

Liberia July 21 – August 9, 2013 activities

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The overall assignment was to evaluate the diseases that were affecting rice in a large number of lowland and some upland rice growing areas of Liberia. The majority of the observations were made in the 21 Urea Deep Placement (UDP) research evaluation plots throughout Liberia. The UDP research locations consisted of six lowland rice bays composed of three treatments replicated twice. The three treatments were UDP, a broadcast fertilizer treatment (typically just a general NPK fertilizer), and “grower practices”. Grower practices included a wide range of activities from no fertilizer, nitrogen fertilizer, to an NPK general fertilizer.

A number of commercial lowland and upland rice growing fields were examined and were not part of the formal evaluation but were identified somewhat opportunistically.

All but a few days at each end of the assignment were spent “upcountry doing rice field surveys and evaluations. The “team” included myself, Bartuah, Garrison, and Natalene.

The fields visited were evaluated by walking several transects through each of the treatments evaluated, sampling any symptomatic plants, incubating the samples in bags to promote plant pathogen development, followed by microscope examination. In addition, pictures were taken of symptomatic tissue, and a number of tissue samples were taken that appeared to be showing abiotic fertility problems.

The UDP plots, as well as the majority of the upland and lowland commercial fields observed, were at an early vegetative stage of development. The rice seedlings from all of the UDP plots were between 3- 8 weeks old. Although numerous diseases were observed at this vegetative stage, none of the diseases observed appeared to be of high enough incidence or severity to cause an economic impact. In addition, some insect damage was also observed, but the majority of the damage appeared incidental and not affecting yield. Fertility, on the other hand, appeared to be affecting the seedlings to a significant extent. A great deal of uneven growth, stunting, and chlorosis was observed at almost all locations, but the degree of severity varied greatly from location to location. Plant tissue samples were taken to try and get direct evidence of what some of the fertility issues observed were caused by. For several of the mature fields, although some disease and insect damage was observed, these maladies did not seem to be significant and it was unlikely they were causing an economically important yield loss. Most rice diseases are

manifested in mature rice, or at least rice that is in a reproductive (panicle development) stage of growth. Thus, for a full evaluation of the impact of diseases, it is important to evaluate three critical stages of development – vegetative (approximately 10-60 days from transplanting), panicle initiation (60-90 days depending on the variety), and panicle maturation (90-140 days).

The following itinerary was provided at the initiation of the assignment:

## TRAVEL SCHEDULE STTA RICE PATHOLOGIST

<b>Date</b>	<b>Activities</b>	<b>Location/Town</b>	<b>County</b>
July 23, 2013	Arrival	Monrovia	Montserrado
July 24, 2013	Travel and visit Palala # 1 & 2, Doetain-ta, Gwenimah, Totota	Ganta	Nimba
July 25 – 26, 2013	Visit all category “A” sites	Payee, Taylay, Dounpa, Gbedain and NCCC	Nimba
July 27, 2013	Debrief	Ganta	Nimba
July 29, 2013	Travel	Voinjama	Lofa
July 30 – 31, 2013	Visit all category “A” sites	Sakonedu, Kugbamai, Sadu Passia, & Kahenjala	Lofa
August 1, 2013	Debrief	Voinjama	Lofa
August 2, 2013	Travel	Gbarnga	Bong
August 3 & 5, 2013	Visit all category “A” sites	Garmue #1 & 2, Jorwah, Gbarngasiaquelleh, Bellemue #2, and Bong Mines	Bong
August 6, 2013	Debrief & Travel	Gbarnga to Monrovia	Bong & Montserrado
August 7, 2013	Presentation	Monrovia Office	Montserrado
August 8, 2013	Departure	USA	USA

**Diseases.** The primary diseases observed during the UPD evaluations were fungal idseases and included rice blast (*Magnaporthe oryzae*), Sheath rot (*Sclerotium oryzae*), sheath blights (*Rhizoctonia* spp.), brown spot disease (*Bipolaris oryzae*), and false smut (*Ustilaginoidea virens*). The disease pressure however was relatively low at this time of the year and during this vegetative stage of development. It appeared unlikely that the level of disease incidence and severity would have an impact on disease.

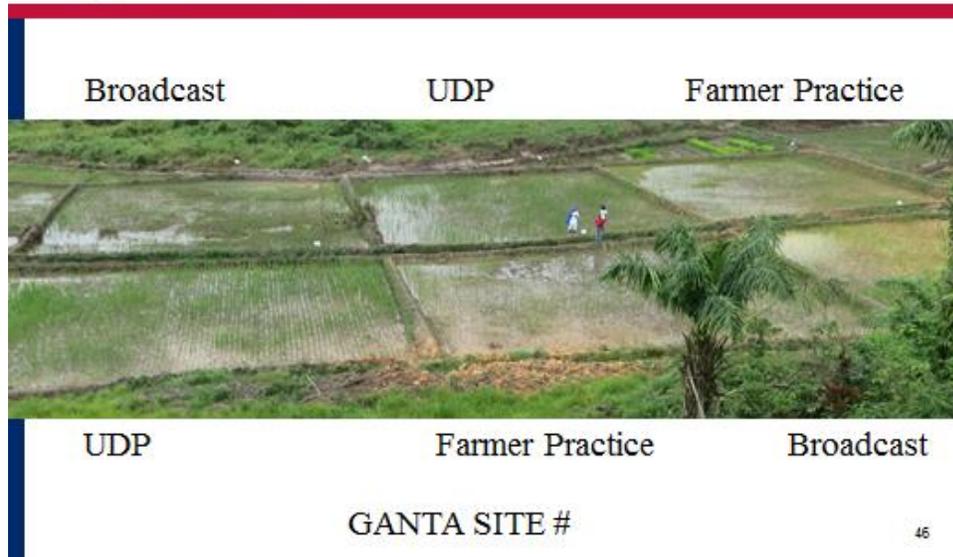
Insect damage on younger seedlings seemed to be limited to case worm chewing damage whereas some higher levels of chewing damage was observed by case worm and grasshoppers in the more mature crops observed. Also, stem borer had caused a significant amount of panicle damage in two of the mature rice fields observed during the field evaluations.

Bird damage also was causing a significant damage to panicles and was affecting grain-fill. The birds appeared to be feeding on the panicles and young grains before they filled, sucking out the juice from the developing panicles. After the damage, the panicles appeared desiccated, particularly at the ends of the panicles, and secondary fungi were often observed colonizing this senesced tissue giving the misleading impression that the panicle damage was diseased.

Fertility Issues appeared to be common among the plots and mature commercial fields evaluated. The most predominant fertility issue observed appeared to be stunted plants and bronzing and chlorosis with what appeared to be iron toxicity due to the presence of high iron levels and low pH soils.

## Rice Diseases in Liberia

- Rice blast
- Sheath blight / sheath diseases (Nitrogen)
- Sheath rot / stem rot
- Brown leaf spot
- False smut
- Insect damage
- Stem borer
- Numerous chewing insects
  - grasshoppers, case worm
- Birds
- Abiotic Disorders / Fe toxicity
- Fertility
- Micronutrient deficiencies?



Typical UDP site evaluated during the assignment.

### Locations and Organizations Visited

- Ganta, Nimba County
- Voinjama, Lofa County
- Gbarnga, Bong County
- Urea Deep Placement (UDP)
- Commercial Lowland
- Commercial Upland
- Screening Sites
  - CARI
  - China-Liberia Demonstration Center



A list of some of the locations visited during the assignment.



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Visiting growers involved in one of the UDP locations.

### **Ganta Debrief and Recommendations**



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One of several of the Disease Management recommendation debriefings held during the assignment.

### Voinjama Debrief Group



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Debriefing on Disease Management practices and general production techniques.

### Gbarnga Debrief



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Debriefing at the Gbarnga location on Disease Management and good production practices.

## General Management Recommendations

- Take accurate notes
  - Variety, planting time, seedling age, harvest time, weather
- Record all management practices
  - Fertilizer, timing, rotations, cropping history,
- Problematic spots within fields
- Variety selection and seed quality
- New ground, rotation/fallow



Some general recommendations provided during debriefings.



## **Disease Management Recommendations**

- Good seed bed preparation – new ground
- Inspect seedlings
- Soil fertility
- Compare “local” varieties to newer varieties
- Straw Management
  - Burn, remove, source of over-seasoning inoculum of pathogens

Some general Disease Management practices provided.



## **Rice Diseases in Liberia**

- Rice blast
- Sheath blight / sheath diseases (Nitrogen)
- Sheath rot / stem rot
- Brown leaf spot
- False smut
- Insect damage
- Stem borer
- Numerous chewing insects
  - grasshoppers, case worm
- Birds
- Abiotic Disorders
- Fertility
- Acute Fe toxicity
- Micronutrient deficiencies

Overall observations on stunting and poor fertility affecting rice seedlings.



### Overview of uneven growth and stunting



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Typical overall bronzing associated with locations that had high levels of iron, low soil pH's and symptoms of iron toxicity in the rice.



Bronzing symptoms on rice of iron toxicity



### Iron toxicity symptoms on rice leaf



Close up symptoms showing bronze flecking in rice leaves associated with severe iron toxicity.

To directly evaluate the fertility of plants in the UDP plots being evaluated, plant tissue showing three distinct symptoms were samples. The samples included (good) tissue which showed either symptoms, with green tissue and no stunting; plants which were intermediate (bronzed) which were not stunted but showed a bronze discoloration in the plant tissue; or severe symptoms (stunted), where the plants were stunted with severe symptoms of chlorosis and bronzing.

The tissue analysis is included below. There is a clear correlation between severity of the symptoms and the level of iron in the tissue examined. The bronzed and stunted tissue had iron levels approximately 400% above the “good” or normal looking rice tissue. However, the phosphorus level of the symptomatic tissue was also quite low. Several soil scientists I have consulted about these results indicate that the relationship between high iron and low phosphorus is closely associated and the effect of both nutrients likely should be further evaluated. By increasing nitrogen levels in the UDP treatments, it may be exacerbating the symptoms due to low phosphorus or high iron.

AGRICULTURE DIAGNOSTIC LABORATORY  
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RESEARCH PLANT SAMPLES

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SAVE SAMPLES: YES  
STUDY:

ADDRESS:

ARRIVED: 09-05-13  
LOGGED: 09-12-13  
OUT: 09-15-13

LOCATION:

ACCOUNT#: 0403-81567-24-2367

PROCEDURES: HNO3 DIGEST, ARCOS ICP, TOTAL NITROGEN BY COMBUSTION WITH ELEMENTAR RAPID N III

LAB #	ID	-----%-----						-----mg/kg-----					
		N	P	K	Ca	Mg	S	Na	Fe	Mn	Zn	Cu	B
36874	GOOD	4.25	0.23	2.69	0.21	0.10	0.26	111	129	194	32.8	11.5	2.1
36875	STUNTED	3.54	0.12	1.76	0.31	0.09	0.22	69	568	178	27.3	6.8	2.1
36876	BRONZED	3.90	0.16	1.01	0.48	0.05	0.19	34	487	327	21.1	5.7	2.3

An in-depth discussion resulted after my exit seminar in Monrovia regarding the assignment. There is a substantial need for a practicing plant pathologist to help with diagnosing disease problems on crops grown in Liberia as there are no practicing plant pathologists in the country. This is a major deficiency regarding crop production. Efforts were discussed to try to recruit two students to pursue their M.S. degrees in the Department of Plant Pathology at the University of Arkansas. The overall plan would be for the students (one focused on rice diseases and one on vegetable diseases) to pursue their classwork in the first year in Arkansas to learn some basic techniques, return to Liberia to conduct their thesis research in their second year, and then return to Arkansas to complete and defend their MS thesis. Jim Correll would support the graduate assistantship and USAID would potentially support airfare for the students and some in-country transportation.