

CHINESE HOP GROWING



Luo xinchao – Hop Growing Association of Gansu Province

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The History and Current Status of Chinese Hops Industry

□, A Retrospective to Chinese Hops Industry

Chinese started growing hops since 1921, a variety called Hadora introduced from Germany, only a about 30mu(2ha) of area in Yimianpo of Heilongjiang Province. In 1943, an area of 100mu(6.7ha) hops was planted in Changbai County of Jiling Province. After founding of P.R. China, did Chinese started industrialized growing of hops in following phases:

1, A period of hard work and pioneering, a wide range of test growing

A 12 years wide range of experimental growth from 1954~~1965, in different area, crossing different latitude, longitude, and in different sea levels, by which we learned initially the basic features of hops, formulated standard and requirements for field management, and decided that Northwest China was the suitable place for growing hops, and from then on, designated Qindaodahua as the main hops variety for China.

2, A stage of popularization and promotion of hops technology and stable development

In 14 years period from 1966~1980, the hops growing area in China had been expanded yearly to a total area of 16,500mu,(1100) total yield up to 1,400 tons, average yield per mu gradually reached 192kg. In another 10 years time span from 1981~1990, hops industry in China has reached a full and rapid growing period, the location of hops planting has been fixed. As determined by the hops features, hops is suitable to growing in high latitude, temperate zones, and cold/cool areas, China decided Xinjiang Autonomous Region, Gansu Province, and Ningxia Autonomous Region of Northwest China as the main growing zones for hops in the country.



Climate zones for hops growth in Xinjiang

I- suitable zones

II- sub-suitable zones

III- oasis zones in north of Tianshan Mt and outskirts of Tarim Basin

III- cold/cool zones in North of Xinjiang

III- unsuitable zones

Briefing of Xingjiang

The growth of hops in Xinjiang concentrates in Brimguole State, Arksu Region, Changji, Brimguole and Yili. Barimguole State is located in Southeast part of Xinjiang, with an area of 482.7 thousand square km, bordering Gansu Province, Qinhai

Province, and Tibet Autonomous Region. Barimguole State belongs to continental moderate temperature, featured in dry, less rain, large evaporation and long sunshine hours.

Arksu Region located in south range of Tianshan Mt, north edge of Tarim Desert, $E78^{\circ}03' \sim 84^{\circ}07'$, $N39^{\circ}30' \sim 42^{\circ}41'$, covering 132.5 thousand square km, bordering Kyrgyzstan and Tajikistan on northwest. Arksu Region is typical continental temperate climate zone, its weather featured with dryness, less rainfall. As a one of the most radiation concentrated areas in China, Arksu is notable for long sunshine hours, with annual radiation up to 2750—3029 hours, total solar radiation amount up to 5340—6220 megajoule/m², large temperature difference between day and night, long in non-frost days as long as 183—227 days, annual average temperature 9.9—11.5 °C, annual rainfall 42.4—94.4mm. Arksu is marked for distinct feature of dry and cold in winter, and dry and hot in summer.

Changji State is located in north of Tianshan Mt, $E85^{\circ}34' \sim 91^{\circ}32'$, $N43^{\circ}06' \sim 45^{\circ}38'$, bordering Mongolia at Northeast, harboring Wulomuqi City, at length of 541km from east to west, 285km from south to north, covering a total area

93.9 thousand km², Changji State is distinct with desert climate at north desert areas, with sufficient sunshine, annual radiation up to 2700 hours, total solar radiation amount up to 133.6 megajoule/cm², annual accumulated heat $\geq 10^{\circ}\text{C}$ up to 3450 $^{\circ}\text{C}$, annual average temperature 6.8 $^{\circ}\text{C}$, January average temperature -15.6 $^{\circ}\text{C}$, July average temperature 24.5 $^{\circ}\text{C}$, annual precipitation 190mm, non-frost day as 160—190 days.

Yili Region is located on slope of Yili River valley at north side of the Tianshan Mt, E79°50'30"—84°56'50" N42°14'16"—44°50'30", covering a total area 56 km², surrounded by Tianshan Mt on three sides flat on west side, covering a total area 56 km². The climate in Yili Region is mild and humid.

Before 2004, the yield of hops in Xinjiang accounts for 58 to total national yield, over 10 thousand tons of yield at best year. The hops industry experienced a rapid growth in the 10-year period from 1981~1990, promoting expansion on hops planting and processing, and upgraded and pioneered the hops industry in China. The Division 222 of Xinjiang State Farm set up the first joint venture hops base in China with Sanbaole Co. of Japan, handling hops growing, processing and exporting, building up a comprehensive model for mechanical hops cleaning on high trellis, and constant-temperature warehouse, introducing Sas hops, a aromatic hops variety from Czech, which dominates the aromatic hops in China.

3, A phase of mechanical and technical processing

In a 10 years period from 1990~2000, there are situations occurred for over stocking in hops industry, the hops that can be sold are stored in warehouses of farms in natural state. As time goes on, there is serious loss for α -acid in hops product. By the time when new hops harvested, the stocked hops have already been valueless. Each year such kind of loss aggregates several million Yuan, therefore, hops farms in China gradually put investment in hops storage, mostly compressed into pellets, vacuum packed and then stored in cold temperature, with technology either self-made or introduced from foreign countries, in which circumstances promoted the hops processing industry in China. By latest result, there are 19 hops processing firms in the country.

4, Market economy create the shaping of hops industrialization and regional economic force

With 20 years forming of Chinese market economy that intensified the competition among Chinese hops enterprises. After years of competition, two main hops growing regions are emerged, Gansu Province and Xinjiang Autonomous Region, from quitting of hops growers in other parts of the country.

As the Hexi Corridor Area on northwestern part of China locates in dry Gobi Desert area, it is favorable to plant and growing hops, and farmers in this area foresee the advantage of this produce and introduced hops. After years of development Hexi Corridor Area becomes the main hops growing and processing region in China.

By the year 2004, the growing area of hops in China reached 62.6 thousand mu,(4.17ha) annual yield 10,379 tons, from which Xinjiang 28.6 thousand mu,(1.91ha) yield 4,774 tons, accounts for 46% to the total market volume. Gansu Province has growing area 34 thousand mu,(2.27ha) yield 5,605 tons, accounts for 54% of the market, ranking No. 1 in the country for growing area and yield.

Gansu Yasheng Group has made several hundred million Yuan investment in introduction of new hops, introduction of machinery harvesting equipment, modern computerized kilns and critical CO₂ hops extraction facilities. In year 2004, hops product in Xiaheqin Farm has been accredited by Tsidao Brewery the Inspection Free Product, which enlightened Chinese hops industry.

It is acknowledged by national experts that Northwestern part of China can be compete with any excellent hops growing regions in the world, and considered that the shifting of hops processing and extracting industry from Northeastern China, Xinjiang and central of Gansu Province into Jiuquan Region of Gansu Province has enables Jiuquan, in the middle of Hexi corridor, one of the world best hops growing bases, and renowned for hops growing, processing, and marketing.



Briefing of Jiuquan City

Jiuquan District is at 98 E], and 39 N]], located in west end of Hexi Corridor Area of Gansu Province, bordering Qinhai Province on south, next to Xinjiang Autonomous Region on the west, and its northern part bordering Mongolia. Jiuquan covers an area of 192 thousand square km account for 42% to total area of Gansu, 700km in length from east to west, 500km in width from north to south. The total population in Jiuquan is approximately 1 million, consists manly of Han nationality and other 25 ethnics groups, namely Hui, Mongolia, Kazak, and Yugur. There are 522 villages, and 76 towns administered respectively by two county level cities, Suzhou Region and Yumen District, four counties Jinta, Anxi, Subei, and Aksai.

Jiuquan is rich with natural resources, especially rich with land, water, and heat resources, annual sunshine period up to 3400 hours. There are 1.68 (0.12ha) million mu arable land, 66.89 million mu(4.46ha) grassland, 4.78 million mu waste land applicable for agriculture, forestry or grazing. Jiuquan is noted for rich water resources, renowned as *Oasis in Desert*. Jiuquan is famous since ancient time for irrigated agriculture, with 3 rivers run through this region, Hehe River, Shule River, and Harteng River, with aggregated surface runoff 3.3 billion m³, capacity of underground water 2.95 billion m³, and there are 73 medium and large reservoirs scattered in the entire region. Jiuquan is marked for its biggest hops base in China, with a growing area 3.4 thousand mu, yield 6000 tons/an, main variety Qindaodahua.

Suzhou Region and Jinta County are the main hops growing area in China
is also the main hops growing area in China









Yumen is a newly developed area for hops industry

Anxi County and Dunhuang County are developing for hops growing area.

The Growing Strategy of Hops Industry in China

With China holding the membership of WTO, China has been more deeply merged into the global economic unity. Hence, to grasp opportunity, and to draft a creative development strategy, is a great significance to the growing tendency of Chinese hops industry. The following passages are to elaborate these strategic tasks.

□, **A sound judgment on the growing prospects of Chinese hops industry, set up high efficient info-marketing net for hops products**

What attracts the eyeballs of international hops counterparts is the yearly increasing capacity of beer consumption in China, an annual premium of 10~~15 million liters, IE, a 7% rise each year on beer market. The increase of beer consumption means the increase of demand of hops. China is the third world largest hops growers in the world,

whereas Gansu Province and Xinjiang Autonomous Region, located in a high latitude, of China are renowned for high quality, and high yield, with over 30 years growing experience. With improving of Chinese people's living standards, there has been a gradual conversion from consumption of liquor into popularization of beer, and the increase of urban beer consumption popularized among rural consumers, which in general enhance the beer demand and leave an enormous growing market space. All these, in return urge the expansion of hops market.

According to estimation, the output of beer in China shall reach 32 million tons per year in year 2010. As calculation, there is 5g of α -acid in every 100L of beer produced, IE, to calculate as per 6.5% content, to produce 100L beer requires 83g hops. Base on 32 million beer output, the annul hops demand will be 26560 tons. Therefore, China has an enormous hops market with large potentiality. With China's hosting of 2008 Olympic Games, the beer consumption will bring about a maximum level. Hence, the Chinese hops industry shall take this opportunity and set forth strategic development on opening up and cooperation.

The starting point and fundamentals of hops industry development is to set up high efficient into-marketing net, such net shall be closely connected with domestic and foreign breweries, taking current hops market shares as well as future upgrading of hops varieties.

□ **Build up Chinese premium hops industrial zone based on Hexi growing area**

China's Hexi Region especially Hexi Corridor Area of Gansu Province is featured for typical dry climate in North temperate zone, long sunshine hours, big temperature difference, few precipitations, big evaporation, annual radiation quantity up to 145.64 kilocalorie/cm², annual average temperature 6.4~12 ℃, accumulated heat at corresponding period 3190~3800℃, annual sunshine hours 3059~3509 hours, 150 non-frost days, annual precipitation 32~240mm concentrated from July ~September, annual evaporation 2511mm. These favorable natural conditions have catered optimum growing condition for hops. The soil type of this region is mainly

desert limy soil thick in strata, most of which above 2 meters. This area is marked for its rich underground water resources that facilitate agriculture irrigation Both Xinjiang and Gansu located in dry Northwestern area of China, and both are the major hops growing bases of the country, both are rich with many years of growing and processing experience, while Gansu has more advantage of lower cost in land transportation than its neighbor province Xinjiang, taking half distance to the coast for shipping, and half distance domestic breweries as well, Therefore, to set up a growing and processing center of China based on Hexi Corridor Area, which is geographically center of China, is more advantageous.

□, **Strengthen the work of introduction and breeding of new varieties.**

The introduction of hops variety shall focus on specified series, and diversifications, highly regard on application of technology to ensure the harmonious combination of technical factors and growing factors, in order to streamline productivity and enlarge the market shares, and maximize profit. Creative concept is also highly recommended both in management creativity and technology creativity enabling hops products to have firm market positions.

It is meaningful, first and foremost, to draft sound introduction plans and set up full range herbarium for hops varieties. Before launching the introduction program, we shall conduct surveys on the current Chinese and world hops varieties, in order to sort out the correct varieties that in demand, and finally, set up Chinese hops herbarium. It is fundamental to keep regular varieties matching and timely replacing old hops, therefore, it is reasonable to adjust our existing ratio of bitter hops and aromatic hops from 90% : 10% into 70% : 30%. In order to maintain a high market percentage, and to satisfy the production demand of premium quality beer, we shall introduce aromatic hops and hops with high commercial values, and speed up the process of propagation. Divided in maturity, there are 3 kinds of hops to be selected before introduction, they are early mature one, mid-term mature one and late mature one, different varieties should be considered and matched for growing, for efficient utility of manpower and farming equipment.

□, **Carry on purification and strengthening of major variety Qindaodahuo.**

The main variety in Gansu Province is Qindaodahua, a conventional bitter and aromatic variety of the province with over 40 years growing experience from 1964. According to its biology features, the economic life for hops is about 30 years, ageing of roots and poor in disease resistance are revealed at this period, large amount of propagation work can be started, namely twig grafting, and tissue culture, with low-temp intoxication treatment nursery period.

□, **Standardize hops production techniques**

1, To strict with the standard bud cutting and selecting growing bud is important technology to ensure hops production. To cut redundant bud and keep main buds are the primary precaution and technology in hops growing management; first sort out the main root of hops, second select the bud to grow, last cut redundant buds. In selecting the growing bud it is important to leave the strongest bud and the bud in good position. After two thorough bud selecting and cutting, main stem shall be kept. To observe primary principle and minor principle is important in disbudding work, in which primary principle is to have an uniformity of growing stems and have majority of strong stems, minor principle is to leave the growing bud for considering the soil type and sequence of harvest to avoid uneven stems in one plot, for convenient machinery harvest.

2, To realize key field management for hops, prevention of pests and diseases and dosage application of fertilizer are primary in hops growing. As a perennial plant, once hops is planted, it will grow in a fixed place for decades, consuming and requiring large amount of fertilizers over a long range of period, particularly a large amount of demand for certain nutritional element, therefore, it is necessary to apply correct amount of fertilizers including right amount of farm manure and sufficient base fertilizers. Amount of organic and inorganic fertilizers shall be adjusted and applied during growing period to meet the growing demand of hops and to reduce land fertility consumption. Hops is kind of plant that is sensitive to potassium in a ratio $N : P : K = 1 :$

0.54 : 1.27, therefore, only to apply sufficient application of organic fertilizer and formularized fertilizer, and trace element can meet the hops demand for nutrition in different growing period.

A formula for amount of fertilizer to apply in theory: to produce 100kg dried hops need N 5.5kg, P3kg, K7kg. For years, the hops farms in China observe this simple formula in hops growing practice, while neglect that hops is in need of certain special trace element that drastically dropped in field, therefore, a 2-3- year regular field test in sample field is required in farms. Plot files shall be made based on analysis of field test and 2-3-year yields, accordingly specific application plan shall be made focusing on adding of trace element, and application rules and regular management system shall be made, to maintain and upgrade hops quality.

The common diseases that happened in Chinese farm are hops mildew, root rot and downy mildew. Downy mildew is a kind of nosomycosis or fungus affecting leaves and corns. The main precautions are to strengthen water and fertilizer management, regular soil loosening, leaves thinning to enable more radiation and ventilation, cutting and removal of affected leaves or plant, cutting and separation of buds, field management in end-autumn and early-winter, spray of zineb, all these precautions are taken non-pollution as consideration.

3, Popularize hi-tech drip-irrigation technology shall ensure hops for demand of water and fertility through drip-irrigation and precision ferti-gation, which is a growing tendency in hops farming. Hops is characterized for its deep and thick main root, demanding large amount of water while sensitive to flood, over-irrigation and poor ventilation in the soil would cause rot in root, resulted malnutrition for hops and growth of root system. Traditional furrow irrigation would easily cause water gathering in low parts of the field and create downy mildew in hot summer time. It is proven that drip-irrigation system can ensure the growing demand of hops for the precise regulation of water amount in different soil types and preventable to diseases caused by water-logging in root zone, and featured for saving water.

¶,Improving baking and storage techniques reducing loss of effective content

The current Chinese hops kilns are standard 3-layer steaming convertible planks kilns in model JFC-80-163(4) that are copies of baking and kiln technology from former Eastern Europe. The hops produced in these kilns are noted for crushing of corns under over-high temperature, loss of hops pollinates, oxidization of hops oil, resolving of α -acid due to much manure work, manure adjustment of temperature by experience, irregular spreading of hops onto conveyors, or over heatedness which influence hops quality. Therefore, the following measures shall be taken to improve Chinese baking technology.

1, One principle is less stirring or churning during baking. Baking is one of the key technologies in ensuring hops quality, with procedures including hops cooling, loading onto kiln, baking and exit, requiring hops moisture between 4%~5%, similar baked color to fresh color, maintaining original corn shape and flavor. Hops corns are not easily baked when they are tightly packed and squeezed. Construction of advanced international, flat-baking kilns is necessary and effective in reducing crushing of hops corns from manual churnings and reducing of effective content of from producing of hops.

2, Computerized temperature, ventilation and conditioning system in hops kilns. A moderate temperature is the key in processing hops corns, a over-low temperature shall not eliminate the anthocyanidin, or oyanidin in fresh hops, over-heated process shall oxidize hops and lose effective content. Scientific experiments showed that an optimum temperature in hops processing is between 60℃~62℃. Currently and in the past, the processing temperature of hops in China is mainly by technicians' experience, a kind of extensive processing, only introduction of computerized kilns can the hops quality be ensured, creating balanced pressure and even-tempo drying conditions to outflow of moisture in hops corns. Generally, the ideal thickness of loading hops corns onto conveyors is below 80cm, a thickness over 80cm shall be less efficient in ventilation and slow in evaporation and drying time and eventually deteriorating hops quality. Introduction of foreign advanced conditioning system is the possible way in changing traditional eye-judging method and keeping the moisture at standard level 9% approximately.

3, Harvest in sequence, compress in pellets on time and store under constant temperature

Certain amount of hops shall be harvested and transported in shifts according to the daily amount of hops that kilns are capable to process. The finished dried hops corns shall be shipped to granulation factory in shortest possible time, better to send to granulation in 48 hours, in such condition the effective content can be well preserved. Good ventilation shall be accompanied during pellets processing. The finished products, both compressed hops or hops pellet shall promptly be send to constant temperature warehouse at 0~4℃.

□, **Construct CO₂ critical hops extracts production line**

The prevailing hops variety in China is Qindaodahuo, can be both bitter type or aromatic type, with α -acid content 6%~8%. The processing of this variety is unified and low cost, the quality of the product, however, is unsecured due to improper storages. Therefore, construction of critical CO₂ hops extraction line shall be list under early schedule, and simultaneously, develop new hops varieties that suitable for extracts processing, IE, α -acid content is above 8%. Owing to the reason, commonly acknowledged, that any hops with α -acid content under 10% is considered poor management, we should start the growing of hi- α -acid hops while having the introduction of critical CO₂ hops extraction line.

Hurry up with construction of critical CO₂ hops extraction line, with collaboration with foreign counterparts and absorb advanced hops production technology, to be able to produce products that used in pharmaceutical, food, and cosmetics industry.

It is recommended that hops residue can be used as fodder for animal husbandry.

▣, **Popularize the concept of organic food, perfect EPA management system**

With China becoming the member of WTO, and with awareness of EPA of membership countries for strong EPA issues, more Green Food Barriers are built up, more countries launch laws, codes, and criterions to ensure food quality, both China and other membership countries are facing the common task-----how to enable its hops products

to comply with WTO standards and break through these barriers, and strengthen its competitiveness.

In order to enable Chinese hops products to excess world market, we must adapt to these world changes and face these realities, build up new concept, issue hops norms that comply with that of the world, aware of Green Food concept and finally perfect China's EPA system for hops.