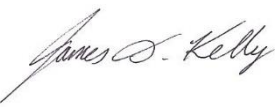


MICHIGAN STATE
UNIVERSITY

DATE: March 6, 2017
TO: Dr. Widders & LIL Teams
FROM: J. D. Kelly, & K.A. Cichy 
RE: Trip Report to Zambia (March 29- April 1, 2017)

Monday March 27: We arrived late in Lusaka and were met by former doctoral student Dr. Kelvin Kamfwa and his wife Clara. Dr. Kamfwa is a lecturer at the University of Zambia – UNZA, and is a cooperator on LIL Project S01.A3 and a co PI on LIL project with Dr. Kramer.

Tuesday March 28: Visited UNZA and met with HC PI Mr. Kennedy Muimui, located in Kasama and we discussed the itinerary for our visit and Dr. Cichy delivered 7-new Multispec Q devises to Kelvin. We met with the Dean of the College of Agricultural Sciences, Dr. Benson H. Chishala and discussed the nature of our visit and our connection with Kelvin. Discussion focused on the current research work underway and the establishment of bean breeding and genetics program at UNZA and the support base from both USAID and the Kirkhouse Trust. We visited the Vice-Chancellor of the University, Prof. Luke E. Mumba where Kelvin had the opportunity to introduce his program, connections with LIL and Kirkhouse Trust who are providing him with funds for a screenhouse and lab equipment to set up a marker assisted lab on campus. The visit was very useful for Kelvin as the VC requested his contact information and seemed enthusiastic to have a young colleague to assist in future biotech workshops on campus. Prof Mumba had previously researched and published on the incompatibility that exists between the two bean gene pools. We shared the concern with both the Dean and VC that the LIL projects will end in Sept 2017 and that future funding is uncertain given changes in Washington. Dr. Kamfwa gave us an enthusiastic overview of all the activities that he initiated since returned to UNZA, including all the crosses he had made and populations under development for MAS for disease resistance, (ANT, ALS, CBB, Rust), bruchid resistance, heat tolerance and yield. His major focus is to improve the local purple seeded landrace, Kabulangeti and the yellow landrace ‘Lusaka’ that are widely consumed in Zambia. His eight students (listed below) joined us in the presentation and Kelvin indicated their individual roles and projects under his direction. Following the discussion we visited the site for the new screenhouse and the field site on campus to see populations being developed, some had been harvested and others were in pod fill stage. Plans are underway to drill a new well to provide irrigation at this field site, so that materials can be grown in the off-season and drought screening can be conducted. We visited the farm buildings where seed was being hand threshed, cleaned and ground for N-analysis and the lab facility where Kelvin plans to set up his MAS lab with equipment being provided by the Kirkhouse Trust. Kelvin will travel to Dr. Gepts lab at UC Davis to run some of the initial markers for ANT and ALS on the populations before the lab is fully functional.



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Following lunch, we travelled to ZARI HQ at Mt. Mukulu and met with the Deputy Director, Mr. Godfrey Mwila. We discussed our visit and the project briefly with him as all financial support for the S01.A3 goes through ZARI. Mr. Mwila recognized the importance of the support for the work underway at the Misamfu Regional Research Station in Kasama and he briefly referred to the \$30m World Bank project that was awarded to Zambia as part of the Coordinated Committee for Agricultural Research Development in Southern Africa (CCARDSA) with country partners in Malawi and Mozambique. Zambia has the lead in grain legumes (common bean, cowpea, groundnuts, pigeon pea, and soybean); Malawi in maize and Mozambique in rice and funding goes through ZARI. We later visited plots on the station where advanced materials from these regions were being tested. The plot was severely damaged by ALS and the discussion focused on planting the differentials to determine the race structure of the pathogen at this site as this would affect which *Phg* genes are deployed for resistance. The surprise was the severity of the disease on elite advanced lines from other countries, suggesting that a more virulent race may be present at this location. Most MA lines showed resistance. No rust was observed. Returned to Lusaka.

Wednesday March 29: We travelled north and east to Kasama – a 500-mile journey by road. On route we visited the ZARI station at Kabwe (1176 masl), met staff and students and visited field site where Kelvin was evaluating RIL population of DOR364 x BAT477 for N-fixation. The soil was sandy and appeared deficient in N as the No-Nod checks were quite chlorotic. ALS was not a problem at this location but the RIL population was derived from the MA gene pool. This large station appears ideal for future bean research given its easy reach (2-3 hr.) from Lusaka. Research is being conducted on sorghum, millet, soybean pigeon pea, cowpea and common bean. Continued journey to Kasama arriving in the evening. During the trip, Kennedy discussed the projects underway with World Bank funding ~ 10 projects on beans with a total of 25 projects on grain legumes and the lead mainly from Zambia, one on low fertility from Mozambique. The project was initiated in 2013, and the last funding round was expected in 2017, as 2020 was the termination date. Legume seed delivery systems were expected to be funded in last round, as they would be shorter term with directly measurable impacts. Other funding was coming from PABRA and Canada with focus on trade in grain legumes. A portion of the funding was being used for training and a number of staff at ZARI were working toward MSc degree at UNZA, with support coming from the World Bank project. No infrastructure improvements at the ZARI stations visited were observed during our visit, with the exception of those funded through the LIL.

Thursday March 30: We visited the Misamfu station outside of Kasama where the major research and breeding activities are being conducted in collaboration with LIL project. The station also focuses on coffee, cassava, sweet potato among other legume crops and livestock. We visited staff (listed below) at the station and Mr. Chikoti Mukuma who was a recent MS graduate from UNL where he worked on bean rust under guidance of Dr. Steadman with support from NIFA root rot project. Mr. Mukuma heads up the crop protection and quarantine unit and is interested in continuing work on bean pathology. We visited the field plots where materials had been planted mid-January and were in full pod set. Nurseries included work being funded through World Bank, PABRA, Irish Aid and

LIL. Stands throughout the nurseries was a major problem and may have resulted from uneven rainfall patterns at planting. This was in contrast to climbing bean nurseries that had had been planted late December. ALS was a problem as was CBB in many plots and rust was observed on only one plot (Durango line) that was severely damaged – suggesting that progress had been made by breeders in eliminating highly susceptible materials. At this growth stage it was not possible to determine if soil borne organisms had contributed to the stand problem but it appeared likely to have the case. In addition to the trials there were seed increases of many new varieties including Chambeshi light red kidney, Lukupa pinto, Lyambai speckled red, Kalambo sugar, Kabale small red, Kalungu white kidney, Kapisha beige, Lwangeneni navy, Lunga, bush purple Kabulangeti type, Mbereshi (NUA 45) high iron red mottle and Kabulangeti purple landrace. There was a large increase of climbing bean Sadzu (formerly MAC23) and this variety looked the best adapted among other climbers in a trial being supported by McKnight Foundation. In addition a single row trial of climbers from Rwanda illustrated a lack of adaptation as these were high altitude climbers (<1500m) and Misanfu is only around 1000m. Discussions focused on need to identify soil borne problems as the stands in the low fertility trial were dramatically reduced. We visited a 1-ha site where Kennedy had set up a drip irrigation system to allow for drought screening in the off season and the seed storage facility being prepared to handle large scale seed increases. Both infrastructure improvements had been funded through the LIL. We discussed the need to improve a screenhouse on the site to allow for crossing and work on bean pathology. Mr. Mukuma is enthusiastic about continuing work on bean pathogens but need a facility to maintain pathogens, host differentials and conduct germplasm screening. An investment in improving the screenhouse with benches, plastic wrap over the screen netting would provide a useful facility for these activities. Later in the afternoon, we travelled west to Kapatu to visit a group (15) of seed growers actively working with ZARI on producing seed of many of the varieties listed above. The group was very enthusiastic having opportunity to produce seed that ZARI provided, and work to retain purity, disease free production that was bought back by ZARI for large scale distribution. Overnighted in Kasama

Friday March 31: Returned to Lusaka. During the trip we were able to contact Mr. Harry Ngoma at the USAID Mission and he agreed to meet with us on Saturday morning.

Saturday April 1: We met with Mr. Ngoma at the hotel and updated him on our trip, observations and recommendations. He talked at some length at some of the mission goals to reduce malnutrition from a high of 43% to 36%. He recognized that grain legumes would play a major role in meeting this goal and was very interested in work being conducted by Dr. Cichy on cooking time, nutrient availability and the potential to further enhance the nutritional value of beans. We discussed climate change and the negative projections that this might have on bean production in the region. He emphasized the need for training and was interested in the efforts that Kelvin was making in this regard particularly with ZARI staff. Other topics included need for bruchid (cowpea weevil, *Callosbruchus maculatus*) resistance to eliminate harvest losses and the work underway to defeat this pest. The looming end date for the project was discussed and the need for interim funding was raised. Following the meeting we returned to the US via Joburg later in the afternoon.

Notes & Recommendations:

- Work by Kelvin Kamfwa to incorporate bruchid resistance into yellow and Kablanketi market classes is very important. Evaluation of end use quality, especially cooking time, should be included in the development of bruchid resistant varieties.
- There is ample research land available at the UNZA farm (Chinese Farm), Dr. Kamfwa has access to this land as well as support with fertilization and cultivation. This farm would be well suited for large-scale field experiments.
- There is a clear need to identify the races of ALS present in different locations in Zambia where beans are being tested. This would facilitate the marker work on which genes are effective.
- Soil pathogens appear to be a major problem at Misanfu site, so soil samples should be collected to allow a determination of the pathogen load in those soils.
- Efforts should be made to upgrade the greenhouse at Msanfu so that it could be used by the pathologist and used for crossing. The program should make every effort to integrate the pathologist into the program given his prior experience with beans.
- The integration underway between programs at ZARI and UNZA is very complementary and should be encouraged in every way.

Prior recommendations made in 2014 that are still valid:

- Select promising lines in the ADP from both locations and consider using them as parents as these materials are Andean and may combine better with local materials for resistance to CBB and tolerance to low fertility. Some of the materials have highly desirable seed traits and prove advantageous in the short run.
- Consider a more in depth study of these lines to determine root traits that might be associated with tolerance to low fertility.

Listed below are the researchers in the programs that we met during the trip to Zambia

<u>Name</u>	<u>Research Area</u>	<u>Organization</u>	<u>Location</u>
Dr. Kelvin Kamfwa	Lecturer, Bean Breeder	UNZA	Lusaka
Mr. Kennedy Muimui	HC PI, Bean Breeder	ZARI	Kasama
Prof. Luke E. Mumba	Vice-Chancellor	UNZA	Lusaka
Dr. Benson H. Chishala	Dean, College Agricultural Sciences	UNZA	Lusaka
Mr. Godfrey Mwila	Deputy Director	ZARI	Mt. Mululu
Ms. Susan Chipandwe	MSc. student, HarvestPlus	UNZA	Lusaka
Ms. Sansala Miyoba	BSc. student, Photosyn Q	UNZA	Lusaka
Ms. Swivia M. Hamabwe	BSc. student, Photosyn Q	UNZA	Lusaka
Ms. Shirley Munadimbwe	BSc. student, CBB	UNZA	Lusaka
Mr. Michael Phiri	BSc. student, photosynthesis	UNZA	Lusaka
Ms. Nalupya Zombe	MSc. student, bruchid resistance	UNZA	Lusaka
Mr. Brian Pule Mwense	BSc. student	UNZA	Lusaka
Mr. Kuwabo Kuwabo	BSc. student, bruchid resistance	UNZA	Lusaka
Mr. Handsome Mugalu	MSc. Student, former farm manager	ZARI	Kabwe
Mr. Stephen Chineshe	MSc. Soybean breeder	ZARI	Kabwe
Mr. Chikoti Mukuma	MSc. UNL – Plant Projection -	ZARI	Kasama
Ms. Atoo Okello	Research Officer	ZARI	Kasama
Mr. Prosperity Chikuma	Technician	ZARI	Kasama
Mr. Robert Lungu	Technician	ZARI	Kasama
Ms. Abigail Lungu Banda	Soil Microbiology	ZARI	Kasama
Mr. Arnold Banda	Ag. Economics, Farm Manager	ZARI	Kasama
Mr. Emmanuel Malaur	Farming systems team	ZARI	Kasama