

Return to China, May 2004

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In September, 2003, Gordon Rouse, Mark Hart and Tom Plocher visited grape researchers in northern China under a USDA Foreign Agriculture Service grant. Due to the press of the harvest season in Minnesota, they could only spend one week in China. Some things were left undone. So they were eager to return at a less pressured time of the year and continue our learning about viticulture in the coldest parts of China.

This trip was especially memorable because it marked the beginning of real cooperation between us and our counterparts in Beijing and Inner Mongolia. We presented them with grape cuttings from Elmer Swenson to use in their breeding work and they presented us with grape pollen collected from their most valuable selections to use in our breeding. We also renewed our old friendships and began some new ones over great northern Chinese cuisine including some memorable Mongolian hotpot dinners, roast lamb, and countless dishes prepared from wild vegetables of the Mongolian steppe. We could not have imagined a warmer welcome everywhere we traveled.

Big Berries and Grape Breeding History in Beijing

In 1954, shortly after the Chinese Revolution, Professor Li Shengchen got the idea of crossing *Vitis vinifera* with native Chinese *Vitis amurensis* to produce some hybrid grapes with improved winter hardiness. Three of his selections were named by The Institute of Botany, Chinese Academy of Sciences in Beijing. They are Bei Chun, Bei Hong, and Bei Mai. These varieties were mostly forgotten. For the nearly 50 years following Professor Li's pioneering idea, breeding work at the Institute concentrated on improving *Vitis vinifera* table grapes for berry and cluster size. The improvements were eye-popping. Clusters averaging 700 grams and berries averaging 11 grams (think golf balls). *Vinifera* table grapes had to be buried under a deep covering of soil in the cold northern China winter, but ample labor made growing them cost effective. Hardy hybrids were not really necessary. Now, with labor costs increasing and soil conservation a concern, there is interest again in hardy hybrids. The pioneering interspecific hybridization work of Professor Li in the early 1950s is again relevant.

In late May, 2004, it was a great experience to visit this historic Institute of Botany, Chinese Academy of Sciences at their farm at Beijing Botanical Gardens. Throughout our visit we were accompanied by no less than four generations of grape breeders who have worked at the Institute, including the revered Professor

Li, developer of Bei Chun, Bei Hong and Bei Mai, his student Professor Luo Guoguang, Prof. Luo's student Shaohua Li, and Prof. Li's student, the current grape breeder, Liu Huifeng. Mr. Liu, a PhD candidate at the Institute, is keenly interested in hardy interspecific wine grapes and winemaking. Fifty years later, he is carrying on Prof Li Shengchen's work with interspecific hybrids.

At the Institute of Botany, Gordon presented a lecture on wine evaluation and we hosted a tasting of Minnesota wines from interspecific hybrids. In turn, we were treated to a tasting of experimental wines made at the Institute from the amurensis hybrids, Bei Chun, Bei Hong, and Bei Mai. We gave good marks to a red wine blend based mostly on the variety Bei Hong, which had deep red color, and a complex aroma of black currants and black pepper. The wine was produced with natural yeast fermentation. Bei Hong is a hybrid of Rose Fragrance (*Vitis vinifera*) X *Vitis amurensis*.

Summer arrives early in Beijing and the grapes were completely done blooming when we arrived on May 25th. Mr. Liu presented us with pollen from three of their super large cluster/berry *vinifera* varieties, Jing Feng, Jing Xiu, and Jing Yu. We will use this pollen in crosses with our most hardy Minnesota hybrids to produce a generation of seedlings with improved genes for cluster and berry size.

Cold Climate Grape Revolution Brewing in Hohhot

Professor Lin Shouren is aiming for no less than a revolution in grape growing in Inner Mongolia. His motto is, "Conclude the past. Better for the future." Current grape culture in Inner Mongolia is based on *Vitis vinifera* and deep covering with soil for winter protection. Professor Lin believes that this approach is profitable in the near term, but not sustainable in the long term. 1) Labor involved in burying and unburying vines accounts for 50% of the cost of grape production in Inner Mongolia. Increasingly, vineyard owners want to capture this money as profit. 2) Dust storms due to unprotected and disrupted soil are a major ecological problem in Inner Mongolia. An approach is needed that minimally disrupts the soil and allows permanent cover crops in the vineyard. The winter of 2003-2004 was the tipping point for Prof. Lin and Inner Mongolian vineyards. With -32°C and no snow in the Yellow River grape region, 50% of the *vinifera* vines died, despite being buried under 50 cm of soil. Prof. Lin is convinced that growing hardy interspecific hybrid grapes with unprotected culture is the way of the future.

During our visit to Hohhot, Prof. Li Xue Wang, her student, Madame Li Xiao Yan, and Prof. Lin lead us on tours of the experimental vineyards at the Inner Mongolia University of Agriculture and the Inner Mongolia Institute of Agriculture. Vines had six-inch shoots but were not yet blooming.

During our vineyard tour in Hohhot we were introduced to Prof Lin's selection, Inner Mongolia #1. He selected this vine from 1400 seedlings that resulted from a cross of Bei Chun X Queen of the Vineyard. Bei Chun is a seedling of Muscat

Hamburg x *Vitis amurensis*. Queen of the Vineyard is a large-clustered vinifera variety from Hungary. Prof. Lin selected Inner Mongolia #1 for its early ripening and wood maturation (earlier than Beta) and large cluster size, averaging 380 grams. It is winter hardy in Inner Mongolia (2004 winter temperature of -32°C) with only light soil protection of 5 cm to prevent desiccation from the cold desert winds.

We saw many other grape varieties in these experimental vineyards. Zuoxia Red Wine #1 is an F3 (third generation) hybrid of *Vitis amurensis* x *Vitis vinifera* developed at the Chinese Academy of Agricultural Sciences institute in the northern Chinese province of Jilin (part of what used to be called Manchuria). This is the first Chinese variety that has the prospect of growing without winter protection in cold snowless regions of China like Inner Mongolia and Ningxia. It is being aggressively propagated by Prof. Lin by means of tissue culture for planting in the far west Yellow River grape region around the city of Wuhai.

Wuhai and the Far West

Wuhai is a rapidly growing city of 450,000 located on the Yellow River in the far west of Inner Mongolia. Think desert--rugged mountains and sand dunes giving way to fertile flood plains irrigated by the Yellow River. Sheep and gecko lizards everywhere. The economy of Wuhai revolves around mining coal. There is an emerging cottage industry in sand dune snowboarding (a favorite of Japanese tourists to the area). Wuhai also is earmarked by the government for development as a grape-growing region.

Other than its small amount of rainfall (15 cm a year) and practically no snowfall, the climate in Wuhai is quite similar to that of St. Paul. 1450 degree days of heat (base 10 °C), growing season of 160 days, and winter low temperatures of -32 to -34 °C. With the lack of snow cover and cold temperatures, the main challenge to grape growing is root injury caused by the extreme cold temperatures deep in the soil. The other challenge is dealing with the wind. There are large plantings of trees and the use of drip irrigation to establish wind breaks along roads and agricultural fields. In the winter, the dry winds cause desiccation of any vine tissue that is unprotected. In the spring, the high winds sometimes interfere with pollination. The long-term solution, of which Prof. Lin is the major proponent, is developing grape varieties that are better adapted to the climate. The near-term solutions to these problems that we observed in Wuhai were greenhouse culture and deep trench cultivation.

Greenhouse Culture

On our trip to China in September, 2003 we saw greenhouse grape production on a gargantuan scale near Harbin in Heilongjiang Province. These greenhouses were simply made of metal hoops or bamboo-reinforced concrete arches and plastic sheeting. No special features in the design to fend off the

winter cold. The vines inside these greenhouses had to be buried deeply in trenches and covered with soil to survive the winter.

The greenhouse grape culture we encountered in Wuhai used quite a different greenhouse paradigm. These greenhouses were designed to not only force early vine growth for early market fruit production, but also to provide winter protection. The basic structure had permanent walls on the west, north, and east sides. The construction of the wall was complex. It consisted of an outer brick wall and an inner concrete wall with an airspace 1.2 meters wide between the outer and inner walls. This space was filled with insulation material. Poly was stretched over this frame to create the south sloping roof/south wall. Before winter, a 5 cm thick mat made from densely packed cattail reeds is rolled out over the poly to completely cover the roof of the greenhouse. Even at midwinter, the temperature inside the protected greenhouse drops to only 2-3°C. The vinifera vines cultivated inside do not need to be buried.

Cultivation of the vines inside the greenhouses in Wuhai was similar to that which we observed in Harbin. The most important varieties are Early Red Globe and Jing Feng, vinifera table grapes with very large berry and cluster. As shown in the photolog each row of vines was actually a double row. Vines were planted in pairs one-half meter apart. The spacing between one double row and the next was 1.8 meters. Each greenhouse contained 1,100 vines producing 2000 kg of fruit. A kg of Red Globe fruit grown in Wuhai currently fetches 20 RMB/kg on the wholesale market if delivered in early summer before the glut of ripe grapes hits the market. Since the greenhouse allows the vines to get a super early start on growth, the fruit is usually ripe and ready to go to market by 20 June, fully a month earlier than any other fresh grapes grown in northern China.

Greenhouse vines in Wuhai are grown on two short trunks, 0.1 meter high that form a Y. A typical vine is pruned to only 3-4 buds per vine and these shoots cluster thinned to produce only 3 clusters. Trunks are replaced every 2-3 years from a single root sucker that is allowed to grow up each season.

Outdoor Vine Culture: Deep Cultivation

Our visits to the Fu Nung Vineyard north of Wuhai and the Demonstration Company Vineyard located on the river flats across the river from Wuhai provided a good introduction to deep ditch cultivation in the area.

The photolog shows the new 32 hectare planting of both table and wine grapes (seven different varieties) at the Demonstration Company Vineyard. Trenches are dug 1 meter deep in clay soil. A 20-30 cm deep mixture of soil and manure are added back the trenches. Then the vines are planted, some 70-80 cm below ground level. Every year as the vine grows up, soil is added to the trench until the soil reaches 20-30 cm below ground level. The vines are maintained at this level. Before winter the trench is filled in with soil up to ground level for winter protection. In spring, this amount of soil is removed.

In this desert region, vineyard water management is crucial. In Wuhai, water from the Yellow River is diverted to flood irrigate the nearby vineyards every 20 days. Irrigation is usually stopped around mid-August to slow vine growth and force the vines to harden off. A late watering is usually done in late October, after the leaves have dropped, to ensure adequate soil moisture for the usually dry winter.

Leaf removal is used tactically in these vineyards to manipulate berry color. Chinese consumers prefer Red Globe grape to be pink. Growers make sure Red Globe has at least some protection from the hot summer sun to retard color development so that the berries are pink, not deep red at harvest. Consumers are accustomed to dark red berries from the variety Jing Feng. If shaded, Jing Feng produces pink berries, but with sun exposure the berries are quite dark, nearly black. Growers use leaf removal to encourage more direct sun exposure of the Jing Feng clusters and darker color.

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