

An Exploration of Culture,
Science and Self

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An Introduction

There are numerous jobs, occupations and vocations open in society. Everyone fits into their own little nook in this one little world. It is impossible to completely describe how everything falls in to place, but that leaves some mystery to it. Some believe in free will and others believe in divine intervention, but in the end it seems to be a little of both. Life is a wonderful thing and we must live up to our potential and always remember to try. Everyone has opportunities to achieve in their lives and this summer was an excellent example for me. I was thrilled to receive a Borlaug-Ruan Internship; the experiences I had will never leave me and will influence how I choose to lead my life.

A Little Bit about Myself

I've always imagined myself to be a pretty average person. This comes from my tendency to be somewhat of a perfectionist and not always meeting the standards that I set for myself. A negative outlook can be harmful to your daily life and a hindrance to success. I try to do my best at all times and put this kind of attitude behind me. I can say that I am a hard and diligent worker. This drive has carried on to my schoolwork and activities. I work well with all kinds of people and look forward to making friends. This is me today, but let me talk a little about my background.

I grew up on a little acreage in central Iowa. My parents wanted my sister and me to grow up away from the busy city and we enjoyed living in the country. My father and grandfather used to farm together, but a decline in the agricultural markets made them stop and make a change. Now their old farmland is rented out to a nearby farmer. A childhood in the country could prove to be limiting to some, but I expanded my horizons to many different places. I became active in FFA, 4-H, Boy Scouts, marching band, and a wide variety of other activities. A wide array of travel and learning opportunities came my way and I took them. One of these opportunities was the World Food Prize Youth Institute.

I set my mind to a career in agriculture before I even got to high school. I never really got to help out with the family farm before the decision to stop farming. This always left me wondering what possibilities there could have been for me. Nothing could stop me from pursuing an understanding and knowledge of agriculture. I accumulated all types of farm toys as a child, because I believed that I wanted to be a farmer. I was able to join our local 4-H club during 5th grade and it gave me the opportunity to raise and show poultry, among other activities. High school and its agricultural curriculum gave me even more possibilities to express my interest in agriculture. I learned more about the agricultural system and how complex it really was. A whole new world of opportunities was open to me.

My freshman teacher, Ms. Driftmier, guided me through my first agriculture class and convinced me to join FFA. It appeared to be just like 4-H on the surface, but it would become to be much more to me. FFA offered a wide variety of fairs, shows, Career Development Events, and leadership events. I was able to practice becoming a better leader, travel, and learn more

about careers in agriculture. I became one of the most active members in our club and all of my effort would come back and reward me.

Ms. Driftmier had been impressed with my abilities after seeing my class work and my desire to excel in my FFA activities during my freshman year. After receiving a letter from the World Food Prize Staff, she thought it would be a wonderful idea for our school to have a participant in the World Food Prize Youth Institute. She came and asked me if I would represent our school in that year's event. She believed it would be a wonderful chance for me to use the gifts that I have. I began my research almost immediately and I received the support of several of my teachers and my parents.

The paper proved to be a little bit of a struggle for me. This would be the longest paper I had ever written and 2,200 words seemed to be an impossible feat. The bright computer screen and flashing bar seemed to foresee my failure. My paper was on the possibility of a "Blue Revolution" in the Caribbean and this odd choice gave me an excellent challenge for research and problem-solving. I worked through my struggles and produced a final product that I could be proud of. There was also just enough time left for me to practice on my first high-pressure presentation.

The next week brought me to the annual World Food Prize International Symposium. I was surrounded by a multitude of people with a vast array of knowledge on agricultural, scientific, and social topics. We students were invited to all sorts of extravagant meals and allowed to listen in on some sessions headed by these very important individuals. Every student was able to help and serve as ushers at the World Food Prize Ceremony. We heard of the accomplishments of Dr. Pedro A. Sanchez made in restoring soil fertility in Latin America and Africa.

I had heard the name Dr. Norman Borlaug several times during the Youth Institute. He had developed the World Food Prize with the help of John Ruan, the owner of the Ruan Corporation, and others. Dr. Borlaug had won the World Peace Prize in 1970 for his work on hybrid wheat varieties. This work started what is now known as the "Green Revolution" and has made an impact on many lives throughout the world. Dr. Borlaug wanted to reward others in related fields of work, but there were no awards focused on food security and other related issues. He has done a lot around the world in order to inform political leaders on the need for improvements in agriculture. I was also surprised to know that Dr. Borlaug was also born and raised in rural Iowa. I have developed a lot of respect for Dr. Borlaug and his work over the past few years. How many adolescents other than myself have a framed poster of Dr. Borlaug on their wall when they were growing up?

The next day was very nerve-racking for me. I had found out that one of the distinguished people that would be listening to my paper summary was Dr. Borlaug. My public speaking skills were not very developed at that time and I felt like I had failed in front of Dr. Borlaug and the rest of the panel. The frown I wore turned into a smile when Dr. Borlaug commented on my strong speaking voice after I finished. I took this compliment as my small triumph.

I wasn't old enough to apply for a Borlaug-Ruan Summer Internship that year, but I was inspired by the achievements of the doctors and scientists in attendance. The panel of interns gave wonderful presentations on their internship and I was hooked. I knew that a Borlaug-Ruan Internship would be a wonderful learning experience and a chance to do something in a scientific field. After two more years of attending the Youth Institute and applying for the internship; I got a chance for an interview. I did not know if my resume and interview would be strong enough and I would think about it all of the time. The letter came several weeks later. It seemed short and to the point. I knew that I had failed, when I saw the key word "chosen." I had finally succeeded in getting one of these prominent illustrious internships.

The World Food Prize staff had given me the opportunity to work and learn at the China Agricultural University (CAU) in Beijing, China. My internship was sponsored by CAU's College of Agronomy. I was put into the care of Dr. Zhaohu Li, one of the lead professors in the agronomy department. He matched me up with his best graduate student, Lin Jian, as my guide and mentor. Lin Jian and I worked together on many projects and we became good friends.

Culture and Daily Life

China hit me very hard on the first day. I arrived at 10:00 p.m., but I had been awake for the last 24 hours. Customs and receiving my baggage were relatively easy, but I was exhausted and just wanted to get some sleep. A throng of people were waiting at the exit for the terminal and I was snagged quickly by my host professor Dr. Li. One of his graduate students grabbed my luggage and we left the airport. We quickly walked off into the dark. When we reached the car, I graciously accepted the bottle of water that was given to me. We put my luggage in the back and I got seated comfortably, very comfortably. I had plenty of time to look around the parking garage and what I saw probably was not what I wanted as my first impression of China. Many people were just loitering and smoking in that level of the parking garage.

We finally left after about five minutes, but I faced several questions as we drove down a seemingly endless, curving highway. The combination of a different accent and sleep deprivation made it very hard for me to understand. I understood their eagerness to know more about me, so I did my best to answer their questions. It was great to hear my own language from the start.

Dr. Li woke me up from my drowsy state once we arrived on the campus of CAU. He helped me into my dormitory and showed me around. I had figured on a small, one-room dorm, but was introduced to a four-room apartment. I knew that I would have it better than most of the other interns on the standpoint of living conditions on site. The room even had common appliances like an air conditioner, a television, and a refrigerator. I made a quick judgment on my room expectations and I felt sorry for thinking like that. They had given me some bottled water and food to start off with. I thanked them both for getting things ready for me and they said they would meet me in the morning. My head hit the pillow and I fell fast asleep upon their departure.

China was unlike any other place I had ever seen. The streets of Beijing were filled with people. I could only compare the pedestrian traffic to the Iowa State Fair, but even this comparison felt lacking. Even the amounts of bicycle and automobile traffic were quite large. There were immense traffic jams every weekday in the morning and night as people traveled from work and home. Most services such as stores and pharmacies had many local and convenient locations, but other important buildings such as hospitals were a little rarer. Our part of Beijing was relatively advanced, but we could drive either way to find completely different environments. There were several villages to the east and the “Silicon Valley” of China was to the west of the campus.

I began to notice several constancies in Beijing over the two months that I spent there. People would sell items and beg on the streets and bridges in high numbers. It saddened me to see that many people who were unable to find better jobs for whatever reason.

An experience with a different culture offers a wide variety of new foods. I am quite fond of the American take on Chinese fare, but I was warned and came to realize how different it was in its true context. Some people would consider me to be a picky eater and I made a goal of trying every food that was within reason. Soy products were quite common in the lower level cafeterias on the CAU campus. I tried soy once on accident when I thought it was chicken. The texture and taste was just so different and I couldn't handle it. I had plenty of opportunities to try a wide variety of seafood. Rice was a relatively common dish in China. I like the fried rice, but the sticky rice was very prevalent in traditional Chinese dishes. My best discovery in China was wontons. This combination of a broth and dumplings was delicious.

Chinese food has such a wide variety of flavors. Many of the dishes were quite similar, but they used so many flavors, spices and sauces to alter the taste. This was very hard for me, because some of the dishes would look delicious or familiar to me. Unfortunately, they would not taste how I expected them to. I had plenty of Pepto-Bismol and Sprite stocked in my dormitory to avoid any adverse reactions to food. Chinese traditional foods change throughout the geographic regions also. Every province seemed to have a different taste and I got to try so many foods. It was a little hard at times to find food that I would love, but Lin Jian usually found something that I would like. My new meal routine only took about month to set up, but off-campus meals were a different story. I did surprise myself this summer and I took some chances to find out some new foods.

There were no major schedule repetitions for me in China, but I will describe my average day. I usually woke up before dawn. Lin Jian would never meet me before 8 a.m., but I always wanted plenty of time to get ready and get a good jump on my summer reading. We went to breakfast together and afterwards we would head directly to the lab. I would usually check my e-mail on arrival, because I wanted to stay in contact with my family, friends, and Lisa Fleming, the Youth Institute Director. My failure to do so would result in more e-mails with expressions of concern.

Our laboratory work was next on our daily agenda. There was never constancy in our location, but this part of the day would take up most of our time. We took lunch at the normal time of noon. Most of the students in the laboratory, including Lin Jian, like taking naps after

lunch. I usually went to my dorm to read or back to the lab to watch one of the American movies in the CAU movie database. It would be right back to work after that. We usually hit the night off with dinner and then tailed off to play basketball. The rest of the night was left for reading and other enjoyable pursuits. I would doze off to sleep at about 10 o'clock every night.

The only part of China that gave me any trouble was the post office. I wanted to send a gift home for my cousin's birthday. Lin Jian and I set out early in the morning to the post office, but it was not open yet. The post office was very busy when we came back later that day. We had to wait in a few lines and sign a few papers, but Lin Jian translated the whole situation. I was just ready to send off the package when Lin Jian told me that we would have to get a bigger package. The facts that I had already paid, the process had taken a long time, and the language barrier all culminated into a lot of stress for me. Fortunately, I managed to get through the ordeal without an outburst and get the package sent off to the United States. The whole experience wouldn't have happened if I was more patient. I plan to use this valuable lesson about patience throughout my life.

The most harrowing cultural experience I faced in China was when one of the graduate students was killed by a truck. I had become accustomed to the normal activity in the lab and the reaction from everyone in the lab this particular afternoon was quite scary. Lin Jian and I had just come back from some fieldwork; everyone was gathered in the office. The other students were all talking loudly in Chinese. At first I thought this was because I had done something wrong and that I was going to be in a lot of trouble. After several minutes of intense waiting, I noticed that some of the students were crying. I asked Lin Jian if he could tell me what was going on, but he was too choked up to give me an answer.

Finally, one of the students managed to tell me that someone in the lab had been hit by a truck. They all began to see my obvious signs of stress and told me that I had nothing to worry about. One of the graduate students took me to my dormitory and the rest of them went to the hospital. I did not hear the whole story until the next day. Two people from the lab had been riding their bicycles on a trip to pick up some laboratory equipment. They were riding on one of the busy side streets, which are commonly used by bicycles. The two of them never saw the truck coming from behind and its drunk driver was so intoxicated that he did not notice them. I would never want to be in another situation like this. The strange surroundings, language, and the power of grief formed some mixed feelings. It was also very sad to see something like this happen on my internship. The student was respected by everyone in the laboratory and he had even talked to me several times. I remember that he had been looking for me earlier that day when I went to lunch because Lin Jian had asked him to watch out for me. I learned that grief and death hits just as strong throughout the world.

I only had one major experience of discrimination this summer. It was not that bad, but it was a little more distressing than the stares and pointing of others. My friend Lin Jian and I were going to play badminton at the large stadium at the College of International Relations. We rode the taxi there and found out that foreigners were not allowed. Lin Jian ventured to ask if the guard could tell the difference between Koreans, Chinese, and Vietnamese. The man replied no, but it was easier to tell that I was foreign. I was really disappointed, but we made do with a makeshift net in the CAU courtyard. We managed to have a fun time in spite of the earlier

situation. This experience was quite different for me, because everyone in the laboratory had been so friendly to me during my internship.

Going to see a doctor in China was not one of the things I wanted to do during my internship. The hospital on campus; however, was quite convenient for my two incidents. My first visit was a result of constant pressure in my ears. Lin Jian and Dr. Li did everything they could to get me to the doctor as soon as possible. I get ear infections quite frequently and I knew that it would not be enjoyable to experience one in a foreign country. We had to wait for a while and I noticed that the doctors were ordered by their specialties. Luckily, through a hard translation, I found out from the doctor and Lin Jian, that I only had a slight sore throat. Lin Jian asked me if I would like to try the Chinese traditional medicine. I had only heard about this briefly, but I was not so sure about using their herbal medicine. The doctor did have antibiotics for me to take and I managed recover quickly.

My second visit to the hospital was a little more complicated. We had been playing basketball for several weeks and I finally received my first sports injury. I was receiving a pass and the basketball hit the tip of my pinky finger and bent it. One of the other students pulled it back into place, but it was still swollen and did not look as straight as it should. The hospital was closed at the time and I had to wait for the next day. We went to see the bone specialist and he requested an x-ray. The x-ray came back to show that I had not broken my finger. This saved me from having to visit one of the larger hospitals in Beijing for them to fix my finger. I knew that modern medicine would not do anything for my finger that traditional medicine could do and I decided to give it a try. Lin Jian was very happy to see me try the Chinese traditional medicine, but joint injuries take a while to heal and the medicine did not work for me. I was neither satisfied nor dissatisfied with my experience with Chinese medicine, but it did increase my awareness of their Chinese customs.

Travel Opportunities

My internship also gave me an opportunity to see many historic sites that I never could have imagined seeing. I was able to see the Summer Palace during the first week. It was amazing to see all the wonderful buildings and scenery that once served as the retreat for the emperor and his family. The next week was my birthday and I had made a little request to go to the Great Wall. It was my 18th birthday and Lin Jian had told me a quote from Mao Zedong. He said, "If you haven't been to the Great Wall, you aren't a real hero." I took this as a motivation on how I should live my life. I had just climbed the Great Wall and I had become a man on that day. I could now start on my path of becoming a useful member of society, which is what I believe a true hero does. We climbed the Great Wall at Badaling and the beautiful scenery of mountains and hills surrounded this immense landmark. The Wall twisted and climbed through the mountains endlessly into the horizon. It was amazing to stand in awe and view what was only a small part of a great milestone in China's long history.

The only shame was that it has become a bit of a tourist trap and that some would think to defile one of the world's greatest landmarks. Every peddler there knew one word of English. They would all say, "Hello!" They did not know any more English, but they were determined to

make a living by selling their wares to Americans and other visitors. This was a trend that continued into many of the other famous sites I visited in China. It was just another way to make a living in the poverty-stricken areas of China. We also visited the Ming Tombs and the Sacred Road that day. I was awestruck by immense palaces they made for their deceased emperors and the Sacred Road gave me insight to the beautiful landscapes created by the Chinese. Many people show their respects to the places where the emperors rest. These sites combined to make this one of the most memorable days of my life.

A trip that I made two weeks later would give me a look at contrasting times in Chinese history. Lin Jian wanted to give another the student the chance to speak English and take me on a trip. One of the girls gladly accepted. This trip would lead to a wide variety of modes of transportation as well. Our first move was a ride in a taxi. Beijing alone has around 70,000 taxis and they are a very efficient mode of transportation; with proper translation. Our ride led us to the above-ground portion of the Beijing subway. The subway was very packed. We had to get off and walk a short jaunt to the other station. This seemingly endless set of exchanges led us to Tiananmen Square and the Forbidden City.

The Forbidden City had many traditional buildings that were saved from the reign of the emperors. Many of the chambers used by the emperors and their families were roped off, but we got to see the intricate attention to detail in the architecture and elaborate decorations. The entire palace was very widespread and there was a beautiful garden within its red walls. A number of the buildings had been converted into museums for many varieties of art as well as history exhibits. This landmark gave me so much knowledge of the Chinese culture at the highpoint of its history.

A picture of Mao Zedong adorns the outer wall of the Forbidden City, but I believe that he should be the symbol for Tiananmen Square. Tiananmen Square almost matched the size of the Forbidden City. This was the place famous for the protests of the Chinese people, but it seemed to be a communal place for recreation. Children and adults alike flew kites all around. It housed the Mao Zedong Memorial, the China Memorial Museum and the Hall of the People. I was unable to see these places, but I got to see a brief glance on how China had changed after the reigns of the emperors.

I made my final excursion with a week left in China. Morgan Moe, the intern from Peking University, Dr. Kang, her host professor, and I were going to Xi An Province for three days. The trip would also be my first trip by train. Everyone at CAU had given me a hearty goodbye and I could tell Lin Jian was sad to see me leave for such a short while. We took a taxi and our next destination was the Beijing train station. My earlier trips had given me glimpses of how busy public transportation can be in China, but the train station was packed. We had to be there very early because there would be a long wait. There was standing room only on some of the waiting platforms and they were alive with restless chatter. We finally boarded the train two hours later and we settled in to get some sleep on this long ride.

I woke up at the break of dawn and watched the villages pass by. There were a lot of small farming plots on elevated ground beside the tracks. The farmers' day was just beginning too and I watched silently as they flickered by. This distraction enraptured me the rest of the

trip. The train station in Xi An seemed even busier and we met up with a guide who spoke English there. The van ride to the hotel gave away hints that Xi An would be another hotspot of tourism. We were surrounded by McDonald's and Kentucky Fried Chicken. I did not come to China to eat American cuisine, but I did bend to the temptation of a cheeseburger, fries, and a shake. There was plenty of time to settle down into my spacious room and reflect on how good I had it compared to some on the other people.

The next two days were filled with the visions of so many sights that I can hardly recall them all. We visited the City Wall, a jade factory, the Wild Goose Pagoda, the Terra-Cotta Warriors, a history museum, the emperor's hot springs, the city bell tower and an old mosque. The Terra-Cotta Warriors and the history museum were two of the sites that really interested me the most. The Terra-Cotta Warriors extended over three immense rooms. We were able to see several of them, but even more lay hidden beneath the soil. The color on the Terra-Cotta Warriors was removed by sunlight and the museum was trying to keep them preserved. This reminded me that we should all take the time to review our history and try to preserve its memory. The history museum started relatively early in Chinese history. It went through so much of the Chinese history that had taken place in the Xi' An province alone. This led me to a realization of how much China has achieved and gone through in its history. I transferred these ideas to how long the United States has existed and what we can do in our future as a relatively young country.

The Experiment

Finding the right experiment with interesting results would be a hard task, but the first idea for this experiment was developed on the first full day I spent in China. The experiment would initially involve the propagation of soybeans and involve grafts, but problems arose in other parts of the experiment. We would run two trials of grafts in order to make sure that the information and procedures would be correct.

Introduction

Soybeans are perhaps the most important crop grown in China. Soybeans are particularly useful due to their high protein content. Studies have shown that soybeans yield the high amount of protein per acre, which makes soybeans a very useful grain. Many of the food products they use or consume in China are made from soybeans. China's total soybean consumption was 30.28 million tons of soybeans in 2002 (Reuter 2003). This only seems natural, because soybeans originated and were first cultivated in the northeastern part of China. World War II and internal revolution hit China hard in the 1940's and the production of soybeans has shifted to the United States since then. Chinese imports of soybeans covered almost half of their total consumption in 2002 (Reuter 2003). China looks forward to advancing its soybean industry during the next decade. This is necessary to gain new ground in the industry that they started and to help them meet the needs of their people. Many changes will need to happen in order for this major shift. China needs to take a lot of time researching and looking into alternatives to meet these goals. Scientists and researchers are always looking for new ways to improve the

production and preparation of soybeans for consumption. Roundup Ready Soybeans are one of many hybrids that show promise on an economic standpoint.

Roundup Ready Soybeans are genetically predisposed with a tolerance for all Roundup brand herbicides. Studies have shown that Roundup is a very efficient herbicide and it can only be used with crops that are genetically predisposed to it. Most other varieties of crop and plants, such as traditional varieties of soybeans, can be killed easily by Roundup. The yields for Roundup Ready Soybeans have also become high and this can increase output significantly. A new no-till method using Roundup herbicide may help reduce soil erosion, conserve moisture, decrease soil compaction, and the obvious a decrease in machinery use. All of these features combine for an interesting agricultural system.

Roundup is an herbicide that is usually applied with water and a surfactant system. It adheres to the leaf surface and the active ingredient, glyphosate, will penetrate into the plant. Once the glyphosate enters the plant tissue, it begins to deteriorate the plant tissue by disrupting EPSP synthase, which is necessary for amino acid production. These amino acids are very important to the plant's growth. The visible effects of glyphosate treatment start with plant wilt and then the plant will begin to yellow. Deterioration follows and the plant turns brown and dies. Glyphosate treatment will also damage the roots of a plant and prevent the plant from regenerating. This chemical usually attaches to the soil, but glyphosate can be taken up through the roots of a plant.

One major concern with genetically modified crops is the possibility of a transfer of genes from the crops to other organisms. We wanted to see if DNA active in Roundup Ready tolerance can move into the traditional soybean by grafting. A gel electrophoresis following DNA extraction and synthesis from the plant tissue samples should show if any DNA has transferred. We also want to see how the glyphosate at different concentrations will affect each and every graph.

The goals of this experiment were as follows:

1. Will there be a transfer of DNA from Roundup Ready Soybeans to traditional soybeans by grafting?
2. Is there any change in glyphosate resistance in Roundup Ready and traditional soybean grafts?
3. To notice any unexpected results that would prove worthy of note.

My hypothesis was that some DNA would transfer from the Roundup Ready Soybeans to the traditional soybeans. I did not believe that there would be any unexpected change in the glyphosate resistance of the grafts (All soybean grafts with a traditional soybean component would die and all pure Roundup Ready Soybean grafts would survive).

Trial #1

During the first week we planted our first set of soybean seedlings. The germination media was sterilized by heat in an oven to destroy all bacteria and any foreign materials that would be detrimental to the growth of our seedlings. The seeds were sterilized by a solution of sodium hypochlorite at a concentration of 10% with water. The seeds soaked for three and were rinsed thoroughly afterwards to remove the solution from the seed coats. Next we applied water to the media in order cool it down and allow it to pack. The seeds were planted immediately afterwards at a depth of approximately ½ inch with three seeds in each pocket to ensure that there would be enough seedlings. We covered the seeds with more media and watered them again to allow soil-to-seed contact instead of packing the soil too hard. The soybean seeds were watered everyday after that in order to keep the media moist enough for germination.

The soybean seedlings were finally brought into the photosynthesis lab after they had developed their first set of true leaves. We transferred them into a water bath and allowed them to grow further in a controlled environment (temperature, light, and humidity). The seedlings were put on a Styrofoam float and they were held in place with foam insulation. We connected tubes to an air flow and placed them into the water baths in order to keep the water oxygenated.

The actual grafting was not performed until the shoots had grown enough to make the cut and seal them with Para film. The initial cuts were made with razor blades that had been sterilized over an open flame. The first cuts were horizontal to the shoot. The top part of each shoot was cut on each side so it would fit into the vertical cut on the lower part of the shoot. There were several grafts made from each of these four combinations: traditional root to glyphosate resistant shoot, glyphosate resistant root to traditional shoot, traditional root to traditional shoot, and glyphosate resistant shoot to glyphosate resistant shoot (T/R, R/T, T/T, and R/R). The grafts were then returned to their water baths.

A period of one week was given to determine which grafts were successful. The successful grafts were set aside in a new water bath to grow more. The following procedures were performed with the intent to extract and replicate the DNA and search for DNA specific to Roundup Ready Soybeans. After two weeks, tissue samples were taken from their shoots. Then the shoot samples were placed in a mortar. Liquid nitrogen was poured on them and the shoots were ground with a pestle into a powder. The tissue samples were not allowed to thaw at this time. Then the sample was placed into a 1.5 mL capsule. Precisely 750 uL of 2X CTAB buffer was added to the powder and then heated in a water bath for an hour. The water bath's shaking platform allowed the samples to mix as well.

Next, the samples were allowed to cool down to room temperature. This was followed by the addition of 750 uL of chloroform. The capsules were hand-shaken until the sample and the chloroform had formed an emulsion. The next step required the solution to be placed in a centrifuge at 10,000 rotations per minute for 15 minutes. The samples were kept at room temperature during the centrifuging. Each supernatant was moved into a clean capsule afterwards. A proportion of 2/3 volume of isopropyl alcohol was added to each capsule. The capsules were each inverted several times until the DNA was precipitated. This process made it possible to remove the DNA and transfer it into a new 10 mL capsule.

The new DNA samples were washed with a solution of 70% ethanol and dried for an hour. A quantity of 20 uL of TE were added to each of the samples and left to cool overnight. The DNA samples were washed two more times with a 70% ethanol solution and transferred into a new 1.5 mL capsules. Each DNA sample was dried again and dissolved into 500 uL of TE after that. It was then time to use PCR replication with 25 uL samples in .5 ml capsules and then to run a gel electrophoresis. The three primers 35S, NOS, and the EPEPS gene were added at 50 pmol each with 10% concentration of buffer (2.5 uL). Magnesium chloride is added at 1 uL to increase the success of the PCR. The gel electrophoresis was run by a laboratory assistant and the final data was taken. Each quantity of solution or chemicals was measured with a pipette.

Trial #2

More soybean seeds were planted afterwards during the second trial. The amount of seeds planted was increased in this trial. This precaution was taken to ensure enough grafts for the development of conclusions for my experiment. The procedure was the same as Trial 1 up until the completion of the grafts. In this trial the grafts were placed in a nutrient solution bath. The nutrient solution received the same filtration as the previous trial. The concentrations of the nutrients and other chemicals are located in Table 1. This solution had been used many times in the same lab environment and for similar purposes among the Weed Science staff.

The grafts were given a week to recover and then the 79 healthiest grafts of different types were moved into beakers with more nutrient solution. Each beaker contained two grafts and the different graft combinations were segregated. The beakers were also equipped with air flow to follow previous procedures. The nutrient solutions were then treated with different concentrations of glyphosate. These concentrations were 1/500, 1/5000, 1/20000, and a control with 0. This can be illustrated by Table 2. The heights of each graft were measured over a period of a few days and observations were made.

This is the point where I returned to the United States. Lin Jian finished the rest of the experiment. The same procedure was followed for the synthesis and replication of DNA. A gel electrophoresis was performed afterwards.

Conclusions

Most of our conclusions from the first trial were made the week after the grafting. The success rate of the grafts came was approximately of 10% with no extremes among any of the possible graft combinations. This number would have to be a lot higher if there were going to be enough grafts for the plans that were made for Trial 2. Trial 1 was more or less practice for Trial 2. The most useful observation during this trial was in the fact that the grafts did not continue growing until a week after the grafting process.

The DNA testing in the first trial was almost a complete failure. The gel electrophoresis showed a few changes, but there was not enough data to come to conclusions. This procedure was new to me and Lin Jian.

Trial 2 showed a dramatic increase in the amounts of graft successes. The success rate was approximately 50% and there were no extremes among the different graft combinations. The most interesting data from Trial 2 was from the attached set of graphs. Some conclusions can be made from these graphs, which show the relationship of height over time for each graft combination and glyphosate concentration.

Decreases in height shown on the attached graphs could possibly mean deterioration of the soybean tissue. Unfortunately, the pure Roundup Ready Soybean grafts also decreased in height at 1/500 glyphosate concentration. This could be a result of plant disease or other condition, but the most likely assumption is that there was human error in the measurements. The growth rates of each graft combination at different glyphosate concentrations appeared to be very similar, but the pure Roundup Ready Soybean grafts tended to have a little higher growth rate. All of the grafts were noticed to have low growth rates that tapered off over time when their solution contained glyphosate. This does not mean that the glyphosate was harming the Roundup Ready Soybeans, but this data is very interesting and the growth rate did not seem as high as expected. Several causes of stress in soybean plants and grafting could be to blame. Still, could there a possibility that glyphosate has negative effects on Roundup Ready Soybeans as well?

The only two graft combinations to survive every concentration of glyphosate were the ones that had a Roundup Ready root. This does not indicate that the traditional soybean parts of the graft received a resistance to glyphosate. The graft combination of traditional root to Roundup Ready shoot lasted longer than the pure traditional grafts at 1/500 glyphosate concentration, but it was equal at all other concentrations.

Lin Jian tried working on the DNA extraction and synthesis for Trial 2, but the data was faulty once again. This data would be very interesting to see if the proper procedure was followed and the gel electrophoresis worked. I believe these parts of the experiments should be followed up by other researchers. It would be interesting to know what was happening within each of the grafts. This data could uncover more of the reasons of why certain combinations died and it could explain the graft deaths. More experiments have been performed as to the chance of DNA transfer and Roundup Ready crops. This experiment should give more reason for these increases.

Experimental Experience

The role I played in my experiment was as a laboratory assistant. I played a major part in my own experiment, but my mentor, Lin Jian, was told to guide me through the process. My experiment was not the only one that I had the pleasure of working with. I was given a wide variety of opportunities in all aspects of experiments.

Lin Jian's current experiment in his graduate studies involved the possibility of genetic transfer from Roundup Ready Soybeans into a common weed, dodder. He had one major question on his mind. Can dodders develop a resistance to glyphosate from Roundup Ready Soybeans? This experiment brought us into many field trials. Lin Jian had 8 small plots on a

farm on the outer part of Beijing. I offered to help him on each of his trips rather than sit around the lab and do nothing. We spent our first trip removing all extra seedlings that were planted. This procedure was needed to ensure that the soybean seedlings had the proper field spacing.

The second trip into the field was a little more painstaking. We had to weed each of the plots with tiny little trowels. Summer was very strong in Beijing at the time and heat really got to me. My final trip into the field was quite exasperating. The object of this trip was to apply dodder seeds at the base of each soybean seedling. This process hurt my back from all the bending over, but I managed to keep up with my Chinese friend. I learned a lot from him during these few trips. He had an incredible work ethic and I enjoyed working with him for this reasons. His laboratory work was on his time and he used his own time quite frequently. We also had a lot of interesting conversations in the field and I learned a little about China, while he learned a little about the United States.

I helped perform numerous laboratory procedures in China. I had a part in every step of my experiment, even with Lin Jian taking charge. Many of the related procedures were new to him as well. Other graduate students in the laboratory gave their advice and helped with my experiment. We needed help during the gel electrophoresis, because Lin Jian was not able to do one without the help of someone in the genetics program. Lin Jian had a roommate in the program and he gladly assisted with me with this procedure. Unfortunately, something in one of the processes led to unreliable final data.

Procedure was a major key to our laboratory work. Lin Jian always reminded me of the little things. Sterilization and cleaning up were two of his major points in experimental procedure. He always wanted to receive proper data and rule out all possible mistakes. We always cleaned up our equipment and work spaces. Lin Jian even seemed like a mother sometimes. He would always say, “Don’t forget to wash your hands.”

Dedication was also a key that I learned in my experimental experiences. My experiments led to a lot of work and I had to learn to go with the flow. The grafting process was very precise in its methods and I was not very good at it. The first set of grafts took almost an entire day to complete. We finally finished about 11 p.m. I am not very skilled with my hands, but I do not believe that I worked up to my full potential at first. The second trial of grafts went a lot easier. I took worked a little harder, tried to converse more with Lin Jian, and try to avoid distractions. Part of this success could be traced to more experience with grafting, but I know that I could not have done this without the other students help.

Changes

Everyone strives for success and this often leads to a desire to be the best at what you do. This is a good goal, but it often leads to selfish thinking. People start to think of what they can do for themselves and leave the interests and well-being of others untouched. We should all try to use our abilities to help and educate others. I do not want to become a self-centered person and several experiences during my Borlaug-Ruan Internship gave me some to new light to a future career along these lines.

With the guidance of my Talented and Gifted advisor and a determined mind-set I have entered the Milling Science program at Kansas State University. Kansas State is the only university in the country that offers this program and milling is one of the most stable and necessary industries in the world. I investigated this career after finding out about my internship and found out that there was a need for qualified individuals in this career. This was my chance for a career in agriculture that would help serve people. The milling industry needs individuals with extra ambition and I felt that I would be able to provide this spark.

My trip to China felt like an introduction to college for me. I saw just how hard the Chinese people work during my internship. It was amazing to see just how many students wanted the chance to continue the graduate studies and even travel as far as the United States to earn their degrees. I learned a lot about graduate studies and I started to think about my own college career. This has motivated me with a desire to continue my education after receiving my undergraduate degree. I know people can learn so much during their lifetimes, but there comes a time when you should share these gifts. I am considering pursuing doctorate degree. Becoming a professor or possibly some other form in the teaching profession during my life sounds like a very good way to use my talents.

A graduate degree can also blaze a path towards career success. The time and ambition required for graduate study increases your worth in society. This is not to say that a graduate degree is necessary, but I believe education to the highest degree is can be very practical. I want to expand my knowledge throughout the range of my profession. Milling science extends in chemistry, operations and engineering. Chemistry holds the greatest attraction over me, but I believe a complete knowledge of the industry would provide me with a greater background. I would become more useful to the industry and society.

I also learned how important communications are first-hand this summer. It was amazing to learn how many of the people in the laboratory could speak very fluent English. The graduate students from the lab explained to me how different English was from Mandarin. Every one of the students was studying English in order to be good at international communication or to attend graduate school in the United States. They had spent countless hours studying English intently. This led me to think about my own experience with Spanish. English and Spanish happen to be very similar and they share several words. I enjoy Spanish and I believe that it is a key language due to our frequent interactions with our country's neighbor. I have decided to add a conversational Spanish course every year I spend in college, after seeing how hard my friends in the lab had to work in order to learn how to communicate with people from other cultures.

Another result of my summer internship was another good friend. I liked Lin Jian as a lab partner and I respected all of his work, but we also became friends for other reasons. He watched over me like an attentive parent at sometimes and was my friend at other times. We had so much fun playing sports and going on our trips. Lin Jian was a very silly person and we had very fun times as a result. I tried to make him laugh all the time and did my best to make him understand me. We would have interesting and stimulating conversations at times. He would always ask questions, but this was one of his best qualities. Lin Jian always wanted to know the answer and this greatly contributed to his lab work. I will always have an interest in what he is

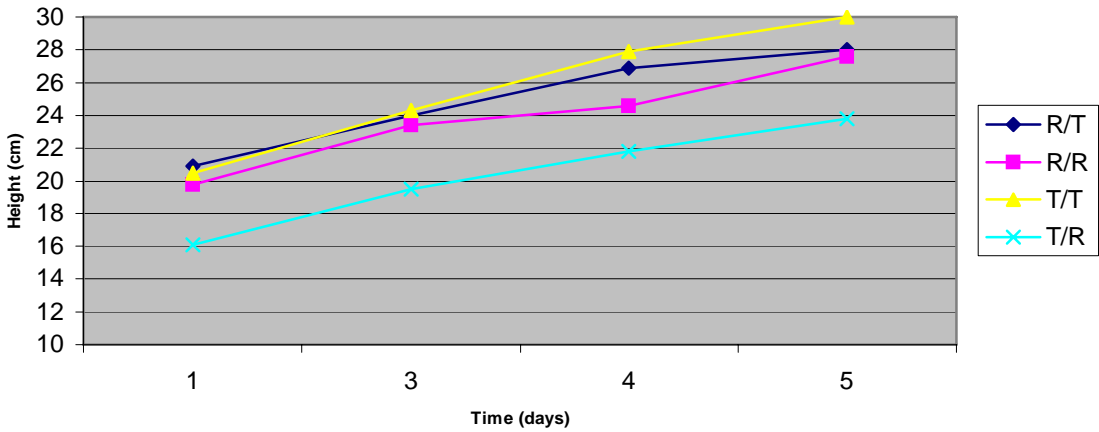
doing and we have kept in contact over the past months. With all luck, I hope that I will get to see Lin Jian once again.

Reflection

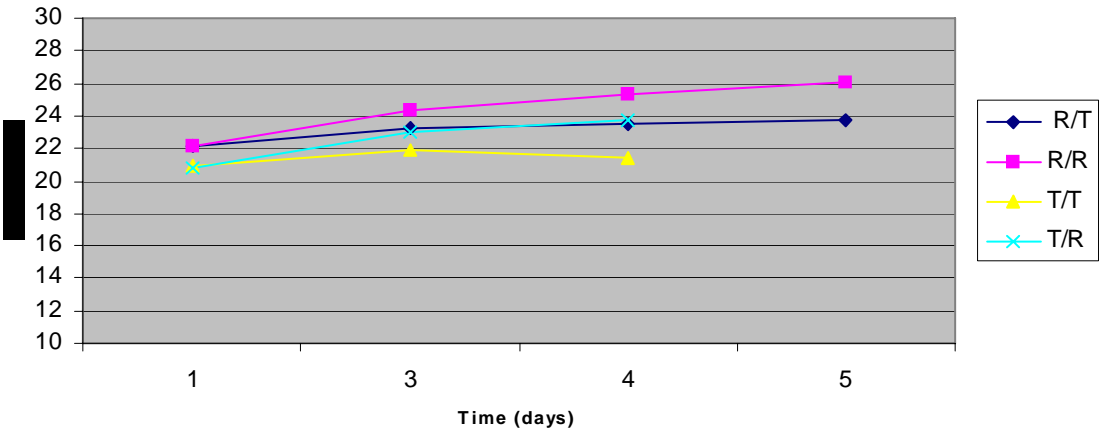
A trip to foreign country opens your eyes and allows you to feel for those who are suffering on a more personal level. I saw people who were not getting enough to eat and people who needed to beg. There were also people who were driving fancy cars and living well. We have all of the same problems in our country, just to a lesser extent. China is getting better everyday and it does have the fastest expanding middle class in the world, but it is not enough when there are so many people still suffering.

I believe that international cooperation is a must for the continued success and existence of mankind. This includes all countries, especially the United States and China. I know that I was somewhat of an ambassador this summer. I represented my family, the World Food Prize, and the United States. This was no easy task, but I believe that I left the laboratory staff at CAU with a good impression. I was glad to help them and they returned the favor just as well. I do not want to stop here though. Everyone can make a difference and my internship has led me even further in this realization. I will go forward now and play my part in society.

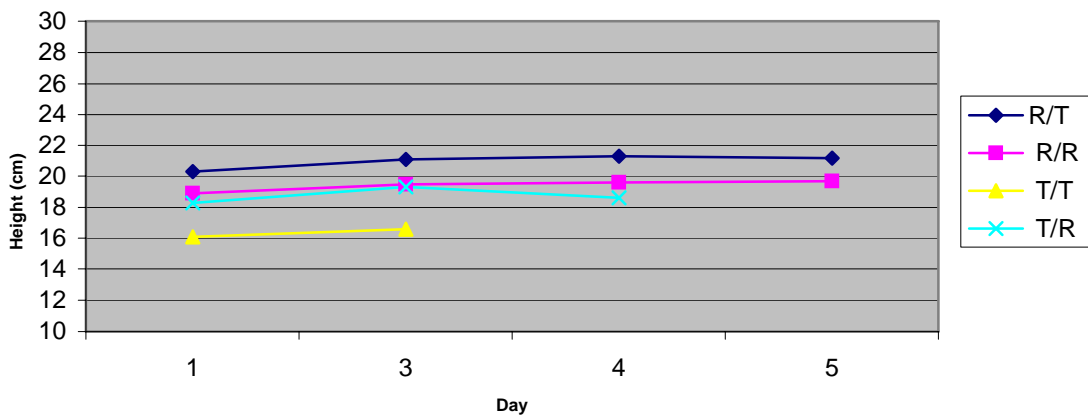
Graft Height Over Time at 0 Glyphosate Concentration



Graft Height Over Time at 1/20000 Glyphosate Concentration



Graft Height Over Time at 1/500 Glyphosate Concentration



Compound	Contents in Final Solution (g)	Stored Solution (g/L)
H ₂ BO ₃	0.01	1.2366
ZnSO ₄ 7H ₂ O	0.0005	0.28754
CuSO ₄ 5H ₂ O	0.0001	0.04994
MnSO ₄ H ₂ O	0.0005	0.16901
NH ₄ 6 Moles	0.0000025	0.006178
FeNa	0.05	36.705
Ca(NO ₃) ₂ 4H ₂ O	1.2492	590
KH ₂ PO ₄	0.24983	68
MgSO ₄ 7H ₂ O	0.50006	246.5
KNO ₃	1.25235	253

Works Cited

<http://forests.org>

<http://www.ncsoy.org>

<http://www.monsanto.com>