

# **The Neem and I**

**Kisii and Suba District, 2002  
Kenya**

**A Project Conducted Under the Supervision of Dr. Francois Omlin and  
the Neem Project**

**ICIPE-Kisii  
ICIPE-Mbita Point Field Station  
(June 5-August 4)**

**Principal Researcher: Josh Wennes Mabel-Canton High School  
Mabel, Minnesota, USA**

## Who am I?

My name is Josh Wennes. I'm an 18-year-old senior at Mabel-Canton High School in Mabel, Minnesota. I live in the small town of Hesper in the Northeastern corner of Iowa. The population is 150, and I think that's stretching it. The community is small, and so is the local school. The school is North Winneshiek, which until this year housed Kindergarten through 12<sup>th</sup> grade. This school was where I got my education over the past 12 years. In that school, the total enrollment never reached over 450. During my junior year, it was decided that North Winn would whole grade share the high school with Decorah, a much larger school to the south. This was due to declining enrollment, which is a problem throughout the state. So, small town boy attends small school, where does the World Food Prize come into play?

One day, back in the year 2000, my current biology teacher, Ms. Meade, asked me if I would be interested in the World Food Prize Youth Institute. To me it sounded really special, world-renowned scientists plus interaction with the youth, what a great idea! Plus, the discussion was about one of the world's most challenging subjects, GMO's. I agreed, and on the way to Des Moines, I read and heard about the International Internship. At first the skepticism was overwhelming. How could I, a kid from a small town get sent overseas to study at a research facility for two months? Well, my cynicism carried on throughout the institute until the year's previous interns started talking. All of a sudden, I was focused directly on them and I couldn't be distracted. I was hooked, I was going on the internship, I was positive. The whole drive home, around 4 hours, I was talking 90 miles an hour, non-stop, all about the internship. Ms. Meade of course kept encouraging me. As soon as I got home, I began the application process. Then, I anxiously awaited my acceptance letter, which never came. Instead, I received a letter that said that I was postponed for one year so that year would help me to mature and grow. It took a little coercing, but I accepted the decision, and I didn't know it then, but the writer of that letter had hit the nail on the head. Then, after the next school had begun, Ms. Meade once again approached me and asked if I was interested in attending again. How could I refuse? I mean this program had already changed my outlook on life so who knew what would happen? After yet another life changing experience in Des Moines, I reapplied for my internship. This year, I was a little less on the positive side, after already encountering defeat a year earlier. There was however, a little twinge of excitement on my part, I almost knew what I was doing for the summer. Upon applying I realized just how much I had grown over the past year, I was more mature and felt completely confident about tackling two months in a foreign country. When I found out that I had received a letter from the World Food Prize, I couldn't wait to open it. It said that I would be a 2002 Borlaug-Ruan Intern at the International Center for Insect Physiology and Ecology (ICIPE) in Nairobi, Kenya.

The first person I told was of course, Ms. Meade. To say that she was excited is a slight understatement. She was the whole reason that I attended the World Food Prize Youth Institute in the first place, so a huge thank you goes to her and all the other role models who provide me with encouragement. Another thank you goes out to the World Food Prize for presenting such an incredible opportunity to the youth of Iowa. This program is without a doubt one of a kind and will be around for years to come. Thank you to the Ruan family for making the program possible, Dr. Norman Borlaug for

realizing the need for a prize for agriculture. A thank you to Dr. Hans Herren, who was a huge supporter of me applying, and encouraged me to apply to ICIPE. Thank you to Dr. Anwar Dil for also encouraging me to reach for the stars.

### **Where in the World Was I?**

Established in 1970, the International Center of Insect Physiology and Ecology (ICIPE) is an intergovernmental organization whose mandate is to ensure global food security through the development of biological methods of pest and disease control. Its various projects and activities incorporate many fields of research including behavioral biology, population ecology and ecosystems science, chemical ecology, molecular biology and biotechnology, and social science. Currently ICIPE is striving to improve its four main areas of emphasis- the 4H's human health, animal health, plant health, and environmental health. Headquartered in Nairobi, Kenya, its activities and programs also expand to other regions of the country as well as other parts of Africa.

The primary mandate of ICIPE is research, capacity, and institution building in integrated arthropod management. The scope of research and training activities covers the development of tools and strategies for controlling and managing human, animal, plant, pest, and disease vectors. ICIPE studies arthropod components of agricultural biodiversity that provide essential ecological services (soil biota/nutrient cycling/soil fertility, pest and disease regulation, pollination, maintenance and enhancement of local wildlife and habitats). Other activities include development of appropriate technologies for insect based income generating activities; bioprospecting for botanicals for human, animal, and plant health products; and the study of socioeconomic aspects of arthropod related development issues. In addition to the research activities, ICIPE plays an important role in strengthening the scientific and technological capacities of the developing countries in insect science and its application through training and collaborative work.

## What Did I do?

The project that I was assigned to was the Neem project, an effort to reduce the devastating effects of malaria. The Neem project has an outpost in the town of Kisii, which is a town located five hours west of Nairobi. As of July, the project was in a pre-epidemic research phase. The workers were determining the risk of malaria epidemics. Soon they will be establishing how effective Neem products are against malaria mosquito larvae. If Neem can be proven as an effective insecticide against mosquitoes and is free of non-target side effects, malaria can be drastically reduced in sub-Saharan Africa. Malaria parasites infect over 500 million people and kill over 3 million people each year. The burden faced by infected countries is slowed economic growth and inhibited development. In Kenya alone, over 170 million workdays are lost per year due to malaria. That averages out to be 6 days per person per year. That's including women and children. "Magic bullets" such as DDT and Chloroquine have failed to sustainably eliminate malaria from most endemic areas. In Africa, the most effective vector species proliferate in hot and humid climatic conditions, which are also ideal for parasite transmission. Four hundred fifty million people live in areas of endemic transmission and 50 million more face occasional malaria epidemics throughout the world.

With these figures staring them in the face, ICIPE decided to create a program to find an environmentally safe way to reduce these numbers. The head of the Kisii program is Dr. Francois Omlin, a visiting scientist from Switzerland. Different ways of controlling malaria have been established, although the most effective treatment is through vector-control. Vector control can target the adult malaria mosquito (*Anopheles gambiae*) through residual spraying, insecticide-treated bednets, and repellants both natural and chemical. The safest way to control malaria, however, is through mosquito larval control. This reduces the human to vector contact and thus is the focus of ICIPE at this time. The larvae can be controlled through larvaciding the breeding sites, and environmental modification. One of ICIPE's research foci is larval mosquito control with botanicals-products of the Neem tree (*Azadirachta indica*). The active ingredient in Neem, Azadirachtin, acts as an insect growth regulator (IGR) inhibiting larval and pupal development as well as influencing adult longevity of many insect species, including mosquitoes. Azadirachtin is highly concentrated in the seeds of the neem tree, but can also be found in the bark, leaves and roots. Neem is growing so very well and fast in most areas of Kenya, and is also used for reforestation. Neem products seem to be promising in terms of local cost-effective production and application. Further studies are required to determine the insecticidal properties and non-target effects in aquatic habitats.

## **What is the Point of the Project?**

The goals of the Neem program in Kisii are as follows:

- 1) Develop “botanicals for effective malaria mosquito larval control.”
- 2) Know the “key” mosquito breeding habitats and having the larval population reduced.
- 3) Inform and train the community while encouraging participation.

As stated previously, Neem products containing Azadirachtin are proven insecticides. It hasn't been widely used though because it's still in experimental and trial stages. This is what the program in Kisii will do in a short time. They first need to establish which are the most prevalent breeding habitats in order to effectively complete the first goal, The second goal is almost complete. The “key” mosquito breeding habitat in Kisii are: swamps, tree ponds, and brick making sites. Brick making is a major source of income in Kisii due to the clay-rich soil. When a family or group decides to make bricks, they dig holes in the ground roughly three feet wide, four feet long, and two feet deep. They add water to these holes to make the soil workable. The water soon stagnates and becomes an ideal breeding situation for mosquitoes. Having the larval population reduced and controlled will be achieved pending Neem's qualities as a larval insecticide. The third goal is often very difficult because not all of the local populace is willing to accept ICIPE's project. This is due to the lack of education about the project. The education starts with a meeting with the area's chiefs (mayors in a sense). The subject is discussed, then the chiefs are asked to circulate this information to the citizens of their respective areas.

## **Who Did I Work With?**

My collaborators were really my closest friends in Kisii and Mbita. They were outstanding, they went the extra mile to help me and they deserve a lot of credit. First was Dr. Francois Omlin, visiting scientist from Switzerland. He was my direct supervisor, responsible for my project and me. That was a lot of work for him, and I know I frustrated him every now and then, though unintentionally. We worked it all out and he was a great help. Next were the guys I stayed with in Kisii. These were my co-workers for the first month of my internship. Erick, Daniel, Sam, Fred, and Evans were the five Kenyans I stayed with. I'd like to thank them individually. Sam for his patience in Blue's and at the email center. Dan for his great sense of humor and for his constant security he provided me with. Erick for his sense of humor and help on my project, and the help on fishing. Fred for his knowledge about mosquitoes and his help when it came to the house budget. Finally Evans, or dere (driver in Kiswahili). Thanks for the safe trips and good driving, and good luck to you and your son.

The rest of my collaborators came from Mbita. Steven Sabato Ogoro was the Neem expert at Mbita. He was in charge of the Neem nursery and was the person who supplied me with the materials needed for my project. He is a direct employee of ICIPE, from the town of Mbita and only had 7 years of standard education. Joshua Ouma Kabondo from Oyugis has a full high school education. While not directly employed by ICIPE, he worked as a manual laborer and was at my place every day to record some results. I also worked with four eighth grade students at the Mbita Point International School on the ICIPE compound. Geoffrey Owour from Kisii was one of the kids I lived with. The other students I lived with was Abdulmalik Omere Okumu from Oyugis, David "Chief" Okombo from Karungu, and Emmanuel Onyango from Kisumu. All of these guys helped with the daily tasks of my project and also helped to entertain me by playing cards whenever we had free time. Thank you to all these guys who helped me!

## What was Different for Me?

When I left, I was thinking, “Let’s go! Bye Mom, Dad, and Taylor, I’ll be fine.” Soon after I got to thinking “Why aren’t these pants clean? Mom did you wash these?” That’s when I realized that I had RESPONSIBILITY. Things that I had previously taken for granted, such as clothes that had been washed, or food waiting for me on the table weren’t there anymore. It’s amazing how much teens rely on their family and friends for food, clothes, money, love, and support. I came to the realization that, one day, everyone lives for themselves and by themselves. I had many responsibilities on my trip, they included: clothes, food, and daily living, not to mention my research project.

Clothes, when they are dirty, what does the average teen do? “Hey, Mom, wash this!” When I was in Kenya, I had the unusual, yet necessary undertaking of figuring out which clothes were dirty. Not just by looks but by smell also. I also had the problem of washing my clothes. Granted, washing facilities were available, I still had many problems.

Food is something you can’t live without. I was pretty much on my own for choosing as well as paying for my food. In Kenya, you need to be careful where you buy your food, so you buy fresh food. I did have the good fortune of living with five Kenyans who knew what they were doing when buying food. Paying for food, that was a different story, while I did pay for some food in the states, usually the family paid for groceries. I also had to decide what to eat. I quickly learned that eating right was important.

Finally, I’d like to comment on the daily life. This was probably the toughest to deal with. Not having my family and friends around was a problem. I soon realized that they made life easier to deal with. Even the little things, the “How was your day?” or “Good job!” Those were absent except through the computer. Emails did help me stay in touch with them, but they also hurt. They often talked about fun times at home, wishing I was there, and soon I did too.

All in all, I really had to suck it up, step it up, and take over to make my time a good time. The responsibility that I had to deal with in Kenya has made me a better person. So much of this program has done that and I am grateful for that.

## **What Were My Results, and How Did I Get Them?**

The project that I carried out was a test of Neem's non-target side effects on fish. The fish is called *tilapia* and is indigenous to Lake Victoria. It commonly is used for many such experiments. I was concerned that even a small amount of Neem could affect fish. The experiment was set up with the following parameters: 12 basins containing 20 liters of water and 10 fish were set up in the spare bedroom of my living flat (to control temperature). Three different concentrations of Neem were used: 7%, 1%, and 0.1%. The Neem was added as it would be applied in nature, by hand spreading it over the surface. The neem that we used is known as Neemros powder, which is neem cake powder. Neem cake is what is left after the seeds have been crushed and the oil extracted. The cake is then ground to make neem cake powder. After application, I observed the fish at 8-hour intervals until all fish were killed. A control group was run to ensure the fish actually died of Neem exposure. The Neem was added on July 12, 2002, at 2:00 pm. The first observation was at 10:00 pm, the highest concentration had killed all the fish as predicted. The fish in the 1% concentration were almost completely killed off, which was unexpected. About half of the 0.1% were also dead. After 40 hours, only the control group remained alive. Over the next two days, we discussed our next move, do we add more to retest, or use this data? On July 15 we added 9 fish to the 0.1% concentration and 15 fresh fish to the control. In eight hours, all of the test fish were dead. After that, we got curious. Could it have been the Neem component or something else? On the 16<sup>th</sup> we added 0.01% of neem cake powder, neem leaf powder, and neem bark to the 9 basins. In one hour, the neem leaf powder had killed all of the fish. However, the neem cake powder, and bark had no visible effects on the fish. In 6 hours, the bark fish were all dead. In 40 hours again, the neem cake powder fish were all dead. This was repeated with almost identical results. Then we added less of the leaf powder. With 0.005% the fish were dead in less than 3 days. We had determined that a Lethal Concentration 99 for neem cake powder was .01% and above. The LC50 was .005% and the non-lethal amount of neem cake was .001%. This is an extremely small amount that is lethal to fish.

This brings up questions of course. Was it the large granule size that clogged fish's gills? No, we sieved a 0.05% concentration in one of my shirts. We tied off the ends with the Neem contained inside, this way we would find out whether or not it was the chemical aspect of Neem or the large granule. The fish still died in two days.

Should we cancel production on neem? Definitely not, with my project, I was working with a short time frame, and limited resources which may have skewed my results. There are other possibilities that we need to explore before we jump to any conclusions.

This project has a very strong correlation to food security. It might not seem like it at first, but if you look very closely, you'll see it. Neem is a botanical, which can be grown and sold for profit, which brings money into a family. It also could be used to practically wipe malaria out of these areas. With that, over 170 million workdays could be saved and used to produce food and make food. Also, fishing is such a huge form of income and it could be greatly affected by some freak accident while shipping Neem.



## Have I Changed?

When I left the states, I knew that this trip would leave a mark on me, but I never thought it would be this large of a mark. When I arrived in Nairobi, I stayed at the ICIPE Guest Center. Dr. Omlin said, "This is not Africa, wait until you see Kisii." He was right; Nairobi was just like the states, TV in my room, fridge in my room, and American meals. That all changed in two short days. On the way to Kisii, we went through many poverty-stricken towns and villages. That was an eye-opening experience. If an average Kenyan is lucky enough to work, they work for the equivalent of a dollar a day. When we got to Kisii, kids ran along the car yelling "Muzungu! How are you?" Muzungu is white person. I quickly came to realize that the word muzungu often was directed to me.

The roads in the states are something that I never thought I would take for granted. Kenyan roads are a world apart. I've tried to find an analogy for them, but I really can't. You have to experience it for yourself. The country has two paved roads, the rest are dirt.

I never thought I could take food for granted, but most Americans do. An average Kenyan meal consists of Ugali, meat, and some green vegetables. Ugali is a mixture of flour and water with the consistency of play dough. You use your hands, rip off a piece of ugali, make a ball out of it, make an imprint in it with your thumb and use it as a spoon to eat the rest. The meat is beef, but extremely tough because the cattle are malnourished. The common greens and ugali got old fast.

Clothes were probably the toughest difference. In Kenya, people don't care what they wear as long as they wear something. Upon saying this, it must be stated that Kenyans usually don't have a choice on what they wear. While we shop for hours looking for the clothes that fit the style, Kenyans wear what they can find that fits. You can always find someone wearing something you couldn't dream of wearing, but for them, clothes are clothes. What the new style is isn't important to them since they don't have the freedom to chose the clothes that they dream of.

I never knew that you could find people that can be more polite than the average American. People in Kenya always have time to greet you and make conversation. In the states, a common greeting is, "Hi" or "hello." In Kenya, you shake hands and ask about the family or weather or crops. African people are always ready to accommodate your every need. You are the first to get food, or soda, or even a chair. It really doesn't matter who you are, if you're new, you're the most important person at that time.

## **Did I Grow?**

This project was a big factor in helping me develop as a young adult. It accomplished this by: helping me become more independent, making me realize that to be heard, you need to speak out, and by helping me in learning how to help others.

The first way, becoming independent is a vital part of growing up. You have no idea how dependent you are of others until they are gone. When I was in Kenya, I was responsible for getting myself up. That may sound foolish, but for most teens it presents a problem. Money had to be rationed and well-taken care of. Spending too much money in a new place is way too easy. Finally there was my project that was an independent effort on my part. It was my project, and I had to do it, that's the reason I was there.

The second factor is speaking out and being heard. The first day I was there, Dr. Omlin said, "If at anytime you don't feel well, tell someone, stay home and rest until you feel better." He was right. The few times I did feel sick, I had to tell someone so they knew what was going on. Also, if I wanted something, I had to say so. I also had to say what I wanted my project to be and what I needed for it.

Finally, learning how to help others is very important. Many of the people that I worked with had never been outside of Kenya and wanted to know what it was like. I was in charge of telling them these things. There were also times that I had to realize that I shouldn't help others. When a beggar asks for 5 shillings, you need to refuse or beggars who want money will swarm you. So helping others comes in good ways and bad, and recognizing the difference is important to helping you grow.

### **Did This Impact My Views on Food Security?**

The biggest daze of my personal experience in Kenya was that, obviously, not everyone had food there. When you did find food, you had to make sure the food was high quality and fresh. Not always having 3 meals a day also took some getting used to. We were in the field until 3 in the afternoon so lunch time had passed. It's often the case of the rich having it and the poor don't. The roads in Kenya are so bad that transportation is out of the question. In Kisii, a town about 2 hours from Lake Victoria, fresh fish cannot be found. This brings up another point, how safe is the food? Most of the time it's fine, but there are the few exceptions. This definitely changed the way I view food security in a small scale environment. On the global standard of food security, I saw just how much a corrupted government can affect a country's food tribulations. The fact that the rich have food and the poor don't is a fault of those in power. Major strides need to be taken to reduce such a problem. That starts from the top down. With world leaders taking the initiative of creating a solution, they construct a good example that others can pursue.

## **Recommendations**

These recommendations are meant for those who would like to alter my work in a positive fashion. They are also meant as an example not guidelines. The first change that I would make is a longer experiment. I feel that that is the most important blemish of my project. Also, a larger scale experiment would probably produce more reliable results. Research on the chemical make up of each individual component of Neem is a necessity. Smaller amounts would also lead to interesting long term results i.e. abnormalities in fish behavior as well as offspring mutations.

## **Works Cited**

Eyes Forward, ICIPE, 2002 Year in Review and Future outlook handbook.  
Published by ICIPE.

## Data

This is an example of a data sheet that was used during my experiment.

	Rep 1	Rep 2	Rep 3
7% Alive	0	0	0
7% Dead	15	15	15
1% Alive	0	0	0
1% Dead	15	15	15
0.1% Alive	9	6	2
0.1% Dead	6	9	13
0% Alive	15	13	15
0% Dead	0	2	0
7% Act. Lvl	none	none	none
1% Act. Lvl	none	none	none
0.1% Act Lvl	Medium	Medium	Low
0% Act. Lvl	High	High	High

## Legend

**Fifteen fish in each basin.**

**Activity level was based on observations done in natural habitat.**

**Data is from Day 2 6:00 am, observation #1.**

## **Special Thanks**

These are a few of the many who need to be thanked at this point in time.

Ms. Birgitta Meade-for all the help on my papers, and your ongoing interest of seeing me succeed and grow.

Dr. Norman Borlaug-for the encouragement of youth and the courage to found the World Food Prize.

John Ruan-for believing in the World Food Prize and its potential to help the youth become interested and active in the world's most difficult issues.

The Board of Directors-for the continuing support of the Borlaug-Ruan Internship and the changes it brings about in the youth.

Lisa Fleming-for constantly updating all the interns and keeping track of us all over the world, keep up the good work!

Dr. Hans Herren-for taking me on as an intern at ICIPE and being a constant role model to me throughout the past two years.

Dr. Francois Omlin-for being so flexible and patient with an Iowan who has never seen anything but cornfields. Not to mention the constructive criticism of my project.

My Family-for being so supportive while their Josh was "ripped from their arms and shipped to a foreign land for two whole months!"

My Friends-for also being supportive, but also having the time to offend me in a positive fashion which in turn raised my sometimes downed spirits.

Bian Li-for helping me really understand the country of Kenya, the help on the paper, and the joke of living next to each other for a week without realizing it.

