

# Promoting High-quality Development of Grain and Oil in Ethnic Areas of the Yangtze River Economic Belt from the Perspective of Agricultural Power

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**Abstract** Accelerating the construction of agricultural power, further promoting the high-quality development of the Yangtze River Economic Belt, and better supporting and serving Chinese-style modernization are the key issues at present. This paper first introduces the Yangtze River Economic Belt and its ethnic areas, and studies the characteristics of the grain and oil industry in the ethnic autonomous areas of the economic belt, as well as the current situation of various types of intellectual property resources, such as industrial cultural heritage, scientific and technological innovation, and brand marking intellectual property. Besides, it analyzes the main problems in the high-quality development of grain and oil in the Yangtze River Economic Belt ethnic areas. Finally, it comes up with recommendations, including protecting the intellectual property rights of cultural heritage in the field of grain and oil, leading the inheritance and development of excellent traditional Chinese culture, use scientific and technological innovation intellectual property rights to promote the innovation-driven development strategy of the grain and oil industry, and providing counterpart assistance to ethnic autonomous areas in the Yangtze River Economic Belt to further promote the high-quality development of the Yangtze River Economic Belt.

**Key words** The Yangtze River Economic Belt, Ethnic areas, Grain and oil, Intellectual property, Agricultural power

## 1 Introduction

The report of the 20<sup>th</sup> National Congress of the Communist Party of China proposed to "accelerate the construction of agricultural power", "establish a greater food concept", "build a diversified food supply system", "ensure the security of food, energy resources, and important industrial and supply chains", and summarized the five characteristics of Chinese modernization. In 2023, the No. 1 central document proposed to "pay close attention to the stable production and supply of grain and important agricultural products" and "based on national conditions and agricultural conditions, reflect Chinese characteristics, and build agricultural power with strong supply guarantee, strong scientific and technological equipment, strong management system, strong industrial resilience and strong competitiveness". China is a country with a large population, and grain and oil security is related to national transportation and people's livelihood, an important foundation for national security and social stability, and a prerequisite for building agricultural power and promoting Chinese-style modernization. General Secretary Xi Jinping<sup>[1]</sup>, the CPC Central Committee and the State Council attach great importance to the issue of food security, and have always regarded solving the problem of people's food as the primary task of governing the country and securing the country.

In China, there are three categories of grain in China: cere-

als, tubers and beans. The main cereal crops are rice, wheat, maize, sorghum, barley, naked barley (highland barley), millet, *Coix lacryma-jobi* L., common buckwheat, tartary buckwheat, oats, *Avena chinensis*, *Chenopodium quinoa* Willd., *Secale cereale* L. and so on. Tuber crops mainly include sweet potato, potato, *Colocasia esculenta*, *Dioscorea opposita*, cassava and so on. The main legume crops are soybean, broad bean, pea, mung bean, adzuki bean, *Vigna umbellata*, etc.

There are two kinds of edible oil plants in China: herbaceous and woody. In addition to rice, maize, and soybean crops for grain and oil, herbal edible oilseeds mainly include rapeseed, peanut, sesame, sunflower, perilla (Suzi), cotton, flax, hemp, *Cyperus esculentus* L., and safflower<sup>[2]</sup>. Among them, maize, flax and hemp are both fiber and edible oil, and perilla and safflower are medicinal oils. At present, there are 12 kinds of woody edible oilseeds vigorously developed in China: *Camellia oleifera*, walnut, *Olea europaea* L., *Paeonia suffruticosa*, *Eucommia ulmoides* Oliv., *Rhus chinensis* Mill., *Acer truncatum* Bunge, *Idesia polycarpa* var. *vestita* Diels, *Cornus wilsoniana* Wangerin, *Xanthoceras sorbifolium* Bunge, *Amygdalus pedunculata* Pall., *Elaeagnus mollis* Diels<sup>[3]</sup>. In addition, China also has woody edible oils such as *Torreya grandis*, hickory, *Litsea pungens*, elderberry, oil palm, coconut, cocoa, cashew nuts, macadamia nuts (*Macadamia integrifolia* Maiden & Betcher), seabuckthorn, almond apricot, *Pinus koraiensis*, hazelnut, common almond (*Amygdalus communis* L.), *Prunus tenella* Batsch and so on. Among them, walnut, hickory, *Torreya grandis*, coconut, cashew nut, macadamia nut, almond, *Pinus koraiensis*, hazelnut, and almond are used for both oil and food, and peony, *Eucommia ulmoides* Oliv., *Rhus chinensis*

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sis Mill., *Litsea pungens* Hemsl., and *Sambucus williamsii* Hance are used for both medicine and oil.

The Yangtze River Economic Belt is a major national strategic development area, an inland river economic belt with global influence, and a pioneer demonstration belt for the construction of ecological civilization<sup>[4-6]</sup>. The research of the Yangtze River Economic Belt mainly focuses on the major cities and urban circles along the Yangtze River, while the ethnic areas and advantageous industries with agricultural characteristics have not received due attention. Promoting the coordinated development of ethnic minority areas, simultaneously building a diversified food supply system and building agricultural power are important ways to further promote the high-quality development of the Yangtze River Economic Belt. Therefore, we studied the strategy of promoting the high-quality development of grain and oil in the Yangtze River Economic Belt under the goal of agricultural power and the strategy of building a strong country with intellectual property.

## 2 Overview of the Yangtze River Economic Belt and its ethnic areas

**2.1 A major strategy to drive the development of the Yangtze River Economic Belt** The *Outline of the Yangtze River Economic Belt Development Plan* issued by the Political Bureau of the CPC Central Committee in September 2016 officially launched a major national strategy to promote the development of the Yangtze River Economic Belt depicted the grand blueprint for the development of the Yangtze River Economic Belt from the aspects of planning background, overall requirements, vigorously protecting the ecological environment of the Yangtze River, accelerating the construction of a comprehensive three-dimensional transportation corridor, innovation-driven industrial transformation and upgrading, actively promoting new urbanization, striving to build a new pattern of all-round opening-up, and innovating the institutional mechanism and safeguard measures for regional coordinated development Economic Belt "one axis, two wings, three poles, multiple points" development pattern.

The development of the Yangtze River Economic Belt and the construction of the Belt and Road and the coordinated development of Beijing – Tianjin – Hebei are the "three major regional development strategies" of China. Promoting the development of the Yangtze River Economic Belt is a major decision made by the CPC Central Committee with Xi Jinping, the general secretary as the core. On October 12, 2023, Xi Jinping presided over a symposium on further promoting the high-quality development of the Yangtze River Economic Belt, and emphasized that "further promote the high-quality development of the Yangtze River Economic Belt to better support and serve Chinese-style modernization". The economic belt covers 11 provinces and cities, including Shanghai, Jiangsu, Zhejiang, Anhui, Jiangxi, Hubei, Hunan, Chongqing, Sichuan, Guizhou and Yunnan.

**2.2 Ethnic areas** The Yangtze River Economic Belt has 16 autonomous prefectures: Enshi in Hubei, Xiangxi in Hunan, Aba

in Sichuan, Ganzi and Liangshan in Sichuan, Qianxi'nan, Qiongzhusi, and Qiannan in Guizhou, and Dehong, Nujiang, Diqing, Dali, Chuxiong, Honghe, Wenshan and Xishuangbanna in Yunnan. These prefectures have a total of 158 counties, including 25 county-level cities, 122 counties, and 11 autonomous counties.

This economic belt has 47 autonomous counties under the jurisdiction of the following municipalities: Jingning in Zhejiang, Changyang and Wufeng in Hubei, Chengbu, Jianghua, Mayang, Xinhuang, Zhijiang, Jingzhou and Tongdao in Hunan, Shizhu, Xiushan, Youyang and Pengshui in Chongqing, Beichuan, Ebian and Mabian in Sichuan, Daozhen, Wuchuan, Zhenning, Guanling, Ziyun, Weining, Yuping, Yinjiang, Yanhe and Songtao in Guizhou, Shilin, Luquan, Xundian, Eshan, Xinping, Yuanjiang, Yulong, Ninglang, Ning'er, Mojiang, Jingdong, Jinggu, Zhenyuan, Jiangcheng, Menglian, Lancang, Ximeng, Shuangjiang, Gengma, and Cangyuan in Yunnan.

These ethnic autonomous areas involve seven provinces and municipalities, including Zhejiang, Hubei, Hunan, Chongqing, Sichuan, Guizhou, and Yunnan, and include 25 ethnic minorities, including She, Tujia, Miao, Dong, Yao, Tibetan, Qiang, Yi, Gelao, Buyi, Shui, Dai, Jingpo, Lisu, Bai, Zhuang, Hani, Lahu, Wa, Bulang, Hui, Naxi, Pumi, Dulong, and Nu. These ethnic areas cover an area of 691 500 km<sup>2</sup>, taking up 33.69% of the Yangtze River Economic Belt, and include a total of 205 counties, including 109 ethnic townships (excluding the two that have been abolished in Hunan in recent years). There are also 431 ethnic townships in the non-ethnic autonomous areas of the economic belt. Among them, one is in Jiangsu, 18 in Zhejiang, 9 in Anhui, 8 in Jiangxi, 8 in Hubei, 79 in Hunan, 14 in Chongqing, 72 in Sichuan, 168 in Guizhou and 54 in Yunnan.

## 3 Characteristics of grain and oil industries in ethnic autonomous areas

**3.1 Planting area and yield** According to the latest relevant yearbooks and local government national economic and social development bulletins, the planting area of grain and oil crops in the Yangtze River Economic Belt was 4 959.98 thousand and 596.11 thousand ha, and the total output is 2 295.16 million t and 1.177 3 million t. Specifically, the planting area of grain and oilseed (mainly rapeseed) crops in Zhejiang was 6.49 thousand ha and 0.14 thousand ha, respectively, and the yield was 36 800 and 100 t, respectively. The planting areas of grain and oil crops in Hubei were 432.27 thousand ha and 67.59 thousand ha, and the yields were 1.675 9 million t and 130 700 t; the planting areas of grain and oil crops in Hunan were 288.68 thousand ha and 100.36 thousand ha, and the yields were 1.526 7 million t and 151.1 million t; the planting areas of grain and oil crops in Chongqing were 26.42 thousand ha and 6.19 thousand ha, and the yields were 119 300 and 115 500 t; the planting area of grain and oil crops in Sichuan was 712.70 thousand ha and 38.82 thousand ha, and the yields were 3.096 million t and 74.1 thousand t; the planting areas of

grain and oil crops in Guizhou were 1 136.76 thousand ha and 248.51 thousand ha, and the yields were 5.787 1 million t and 43.3 million t; the planting area of grain and oil crops in Yunnan were 2 356.66 thousand ha and 134.50 thousand ha, and the yields were 1 070.98 million t and 272.8 million t.

**3.2 Grain and oil seed industry** China strives to strengthen the agricultural "chip" and promote the modern seed industry upgrading project. The Ministry of Agriculture and Rural Affairs has identified a total of 190 regional breeding bases and large seed production counties. Among them, there are national-level regional breeding bases for the grain and oil industry in the ethnic autonomous areas of the economic belt: Zhaojue County of Liangshan Prefecture (potato), Weining Autonomous County of Bijie City (potato), Changshun County of Qiannan Prefecture (rape), Xundian Autonomous County of Kunming City (summer breeding); five state-level seed production counties: Jingzhou Autonomous County of Huaihua City (rice), Cengong County of Qiongzhusi Prefecture (rice), Xichang City of Liangshan Prefecture (maize), and Yuanmou County of Chuxiong Prefecture (winter and summer breeding in national seed breeding base in Hainan). The Ministry of Agriculture and Rural Affairs has identified a total of 81 national crop and agricultural microbial germplasm resource banks (nurseries) in two batches. That related to the ethnic areas of the Yangtze River Economic Belt is the National Plateau Wild Rice Germplasm Resources Nursery (Kunming). The Ministry of Rural Agriculture announced 69 national seed industry formation enterprises for crops. Among them, the grain and oil industry of the ethnic autonomous area in the economic belt has Hubei Kangnong Seed Industry Co., Ltd., which uses maize as a species.

**3.3 National grain production functional areas and important agricultural product production protection areas** The State Council issued the *Guiding Opinions on the Establishment of Functional Areas for Grain Production and Important Agricultural Products Production Protection Areas* (Guofa[2017] 24), and deployed the establishment of three functional areas for grain production, namely, rice, wheat and maize, and five important agricultural product production protection areas, namely, soybean, maize rapeseed, sugar cane and natural rubber. It required to delimit the rice, wheat and maize production functional areas of 22.66 million, 21.33 million (including 4 million ha of rice and wheat multiple cropping areas) and 30 million (including 10 million ha of wheat and maize multiple cropping areas) respectively. The protection zones for soybean, rapeseed and cotton production are respectively 666.7 million (including 1.33 million ha in the wheat and soybean multiple cropping area), 4.667 million ha (including 4 million ha in the rice and rapeseed multiple cropping area) and 2.333 million ha.

The ethnic autonomous areas of the Yangtze River Economic Belt had 1.13 million rice, 0.185 million and 1.23 million ha, respectively, and 306 000 ha of rapeseed production protection area (including multiple cropping area). Specifically, Zhejiang

had 2 000 ha of rice production functional areas, Hubei has 49 000, 3 333, 106 700 ha of rice, wheat and maize production functional areas, 40 000 ha of rapeseed production protection areas, Hunan had 163 000 ha of rice production functional areas and 56 000 ha of rapeseed production protection areas, Chongqing had 47 000 ha of rice and maize production functional areas and 30 000 ha of rapeseed production protection areas, and Sichuan had 45 000 ha of rice, 38 000 ha wheat and 87 000 ha maize production functional areas, Guizhou had 290 000, 50 000 and 218 000 ha of rice, wheat and maize production functional areas, and 139 000 ha of rapeseed production protection areas, while Yunnan had 530 000, 93 000 and 730 000 ha of rice, wheat and maize production functional areas, and 40 000 ha of rapeseed production protection area.

**3.4 Advantageous area of Chinese characteristic agricultural products** From 2017 to 2020, nine ministries and commissions, including the Ministry of Agriculture and Rural Affairs, jointly identified a total of 308 advantageous areas for Chinese characteristic agricultural products in four batches, 38 of which involved grain and oil. Among them, there are 4 grains and oils in the ethnic autonomous areas of the economic belt: Xingren coix seed in Xingren City, Guizhou Province, Weining potato in Weining Autonomous County, Jinping Tea Oil in Jinping County and Yangbi Walnut in Yangbi Autonomous County, Yunnan Province.

**3.5 Advantageous counties of national characteristic agricultural products** China's *Regional Distribution Plan for Characteristic Agricultural Products (2013–2020)* focuses on the development of 144 kinds of characteristic agricultural products in 10 categories (excluding rice, wheat, maize, sweet potato, potato, soybean, rapeseed and other major grain and oil). Among, there are 14 kinds of grain and oil crops related to the ethnic areas in the Yangtze River Economic Belt, including sorghum, barley, highland barley (naked barley), coix, oat, buckwheat, yam, broad bean, pea, mung bean, red bean, woody oil (mainly *Camellia oleifera*), special walnut (both oil and grain), *Eucommia ulmoides* (medicinal oil), as shown in Table 1.

**3.6 National "one village, one product" demonstration villages and towns** There are only 25 national "one village, one product" demonstration villages and towns of grain and oil in the ethnic autonomous areas of this economic belt. Among them, there are two villages and towns in Hubei, both involving *Camellia oleifera*; one in Hunan, involving rice; five in Chongqing, separately involving rice, sweet potato and sweet potato powder; two in Sichuan, both involving walnut; five in Guizhou, involving rice, hybrid rice seeds, sweet potato and potato; and 10 in Yunnan, involving rice, buckwheat, potato and walnut.

**3.7 National famous, special and excellent new agricultural products** According to the *National Famous, Special, Excellent and New Agricultural Products List Collection and Registration Information System* of the Ministry of Agriculture and Rural Affairs, there are 17 kinds of national famous, special, excellent and new agricultural products of grain and oil (13 kinds of grain and 4

kinds of vegetable edible oil) in ethnic autonomous areas of the Yangtze River Economic Belt. Among them, there are Yongshun rice in Hunan Province; Shizhu rice, Youyang tribute rice, Pengshuijing Sitiao powder, Youyang tea oil, Pengshui perilla oil in Chongqing City; Jinyang black potato in Sichuan; Luodian rice,

Shibing pearl rice, Gaoniang rice, Pinglang rice, Sandu rice, Luodian table corn, Ziyun red core sweet potato, Changshun rape-seed oil in Guizhou Province; Xundian potato, Yangbi walnut in Yunnan Province.

**Table 1 Advantageous counties of oil and grain categories of national characteristic agricultural products in ethnic areas of the Yangtze River Economic Belt**

Characteristic agricultural products	Advantageous counties
Sorghum	Pingtang County in Guizhou Province
Barley	Shilin, Xundian, Yulong, Nanhua, Yao'an, Luxi, Wenshan, Xiangyun, Midu, Nanjian, Weishan, Eryuan, Jianchuan and Heqing in Yunnan Province
Highland barley	Songpan, Heishui, Maerkang, Rangtang, Aba, Ruogai, Kangding, Daofu, Luhuo, Ganzi, Xinlong, Dege, Baiyu, Litang, Daocheng and Muli in Sichuan Province
Coix	Ziyun, Xingyi, Xingren, Puan, Qinglong, Zhenfeng, Wangmo, Anlong and Changshun of Guizhou Province; Wenshan, Qiubei and Guangnan of Yunnan Province
Oats	Butuo, Jinyang, Zhaojue, Yuexi and Meigu in Sichuan Province; Weining in Guizhou Province; Ninglang, Shangri-La, Deqin and Weixi in Yunnan Province
Buckwheat	Youyang in Chongqing City; Muli, Yanyuan, Huidong, Puge, Butuo, Jinyang, Zhaojue, Xide, Mianning, Yuexi, and Meigu in Sichuan Province; Weining, Guizhou; Ninglang, Mojiang, Jingdong, Lancang, Shuangjiang, Cangyuan, Chuxiong, Mouding, Nanhua, Yao'an, Dayao, Luxi, Honghe, Luchun, Xiangyun, Eryuan, Heqing, Shangri-La in Yunnan Province
Yam	Shilin, Luquan, Jinggu, Yuanmou, Lufeng, Jianshui, Shiping, Wenshan, Yongping and Lianghe in Yunnan Province
Broad beans	Xichang and Zhaojue in Sichuan Province; Zhenning, Guanling, Weining, Yuping, Xingyi, Xingren, Qinglong, Kaili, Leishan, Dushan and Huishui in Guizhou Province; Shilin, Luquan, Chuxiong, Shuangbai, Mouding, Nanhua, Yao'an, Dayao, Lufeng, Kaiyuan, Mengzi, Jianshui, Maitreya, Dali, Xiangyun, Binchuan, Midu, Nanjian, Weishan, Yongping, Eryuan, Jianchuan, Heqing and Lanping in Yunnan Province
Peas	Lichuan and Badong in Hubei Province; Huidong and Ningnan in Sichuan Province; Daozhen, Zhenning, Guanling, Weining, Xingyi, Xingren, Qinglong, Kaili, Majiang, Dushan and Huishui in Guizhou Province; Nanhua, Mengzi, Jianshui, Qiubei, Guangnan, Dali, Yangbi, Xiangyun, Midu, Nanjian, Weishan, Yongping, Yunlong, Eryuan, Jianchuan and Heqing in Yunnan Province
Mung bean	Badong in Hubei Province and Zhenning in Guizhou Province
Red adzuki bean	Jianshi and Badong in Hubei Province; Ziyun in Guizhou Province; Ninglang and Weishan in Yunnan Province
Woody oil crops	Jingning in Zhejiang Province; Changyang in Hubei Province; Jianghua and Yongshun in Hunan Province
Characteristic walnut	Changyang in Hubei Province; Ning'er, Mojiang, Jingdong, Jinggu, Zhenyuan, Jiangcheng, Menglian, Lancang, Ximeng, Shuangjiang, Gengma, Cangyuan, Dali, Yangbi, Xiangyun, Binchuan, Midu, Nanjian, Weishan, Yongping, Yunlong, Eryuan, Jianchuan, Heqing, Mangshi and Longchuan in Yunnan Province
Eucommia ulmoides	Changyang, Lichuan, Jianshi, Badong, Xianfeng and Hefeng in Hubei Province; Yongshun and Longshan in Hunan Province; Youyang in Chongqing City; Daozhen, Wuchuan, Yinjiang and Guiding in Guizhou Province

**3.8 China's good grain and oil** The National Food and Strategic Reserves Administration has implemented the "China's Good Grain and Oil" action plan and identified China's Good Grain and Oil. There are only three good Chinese grain and oil brands in the ethnic autonomous areas of the economic belt: Xili Tribute Rice of Guizhou Rongjiang County Lilixiang Rice Industry Co., Ltd., Gaofeng Shilixiang Rice of Guizhou Gaofeng Shilixiang Rice Industry Co., Ltd., and Xingren Coix Seed of Guizhou Xingren Jufeng Coix Seed Co., Ltd.

**3.9 National advantageous and characteristic industrial clusters** In 2020, the Ministry of Agriculture and Rural Affairs and the Ministry of Finance launched the construction of national advantageous and characteristic industrial clusters, and so far a total of 180 construction lists have been issued in four batches. Among them, the grains and oils related to the ethnic autonomous areas of the Yangtze River Economic Belt mainly include: Hubei Rice In-

dustry Cluster, Hunan Early Maturing Rape Industry Cluster, Chongqing Wheat Products Industry Cluster, Sichuan Rape Industry Cluster, Guizhou Mountain Winter Fallow Rape Industry Cluster, etc.

## 4 Agricultural intellectual property rights of grain and oil in ethnic autonomous areas

Agricultural intellectual property rights<sup>[7-11]</sup> are the strategic resources of national agricultural development, the core elements of international agricultural competitiveness, and the important production factors of rural knowledge economy, which can become a powerful engine for the high-quality development of grain and oil industry. Heritage intellectual property rights promote the inheritance of farming culture, innovative intellectual property rights protect agricultural innovation drive, and label intellectual property rights promote industrial brand development.

**4.1 Cultural heritage intellectual property resources** Cultural heritage intellectual property rights include traditional knowledge, biological genetic resources and so on. Ethnic autonomous areas in the Yangtze River Economic Belt are rich in traditional knowledge and non-cultural heritage resources related to grain and oil, including traditional grain and oil planting knowledge, traditional processing techniques, and traditional agricultural cultural system (important agricultural heritage), traditional medical knowledge of highland barley, coix seed, tartary buckwheat, yam, perilla, safflower, peony, *Eucommia ulmoides*, *Rhus chinensis* Mill., *Litsea pungens* Hemsl., *Sambucus williamsii* Hance, and *Hippophae rhamnoides* L.

The national non-cultural heritage in these ethnic areas includes the production techniques of Mengzi Crossing-over Bridge Rice Noodles, and the provincial non-cultural heritage is more. Among them, Sichuan ethnic autonomous areas have: traditional brewing techniques of wine [Za wine brewing techniques of the Qiang people, Gangan wine brewing techniques of the Yi people, ancient oat wine brewing techniques of the Yi people, traditional brewing techniques of corn wine, folk brewing techniques of Arang (distilled liquor) in Jiarong Tibetan area, *etc.*], folk Tibetan wine brewing techniques, Shuitao Zanza production techniques, Mosuo Qingna oil production techniques, *etc.*, bait block hand-made techniques, traditional production techniques of bean jelly in northern Sichuan, *etc.*

There are two Globally Important Agricultural Heritage Systems: Rice-fish-duck System in Dong Township, Congjiang, Guizhou, and Hani Rice Terrace System in Honghe, Yunnan.

There are 10 China important agricultural heritage systems: Hunan Huayuanzila Tribute Rice Complex Planting and Breeding System, Xinhuang Dong Tibetan Red Rice Planting System, Yongshun Camellia oleifera Forest and Agriculture Complex System, Sichuan Meigu Tartary Buckwheat Cultivation System, Guizhou Congjiang Dong Rice-fish-duck System, Xingren Coix Seed Rice Cultivation System, Yunnan Honghe Hani Rice Terrace System, Guangnan Babao Rice Ecosystem, Jianchuan Rice-wheat Multiple Cropping System, Yangbi Walnut-crop Complex System. One Globally Important Agricultural Heritage System: Honghe Hani Terrace Cultural Landscape.

The ethnic autonomous areas in this economic belt are rich in biodiversity in China, and the diversity of crops such as grain and oil is also rich and colorful, including rice, wheat, maize, sorghum, barley, highland barley, coix, buckwheat, tartary buckwheat, oat, *Avena chinensis*, sweet potato, potato, taro, yam, cassava, broad bean, pea, mung bean, soybean, adzuki bean, rice bean, rape, peanut, sesame, sunflower, perilla, cotton, safflower, *Camellia oleifera*, walnut, pecan, olive, peony, *Eucommia ulmoides*, *Rhus chinensis*, *Idesia polycarpa*, *Torreya grandis*, *Cornus wilsoniana*, *Litsea pungens*, *Sambucus williamsii* and *etc.* According to the data of barley genus on the National Crop Germplasm Resources Sharing Platform, there are 330 local varieties (29 types of barley and 301 species of barley) in Sichuan Ethnic Autonomous Region and 313 local varieties (218 species of barley and 95 species of barley) in Yunnan Ethnic Autonomous Region.

**4.2 Intellectual property resources of science and technology innovation** Intellectual property rights of scientific and technological innovation include new varieties of agricultural plants, new varieties of forest and grass plants, national invention patents, and national new utility patents. There are few new varieties of grain and oil plants in the Yangtze River Economic Belt. There are 28 new national agricultural plant varieties of maize were obtained in Hubei ethnic autonomous areas: Fengyu 3, Huanleyu 3, Huanleyu 123, Eyu 17, Enyu 4824, NQ231, Endan 116, FL218, KNL1088, FL018, FL518, SCL05, FL025, FL0409, FL706, FL3095, Huazi 011, FL119, Kangnongyu 508, Hekang 806, Funongyu 6, Kangnongyu 518, Jiyu 18, Kangnongyu 868, SM38, FL14377, Kangnongyu 9, and Fengnong 88. The ethnic regions have obtained new varieties of national agricultural plants of maize. The variety owners are Hubei Kangnong Seed Industry Co., Ltd., Enshi Tujia and Miao Autonomous Prefecture Academy of Agricultural Sciences, Enshi Grain Gold Seed Industry Co., Ltd., and Wufeng Tujia Autonomous County Institute of Agricultural Sciences.

There are mainly three types of rapeseed cultivated in China: *Brassica napus* L., *Brassica campestris* L., and *Brassica juncea* (L.) Czern. Et Coss. They were separately listed in the second, sixth, and tenth batches of the *List of New Varieties of Agricultural Plants of the People's Republic of China* on March 7, 2000, May 20, 2005 and April 16, 2016. Up to now, China has not authorized new varieties of national agricultural plants to *Brassica campestris* L. and *Brassica juncea* (L.) Czern. Et Coss., and has authorized 306 new varieties of national agricultural plants to *Brassica napus* L. However, the ethnic autonomous areas of the Yangtze River Economic Belt have not obtained new varieties of rapeseed agricultural plants.

There are few new varieties of grain, oil, forest and grass plants in these ethnic areas. There are only two types of oil peonies in China, namely, *Paeonia ostii* T. Hong et J. X. Zhang and *Paeonia rockii* (S. G. Haw & Lauener) T. Hong & J. J. Li. Peony (*Paeonia suffruticosa* Andr) has oily, edible, medicinal, ornamental and other values, and was included in the first batch of the *List of New Plant Varieties of the People's Republic of China (Forest and Grass Part)* on April 22, 1999. There are about 35 varieties of *Paeonia* L. (including *Paeonia suffruticosa*), which were listed in the fourth batch of *List of New Plant Varieties of the People's Republic of China (Forest and Grass Part)* on October 14, 2004. There are more than 100 varieties in *Melastoma* L. It was listed in the fifth batch of the *List of New Plant Varieties of the People's Republic of China (Forest and Grass Part)* on January 22, 2013. So far, China has authorized 33 new varieties of national forest and grass plants of peony, 201 new varieties of national forest and grass plants of *Paeonia* L., and 14 new varieties of national forest and grass plants of *Melastoma* L. However, the national autonomous areas of the Yangtze River Economic Belt have not obtained the rights of new varieties of national forest and grass plants of *Paeonia suffruticosa* Andr, *Paeonia* L. and *Melastoma* L.

In the ethnic autonomous areas of this economic belt, there are not many national invention patents and national new utility patents. For rice, wheat, maize, buckwheat, tartary buckwheat,

sweet potato, potato, broad bean, pea, mung bean, soybean, rape, peanut, sesame, *Camellia oleifera* and other 15 kinds of common grain and oil crops, in ethnic autonomous areas of the Yangtze River Economic Belt, there are 10 649 national invention patents, with an average of 51.9 patents per county, and 3 954 national invention patents, with an average of 19.3 patents per county. Among them, Zhejiang has 22 invention patents and 22 patents for utility model; Hubei has 1 082 invention patents and Hubei has 733 patents for utility model; Hunan has 972 invention patents and 392 patents for utility model; Chongqing has 460 invention patents and 125 patents for utility model; Sichuan has 796 invention patents and 364 patents for utility model; Guizhou has 4 961 invention patents and 821 patents for utility model, and Yunnan has 2 356 invention patents and 1 497 patents for utility model.

In the field of agriculture (IPC classification A01), there are 2 797 national invention patents in the above 15 kinds of common staple grain and oil, with an average of 13.6 patents per county, and 1 234 patents for utility model, with an average of 6.0 patents per county. Among them, Zhejiang has 7 invention patents and 8 patents for utility model; Hubei has 281 invention patents and 169 patents for utility model; Hunan has 189 invention patents and 75 patents for utility model; Chongqing has 101 invention patents and 29 patents for utility model; Sichuan has 170 invention patents and 106 patents for utility model; Guizhou has 1 197 invention patents and 191 patents for utility model; Yunnan has 852 invention patents and 656 patents for utility model.

In the field of plant breeding (IPC classification A01H), these 205 counties have 212 national invention patents in the above 15 kinds of common staple grain and oil, with an average of 1.0 patent per county, and 30 patents for utility model, with an average of 0.1 patents per county. Among them, Zhejiang has 7 invention patents and 8 patents for utility model; Hubei has 21 invention patents and 1 patent for utility model, Hunan has 9 invention patents and 1 patents for utility model; Chongqing has 1 invention patent and 0 patent for utility model; Sichuan has 6 invention patents and 9 patents for utility model; Guizhou has 66 invention patents and 4 patents for utility model, and Yunnan has 109 invention patents and 15 patents for utility model.

**4.3 Brand mark type intellectual property resources** Brand mark type intellectual property resources include geographical indication products, geographical indication trademarks, geographical indications of agricultural products, general trademarks, collective trademarks, certification trademarks, well-known trademarks in China, provincial well-known trademarks, industrial design patents, etc.

In the ethnic areas of the Yangtze River Economic Belt, there are 37 kinds of grain and oil geographical indication products. Specifically, there are 3 kinds in Hubei: Xuan'en Tribute Rice, Enshi Potato, Lichuan Yam; 3 kinds in Hunan: Xinhuang Dong Tibetan Red Rice, Jiugui Liquor, Yongzhou Litsea Cubeba Oil; 4 kinds in Sichuan: Ganzi Shuitao Zanza, Liangshan Tartary Buckwheat Tea, Kazi Walnut, Huidong Pine Seed; 16 kinds in Guizhou: Xili Tribute Rice, Danzhai Selenium-Zinc Rice, Huishui Black Glutinous Rice, Liping Xianghe Glutinous Rice, Xingren Coix Seed Rice, Weining Buckwheat, Zhenningbo Sugar, Xingyi

Bait Cake, Kaili Red Sour Soup (containing glutinous rice), Daozhen Grey Bean Curd Fruit, Huishui Black Glutinous Rice Wine, Huangguoshu Cellar Wine, Jinping Tea Oil, Yuping Tea Oil, Ceheng Tea Oil, Zunyi Eucommia; 11 kinds in Yunnan: Guangnan Babao Rice, Zhefang Tribute Rice, Mojiang Purple Rice, Shiping Tofu, Shiping Tofu Skin, Lunan Spiced Tofu, Mouding Sufu, Lufeng Vinegar, Heqing Dry Wine, Yangbi Walnut and Dayao Walnut.

There are 119 grain and oil geographical indications trademarks (belonging to collective trademarks or certification trademarks) in these ethnic areas. Among them, Hubei has 12 trademarks: Xuan'en Gongmi, Baiyidao (Registration No. :10831615; 21456037), Wufeng Tartary Buckwheat, Enshi Potato, Lichuan Yam, Juwan Suanjiang Noodles, Badong Spiced Dried Bean Curd, Xiaocun Red Skin Peanut (Registration No. : 11294236; 11294237), Wufeng *Rhus chinensis*, Yichang Litsea pungens; Hunan has 7 trademarks: Xinhuang Red Rice, Fenghuang Tartary Buckwheat, Fenghuang Ginger Sugar, Tongdao Bitter Wine, Mayang Small Seed Peanut, Xiangxi Camellia Oil, Jingzhou Hickory; Chongqing has 14 trademarks: Youyang Tribute Rice, Pengshui Guichi Rice, Pengshui Sorghum, Pengshui Tartary Buckwheat, Youyang Tartary Buckwheat, Pengshui Sweet Potato, Pengshui Potato, Pengshui Soybean, Xiushan Fermented Bean Curd, Pengshui Crystal Silk Sweet Potato Powder, Pengshui Millet Peanut, Pengshui Perilla Oil, Pengshui Camellia oleifera, and Youyang Camellia Oil; Sichuan has 34 trademarks: Dechang Fragrant Rice, Puge Plateau Japonica Rice (Registration No. :19201643; 46750403), Mianyang Rice Seed, Seda Black Highland Barley, Luhuo Black Highland Barley, Kangding Black Highland Barley, Xide Oat, Butuo Oat, Meigu Buckwheat, Zhaojue Tartary Buckwheat, Liangshan Potato, Jinyang Potato, Litang Potato, Luhuo Purple Potato, Meigu Potato, Puge Gaoshan Black Potato, Huidong Colorful Potato, Butuo Black Potato, Xiangcheng Shuimo Zanza, Xinlong Rape, Yanyuanzaow Walnut, Wenchuan Plateau Hickory, Derong Walnut, Meigu Walnut (Registration No. :41741304; 41741679), Huili Walnut, Heishui Walnut, Luding Walnut, Batang Walnut (Registration No. : 13759764; 18151082), Huidong Pine Nut, Rangtang Rapeseed Oil, and Luhuo Rapeseed Oil; Guizhou has 10 trademarks: Huishui Rice, Xingren Coix Seed Rice, Qinglong Glutinous Coix Seed, Weining Tartary Buckwheat, Ziyun Red Core Sweet Potato, Weining Potato, Yinjiang Sweet Potato Powder, Weining Buckwheat Crisp, Ceheng Tea Seed Oil, and Puan Thin Shell Walnut; Yunnan has 42 trademarks: Yuanjiang Yangjie Rice, Dehong Fragrant Soft Rice (Registration No. :11319551; 11568316), Pantiang Black Grain Rice, Menghai Fragrant Rice, Mojiang Purple Rice, Yuanyang Terrace Red Rice, Jiangcheng Yaojiashan Red Rice, Ximeng Rice Buckwheat, Ning'er Yellow Heart Sweet Potato, Shangri-La Potato, Yingjiang Xima Small Potato, Yao'an Yam, Weixi Glutinous Yam, Midu Taro, Yao'an Pea, Shiping Tofu, Shiping Tofu Skin, Mouding Sufu (Registration No. :51918425; 9132397), Mengzi Rice Cake, Mengzi Cross-Bridge Rice Noodles (Registration No. : 7374667; 8357860), Dayao Small Vermicelli, Lufeng Vinegar, Menglianhua Peanut, Zhenyuan Walnut, Yangbi Walnut (Registration No. : 8541092; 8541093), Binchuan Lawu Walnut, Jingdong Walnut (Registra-

tion No. :11401586; 11401587), Weixi Walnut, Dayao Walnut (Registration No. :6401647; 13981290), Nanjian Wuliang Walnut, Chuxiong Walnut (Registration No. :17378855; 16475817), Lincang Macadamia Nut (Registration No. :32051603; 32051762), *Prinsepia utilis* Oil, Longchuan Camellia Oil.

In the ethnic autonomous areas of this economic belt, there are 33 kinds of geographical indications of agricultural products. Among them, Hubei has 5 kinds: Shuizhuyuan rice, Zhizheping rice, Enshi potato, Xiaocun red skin peanut, Yichang *Litsea pungens*; Hunan has 2 kinds: Songbai rice, Baiyun tribute rice; Chongqing has one kind: Pengshui *Perilla frutescens*; Sichuan has 6 kinds: Ganzi highland barley, Ganluo black tartary buckwheat, Liangshan tartary buckwheat, Liangshan potato, Ningnan winter potato, and Ebian potato; Guizhou has 13 kinds: Kaili Pingliang tribute rice, Guojiawan tribute rice, Jinzhu tribute rice, Dushan rice, Gangcun rice, Congjiang Xianghe glutinous rice, Huishui black glutinous rice, Xingren coix seed rice, Qinglong glutinous rice, Bandang coix seed rice, Ziyun Hongxin sweet potato, Tongren pearl peanut, Tianzhu camellia oil; Yunan has 6 kinds: Guangnan eight treasure rice, Ninglang Plateau red rice, Shangri-La highland barley, Luxi tartary buckwheat, Yanshan peanut and Lincang nuts. Among the above-mentioned geographical indications, 7 kinds of geographical indications, including Jiang Kam Sweet Rice, Xingren barley rice, Anshun yam, Huishui black glutinous rice wine, drunkard wine, Lincang nuts, and Wufeng *Rhus chinensis*, have become Chinese geographical indication products protected in the EU according to the *China-EU Agreement on Geographical Indications*.

There are many common trademarks in the grain and oil industry in the ethnic areas of the Yangtze River Economic Belt, but the brand function of the common trademarks owned by individual operators is limited. Geographical indication trademarks are mostly certification trademarks, less collective trademarks, in addition to geographical indication trademarks, collective trademarks in these ethnic areas include Shansen Youdao, Shansen Youbao, Shansen Youdao, Jiapinxian, Zhilangu, Fujiayan, Kekeqiao and so on. There are few well-known Chinese trademarks of grain and oil in ethnic autonomous areas in this economic belt, mainly including more than 30 trademarks such as Three Gorges, Yizhi, Graphics (Registration No. :8003584), Temiao, Meijinyuan, Jiugui, Xianquan, Linong, *etc.* There are few national industrial design patents in these ethnic areas of this economic belt, and there are 505 national industrial design patents for packaging and containers (the 9<sup>th</sup> category of Locarno Classification system) in the 15 common bulk grain and oil products mentioned above, with an average of 2.5 items per county. Among them, there are 4 items in Zhejiang, 39 in Hubei, 37 in Hunan, 21 in Chongqing, 47 in Sichuan, 160 in Guizhou and 197 in Yunnan.

## 5 Main problems in the high-quality development of grain and oil in ethnic areas of the Yangtze River Economic Belt

The high-quality development of grain and oil in ethnic areas of the Yangtze River Economic Belt mainly has the following prob-

lems. (i) The intellectual property rights of cultural heritage and the promotion and inheritance of farming culture are weak. (ii) The ability to create intellectual property rights of scientific and technological innovation is not strong. (iii) The regional integration of intellectual property rights of brand marking is imperfect. (iv) The regional integration of intellectual property rights of brand marking is weak. (v) The whole chain of intellectual property creation, application, protection, management and service is not strong. (vi) The biological breeding and introduction in the same suitable ecological area lag behind. (vii) Except for camellia oil, the scale of development and utilization of woody edible oil is small. (viii) The construction of national grain production functional zones, important agricultural product production protection zones and characteristic agricultural product advantage zones lags behind. (ix) The construction of an effective supply system for characteristic and diversified food needs to be accelerated. (x) The development capacity of grain and oil industry in ethnic areas is limited. (xi) The spirit of the 20<sup>th</sup> National Congress of the Communist Party of China (CPC) and the spirit of the symposium on further promoting the high-quality development of the Yangtze River Economic Belt need to be further implemented.

## 6 Conclusions and recommendations

Agricultural intellectual property rights can embody the local characteristics of the Yangtze River Economic Belt, help to build a diversified food supply system, enhance the supply of important agricultural products such as grain and oil, strengthen scientific and technological equipment, reinforce the management system, and boost industrial resilience and competitiveness, so as to help build agricultural power, further promote the high-quality development of the Yangtze River Economic Belt, and better support and serve Chinese-style modernization.

We came up with the following recommendations for promoting the high-quality development of grain and oil in ethnic areas of the Yangtze River Economic Belt.

(i) It is recommended to protect the intellectual property rights of cultural heritage in the field of grain and oil, lead the inheritance and development of excellent traditional Chinese culture, and create a new glory of socialist culture. (ii) It is necessary to use scientific and technological innovation intellectual property rights to promote the innovation-driven development strategy of the grain and oil industry. (iii) We should promote the intellectual property rights of grain and oil brand labels and boost the development of regional brands. (iv) It is necessary to promote the strategy of strengthening the country with intellectual property rights and also promote the knowledge-based and high-quality development of the grain and oil industry. (v) It is necessary to break the bottleneck in grain and oil agriculture and promote the upgrading project of modern seed industry. (vi) It is suggested that the development strategy of woody oilseeds should be implemented to accelerate the development of woody edible oilseeds industry. (vii) It is necessary to demonstrate the national grain production functional areas, important agricultural product production protection areas and

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