Food Safety Strategies of Wild Vegetable Products Derived from Xiaolongshan Forest

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Abstract. Based on Zuolin wild vegetable processing plant of Xiaolongshan Forestry Experimental Bureau, an analysis focused on food safety during the period of wild herbs cultivation and processing and corresponding strategies were proposed. Total more than 10 species wild herbs are available for cultivating in Xiaolongshan forest. Intended to provide safe food, the green food standards and pollution-free cultivation techniques should be introduced in the field. The wild herbs processing plant should be standardized following the national standard format. Green production procedures, such as dried and frozen should be the key processing methods. At the end, the production should meet for the enterprise standard signed by Tianshui Bureau of Quality Supervision (Q/11yc01-2004) as well as food safety criterion.

The Necessity and Significance

Food safety is one of the most important issues received great concern in national and international. As a result, demand of pollution-free food and green food is increasing. Wild herbs, including wild vegetables, wild herbs Lin and Yano Nami, are traditional vegetable supplementary food which have six major characteristics: variety, wide distribution; high nutritional value; medical value; unique flavor, eat a variety of natural pollution-free; unique goods value [1]. "Wild herbs" is one kind of the undisputed "green food" or "pollution-free food" which showed prospective market. To cultivate and process wild herbs in a safe way would benefit the society a lot. Firstly, in addition to providing high quality and safe food, it would contribute to fully utilize and protect the forest resources, produce ecological benefit, economic benefit and social benefit. Secondly, it is a broad prospect forestry industrial projects, which consistent with the national implementation of the natural forest protection project, aiming to achieve national development goals, increase resource, efficiency, and the income of worker’s unit, which results in a sustainable development forestry. Third, it can cultivate the economic growth point for forest region, promote the regional economy to develop rapidly and construction of the new socialist countryside in forest area and mountainous area. Last, it is an effective way to get rid of poverty in the deep forest area.

Status quo and Problems

Species of Wild Herbs

There are more than 200 wild herbs species in China, belonged to 40 families and 100 species of common [2]. According to incomplete statistics, more than 40 families [3] and over 120 species of wild herbs distribute in Xiaolongshan forest, forest edge areas and mountain areas. Among them, more than 50 species belonged to national distribution, and more than 70 species belonged to regional distribution. They are in wide types, shapes, different flavor. Some of them are popular food consumption, however, some are high-grade delicacies, can be seen only in the state banquet, dinner. There are more than 40 species that people can often pick up and are edible growing in Xiaolongshan forest range. Through the market investigation and screening, total 19 species wild herbs widely distribute in Xiaolongshan forest are (Capsella, Bursa-pastoris) Shepherdspruse (Toona sinensis), toon fern (Pteridium aquilinum) Sonchus oleraceus (Sonchus, oleraceus), Ixeridium (Sonchus brachyotus) (Chenopodium, album), quinoa Aralia (Aralia chinensis), shamrock (Medicago lupulina) and alfalfa (Medicago sativa), Pu Gongying (Taraxacum...
mongoliaam), Huanghua Seseli (Seseli inciso-dentatum), black locust (Robinia pseudoacacia), walnut flowers (Juglans regia), pepper (Zanthoxylum bungeanum) flower bud (Codonopsis, pilosula), yellow Dangshen Cauliflower (Hemerocallis minor), black fungus, letinous edodes, pine mushroom. These wild herds are relatively abundant resources. They also highly enrich and conveniently collect, transport, process and utilize, and fit for many people, which can be developed and utilized.

Development and Utilization

Xiaolongshan forest is the largest state-owned forest farm group in China. There is a large area of forests, also has quite a large area of barren hills, wasteland, farmland, water and roads, rich resources of wild herbs. Within the jurisdiction of their staggered, there is convenient transportation and communication, good development environment. At present, the level of exploitation and utilization of wild herbs resources in Xiaolongshan forest area is very limited. More than 10 species of wild herds, such as toon, oolong, pepper, peach kernel, head of alfalfa, bracken, shepherd's purse, fat hen, Chinese cuisine, and black fungus processed by Xiaolongshan forest left wild vegetable processing plant using dried and frozen procedure. The wild herds production including two categories and three specifications of dozens of varieties, which has already registered "long Lin" brand trademark formed a certain reputation. These products have been available in Xiaolongshan forest tourism, farmhouse, part of the hotel and restaurants in Tianshui, Longnan City, Lanzhou city. Xiaolongshan forest left wild vegetable processing plant’s production of "long Lin" brand "wild vegetables" warded the Gansu province forest products silver; the series production of "long Lin" brand "Langya honey" won the quality award China forest products expo.

Problems

There are five problems that Xiaolongshan Forest wild herbs processing industry have to settle down: insufficient in wild herbs resources utilization, resource advantage has not formed industrial advantages; restricted funds and other conditions, the processing factory is small, efficiency is not significant; types of processing and utilization of less; in the use of artificial cultivation of wild herbs as a supplement resources, no base construction and management work at the same time to catch up; the content of science and technology in the production process of some remains to be further improved.

Food Safety Strategies

Site Selection

The wild herds processing plant should be built in far away from the pollution of forest, forest margins or rural, also not around the industrial enterprises, and can be provided with good quality water and air, sanitation facilities, water, electricity, road three, communication is convenient, but also take into account the factors to facilitate the organization of labor. Wild herbs processing plant location should meet requirements of atmospheric environmental quality standards (GB3095-82) standard, the soil environmental quality standard (GB15618-1995) two standards, standards for irrigation water quality standard (GB5084-92) three.

Wild Herbs Base Construction

In the safe utilization and development of wild herbs, excessive collection of traditional wild herbs might appear in traditional collection area and the natural resources would be deficient, after entering large-scale production, receiving orders and supplying products. Therefore, the experience of wild herb production in the forest area of the northeast can be learned from and wild herb base of artificial domestication and cultivation can be developed as the supplement to natural wild herb resources, which should be given full attention because it can alleviate the pressure of excessive utilization of wild herb resources to a certain extent. The artificial cultivation of wild herbs can be divided into two parts. One is for woody plants like Toona sinensis, Aralia chinensis, Zanthoxylum bungeanum, and Juglans regia, and the other is for herbaceous plants like Medicago lupulina,
Amaranthus lividus, and Taraxacum mongolicum, and so on. In this way, the wild herbs bases can be further divided into artificial cultivation woody plants base, artificial cultivation herbaceous plants base, and natural wild herbs base. Although the requirements for construction of the three types of bases are different, all of them should take providing raw material up to the standards of "green food" as their goal.

**Construction of Artificial Cultivation Woody Plants Base.** Artificial cultivation woody plants bases are generally constructed and managed as economic forest. Apart from careful planting and reasonable collocation, it requires not only regular management including timely mowing, expanding pits, loosing soil, and fertilizing, but also special management for specific plant in specific place at specific time in accordance with the ecological habits of different woody wild herbs and the needs for construction of the economic forest. For example, Zanthoxylum bungeanum requires the replacement of soil at the right time and Robinia pseudoacacia needs budpicking in its seedling stage. Meanwhile, attention should be paid to the particularity of the construction and management of wild herbs base to realize the goal of stable and high yielding.

**Construction of Artificial Cultivation Herbaceous Plants Base.** The planting and management of domesticated herbaceous wild herbs like Medicago lupulina, Sonchus oleraceus, and Amaranthus lividus, is not difficult. It is even more extensive than the planting of vegetables, so regular management methods are mainly adopted, like thinning, weeding, and watering. The goal of artificial cultivation of wild herbs should be providing "green food". In order to ensure that the raw materials are qualified, it is better to apply farmyard fertilizer to the subsoil. For pasture bases that can provide raw material of wild herbs, like the pasture base in Yongning of Huixian County, necessary guidance can be provided to turn them into the base producing both wild herbs and pasture, achieving the mutual benefits of the processing factories and farmers. When the variety of wild herbs and the location for planting are chosen, quality tests should be implemented and long-term supply contracts should be signed to solve problems from the source such as centralized collection and supply to facilitate production, reduce shipping costs, and ensure the quality. Annual quality inspection is necessary. Only through the introduction of constraints and interest mechanism, can we fundamentally ensure the quality and the steady and healthy development in a sustainable manner.

**Construction of Natural Wild Herbs Base.** For areas rich in natural wild herbs resources in forest or mountain regions, like the forest and slopes with much Pteridium aquilinum, Chenopodium album, and Capsella Bursa-pastoris, consideration should be given to the construction of natural wild herbs base. The cooperation mode with the factory providing technology and necessary guidance, local farmers and forest rangers providing labor for management and collection, and finally the raw materials purchased at suitable price by the factory can be adopted. In addition, planned development and utilization should be implemented to reach the goal of scientific development, stable production, high yield, permanent utilization, and long-term benefits.

**Collection of Wild Herbs**

**Requirements for Collection.** Because the growth periods and edible parts vary for different varieties of wild herbs, the time and methods for collection are also different. Generally speaking, the following requirements should be met: (1) timely collection; (2) collecting the stout and sound plants; (3) the plants collected should be put into baskets; (4) collection, sorting and putting into baskets should be completed simultaneously; (5) collection should be completed in accordance with the specific requirement for size.

**Storage after Collection.** After a large quantity of wild herbs are collected, long-term storage and processing methods are generally adopted. If the quantity is small, temporary or short term storage methods can be used. The methods include:

1) Fresh storage
   
   The wild herbs are stored directly without any processing. In order to follow the principle of keeping water and preventing wilting, they can be packed in newspapers and plastic bags. The
method is: well preserved wild herbs with less injury can be sorted out, put into small bundles and wrapped in paper. They should be stored in cool and shade places or warehouses with the tip on top and the root on the ground. It is best to place them in artificial cold storage. If they are packed with plastic bags, holes with a diameter of 1 centimeter should be cut at four corners to maintain the coolness. In general, wild herbs can be preserved for 5-7 days.

2) Storage after boiling

Some wild herbs, like *Pteridium aquilinum*, are not suitable for fresh storage because they would be harden and loose the flavor soon. Therefore, they can be put into boiling water to remove the astringency before putting into plastic bags and then directly stored in cold storage. Attention should be paid to that much water should be used and iron pot should be avoided. Because such wild herbs contain much tannin substance, they would turn black when they meet iron. In addition, the timing for boiling should be accurately controlled. It varies for different parts of the same herb. The time should be increased gradually from leaf, stem, flower, and root. It also differs for different varieties. Experience should be constantly acquired in practice. Some of them are of strong astringency (like *Pteridium aquilinum*), so the astringency should be removed in the process. The method is to add plant ash or sodium carbonate in the water. For every kilogram of the herb, 40 grams of plant ash in 1.5 kilograms of water should be used. The wood ash should be put into the water to soak at first. The filtered liquid should then be boiled and poured into the container of herbs to completely immerse them. Finally, heavy stone should be pressed on the herbs. The astringency can be removed in 20 hours. When sodium carbonate is used, 1.5 liters of water and 3 grams of sodium carbonate are used for each kilogram of herbs. The process is same as that of plant ash.

**Processing of Wild Herbs**

It is not easy to transport and store the collected fresh herbs. Therefore, they should be processed for either export or long-term preservation. There are two major kinds of processed products for wild herbs processing plant in left forest of Xiaolong Mountain. One is dried products, including *Hemerocallis minor*, *Juglans regia*, and all kinds of edible mushrooms; the other is frozen products, mainly referring to leaf herbs.

**Dried Products.** Drying is a common method for simple processing of edible wild herb. The weight can be greatly reduced after drying to facilitate storage and transportation. In addition to edible mushroom, common dried products include *Portulaca oleracea*, *Pteridium aquilinum*, *Hemerocallis minor*, flower of *Juglans regia*, and so on.

**Frozen Products.** Frozen is a new method for processing wild herbs raw materials found by left forest wild vegetable processing plant of Xiaolong Mountain Forestry Experimental Bureau in the production practice. The wild herbs are dehydrated after boiling and then frozen for storage. Without adding any chemical, it can keep the original flavor of the wild herbs. Once they are thawed, they can be cooked into different flavors just like common vegetable. This kind of products are warmly welcomed in tourist sites, hotels, and restaurants. The products follow the standard (Q/llyc01-2004) made by the enterprise and approved by the Bureau of Quality and Technical Supervision of Tianshui City.

**Quality Inspection**

Quality inspection is a very important part for ensuring the quality of the product. Attention is paid to three links, namely raw material, boiling, and finished products. Boiling is the key for quality inspection of natural wild herbs while raw material and boiling should be emphasized for artificial cultivation of wild herbs. The quality inspection process can be completed by the factory or in cooperation with related government departments. The raw materials, especially those from artificial cultivation herbaceous plants bases, should be inspected annually through sampling. Every batch of product should be inspected. The ideology of quality first, sanitation first, safety first, and reputation first should be established in the production of wild herbs to ensure the quality of products when they have entered the market.
Food Safety Management

(1) The construction of factory should be in strict accordance with the fire protection standards with appropriate fire-fighting equipments. Training on fire safety should be organized for employees and fire protection inspection should be organized frequently. (2) Disinfection change room should be established. Employee should wear unified work hat, clothes, shoes, masks, and gloves according to the operational norms. (3) All employees should have health certificate and participate in regular health examination. Only those passing the examination can continue the work. (4) The technical training of staff should be enhanced to ensure that they are working in accordance with the rules.

Environmental Protection

(1) The layout of the factory construction should separate the production area from living area. Clear boundary should be set between the production area and the dormitory, canteen, bathroom, boiler room, and so on, to avoid contamination. (2) The water supply and drainage system should be kept properly. Waste water should be discharged in accordance with the requirements. Waste from production should be properly handled.

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