Making a Difference in Food Security

By

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Placement Center:

Chinese Academy of Agricultural Sciences

Introduction: My Involvement in the World Food Prize

At the end of the second semester of my sophomore year in 2000 was when I first became familiar with the World Food Prize organization. I was told that the organization was involved in promoting efforts to extinguish the problem of world hunger. My school journalism advisor had approached me about participating in the World Food Prize Youth Institute.

Through the Youth Institute I would research a topic of concern for global food security and get a chance to attend the annual symposiums and award ceremony. Accepting the opportunity to get involved in a valuable organization, I began my research.

At that same time I was living in Brazil as a foreign exchange student, so I was able to do my research from a Brazilian perspective. Researching in Portuguese and using Brazilian resources I finished my report. However, I had to face the problem that I was still in Brazil and would not be able to attend or present my paper at the annual event.

Having missed the opportunity to participate in the event, I eagerly accepted the chance to do it again the following year. Participating in the 2001 Youth Institute would prove to be very rewarding for me. Researching a new topic, this time in Spanish, I was able to expand my language skills while preparing to participate in the events. I hoped from the beginning to take advantage of the opportunities the World Food Prize offers youth participants. I was interested in the Youth Institute Internship Program that I had missed out on the previous year and I wanted to become more involved in the tremendously important issue of global hunger. With determination and goals, I succeeded and was granted a position in what Ambassador Quinn has said, "… is the highest honor that can be bestowed upon and Iowan teen".

Center Placement

With such a rapid growth in the Youth Institute and growing interest in the Internship Program, new centers became available. I was selected to do my research and represent the World Food Prize at the Chinese Academy of Agricultural Sciences, one of two new intern centers in Beijing, China.

The Chinese Academy of Agricultural Sciences (C.A.A.S.) has a total of 39 research institutes, one graduate school, and one Agricultural Scientech (scientific and technological) Press. Among the 39 research institutes, 16 are engaged in plant research, ten in animal breeding, eight focus on economy and the environment, and five are committed to agricultural engineering and new technology. Twenty-four of these research institutes are distributed throughout 16 provinces, municipalities, and autonomous regions. C.A.A.S. has more than 9,000 faculty and staff members, with around 6,000 being researchers.

C.A.A.S. has two key state laboratories, 20 key ministerial laboratories, six state crop improvement centers, 27 quality supervision and test centers, one national crop genebank, and 11 national nurseries of crop germplasm and closely related wild species. It also has 26 experimental agriculture and livestock farms, with a total land area of 103,000 mu (metric units) in addition to 740,000 square meters of office space for research and development. Recently, C.A.A.S. has invested more than 300 million RMB, around 36 million U.S. dollars, in research equipment. The academy was ranked number one in agricultural scientech information resources.

With all of these resources available C.A.A.S. is on the cutting edge of Chinese agricultural development. The academy has systematically organized and conducted important research on agricultural development strategies and put forth climate resource atlases of China's major agricultural and forestry crops.

"As a national level agricultural research organization, the Chinese Academy of Agricultural Sciences undertakes the tasks of national key basic, applied basic, application research, and research in technology and industrial development. C.A.A.S. is on the road to constructing a modernized agricultural academy … sparing no effort in contributing to the creation of an agricultural innovation system with Chinese characteristics", Dr. Zhai Huqu, President of the Chinese Academy of Agricultural Sciences said.

Program Placement

The entrance to the Institute of Vegetables and Flowers(Above).

I was placed into the Institute of Vegetables and Flowers. The Institute of Vegetables and Flowers (I.V.F.) is one of the specialized institutes governed by C.A.A.S. Its mission was produce crops that are of a superior quality, have a high yield, and are disease resistant.

Established on September 22, 1958, the institute grew out of the Department of Horticulture of North China Institute of Agricultural Sciences. It is now the national academic center for vegetable research in China. The mandate of the institute is to conduct applied research and related fundamental studies of vegetables and flowers. It has conserved over 30,000 accessions of vegetable germplasm resources and developed more than 160 new varieties or hybrids which meet the academy’s goal of high quality, high yield, and disease resistance.

Not knowing which vegetable program in the I.V.F. to choose, I was assigned to seven different groups, around one for each week of my stay. The assignments were as follows:

1st Week: Chinese Cabbage

2nd Week: Eco-Organic Soiless Culture-Tomato

3rd Week: Eggplant

4th Week: Cucumber

5th Week: Green Pepper

6th Week: Soiless Cultures

7th Week: Potato

Taking on a new group each week gave me an insight into many different aspects of Chinese agriculture and some of its main crops. Although each group involved a different plant, the work and research were similar.

Each group's mission was to develop a strain of a particular plant that produced high yield, high quality, and disease resistance. To accomplish this each group, except the soiless culture group, used DNA technology. Through DNA isolation and purification (for procedure see Appendix I) each group could successfully choose the plants they wanted that met the programs goals, and disregard those who did not. Using this method each group continually works toward a goal of finding the perfect strand of DNA for plants that meet the programs goals.

The goal of the eco-organic soiless culture groups is the same as the other groups, but instead of using plant DNA, different soil mediums are tested to see which increase the quality and yield of green house crops.

There was one similarity in every group that I had noticed. Not one of the groups I worked with seemed to have a major impact on Chinese agriculture, or so I thought. After further research and questioning I found out exactly how important the job of each group was, but I first needed to understand Chinese agriculture.

Chinese Agriculture

China has a unique position in the world today. As one of the fastest growing, and developing countries in the world it faces many challenges. By joining the WTO and exposing itself to a world market, China has opened up to a new way of business and growth.

The outside world often questions the methods used in China. To understand Chinese agriculture at the present one must first understand the traditional methods that were first used. Being the most heavily populated country in the world China's first agricultural plan was to produce high yields to support its population.

"In the past the yield was emphasized above everything else," President of the Chinese Society for Horticultural Science Dr. Zhu Dewei said.

China was successful at its goal of producing a large quantity, but emphasizing only yield led to other problems.

"The world average consumption capita is 110 kilos, and China is above the world average producing around 330 kilos. But, now that we know we can produce high yields, we need to start producing higher quality, especially now that we have joined the international market," Dr. Dewei said.

Joining the international market is not only changing the quality of crops, but also what kinds of crops are grown in China.

"We not only need to grow higher quality crops, but we also need to grow crops that are in demand. We need to get away from our traditional crops and tune in to what the international market demands," Director General of C.A.A.S. Liang Qu said.

With the problems identified and a large workforce, why hasn't China been able to correct these problems?

The answer to that question is a lack of education.

"Almost all of the rural farmers lack a proper education. With China's involvement now in the WTO these farmers cannot compete at an international level," Professor in the Department of Molecular Biology and Genetics at Cornell University Dr. Ray J. Wu said.

An education in international business is not the only type of education farmers need.

"They need to understand that quality, not yield, is now important. They need to be shown new methods for growing crops that raise quality, such as reducing pesticides, and using crops that grow well in their particular region," Liang Qu said. "They need to know that with the international market now available, if they don't produce products that aren't up to international standards, they will be beaten by higher quality, cheaper international products."

With such a drastic threat to Chinese agriculture C.A.A.S. is offering solutions.

"Our most important mandate is to help educate farmers. We help them by offering hands-on teaching programs, and by producing seeds that are already of the highest yield, quality, and disease resistance," Liang Qu said.

The International Problem

As the Chinese Academy of Agricultural Sciences is currently working to improve Chinese agriculture with small steps, there is a need for better international understanding.

Many countries look upon China's agricultural status by comparing it to already developed countries and think the problems should be addressed in the same way.

First one must look at the culture. With the largest population in the world and a third world economy, China faces issues that are unique to itself. With a developing economy China must be careful about the speed at which it develops. For example, using technology to solve Chinese agricultural issues may do more damage than good. If farmers were given technology such as we use in the United States it would enable only a few farmers to do the work of hundreds, thereby forcing the other farmers into the already overpopulated cities, contributing to poverty, and putting wealth in the hands of few, further dividing the rich from the poor.

Other nations need to recognize China as a developing country and allow it do what works best for it in its particular situation. Even though it is a developing country, it is one of the oldest civilizations in the world, and it will take time to ease into an international economy and market.

A common scene at a wholesale food market in rural China. Farmers perform every activity involving their crops from harvest, to taking them to the market. With such over-production farmers are forced to sell, and in most cases bargain, their goods at extremely cheap prices.

Group Research

Working in a Chinese Cabbage field in the Hebei Province outside of Beijing to collect samples, data, and results (Above).

With my new knowledge, I began to understand that producing the highest quality, yield, and disease resistant crop was very important to the Chinese farmer because this was how they made their living and it enabled them to compete with an ever-growing international competition.

In each group, except the eco-organic soiless culture, I would help the researchers perform tests, such as DNA isolation and purification. I also helped record data about the different plants, and allowed them to practice their English.

Using the microcentrifuge in DNA lab work with the cucumber group (Above).

In the eco-organic soiless culture groups I was introduced to this technology. Eco-organic soiless culture tested different mediums and their productivity in growing crops. Using a greenhouse for a controlled environment, crops were planted in the medium which was put in a brick trough (See diagram below of layout). I helped collect data about the status of the environment and the yield of the crop.

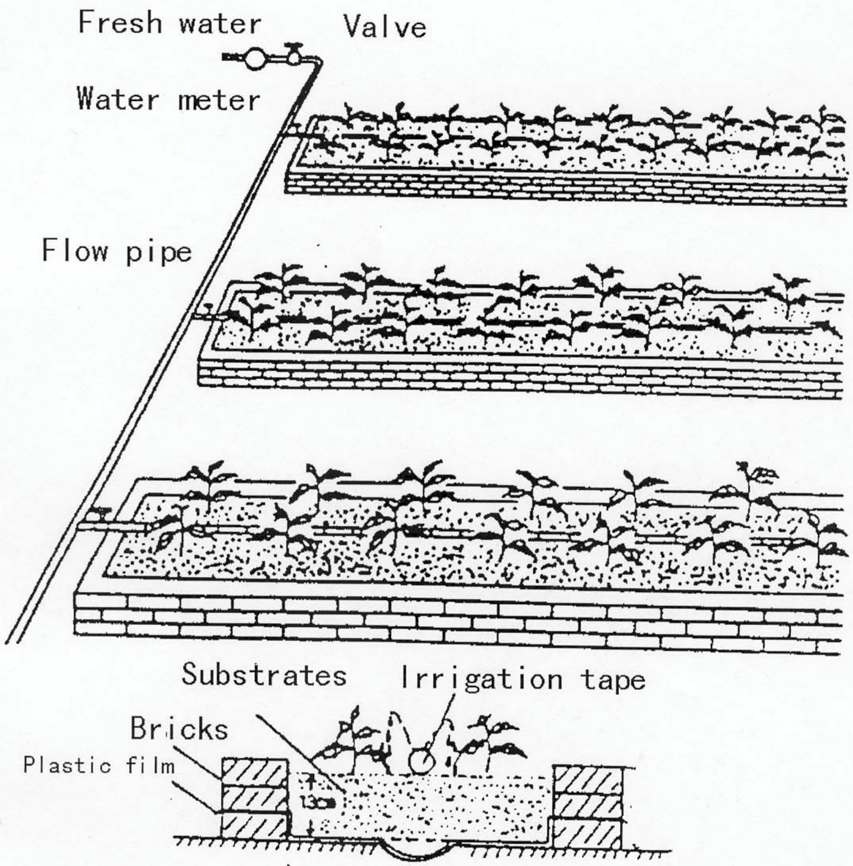

Figure 1 The structure of eco-organic type soilless culture system

Improving Food Security

While my work at first seemed to hold little importance as to the food security of the entire country, I later learned that what I did was the beginning process in a long path that would eventually help the farmers of China develop Chinese agriculture into a world leader. Taking these small steps I helped the researchers at C.A.A.S. collect data that may hopefully turn out to be the perfect strain they are looking for to help Chinese farmers lift themselves from poverty.

As past intern Jason Held said at last year's World Food Prize, "The big problem of world hunger can only be solved by first solving the little problems."

Now having the same experience as Held did, I better understand that breaking apart these smaller problems is the first step in solving the larger problem of world hunger.

Reflections

It was very unique to see the world from another culture and hemisphere's point of view. It opened my mind to new thoughts, questions, and perspectives on the issue of world hunger. The internship has changed my view of world hunger from that of a United States citizen, to a citizen of the world. I have taken away the lesson that things are not always as black and white as they seem.

With the knowledge I have gained I believe that the only way to erase the stereotypes about Chinese agriculture is to use the media. Journalists would be able to give accurate knowledge to the rest of the world about the problems and advantages that Chinese agriculture offers. Without an accurate understanding the rest of world is unable to effectively help or give guidance. As a future agricultural journalist I have made it my goal to return to China and report on Chinese agriculture to help the world better understand agriculture from a Chinese perspective. I hope that from there I will be able to start a career using the media to bring the problem of world hunger in many countries to the public attention.

I have also taken away great friendships and valuable information that will be useful for the rest of my life. To live and breathe another culture so opposite of my own for two months is something I will never forget.

Appendix I

Streamlined DNA Extraction Protocol

Expected yield is 5-30 ug, depending on the quality and quantity of the foliage. Yields can be increased beyond 30 ug by using multiple young leaves and increasing the volumes of the grinding and extraction buffers.

1. Add Diethyl Dithiocarbamic Acid Sodium salt (4 mg/ml) and RNAase A (100 ug/ml) to an aliquot of Grinding buffer, and B-mercaptoethanol (1%) to an aliquot of Lysis Buffer (see below).
2. Use a single newly emerged, still rolled-up leaf (~10mg, the newer the better). Place foliage in microfuge tubes in a liquid nitrogen bath.
3. Add approximately 200 to 400 ul of liquid nitrogen to a tube containing foliage. Grind approximately 10-15 seconds using a motorized pestle. Stop grinding when liquid nitrogen evaporates and tissue defrosts.
4. Add 200 ul Grinding Buffer. Grind another 10 seconds until tissue is well-homogenized.

5. Place tube in hot water bath (~40-65C) and incubate while grinding other samples. Each sample should be incubated at least 10 minutes.
6. Add 200 ul Lysis Buffer to each tube. Mix by inverting several times.
7. After grinding all samples (typically as many as will fit in the microfuge), incubate at 65C. for 30-60 minutes. Every 10 to 15 minutes, mix by inverting tubes several times.
8. Add equal volume of phenol:chloroform:IAA (25:24:1). Mix well by inverting at least 10 times. Spin 8-10 minutes at 12,000 rpm at room temperature.
9. Remove 50-70% of supernatant to new tube, taking care to avoid interface. If supernatant is cloudy or contaminated with interface, go to step 10. Otherwise skip to step 12.
10. (Optional) Add an equal volume of chloroform, mix well by inverting at least 10 times. Spin 5 minutes at 12,000 rpm at room temperature.
11. Remove 50-70% of supernatant to new tube, taking care to avoid interface.
12. Add 2/3 volume of isopropanol. Mix by inverting.
13. Incubate 15-30 minutes on ice or room temperature.
14. Spin in microfuge 5-10 minutes at room temperature.
15. Decant supernatant and tubes on kimwipe.
16. Dry in speed-vac for 2-4 minutes until no isopropanol odor is apparent.
17. Add 50ul TE Buffer (10:1), pH 8. Let sit at room temperature for 10-20 minutes, or at 4C overnight (preferred). Mix by flicking tube several times.

<u>Grinding Buffer</u>
100mM Tris pH 8
20mM EDTA pH 8
4 mg/ml diethyl dithiocarbamic acid, sodium salt, added just prior to use
100 ug/ml RNAase A, added just prior to use

<u>Lysis Buffer</u>
100mM Tris pH 8
20mM EDTA pH 8
1 M NaCl
2% SDS
1% B-mecaptoehanol, added just prior to use

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