93	6.22	0.39	1.20

Table 3 Soil chemicals in KFP area of Awati town (mg/kg)

Sites	Soil depth (cm)	Cd	Cr	Ni	Pb	Zn	Cu
No.1	0–20	0.16	57.31	24.66	16.48	84.58	27.04
	20–40	0.13	53.43	24.96	15.53	71.83	26.49
	40–60	0.19	81.78	37.35	25.83	91.75	34.42
	60–80	0.17	79.48	38.48	24.33	89.92	36.11
	80–100	0.18	87.37	35.47	23.95	87.42	33.66
No.2	0–20	0.15	81.24	21.79	15.63	74.88	21.71
	20–40	0.14	72.11	23.95	15.49	70.68	22.79
	40–60	0.12	73.00	26.45	15.67	63.13	23.37
	60–80	0.14	75.18	26.14	16.37	63.50	20.64
	80–100	0.10	70.66	22.49	13.35	51.66	19.30
N0.3	0–20	0.11	65.77	17.54	16.75	55.06	15.47
	20–40	0.10	69.10	16.97	16.68	51.60	14.28
	40–60	0.07	69.91	16.62	17.74	49.52	13.41
	60–80	0.06	53.25	13.26	15.37	38.75	9.79
	80–100	0.06	48.87	12.25	19.13	39.08	15.02
No.4	0–20	0.16	79.70	31.74	–	–	–
	20–40	0.13	71.15	27.67	20.76	70.78	24.74
	40–60	0.15	89.61	36.72	26.90	89.03	37.30
	60–80	0.15	94.33	42.52	29.06	103.4	37.40
	80–100	0.17	75.27	33.62	24.54	78.47	30.60
No.5	0–20	0.13	53.94	20.94	14.53	54.47	19.52
	20–40	0.14	50.46	22.35	15.84	52.81	21.33
	40–60	0.11	51.78	18.78	15.37	48.20	14.30
	60–80	0.10	42.80	16.17	15.39	44.75	12.83
	80–100	0.10	42.87	15.69	16.15	43.80	11.58
GB15618-2018[1]	For pH>7.5	<0.60	<250	<190	<170	<300	<100
Council Directive 86/278/ EEC of 12 June 1986[2]	–	1–3	–	30–75	50–300	150–300	50–140

[1] GB15618-2018 National standard - agricultural land soil pollution risk control value of China.

[2] Council Directive 86/278/EEC of 12 June 1986.

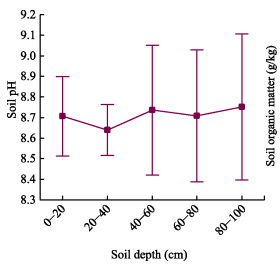

Figure 7 Soil pH

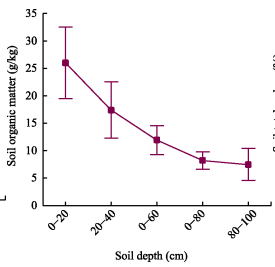

Figure 8 Soil organic matter

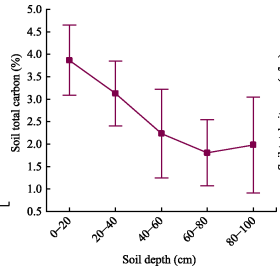

Figure 9 Soil total carbon

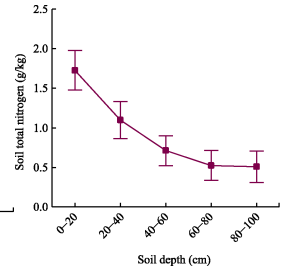

Figure 10 Soil nitrogen

4.3 Irrigation Water Quality Analysis of KFP Plantation

The irrigation waters of the KFP plantation were sampled in Awati town in terms of surface water and groundwater. The surface water was obtained from the Kongque River, and the groundwater was obtained from the irrigation wells in the plantations. The water samples were analyzed by the Service Center of Public Technology Xinjiang Institution of Ecology and Geography CAS. Parameters analyzed include: pH, the concentrations of 9 heavy metal ions (mg/L): cadmium (Cd), chromium (Cr), nickel (Ni), lead (Pb), zinc (Zn), copper (Cu), manganese (Mn) and iron (Fe) and arsenic (As). The water sample results were evaluated against the national Surface Water Environmental Quality Standard (GB 3838—2002), the Groundwater Quality Standard (GB/T 14848—2017), and the EU Environmental Quality Standard for Agricultural Water[11].

The comparative analysis show that the surface water in the core area of KFP in Awati town is alkaline with pH of 8.14, lead (Pb) ions were not detected, and the other ions were present at trace levels. The water meets the national surface water standard class I, and is suitable for living, drinking and source protection. The groundwater in the study area is also alkaline with pH of 8.40, and no lead (Pb) was detected; except for manganese (Mn), which exceeded the national standard, all other elements were present only in trace amounts. The test results for the water samples in this area meet the European environmental requirements for agricultural water (Table 4, 5).

Table 4 Surface water chemicals of Awati KFP area (mg/L)

	pH	Cd	Cr	Ni	Pb	Zn	Cu	Mn	Fe	As
Surface water	8.14	0.000,013	0.000,36	0.000,786,9	0.00	0.003,831	0.001,608	0.001,441	0.101,43	0.001,917
GB 3838—2002 NS class I	6–9	<0.001	<0.01	<0.02	<0.01	<0.05	<0.01	<0.1	<0.3	<0.05
GB 3838—2002 NS class II	6–9	<0.005	<0.05	<0.02	<0.01	<0.05	<0.01	<0.1	<0.3	<0.05
GB 3838—2002 NS class III	6–9	<0.005	<0.05	<0.02	<0.05	<0.05	<0.01	<0.1	<0.3	<0.05
OJ L 348, 24.12.2008 Directive 2008/105/EC[3]	–	<0.00008	–	<0.02	–	<0.0072	–	–	–	–

NS = China National Standard

Table 5 Ground water chemicals of Awati KFP area (mg/L)

	pH	Cd	Cr	Ni	Pb	Zn	Cu	Mn	Fe	As
Ground water	8.40	0.000,015	0.000,43	0.000,5	0.00	0.001,48	0.000,7	0.178,5	0.119,3	0.000,48
GB/T 14848—2017 NS class I	6.5–8.5	<0.0001	<0.005	<0.002	<0.005	<0.01	<0.01	<0.05	<0.10	<0.01
GB/T 14848—2017 NS class II	6.5–8.5	<0.0001	<0.005	<0.002	<0.005	<0.05	<0.05	<0.05	<0.20	<0.01
GB/T 14848—2017 NS class III	6.5–8.5	<0.0005	<0.01	<0.02	<0.01	<0.05	<1.00	<0.10	<0.30	<1.00

NS = China National Standard

[3] OJ L 348, 24.12.2008. Directive 2008/105/EC.

4.4 NDVI of the Kongque River Oasis

Normalized difference vegetation index (NDVI) was calculated from Sentinel-2 L2A data, NDVI = (NIR−Red)/(NIR+Red), NIR and Red using Band8 and Band4 respectively, with a resolution of 10m. The range of NDVI values is [−1, +1]. Figure 11 shows that NDVI of the Kolar Kongque River oasis in September 2020 ranged from −0.35 to 0.91, with a few water bodies present within the oasis, bare land with sparse grassland at the periphery, and the NDVI ranged between 0.00 and 0.23. The farmland and KFP plantations within the oasis had NVDI values reaching 0.45–0.91 (Figure 11).

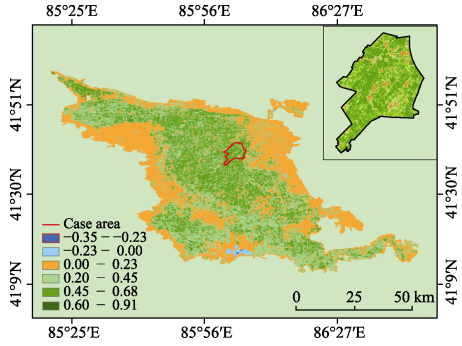

Figure 11 NDVI of Kongque River oasis (September 2020)

5 Kolar Fragrant Pear (KFP): Biology, Nutrition, and Cultivation

5.1 KFP Biological and Nutritional Characteristics

KFP is the only pear variety in the pear industry in the region of the Bayingoleng Mongol autonomous prefecture, Xinjiang[3]. The typical KFP is small, wide ovoid or spindle in shape. The fruit pedicel is semi-fleshy near the fruit part expansion. The fruit surface is waxy and relatively thick. The skin is green or yellow-green at maturity, and some fruits are red. The fruit skin is thin, the flesh is white, tender, crisp, juicy, sweet, and aromatic. The fruits can be stored for a long time. The fruit identification standards of KFP are divided into two categories: sensory requirements and physical and chemical indicators.

For sensory requirements, the KFP fruit should meet the standard of the Geographical Indication Product of Kolar fragrant pear (GB/T 19859—2005)[5]: The fruit shape is upright, and the surface is smooth and clean. The fruit should be fresh, without pest or mechanical damage. The fruit pedicels should be intact, with no scars on the fruit surface. The single fruit weight falls between 120–150 g for the special grade fruit. In terms of physical and chemical indexes, the soluble organic matter content of KPF fruit is required to be ≥11.5%, the total acidity ≤0.10%, and the fruit hardness should be between 45–75 N/cm^2[5].

5.2 Technical Specification for Cultivation of KPF

(1) Establish a new plantation. Planting of KPF requires the land to be leveled, with north-south rows. Large plantation should be divided into smaller sections with 2–3 hm^2 in size. Windproof forests should be installed before or during planting, with a mixture of high trees and short shrubs. The robust dew pear should be the rootstock, using seat rootstock grafting to build a KPF plant. Similarly, using the robust dew pear as the rootstock, seat rootstock grafting should be employed to build a KPF plant.

(2) Soil, fertilizer and water management. Soil requires deep tillage together with autumn fertilization, and full winter watering. Soil should be loosened and weeded in time so as to keep it loose. The KPF plants should be intercropped with alfalfa, clover, flat-stemmed astragalus and other green manure crops. Tall crops should be avoided between the rows, so do the pests and diseases host plants. Amount of organic fertilizer should be 20–50 kg per young plant and 50–100 kg per fruiting tree; the amount of inorganic fertilizer is 2%–3% that of the current year's yield, and nitrogen, phosphorus and potassium fertilizers should be

applied in the ratio of 2:1:1. During the pre-flowering, post-flowering, young fruit expansion and other phenological periods, fertilizer and watering should be also be applied. Microelements should be applied in appropriate amounts according to the nutritional condition of the trees. At the same time, the irrigation water ammount should be adjusted according to the needs of the trees and soil moisture.

(3) Pollination. Dangshan pear and Yali pear should be used to help pollinate, and the number of pollination trees should be more than 12% of the KFP plants.

(4) Flower and fruit management. Need fine pruning, and artificially assisted pollination, orchard bee pollination; thin flower and fruit to control the single plant load. When thinning flowers, remove the string flowers, weak flowers, central flowers, but keep peripheral flowers; 2–4 flowers per inflorescence. When thinning the fruit, keep the single fruits, thin out the small fruit, insect-damaged fruit, or deformed fruits. If flowers and fruits are scarce, keep all flowers and fruits.

(5) Pest and disease control. The main pest and disease are apple borers, mites, moths, pear woodlice and pests such as rot and yellowing disease. The natural enemies of the pests should be protected and utilized so as to keep ecological balance and reduce pollution, and the nationally banned pesticides should not be used.

(6) Crown management. An appropriate tree shape should be selected according to the canopy density. Common tree shapes are the basal three main branches sparse layered shape, the three main branches in the trunk shape, or the open shape. Pruning of young trees should be based on the principles of trucking, cultivating backbone branches, expanding the canopy, making the whole tree with distinct branches and trunks, and applied early. When pruning fruiting trees: adjust or maintain the skeleton structure of the trees in winter, cultivate the backbone branches at all levels and expand the crown, optimize the fruiting branches. In summer, thin out overly dense branches, long-lived branches and secondary tips of the vigorous fruit table. For senescent fruit trees, the central trunk should be cut, dense crowded branches should be thinned out, and long branches should be rebuilt to achieve a balanced configuration and renewal.

(7) Harvest: KFP ripens in early September. Famers should pick KPF with thread-woven soft gloves, pick lightly and reduce the number of transits. The fruit basket should have a hook, and an inner wall with soft material liner[5].

6 The Role of Social Infrastructure in the Development of KFP Industry

99% of the Kongque River oasis is located in the territory of Kolar city, Tielmengguan city and Yuli county in the Bayingoleng Mongol autonomous prefecture (BMAP), Xinjiang. According to the statistics in 2019, the population of the oasis was about 570,000, of which approximately 420,000 were urban and 150,000 were rural. The planting area of KFP in the oasis was 403.45 km^2, and the KFP yield was 395,200 tons[12]. The planting area of KFP in Kolar was 303.33 km^2, 233.33 km^2 of which is fruiting and yields 227,000 tons of KFP, with a unit yield of 0.644 t/mu, and the per capita income of 6,006 Yuan, accounting for 28.11% of the total income of fruit farmers[3]. To promote the KFP industry and protect the oasis, the governments of BMAP and Kolar city have taken the following measures.

6.1 Promote KFP Plantation Standardization

To foster the standardized management of the KFP plantation, the local governments ask the leaders at the prefecture, city and town levels to establish demonstration orchards. The demo orchards should be no less than 500 mu, 300 mu, and 200 mu at prefecture, city and town levels, respectively. By means of responsibility plates, strengthening standardized management, and efficiency assessment, these demo orchards promoted the innovation and stand-

ardization of KFP plantation. In total, 328 demo plantations were established in 2018–2020, including 10 at the prefecture level, 27 at the city level and 291 at the town level, effectively improved the standardized management in nearby orchards. The next step will be to promote the construction of standard orchards on a larger scale[3].

6.2 Water Saving Technique

In 2014, Awati town started to construct the KFP experiment base. It has finished land leveling, a protective forest, and field roads and other infrastructure. A 20-mu (1 mu = 666.67 m^2) of KFP germplasm resource field has been completed. A 1400-mu demonstration plantation has been equipped with a percolation irrigation system of integrated water and fertilizer. This system allows accurate irrigation water for 20 to 25m^3 per mu, an irrigation cycle of five days. Compared with the conventional diffusion irrigation method, it saved water by more than 30% and fertilizer by 10%[3].

6.3 Technology Empowerment

Awati town of Kolar is a demonstration area for scientific and technology application, Soil moisture and meteorological monitoring equipment with big data aggregation and a visualization platform have been introduced (Figure 12, 13). To increase the standardized production of the orchard base, water-saving irrigation has been implemented by strengthening the infrastructure and promoting water and fertilizer integration. Disaster prevention and mitigation facilities have also been built, with standardized orchard automatic weather monitoring stations for orchards. The standard orchard was improved, and the quality and commercial rate of KPF were significantly improved by applying modern agricultural technologies such as soil testing formulas, tree nutrition diagnosis, standardized cultivation, and green pest control. A combination of field data collection and remote visualization effectively aid the FPF management.

6.4 KFP: Brand Nurture

In 1996, KFP was registered as the national certificate of origin trademark, and this was also the only geographical indication mark of origin for agricultural products in China at the time, and was recognized as a well-known trademark in China. In 2012, the government of Kolar city made efforts to promote the standardization of geographical indication public trademark, as a Kongque River side. In the same year, Kongque River side was chosen as the only brand trademark for KPF (Figure 14). In 2019, KPF was selected for China's agricultural brand directory, and was also selected as one of China's top 100 brands of agricultural products. In 2019, the KPF brand value was estimated to be 10.092 billion Yuan, ranking the first in pear category. In 2020, KPF was included in the first protection list of China-EU geographical indication agreement[3].

Figure 12 Soil moisture meter **Figure 13** Big data platform **Figure 14** Peacock River side trademark

The demonstration area of KFP forms an integrated system for KFP production, processing, preservation, transportation, and realizes the intensive and large-scale operation of

the graded sales and preservation. While the current sales of fragrant pears are mainly fresh fruits, some KFP will be processed into fragrant pear paste, juice, and wine in the future.

6.5 FKP Skill Training

In 1994, the local government helps set up the Association of KFP of BMAP, and issued the guidelines for KFP protection and promotion. Since 2010, closed planting technique training programs have been regularly carried out, as well as on-site demonstration training programs and the production management skills grand prix of KFP.

More than 2,000 farmers were trained annually, in this way to effectively improve the management skills of practitioners. Since 2017, the local governments began to hold high-level training activities, making full use of night schools, special training, on-site guidance and observation, to widely implement technical training, especially winter and spring management, pest control and standardized production, gradually training a skilled person for every household[3].

In addition, scientists, local government, and farmers have co-operated to practice the Clear waters and lush mountains are invaluable assets development concept. In April 2021, Professor Liu, C. from Institute of Geographic Sciences and Natural Resources Research of CAS visited Kolar city and proposed this case study of GIES of KFP for Kongque River oasis environment protection. In February 2022, Professors Gui, D. W. and Fan, J. L .from the Ecology and Geography Institute of CAS in Xinjiang came to Awati town, Kolar, and negotiated the cooperation framework of the case study with local government and practitioners.

6.6 Low Yield Orchard Improvement Pilot Project

Korla began to implement the Xinjiang Special Industries Project in 2019. A pilot project was conducted in Qigaikeqike village of Awati town. The pilot project covered an area of 2,895 mu and included 108 households. So far, KFP tree transformation, flower and fruit management, additional organic fertilizer, green manure planting, garden cleaning, integrated pest control, the blight disease prevention have been implemented.

The average yield (commercial fruit) in the pilot area in 2021 was 1,800 kg per mu, which is 566.7 kg higher than the average yield of 1,233.3 kg per mu during the previous three years. An increase in per-mu-yield of 45.9% translated into an increase in the commercial fruit rate of 12%. The average output value per mu increased from 5,525.2 Yuan in the first three years to 8,100 Yuan in 2021, (an increase of 2,574.8 Yuan per mu) so that the average profit of the local KPF household increased by 1,030 Yuan, and the total profit of 2,895 mu of the low efficiency garden of KFP increased by 298.19 million Yuan (Figure 15).

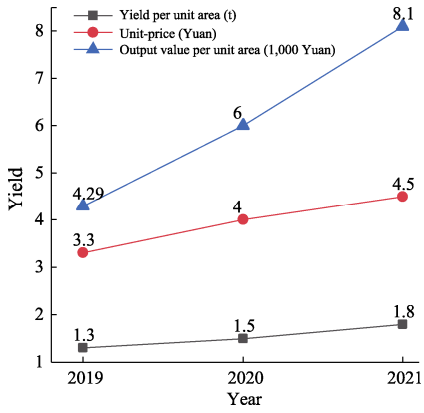

Figure 15 Effect of low yield orchard improvement in Awati pilot project

7 Discussion and Conclusion

The Xinjiang oasis ecological environment has scarce precipitation and high heat resources, and KFP is a quality geographical indication product bred for that the environment. Through this GIES case study of FKP of Kongque River oasis, the natural environment data, variety quality data and planting management specifications of the core area of KFP in Awati town,

Kolar were sorted out. This research has attempted to create a new path for the high-quality development of KFP.

Author Contributions

Liu, C. and Gui, D. W. designed the study. Li, B. F. completed the sampling, data analysis, information collection; Fan, J. L., Huo, J., H, hou, J. Z. and Ritif, P. were responsible for the supervision; Liu, M. Z. and Tian, H. S. provided the management information; Zhang, F. and Tian, H. S. assisted the case study.

Conflicts of Interest

The authors declare no conflicts of interest.

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