Report on Trip to Mali
June 20 - July 2, 1999

USAID Grant No. LAG-G-00-97-00002-00
SM-CRSP Project *Decision Aids for Integrated Nutrient Management*

Travel Team:

Lloyd R. Hossner – Texas A&M University
Frank M. Hons – Texas A&M University
Frank J. Smith – North Carolina State University

Objectives:

Cinzana, Mali is the IntDSS project's intensive testing site for the semi-arid ecosystems. Texas A&M University coordinates our project activities in Cinzana with collaborators from Institut d'Economie Rurale (IER). Ongoing activities with IER collaborators include field trials at the Cinzana Exp. Station with cowpea and millet to test and refine the IntDSS prototype, on-farm trials in the Cinzana region with manure, compost and rock phosphate mixtures, and laboratory incubations of West African soils to estimate soil P buffer coefficients. In all these activities, data from last year must be assembled, reviewed and interpreted, and plans must be developed for this year's planting season. Travelers will also assist IER collaborators in undertaking a midterm socio-economic survey in the Cinzana region to assess project-induced changes since the baseline survey in year 1.

Specific travel objectives are to:

1. review research progress and data from the 1998 field and laboratory trials;
2. coordinate implementation of the 1999 field and laboratory trials; and
3. conduct the mid-term socio-economic survey in the Cinzana region.

Itinerary:

June 20-22	Travel to Bamako, Mali
June 23	Met with IER scientific directors; went to Sotuba Station and met with director.
June 24	Met with Oumar Doumbia at Sotuba Station; drove to Segou; toured field study area for Jacques Gigou; met with Cinzana staff in Segou.
June 25	Drove to Nione and visited with Nione Center staff; drove to Mopti.
June 26	Toured Niger and Bani River delta; visited Mopti Research Center; flew to Tombouctou
June 27	Flew back to Mopti; toured Dougon Plateau and visited IER Center; returned to Mopti.
June 28-29	Drove to Segou; visited Jenne Village; drove to Cinzana; toured and discussed experiments; visited local villages; drove to Sikasso.
June 30	Toured agri-businesses and Cotton Exp. Station; drove to Bamako.
July 1	Visited Ministry of Agriculture; Hossner and Hons departed for U.S.
July 2-5	Smith remains in Mali to work on mid-term appraisal with IER staff.

Sotuba Station

We met the Director of Sotuba Center and discussed building and scientific training programs. Rainfall is later this year than normal in Mali, similar to the pattern in 1988. Planting has been delayed by around 2 to 4 weeks, especially at Cinzana.

Abou Berthe heads the Inter-CRSP program in Mali. Mamadou Doumbia and Aminata Sidibe are also involved in this program. One project is contour ridging for soil and water conservation - water infiltration, crop yield, etc. They are working with 6 others on this project. Another project is a manure extender - using manure plus mineral fertilizer. Mamadou is working with 10 farmers on the second project. They will also measure runoff and erosion on a watershed basis to place in a model. They are also trying a model from Purdue University for watershed and runoff management and are monitoring wells in Dougouba to assess any pollution from farming practices. Mamadou's activities involved environmental consequences on well water. In Dougouba, he is cooperating with the 25 farmers previously surveyed (low/no input) and in South Mali will use high input farmers and do the same. He will analyze for N, P, and basic cations. They also tried to share projects with other agencies but Mamadou's involvement is only environmental.

The NDSS and PDSS modules do not include irrigated rice in the models and there is a need for this in the Mali work. This type of information would also be very useful for cotton. Mamadou also wants to be able to determine P coefficients for PDSS using Tilemsi rock phosphate.

We met with Oumar Doumbia, Soil Pedologist at Sotuba and discussed how he is trying to integrate the French and USDA classification system. We met the head of the project for agricultural use of human wastes including septic, trash and commercial sources. This project has just been initiated. Mamadou Doumbia is providing soil analysis. We also met the head of the GIS project plus a young Canadian working in the GIS laboratory.

Drive from Sotuba to Segou

We left Bamako for Segou and met with Jacques Gigou, a French soil scientist, around 50 km from Segou and toured field study areas. He is working cooperatively with Mamadou on contour ridging, erosion, and runoff projects. He showed one soil that was like pavement. Another soil was also very hard and seemed impermeable. He thought texture caused this type of sealing. He was also interested in agroforestry and ways of increasing tree growth and survival. Some of these fields were pH 4 to 5. Cooperating farmer was Zan Diarra.

We arrived in Segou around 6:30 p.m. After checking in to the hotel we met with Adama Coulibaly, Zoumana Kouyate and Oumar Coulibaly. A thunderstorm developed overnight and it rained heavily from around 6-7 a.m.

Drive from Segou to Niono and Mopti

We traveled from Segou to Niono. There is some sugarcane and much rice production in this area, possible because of the dam on the Niger River. We met with the Center Director of Niono (Dore Guindo), Yacouba Doumbia (rice agronomist here for 15 years), Arnold Beitelman, Dutch Advisor interested in agroforestry and rice, and Adama Coulibaly - millet/sorghum coordinator at Cinzana. We discussed Adama's potential Ph.D. program at Texas A&M.

IITA has 3 years of information on soil fertility management from farmers' fields and their strategies. A paper from this work is almost ready. They are also putting together a book-type chapter that gives some appraisal of land and practices and makes some estimate of nutrient balances and recommendations for fertilization. We had a long discussion about oxalate extractable P in rice soils with Yacoube. Some software is also available here. The potential is to irrigate about 1 million ha of rice around Niono from the Niger River. We observed much activity of small farmers clearing land in the Niono region. Farmers can make around $600/ha on rice after expenses. We traveled from Niono to Segou to Cinzana.

We traveled about 4 hours from Cinzana to Mopti, stopping on the way to observe a demonstration on the use of basin tillage to retain more water in silty, sealing soils. This is a fairly common practice in the area. Many of the soils are very hard with no structure. We met with Odiaba Samake (Agronomist, Mopti), who is a former graduate student of Frank Hons, later that evening.

Visit to river deltas, Mopti, Tombouctou, and Dougon Plateau

Traveled to Odiaba Samake's house then onto the island where Mopti is located at the confluence of the Niger and Bani Rivers. We saw much activity in the delta area to prepare soils for deep water rice prior to the rainy season. Water will be very high in September and October. We went to the Center Director's home in Mopti then to the Research Center where Samake pointed out the Director's and his offices and briefly discussed his research programs. The Mopti area has been without power for several weeks.

In the afternoon, we flew a "hot" Russian - made plane (Mali Air) on a one-hour flight to Tombouctou. We visited a mosque built in the 1400's. Tombouctou was started in 800's B.C. We toured the city and then took camel rides into the Sahel. Annual rainfall is around 50 mm/year. We observed attempts to revegetate and stabilize dunes to decrease soil movement.

We left Tombouctou on Mali Air to Mopti and arrived around 9:30 a.m. We picked up Odiaba Samake and left for the Dougon Plateau. We observed how Dougons use rock, which is abundant, for terraces to decrease erosion and mark field boundaries. They build houses from stone rather than mud which is more typical of Mali. They transport sandy soil from south of the Dougon Plateau up to the Plateau and place it upon rocky areas to grow crops. At one time they lived in the rocky cliffs for protection. We traveled south of the plateau through extensive, very sandy soils (Seno series) to an IER Center in the area. We met the Center Director and his staff and discussed research at the Center. Mamadou Doumbia arranged for this Center to be a testing site for INTDSS. We drove across miles of very poor road (gravel, rock, and sand base). We observed a common farmer practice of hilling soil over weeds in small piles and then seeding millet directly in the top of the hill the next season. We observed several fields being planted by hand. The rains are very late this year and the outlook for a good crop is rapidly diminishing. We returned to Mopti around 5:30 p.m. Significant water erosion was observed in fields bordering the Dougon Plateau.

Return drive to Segou

There was a duststorm followed by a thunder shower from around 7 to 8:30 a.m. in Mopti. On the drive from Mopti for Segou thunder showers appeared to be widespread. We estimated rainfall at 25 to 30 mm. Considerable cultivated acreage was observed with water ponded in fields, even when soils the day before had been so dry. This again indicates crusting (sealing and low water infiltration rate) on many of the soils. Farmers from Mopti almost to Cinzana were again plowing fields prior to planting. Near Cinzana they did not plow again but planted into the moist seedbed, possibly to conserve both time and moisture.

Enroute to Cinzana, we detoured to visit the village of Jenne. It has a mud mosque built in the 1400's with 100 pillars inside - The mosque at Tombouctou had only 95 pillars. We were not allowed in the Jenne mosque because we were not Muslims although we had been allowed inside the mosque at Tombouctou. These mosque are very plain compared to those in Egypt and much of the Arab world.

It was market day in Jenne and anything from wheel bearings to smoked fish could be found. Frank Smith (NCSU) took a photo of a blanket that had an assortment of animal hides, heads, and

limbs, presumably to be used for medicinal purposes. The vendor was agitated by the photo. Smith offered him 100 CFA and he became more irate, saying he was insulted by such a low payment. Our guide had to quiet the vendor.

We stopped for lunch in a village along the road to Segou. The restaurant was open air and very "quaint". We could see them pounding the meat that was to be served for the meal. Around 3:30 p.m. we arrived in Segou. Mamadou was to meet us at 7:30 a.m. on June 29 for the trip to the Cinzana Research Station and discussion of last year's results for the core experiment and trials for the upcoming year.

Cinzana Experiment Station

We traveled from Segou to the IER Research Center at Cinzana. We met Mamadou, Zoumana Kouyate, Adama Coulibaly, and Aminata Sidibe. We toured the Ca study sites on sandy and heavier - textured soil. We went to heavy and sandy soil sites of Kouyate's rotation work and took slides for Sherry Blanton-Knewtson to use in her Thesis. We visited a farmer at Cinzana where Mamadou is conducting his compost work. There may be a problem because now everyone from the Center wants to conduct on-farm research there. The farmer's father was the village chief so many farmers want to observe what is being done. This increases the probability that various programs can have widespread impact.

At Cinzana, Mamadou stated that the Soil Management CRSP report will be late. It will have to be completed by the end of July since their annual research report to IER is due at that time. He stated that the situation for Adama's training at Texas A&M has been formalized and it is now up to Adama to complete to TOFEL and GRE with acceptable scores and be in College Station by early January, 2000. Frank Smith arranged to meet Oumar Coulibaly and Mamadou in Bamako after Hossner and Hons leave to formulate new survey questions.

Core Experiment Mamadou reported that they have collected and analyzed soil data before the experiment, crop data, and soil data after the season. Cowpea and millet trials have Bray-1 at 2 top soil depths, pH at all depths, KCl extractable Ca and Mg at all depths, soil C at the first depth, exchangeable acidity at the first depth, and are working on exchangeable K. They are also doing P buffer coefficients (incubation) on profile samples taken. They did not do soil C on any other samples nor NO_3^- (Sherry is doing NO_3^-). Nitrogen, P, K in plant samples have not been completed. They have planting data, plant density, plant height, and yield data for the core experiment.

Calcium Movement Study (both soils) Aminata does P, Ca, Mg, another technician does exchangeable acidity and pH, and another one does organic C. They have P analysis completed on all depths; pH, Ca and Mg need to be done on the lowest depth. These parameters are for both preplant and post harvest samples. Exchangeable acidity has been determined on pretreatment samples, but not after. Mamadou calculates they still have around 600 soil analyses to complete. He says they will finish before July 31. The laboratory is still having difficulty obtaining chemicals. The easiest way to obtain KCl is to have Richard Kablan (Hawaii) order, pack, and ship and bill to Texas A&M University. He apparently has a way of expediting the shipment.

Typical Ca data for gypsum application at the highest rate is as follows:

	Before Application	After Harvest
1^{st} depth	0.2 cmol/kg	1.4 cmol/kg
2^{nd} depth	1.3 cmol/kg	2.0 cmol/kg
3^{rd} depth	0.6 cmol/kg	2.9 cmol/kg

Other activities Mamadou and his colleagues also have data from 26 research sites in Mali and 18 in Niger comparing calculated P buffer coefficients by PDSS vs. laboratory incubations. Samples varied from 2 to 54 % clay. Cowpea data from the core experiment have also been collected, but haven't been statistically analyzed.

Dan Israel may come this year to measure biological nitrogen fixation by acetylene reduction. He will have to bring acetylene and all other needed materials. Mamadou and Adama said they would cooperate. Lloyd Hossner will check with Jot Smyth to determine Dan's intentions. Mid-August would be a good time if cowpea is planted in next few days as planned.

Frank Smith raised the question of what surveys need to be completed to show the impact of this project over the next two years at the farm, research, and national policy levels. At the farm level, how will the impact be determined? One way is to measure acceptance of composting waste plus Telemsi rock phosphate plus N., i.e., the farmer at Cinzana has already trained or influenced around 20 farmers.

Copies of PDSS and ADSS were given to rice, peanut, and cotton researchers for use. They need some education or training on it before it can be used nationally. They have been waiting for the integrated DSS model to be available before doing the education. They also will study price (will get product prices and import prices) fluctuations over time and as influenced by other factors.

Afternoon session Lloyd Hossner asked Mamadou to plant, take soil samples, and analyze soil samples in as timely a fashion as possible. We do not want to go into next July without receiving information for 1999. Mamadou said that is possible. We also asked him to review all data for reasonableness before any of it goes into a report. Hossner suggested Adama bring 5 kg of each soil type to do column and Ca equilibrium/chemistry research and to generate additional information for his soils to complement field studies. Adama agreed. We also suggested placing a rain gauge at the site of the core experiment to determine if the amount is similar to the recording rain gauge at the station, around 1.5 km from plots. Lloyd Hossner will write a letter to Adama and copy to Alpha Maiga (Director General, IER) outlining requirements that Adama must meet for entry into Texas A&M, travels costs via IER, stipend paid by Hossner while at Texas A&M, etc. Sotuba will get new AA unit in September. Mamadou wants to have a lab at Cinzana where he can analyze for all items except exchangeable bases.

We left Cinzana at around 3:30 p.m. enroute to Sikasso, about a 4-hour drive. Before driving many miles south, it was evident that rainfall was higher in the area or soils were better or both. About halfway to Sikasso, lateritic soils were much more prevalent and became the main feature. Just south of Cinzana some fields of millet apparently had been planted about 3 weeks earlier and were up to good stands. Fields of either cowpea and/or peanut were also noted. Further south, a few fields of corn were observed. The more lateritic region toward Sikasso was very extensive and supported primarily shrub/forest vegetation. The landscape also went from generally flat to hilly with broad valleys between ridges. Severe water erosion was noted, particularly in the lateritic soils. Slightly more cultured agriculture was noted as we neared Sikasso.

Sikasso Region

We left the Wasserlou Hotel in Sikasso at 8:00 a.m. to go to Senchim and Mali-Agri Services in Sikasso. Senchim is a fertilizer company based in Senegal and Mali-Agri Services is a consulting group (recommending inputs). These companies work closely with the government cotton buying program and farmers' cooperatives. We met the former cotton agronomist with IER (18 years) who recently started work with Senchim/Mali-Agri Services. He provided some

fertilizer tax information for Frank Smith. We traveled to the main ag-research center in Sikasso and met the director and several researchers working primary in the areas of farming systems, breeding, pathology, and entomology. We also met Dr. Joep Slaats, a Dutch Advisor to IER. He represented the Dutch Royal Tropical Institute. We then traveled to the upland cotton/rice station just outside Sikasso. We met the cotton breeder and rice breeder. The cotton breeder selects for both yield and quality. Cotton yields average 1200 kg lint/ha, but some farmers produce as much as 3000 kg lint/ha. All use fertilizers, herbicides, and insecticides. Six insecticide applications are commonly made. The rice breeder breeds for tall rice varieties, no semi-dwarfs. We left Sikasso after lunch and headed toward Bamako. Much of the area appeared to have lateritic soils with brush and tree vegetation. Most cultivation probably occurred behind the trees away from the main road. We saw some corn, cotton, peanut, and millet being grown. Halfway to Bamako, we visited Mamadou's home village and visited several of his cousins, aunts, etc. His cousins appeared to be good farmers and we observed peanut and cotton growing in their fields. Conditions in Mamadou's village were primitive as in most villages. Lands observed between Sikasso and Bamako appeared to consist mostly of lateritic soils. Most of Bamako's solid waste (trash) appears to be spread on lands on the city's outskirts and plowed under. They do not remove plastics so they tend to be very noticeable on the soil surface.

In Bamako

We visited Zana Sanogo, Technical Advisor to the Minister of Agriculture. He explained recent activities of IER in Mali, including tentative plans to develop a fertilizer facility near Niono that would utilize Tilemsi rock phosphate. The plant would cost $2 - 3 million. After initial surveys and planning were completed, the project was moved to the Ministry for Industrial Development, where the project has stagnated. We visited the market in downtown Bamako briefly before final preparations for the return trip to U.S. Frank Smith stayed on to complete his work and will travel to Ghana later in the week. We left for the Bamako airport at 6:l5 p.m. Flight was delayed about 1 hour. We left Bamako enroute to Brussels at 10:45 p.m.

Names and Titles of the Contacts in Mali:

Dr. Ibrahim N'Diaye (Scientific Coordinator of IER, Bamako)
Dr. Abdoul Karim Traore (Director of the CRRA of Sotuba)
Miss Aminata Sidibe (Soil Chemist, LaboSEP)
Mr. Oumar Doumbia (Pedologist, LaboSEP)
Dr. Cheick Hamala Diakite (GIS Specialists, LaboSEP, Sotuba)
Mr. Sibiry Traore (GIS Specialists, LaboSEP, Sotuba)
Mr. Hamidou Konare (Chemist, LaboSEP)
Mr. Oumar Bagayoko (Waste Niono)
Dr. Dore guindo (Director, Niono Station)
Mr. Yacouba Doumbia (Agronomist, Niono)
Dr. Arnold Budelmann (Scientific Advisor to Dr. Dore Guindo)
Dr. Bengaly Cisse (Vegetable Specialist, Niono)
Mr. Zoumana Kouyate (Agronomist, Cinzana)
Mr. Adama Coulibaly (Agronomist, Cinzana)
Mr. Birama Sekou Coulibaly (Agronomist, Cinzana)
Mr. Oumar Coulibaly (On-farm research, Cinzana)
Mr. Seriba Katile (Plant Pathologist and Station Manager)
Mr. Mamadou N'Diaye (Entomoligist< Cinzana)

Mr. Odiaba Samake (Agronomist, Mopti)
Mr. Flakoro Diakite (Station Manager, Koporokeniepe, the Seno Station)
Dr. Mama Kone (Agronomist and Fertilizer Dealer, Sikasso)
Dr. Huep Slatts (Scientific Advisor to the Director of the CRRA of Sikasso)
Mr. Richard Kablan (University of Hawaii)
Mr. Jacques Gigou (Segou - Soil Scientist)
Dr. Zana Sanogo (Technical Advisor to the Minister of Agriculture)