

The Planting Of Pueraria Crops In Addressing Food Security: An Investigation Of Woody Crops In Southwest Of China

Zhenxing Zhang, Canyu Yang

(School Of Marxism, Guizhou Medical University, Guiyang Guizhou, China)

Abstract:

To comprehensively strengthen the foundation of food security, adopt a holistic view of food, develop facility agriculture, construct a diversified food supply system, and better meet the needs of a better life for the people, is one of the important national strategies of China today. Pueraria crops have a long cultivation history in China, with records dating back to at least the pre-Qin era, they possess high economic and ecological value, and their extensive living cultivation and utilization are still preserved in the mountainous areas of Southwest China, providing an important food source for various ethnic groups in the region. We believe that by achieving a transformation in conceptual framework, introducing facility agricultural technology, cultivating and utilizing pueraria crops in southwest China as an important supplementary food source, reviving the planting of pueraria crops in the mountainous areas of southwest China, ensuring food security, and potentially providing valuable insights for the current construction of ecological civilization.

Keywords: pueraria crops, holistic view of food, food security, construction of ecological civilization

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1- Introduction

General secretary Xi Jinping proposed in the report of the 20th National Congress of the Communist Party of China that comprehensively strengthen the foundation of food security, establish a grand view of food, develop facility agriculture, and build a diversified food supply system (Xi, 2024). How to strengthen the foundation of food security, establish a grand view of food, and build a diversified food supply system has become one of the important research fields in the academic community at present. Some scholars may take the “grand view of food” as the entry point to discuss the development stages, evolution, categories and utilization of tree-based grains in historical periods in China, explain the contemporary value of developing tree-based grains, and propose to break away from the traditional view of grains, inherit the tradition of tree-based grains, tap the potential of tree-based grains, develop and make good use of 3.3 billion mu of forest resources, and help build a higher-level food security guarantee system (Lu & Qu, 2023). Or from the perspective of the adjustment of staple food policies and environmental changes, explore the historical process of the rise and fall of arenga species, which were important food crops for the ancestors of all ethnic groups in the south, summarize experiences and lessons, and explore their contemporary economic and ecological values (Geng, 2019). There are also many scholars from the perspective of the under-forest economy (Zhao & Dou et al, 2024), woody oil-bearing plants (Yan & Fu et al, 2024), edible mushrooms (Wang, 2024), aquaculture (Xu & Zeng, 2024), animal husbandry (Xin, 2024), and other fields, extensive and in-depth discussions on food security under the “grand view of food” have been carried out.

Tuberous root crops, as a traditional source of food in China, are one of the important means to ensure food security under the “grand view of food” (Yang & Nong, 2010), Pueraria crops are an important representative among them. However, at present, most of the academic research on pueraria crops focuses on the relationship between pueraria lobata and ethnic cultures (Zhang, 2012), the feasibility and necessity of reviving the pueraria-type crop planting industry in the southwestern mountainous areas (Yang, 2018), the ancient planting and utilization of pueraria-type crops and their value in the construction of modern ecological civilization (Yang & Yang, 2018), the cultural changes in the planting and utilization of pueraria-type crops (Yang, 2019), the historical experiences and lessons of the rise and fall of the pueraria-planting industry in Guizhou (Ma & Wu, 2016), the cultivation of pueraria-type crops in rocky desertification control and soil and water conservation (Yang & Wu et al, 1990), contents such as the ecological maintenance benefits in aspects like

Corresponding author: Canyu Yang

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waste slag treatment(Yang, 2020), less often is the important value of pueraria-type crop planting in dealing with food security explored from the perspective of the “grand view of food”.Based on the perspective of the “grand view of food”, starting from the supplementary food value of pueraria-type crops, this article combs the origin of pueraria-type crop planting, analyzes the historical and cultural causes of the decline in pueraria-type crop planting, and discusses the feasibility and role of the contemporary supplementary food-oriented transformation and utilization of pueraria-type crop planting, hoping to provide useful references for China’s food security guarantee and contemporary ecological civilization construction.

2-The Origin And Technical Operations Of Pueraria-Type Crop Planting

Pueraria DC, also known as kudzu vine, pueraria leaf, sweet kudzu vine, and arrowroot kudzu vine, etc, is a perennial twining vine in the Leguminosae family. There are nearly 18 species of pueraria plants in the world, mainly distributed in subtropical and temperate regions. China is the distribution center of pueraria plants, with 10 species, mainly concentrated in the southern mountainous areas of China. Pueraria has extremely high economic value and is one of the first batch of plants approved for both medicinal and edible uses by the Chinese Ministry of Health(Lu & Huang etc, 2006), its whole plant is valuable. The pueraria root is an important tuberous food crop and also a significant medicinal herb, often praised as the “asian ginseng”. Pueraria fiber can be woven into clothes and various utensils. Pueraria flowers are medicinal and nectar-producing plants. Pueraria sprouts are important vegetables, and pueraria leaves are fodder. However, under different regional and cultural backgrounds, people’s understanding and evaluation of pueraria-type crops vary, unintentionally forgetting the domestication, cultivation, planting, and multi-channel, multi-level efficient utilization of pueraria-type crops, which are excellent Chinese traditional culture and important agricultural heritage, providing rich food sources and high-quality clothing materials for our ancestors of various ethnic groups in China.

Pueraria-type crops, due to the swelling of their underground roots during growth, accumulate rich nutrients and moisture, making their underground roots a food source for many animals in the ecosystem. The greatest advantage and convenience of foraging for the underground roots of pueraria-type crops is that it can be done regardless of the season, and the corresponding plants do not die after being foraged by humans. This is because as a woody leguminous vine, each node on the kudzu vine can grow adventitious roots downward, and once they touch the soil, they will develop stable root systems and form new plants. It is precisely because of this vegetative reproduction mechanism that ancient humans only needed to recognize and remember the areas where kudzu grew. When hungry, they could come here to fill their stomachs and return year after year, without ever being banned, thus it was called the “permanent living granary”(Huang, 2016), this is not an exaggeration. Its greater advantage lies in the fact that almost the entire pueraria plant can be considered as a collection object. The underground roots, regardless of age, even those that have grown for decades, can be foraged, and the newly grown adventitious roots can also be foraged. In addition, fresh pueraria sprouts, blooming pueraria flowers, and even insects (pueraria plankton) parasitic on the pueraria vine can also be foraged by ancient ancestors. Because of this, ancient humans before the late Neolithic Age did not need to “plant kudzu” and “protect kudzu”, and simple collection was enough for their daily needs. Of course, because of this, the domestication and planting of pueraria as an agricultural production project was not an object that ancient humans needed to include in their agenda. The original intention of our ancestors for domesticating and cultivating pueraria-type crops was not for “eating”, but for “clothing”.

The original pueraria plant’s bast fibers, from the root to the tip of the vine, the length of the bast fiber can be penetrated, so that the bast fibers stripped off, after processing, not only are tough and fine, but even longer than silk, and have a smooth and clean surface, capable of weaving into exquisite fabrics. In addition, the fiber substance composition of pueraria vine belongs to carbohydrates, rather than mainly protein as in silk or wool. Therefore, even with the most primitive dyeing methods, the kudzu cloth can be dyed with beautiful and bright colors, which silk or wool cannot achieve.

Because of the above advantages of pueraria vine fibers, this has made the original intention of our ancestors to domesticate pueraria-type plants differ greatly from the domestication of other crops from the very beginning. The domestication of pueraria-type crops until the large-scale cultivation of kudzu was not for eating, but for exquisite clothing. This determined the orientation and technical operations of domesticating pueraria-type crops from the beginning to diverge from domesticating other crops. Ancient ancestors domesticated other crops, all aimed at advancing according to the seasons-spring planting, summer cultivation, autumn harvest, winter storage, or planning the institutional arrangements for domestication and planting according to the division of dry and wet seasons. For pueraria-type crops, it was different. Pueraria could be planted and harvested at any time, used immediately after harvest, regardless of age, and there was no need for seasonal technical arrangements for pueraria-type crops. But for the use of pueraria-type crops as raw materials for exquisite fabrics, it was another matter. That is, the growing pueraria vines must be picked every day, not only the new tender buds sprouting from the axillary leaves must be picked, but also the fresh tender

adventitious roots just grown at the same position must be timely harvested, otherwise, the whole pueraria vine after harvest, when used as textile raw materials, its bast fibers will have knots and cannot be used as excellent raw materials for exquisite fabrics. “*The Book of Songs·Wangfeng·Caige*” says, “he who gathers kudzu, a day apart seems like three months! He who gathers wormwood, a day apart seems like three seasons! He who gathers mug wort, a day apart seems like three years!”(Cheng & Jiang, 1991) It is precisely this love lament issued against this technical operation specification.

When the author once led students to conduct field investigations in Jingzhou, Huaihua, Hunan province and other places, it was found that in the agricultural production of the local Miao and Dong villagers, the planting of pueraria is still actively inherited to this day. When we interviewed the local villagers, they repeatedly talked to us about the contemporary experience summary of “pueraria cakes are delicious, but the roots are difficult to dig(Yang & Geng, 2018).” According to the villagers, they often have to spend a whole day to collect complete pueraria roots under the earth-and-stone accumulation layer more than 1 meter deep, and the fruits of a whole day’s labor are not enough for a full meal. Of course, what they said is the truth, but it is not the actual situation encountered by our ancestors. This is because after the cultivation of pueraria faded out of the historical stage, the surviving pueraria grew in the karst mountainous areas in a completely natural state. The delicious pueraria roots penetrated into the rock crevices everywhere, so it requires a huge amount of labor input to achieve a harvest, which is due to the fact that we have long abandoned the standardized technical operations of pueraria cultivation in historical periods. How did the ancient ancestors plant pueraria? Since there is a lack of literature, we no longer know today. However, the descriptions and reminiscences of ancient funerals in the literature and classics may provide us with references for the technical operations of pueraria planting by our ancestors.

“*The Book of Songs·Tangfeng·Gesheng*” records: “Pueraria grows under the thorn bushes, and the convolvulus spreads in the field. My beloved is gone, who will be alone? Pueraria grows under the thorns, and the convolvulus spreads in the domain. My beloved is gone, who will be alone in rest?”(Cheng & Jiang, 1991)

Scholars of the Han and Tang dynasties unanimously identified this as a poem of mourning for the dead(Cheng & Jiang, 1991), but upon close reading of the relevant descriptions, we can reveal the technical operations of ancient ancestors in planting pueraria. The basis for this lies in the fact that the beginning of the poem, “pueraria grows under the thorn bushes,” comes from the practice of planting pueraria. The technical key point is to ensure that the long pueraria vines do not take root at the bottom and branch at each node. When planting pueraria, the vines need to be hung on the shrubs above. The “thorn bushes” in the poem are artificially trimmed shrubs with pueraria vine supports. The term “covered by thorn bushes” in the poem refers to the fact that the female lover who collected pueraria has passed away, no one collects pueraria, so the pueraria vines cover the supports like curtains, and the growing pueraria vines cannot be used normally. This is to express the pain of mourning for the female lover by using the scene of wild pueraria in the field that no one takes care of, and to use the worst result of planting pueraria to metaphor the sorrow and misfortune of losing a lover, but it also helps to prove the key points of labor that pueraria must be controlled above the shrubs and needs to be picked every day.

Based on this record, we may infer that in ancient times, pueraria was not planted by underground cutting or transplanting, but by ridging. Fine gravel and soil were piled up on the spot to form high ridges, and pueraria was transplanted onto the ridges, thus deep ditches were formed between the ridges. Pueraria collectors could walk in the ditches to collect pueraria. When it was time to eat, after pushing aside the sand and soil on the side of the ridge, the whole pueraria root could be collected.

Similarly, data from field investigations can also provide new evidence. When we conducted field investigations in Guizhou, Yunnan and other places, the villagers everywhere clearly told us that harvesting pueraria roots and planting pueraria roots need to be carried out simultaneously. After the pueraria roots are dug out, more than 90% of the underground roots can be cut off, but lime or plant ash needs to be smeared on the cut at the top of the pueraria root and then buried on the spot, and the dug-up earth and stone are restored, thus completing both the harvesting and planting operations at the same time. If you want pueraria to grow more easily for harvesting, when harvesting and planting pueraria, the base of the pueraria root can be cut into several pieces and planted. The pueraria roots planted in this way will grow relatively short, thick and branch a great deal, and it will be more convenient to harvest them in the future(Yang & Geng, 2018). “When rites are lost, seek them in the wild,” these investigation materials, although obtained in the contemporary era, may allow us to infer the operational practices and norms of our ancestors, and restore the origin and historical overview of pueraria planting.

In summary, we have to admit that pueraria-type crops, as an important source of clothing materials and food, once played an important role in Chinese history and are still actively inherited among the people of all ethnic groups in the southwestern mountainous areas of China today. Through the method of cross-verification between literature records and field investigations, we may infer that the key technical point of pueraria-type crop planting in historical periods was “ridge-planting”. Although this operational key point has

undergone significant changes today, the still-actively- inherited pueraria-type crop planting today may provide useful references for us to understand the origin of pueraria-type crop planting. However, why did the once-prosperous pueraria-type crop planting gradually decline in the course of history? Exploring the historical and cultural causes of its decline is crucial for us to revive the planting and utilization of pueraria-type crops.

3

Feasibility And Role Of Pueraria-Type Crop Planting As Supplementary Grain Utilization

Just because the tradition of planting and using Pueraria is still actively inherited among the people of all ethnic groups in the vast southwestern mountainous areas of China, the planting of pueraria-type crops for contemporary supplementary grain utilization is very convenient and possible. But the key lies in the conceptual transformation and inclusion in the framework of facility agriculture.

The conceptual transformation mainly refers to changing people's habitual thinking pattern of dividing staple grains and supplementary grains and accepting Pueraria as a food source. In the grain reserves controlled by the state, the classification of staple grains, supplementary grains and other types, although it is the habitual practice of the central dynasties in Chinese history. But today, in essence, it has lost its practical value and significance. However, the historical accumulation will not easily withdraw from people's habitual thinking and will continue to play a decisive influence, thus becoming an obstacle to the use of pueraria-type crop planting as supplementary grains. Pueraria-type crops are woody vines, which are very different from the conventionally understood food crops. It is understandable that contemporary people regard pueraria as a weed. However, the historical and cultural causes for pueraria-type crops to withdraw from food crops have long disappeared today. Although the food produced by pueraria planting is not easy to store, today's consumption habits happen to require fresh food, and there is also support from modern transportation facilities and a fast and convenient logistics system. It is no problem at all for the fresh food produced by pueraria-type crop planting to be consumed within 24 hours. Therefore, people's impression that the grain food produced by pueraria-type planting is not easy to store is just a habitual thinking in historical memory. In fact, among the tributes presented to the imperial court by the ethnic minorities in today's Zunyi area of Guizhou in the Tang Dynasty, pueraria powder was included, after being processed, pueraria powder can be stored and maintained in quality for a long time effectively. Today, in the bases where pueraria-type crops are planted in large contiguous areas, it is no problem at all to introduce the most basic processing facilities to process pueraria roots into storable foods. As for the fact that pueraria-type crops do not have the value for currency exchange, of course it is a fact. However, the key to solving this problem has actually been in our hands for a long time. Because today's market value accounting uses paper money, and there is no need for barter at all. This is not only a problem for pueraria-type foods, but even traditional herbaceous food crops no longer bear such a social function long ago. Logically speaking, there should be no interfering factors in any sense for the revival of the pueraria-type crop-planting industry. However, people's consumption concepts still need to be adjusted. Everyone is still habitually convinced that the staple grains (i.e., cereal crops) deposited in history are delicious and are all happy to consume. The foods produced by pueraria-type crops lack good taste, so people are reluctant to consume them. But this is a complete prejudice. Among the people of all ethnic groups in the southwestern region today, pueraria roots are still one of the main sources of food for their breakfasts. Even processed pueraria-type foods, as rare delicacies, have entered high-end restaurants and are favored by a large number of consumers. However, in the daily consumption of individuals and families, the foods produced by pueraria-type crops are still relatively few. Some people think that the investment of labor in planting pueraria is large and the yield per unit area is low. With the progress of social development, the discontinuation of planting pueraria-type crops is the product of the development of the times and has nothing to do with personal preferences. But the problem precisely lies in the fact that under the condition of standardized planting, the investment of labor in pueraria-type crops is much lower than that in planting other food crops, but the actual output level per unit area is much higher. Therefore, this understanding is also a prejudice of habitual thinking.

Adopting facility agriculture means that it is necessary to bring the cultivation of kudzu crops into the framework of facility agriculture and use a variety of mechanical equipment or technical means to carry out the cultivation and utilization of kudzu crops. In the vast mountainous areas in southern China, annual herbaceous crops cannot actually be effective locally under the existing farming agricultural machinery and equipment conditions, but it happens to be the best planting area for kudzu crops. Making corresponding adjustments and improvements to mountain agricultural machinery, there is no problem at all in large-scale planting and processing of kudzu crops. At the same time, since kudzu crops are a typical perennial woody vine crop, they can be effectively compatible with forests, wetlands, deserts, and even the accumulation sites of toxic waste residues from mining. As long as the management and operation methods of facility agriculture are introduced, all the previously unusable arable land can become "fertile fields" for kudzu crop cultivation. The specific operation lies in that as long as the main product part of kudzu crops, that is, the underground roots, are placed in containers isolated from the external environment and supplemented with drip irrigation, it is completely achievable to produce the safest ecological and healthy food in various complex environments, and there are no

technical obstacles in any sense.

As long as the above-mentioned ideological transformation and the implementation of facility agriculture are realized, it will be possible to revive the cultivation of kudzu crops for use as supplementary grains, which has a very high guarantee effect on China's food security.

First of all, the start-up speed is fast, and the operation and management after start-up are extremely simple. Taking kudzu crop cultivation as supplementary grain cultivation also needs to carry forward this advantage just right. Any modern transformation of agriculture in any sense requires huge support in terms of manpower, material resources, and financial resources. The provision of technical equipment, land leveling, supporting water conservancy projects, and support for transportation facilities are all indispensable. However, all of these are basically not required in the modern transformation of reviving kudzu crop cultivation in the southwestern mountainous areas, and it can be completely achieved that once started, production can be immediately realized.

Secondly, the cultivation and utilization of kudzu crops have a good and complete social and cultural heritage. Because it has always been in a living inheritance state among all ethnic groups in the southwest, no matter what new equipment or new farming systems are introduced, or even breeding and seed conservation can be completely exempted. The villagers of all ethnic groups in the southwestern mountainous areas of China can know it at a glance and learn it easily, and all kinds of technical training can be exempted. The simplicity and ease of transformation also exceed the modern transformation of other herbaceous agriculture.

Finally, the revival of kudzu crops, the anti-risk ability of its supplementary grains plays a very important role. This is because the kudzu root, which is the grain produced by kudzu crops, is buried underground, and its nutrients and water are stored in the crop body. General natural disasters, whether drought, waterlogging, or hail, will not pose a threat to kudzu crops. After the introduction of facility agriculture, its anti-risk ability is more guaranteed. In this way, no matter how the supply and marketing of herbaceous agriculture fluctuates due to various natural disasters, the grain food produced by kudzu crops can be dealt with calmly and ensure foolproof, and this is precisely the rarest superiority as a supplementary grain. Besides natural disasters, social disasters can also be effectively dealt with. Just because the grain - producing part is the tuberous root buried deep underground, even in the face of chemical warfare, ecological warfare or nuclear warfare, all kinds of man-made pollution will not endanger its tuberous root. As long as it is harvested in time, the safety of food will be absolutely guaranteed.

In short, all kinds of difficulties surrounding the cultivation of kudzu crops are completely unfounded in specific operational practices, and once put into practice, it can make a huge positive contribution to China's food security. From this point of view, the cultivation of kudzu crops is expected to make unexpected outstanding contributions in terms of food security. This is not only a problem of kudzu crops. Other woody crops and tuberous crops are superior to general herbaceous crops in this regard. As supplementary grains to promote and realize the modern transformation of Chinese agriculture, positive results beyond expectations can be achieved.

4-Conclusion And Discussion

Although this article focuses on the auxiliary value of kudzu crop cultivation in addressing food security and explores the rise and fall of kudzu crops in the contemporary era, the new ideas derived from this go beyond the cultivation and utilization value of kudzu crops themselves.

As a supplementary grain, kudzu crops, because the edible part people consume is its underground roots rather than its seeds, have an indisputable output continuity and stability. Once planted, it will naturally grow and form grain. After harvesting, with a little technical processing, it can immediately exert output benefits, and will not be disturbed by seasonal changes and re-planting, and can produce useful grain products all year round. Therefore, its yield per unit area is much higher than other herbaceous crops, which is an indisputable fact. Moreover, it truly realizes "storing grain in the land, storing grain in technology". Whenever harvesting is needed, it can be put into practical operation at any time and processing can be completed anytime and anywhere. As a supplementary grain, it can just make up for the seasonal fluctuations and gaps of herbaceous crops. Defining it as a supplementary grain is in line with its nature and appropriate use.

Similarly, because kudzu crops are woody vine tuber crops, their products can be fully utilized in a fresh and living state, and there is no need for any kind of storage. No matter what kind of herbaceous grain crop products, the state needs to invest a lot of manpower, material resources, and equipment to ensure the stability and sufficiency of grain supply. Such consumption is still surprisingly large until today. The national grain depot needs to spend hundreds of yuan in manpower and equipment materials every year to store 1 ton of corn. Within three years, the storage expenditure will offset the actual value of the storage object. The actual social benefit of storage has become an ineffective idle rotation, while kudzu crops can completely do without any kind of storage. As long as they are not harvested, they will continue to grow and will not deteriorate at all. Not only can any kind of storage investment be saved, but also the risk of deterioration will not be triggered.

The safety of grain quality is more guaranteed, and the interference and pollution to the environment can almost be said to be reduced to the lowest point. This is because in the cultivation of kudzu crops, farmland and storage have already been integrated.

At the same time, the cultivation of kudzu crops can also play an important role in maintaining the ecological environment. As mentioned above, the cultivation of kudzu crops does not compete with traditional staple crops for land. Barren mountains, wasteland, even highly rocky karst mountainous areas and desertified red soil belts can be widely planted, and can be combined with multiple traditional crops. Therefore, the land resources that were previously unable to be used as grain production sites can be fully used for staple grain production. This is even more beneficial to improving the staple grain structure in our country and maintaining the ecological environment. In response to serious ecological problems such as “soil erosion” in our country, the government timely introduced policies such as “returning farmland to forests” and “returning farmland to grasslands”. However, in the actual implementation process, due to the need to catch up with the progress and overcome many technical and material reserve difficulties, the ecological restoration activities of “returning farmland to forests” are, in most cases, restored to single-species forests or simple-species grasslands. Due to the single species structure, it cannot form a truly living ecosystem, so not only is the risk of ecological disasters very high, but the maintenance cost is also very high. If kudzu crops are planted in such reforested land, it can help eliminate the above drawbacks, greatly increase the level of biodiversity, and support the rapid growth and closure of surviving trees, which is even more helpful to inhibit the risk of soil erosion. If the “returning farmland to forests” policy is slightly modified, it can even promote the revival of the kudzu crop planting industry.

During the Two Sessions in March 2022, General Secretary Xi Jinping pointed out that “we should establish a grand view of food. Starting from better meeting the people’s needs for a better life, we should grasp the changing trend of the people’s food structure. While ensuring the supply of grains, we should also guarantee the effective supply of all kinds of foods such as meat, vegetables, fruits and aquatic products, none of them can be lacking.”(Zhong, 2024) With the passage of time, regional differences, and cultural changes, the same ordinary crop may experience great rises and falls on the stage of human society, and the entire society will be constantly renewed as a result. Now when we talk about food security, it is actually food safety. The food demands of the common people have become more diversified. This requires us to change our concepts, establish a large-scale agricultural view and a large-scale food view, and obtain calories and proteins from cultivated land, grasslands, forests, and oceans, as well as from plants, animals, and microorganisms, and develop food resources in all-round and multi-way manners(Shi & Gu, 2024) . Therefore, in the current era of China’s agricultural modernization transformation and the development of new-quality productive forces, we should not only develop herbaceous agriculture, but also vigorously develop other agricultural sectors such as woody agriculture, oasis agriculture, and grassland animal husbandry, so as to ensure China’s food security and firmly hold the rice bowl in our own hands. This is a research area that should be highly valued and focused on in the new round of China’s food security response and agricultural modernization transformation research. This article, despite its simplicity, hopes to encourage colleagues in the academic community and put forward its own humble opinions for the protection of China’s food security.

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