

**Trip Report for Zambia (November 7-15, 2014)**  
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The purpose of the trip was a discussion on Legume Innovation Lab (LIL) project funded by USAID and Root rot fungal pathogens of bean in eastern/southern Africa project funded by USDA-NIFA, with Kennedy Muimui, Co-PI and bean breeder.

Visited Zambia Agricultural Research Institute (ZARI) located outside Lusaka. Director Moses Mwale, M.S., with Dan Walters, UNL, gave an introduction about ZARI. There are four divisions of Crop Improvement and Agronomy (CIA) that deal with 27 crops - Plant Genetic Resources, Soil & Water Management; Plant Protection and Quarantine, and Farming Systems Social Issues; Social/Economic Studies; and Extension.

Presentations were made to 25 staff at ZARI by J. Steadman – NIFA/LIL grant interactions focused on bean rust identification and race structure and root rot, and C. Urrea – Dry bean breeding and Molecular Marker Assisted Selection. A workshop was given for ZARI staff who participated in processing tissue from interface between infected and healthy roots for fungal isolations and DNA processes used for fungal pathogen identification.

The best 15 bean lines for the 2015 planting season were chosen using data from 65 lines planted in 2014 in Zambia. Criteria used were: no root rot, and lower angular leaf spot, common bacterial blight in Zambia and North Platte, NE, anthracnose, and rust plus larger seed size and high stand count. Overall best lines were ADP 188 (G 1375) and NE 34-12-50 (NE line had top yield) + PI 321094-D.

Discussed identification of needs for Zambia to be successful in finding best the germplasm for Zambian farmers, including training for root and crown rot, and foliar disease identification. Research projects can be designed for students from the University of Zambia (UNZA) working at ZARI.

Visited ZARI for a meeting in conference room with plant biologists and pathologists, and Co-PI Kennedy Muimui. Discussed collection of bean leaves with rust from many locations (ecosystems, districts, and farms). Overall collectors should try to represent major bean growing areas where rust is found.

Carlos gave an overview of NE dry bean breeding program, making crosses, field plots (large) on station and on farm. He introduces local students to his breeding program through helping plant, maintain and harvest bean experiments. Visitors from Americas came to see plots, and he hosted a multistate meeting in Scottsbluff, NE. CIAT & UPR/USDA collaborators also visited. Carlos demonstrated field book data file program that gives randomizations and data analysis design for the ZARI staff scientists.

Review of NIFA progress highlights at Nebraska, e.g. M.S. student projects on root and crown rot at UNL. The 2015 bean nursery experiments will have split plots for the 15 best bean lines with 3 replications, with and without fertilizer and with and without stem maggot control in two areas of Zambia, Kasama and near Lusaka. Kennedy presently has LIL nurseries for foliar

diseases in cooperation with Roland Chirwa (CIAT) who coordinates seed distribution for east and southern Africa. Drought nurseries will be co-planned in 10 countries.

Farmer field schools are being used in Zambia to demonstrate improved farming practices – best farmers show other farmers how they obtain better yields and income. Small farm managers need to learn new technologies and new germplasm/varieties as they become available, but all have favorite seed colors they prefer to grow. Kennedy will help show advantages of new bean lines.

Drought nurseries were discussed. July is the best time for planting for the Kasama region, and in Lusaka area. Furrow irrigation is used since this is the dry season. Methods of detecting water use were discussed. Days to harvest, days to maturity, total weight per plot, and 100-seed weight need to be recorded. Several drought indexes like Drought Intensity Index, Drought Susceptibility Index, and Geometric means will be used. The experiments will be planted in side-by-side blocks under drought and non-drought stress. Water stress will be initiated at flowering stage (terminal drought). Top lines under drought stress in Nebraska will be included in the drought trial provided by CIAT, Malawi. The protocol for drought plot management will be sent by Carlos.

We presented seminars at the University of Zambia (UNZA). Students were taking exams, but the Dean of Agriculture, the Associate Dean and Assistant Dean and soil microbiologist attended our seminars. The Associate Dean was a breeder and former student of John Schmid in wheat breeding at UNL. NIFA and LIL bean projects and bean breeding plus Marker Assisted Selection were topics of seminars. The use of DNA identification of pathogens were new methods we introduced to UNZA. Rust races also were new topics. Students from UNZA will be identified to work at ZARI with the LIL and NIFA projects and Kennedy's research program.

Nebraska is benefiting from both LIL and NIFA root rot projects. Sources of resistance to multiple diseases and drought identified in Africa and Nebraska will be introgressed to Nebraska germplasm through hybridization. Both projects are funding 2 M.S. students at UNL (Suzana Fernandez and Mukuma Chikoti from Mozambique and Zambia, respectively). In summer 2015, both students will come to Scottsbluff, NE and spend time learning about Nebraska dry bean breeding activities.