



History Note no. 6: A Brief Overview of Vegetable Disease Control in China in 1977 as reported by Dr. Paul H. Williams

It all started with a ping pong match. That's all it was. In the early 1970s, the United States and China had virtually no relationship — no embassy, no ambassador, nothing. Then came ping pong diplomacy. And in 1974, a year after that famous match, the leaders of the two countries (Presidents R. Nixon and G. Ford of the USA and Chairman Mao Zedong of China) agreed to initiate scientific and cultural exchanges. That was the beginning. Interestingly, there was no USA Embassy and thus no ambassador. George H. W. Bush served as the top State Dept diplomat in China for part of the 1970's. He was known as the 'bicycle-riding envoy' as he enjoyed cycling around Beijing.

The agricultural scientists in the USA knew almost nothing about what was happening in China. The Russians had been in China for years, but China was essentially closed to USA scientists. In 1977, I was chosen as the Plant Pathologist as part of a USA team of twelve scientists, mostly prominent scientists in the various aspects of vegetable production, to visit China. Our mission was called "Vegetable Farming Systems" with the objective of observing how vegetables were grown. I had grown up in Vancouver, Canada, where there were Chinese groceries supplied by Chinese growers, and I was aware of the Chinese "market gardens" as something truly excellent.

Before we left, the CIA briefed us, and when we arrived, the Chinese briefed us too: no photographs from airplanes, none near bridges, none of government buildings, etc. Following security protocols was extremely important.

When we arrived in Beijing (Peking at the time), the city was still reeling from a catastrophic earthquake. It hadn't struck Beijing directly — the epicenter was in Tianjin, the large city nearby — but the devastation was immense. Tens of thousands of people died. In Beijing, millions abandoned their homes out of fear of collapsing buildings. They were living in makeshift shanties along the sides of the streets.

We were housed in a hotel on Tiananmen Square, and each morning I

would go out for a run. This was my introduction to the country.

Our team traveled between cities by train and plane (June 6th to July 6th). Everything was arranged by the four Chinese guides, who traveled with us. We stayed in bunker-like, concrete, Russian-built hotels — very primitive. The team visited colleges, research institutes, markets, and communes near the city. Sightseeing, banquets and cultural events were part of the day. The team started in Beijing (north), then Sian (west), Tsinan, Nanking, and Shanghai (center), Kweilin (sightseeing), finally Hangchow and Canton (south). After the tour, we flew to Hong Kong.



Goods of all kinds were transported by carts.



Tiananmen Sq., Peking with the Great Hall of the People. Note the lack of cars.

The Chinese government recognized the importance of vegetable production and had set a goal of providing 1.2 lbs of vegetables/person/day. Most of the attention of the government was on vegetable production near cities and less in rural areas. The government encouraged modernization of agriculture and focused on four factors: mechanization, electrification (electric pumps for water), chemical fertilizer, and good crop varieties. At this time, vegetable production was very labor intensive and painstakingly carried out by workers. It was critical to produce blemish-free products as only these were considered marketable. Besides the high-quality vegetables seen in the market, our team observed a considerable amount of crop loss from diseases and insects in the fields. We had an opportunity to discuss these disease and pest problems with plant protection specialists at research institutes, agricultural colleges, and people's communes.



Plant protection embodied a fascinating mix of ancient practices derived empirically over centuries along with modern methodologies of integrated control requiring precise timing of the introduction of biological agents and/or chemical pesticides. Disease and pest management involved three components: i) identification, ii) prevention methodologies, and iii) control practices. In our travels, the team would view vegetable production mainly around cities in north China (185 frost-free days, ca 35 inches rain), central China (270 frost-free days, ca 56 inches rain), and south China (no days with frost, 72 inches of rain).

The following are brief comments on the three components of disease and pest management. 1) Identification of diseases – Starting in 1971, an effort was made to produce handbooks with drawings of the pathogen, colored identification of symptoms and information about the disease cycle and management practices. These resources were widely distributed to plant protection specialists. The identification of diseases was part of the monitoring and forecasting system. Typically, the crops were monitored by a team of specialists every 2-3 days and reports were prepared. This information was collected nationally and when control measures were necessary, production



Harvesting Chinese cabbage.

teams were informed. Besides these visual observations, most communes also had spore collection devices, mainly for rice and wheat pathogens. Weather data was also collected and used to help make management decisions for disease control. Predictive modeling was not widely practiced. 2) Prevention methodologies – Communes were primarily self-sufficient, and seeds and vegetatively propagated plant parts were produced and remained on the commune. However, if seed potatoes were moved from one province to another, they were inspected for ring rot. Additionally, considerable effort was devoted to minimizing the effects of viruses on reducing potato yields. This involved sending

young plants to Mongolia where individual plants were checked for viruses using antisera. Virus-free seed potatoes were then sent to provinces in China. Sanitation was an important component of the

prevention strategies, e.g., as soon as the cabbage crop was harvested, all excess leaves were removed and fed to cattle, pigs or fish. Plant material not used for animal feed was composted. Crop rotation was an important management practice. Even with these practices employed, our team



observed numerous root diseases on cucumber and eggplant. In central and south China, vegetable production areas are commonly converted to water production crops as part of the crop rotation system, e.g., rice, water spinach, water chestnut, water bamboo, or lotus. To reduce bacterial diseases of vegetables, ditch and furrow irrigation were used instead of overhead sprinklers.

Intercropping was also commonly practiced, to help reduce the spread of pathogens. Avoidance of disease by growing certain vegetables earlier or later in the season was another common practice. In the north, peppers and eggplant were planted early under plastic so crops would be productive in July, a month earlier than normal. This avoided fruit rot losses caused by *Phytophthora*, *Pythium* and *Phomopsis*. Hot water seed treatment was used with cucumbers to control *Fusarium solani* and *Colletotrichum legendarium*. 3) Control Practices - Chemical applications



contain for mixing the fungicide, Bordeaux Mixture.

were a major means for controlling insect damage. The primary fungicide used was inorganic Bordeaux mix, which was applied weekly to tomatoes and potatoes. Seed treatment of tomatoes with potassium permanganate was used to disinfect seeds of *tobacco mosaic virus*. Maneb and Zineb were widely used particularly for control of downy and powdery mildew of cucurbits. The development of disease resistant varieties was a high priority. There were

approximately 50,000 communes and with each commune focusing on disease resistance, there was a tremendous genetic resource being produced. In almost all provinces, active programs were observed for development of mosaic-resistant tomatoes, downy mildew-resistant cucumbers, and mosaic- and downy mildew-resistant Chinese cabbage.



Dr. Williams with students in plant breeding class.

Another observation was that the only significant disease caused by nematodes was root knot of tomato caused by *Meloidogyne* sp., and this was controlled by soil fumigation with dicloropropane-dicloropropene.

After this initial visit, two colleagues from UW-Madison and I, were invited to return to China in 1980 to spend a month conducting workshops on plant breeding and other modern technologies, such as tissue culture. We stayed at the Friendship Hotel in Peking, which



Hop structure to allow early planning and intercropping with tomatoes and cucumbers.



Backpack sprayer was the main way fungicides were applied.

was a great improvement over the concrete bunkers of 1977. Afterwards, we were taken to parts of China that had been forbidden in 1977.

These trips to China resulted in building relationships that changed the course of my laboratory. A continuous stream of Chinese scientists, starting with the most distinguished cabbage breeder, Li Chawen, was sent by the Chinese government to my laboratory to learn about approaches to breeding for disease resistance.

Another spinoff from these and other international experiences, such as congresses in Poland and South Africa, led me to create a presentation called “Around the World with Brassicas,” a slideshow built from the hundreds of slides that I had collected over many years and places.

It was an honor to be selected to join this first scientific exchange to China in 1977, and I gratefully recognize the immeasurable impact international experiences have had on my professional career.

Sources:

- 1) An AI-generated transcription of an oral interview of Professor P. H. Williams by Dan Lauffer, Director of Wisconsin Fast Plants.
- 2) Plucknett, D. L. and H. L. Beemer, Jr. 1981. Vegetable Farming Systems in China. 386 pages. Chapter 6, Plant Protection by P. H. Williams and Chapter 9, Plant Breeding by W. H. Gabelman and P. H. Williams.
- 3) Images selected from a collection of more than 500 35-mm slides taken by Professor Williams on his two trips to China.

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