VOLUNTEER REPORT FORMAT

To be submitted to CRS at the end of volunteer assignment and shared with the Host

1.1 Assignment information

1. Volunteer Name: Reuben DeMaster
2. State of Origin: Pennsylvania
3. Host Organization: St. Amedeus Secondary School
4. Assignment: TZ 74
5. Dates of Assignment: January 6-29, 2017
6. Number of days worked 18

1.2.1 Objective 1 in your SOW

To put an additional 3 acres into vegetable production.

1. Progress with the objective

St. Amedeus Secondary School is a boarding school that instructs 600-700 students. During the school term, it must feed these students along with up to 80 teachers and staff members. The school has an adequate supply of water from a nearby river but this water must be used efficiently. During certain times of the year, the seasonal rains provide enough water for vegetable production. However, during the dry season the school also would like to produce vegetables. A drip irrigation system would help to make better use of the limited water resources.

The school has set aside 3 acres for vegetable production in addition to the 3 acres that it already uses. Brother Charles estimates that they already have the 40,000 liters of water per day that would be needed to irrigate the additional 3 acres. I received estimates from Balton and Puff Ader for drip systems that would cover an area of 30 meters by 120 meters. These companies in Arusha would install the systems and would teach the farmers how to use them. The estimates range between $3.6 million and $4 million TSH and do not include the cost of the tanks and tower. A tower with 10,000 L of water is the minimum for a one acre field and 20,000L of water is the minimum for a three acre field. The tanks must be at least 5 meters high in order to provide enough psi for the drip system to function. In order to irrigate the entire 3 acres, TAHA can keep the costs to $2-3 million TSH not including the tanks and tower.

Erick Joseph, an agronomist from the Tanzanian Horticultural Association, visited the farm and said that he would be able to provide the same service for approximately $2-3 million TSH. Erick's assistance with the planning and installation is a service that members of TAHA receive. St. Amadeus School will join TAHA before the end of this project.

If the school board decides to go ahead with this project, vegetables will be planted in June, July and August and will be harvested in August – November. One this area, the school will be able to grow 9,000 chinese cabbage, 9,000 kale, 9,000 cabbage, 6,700 cucumber plants, 108,000 amaranth, and 108,000 of a local variety of greens. If half of these crops were used to feed the students and half of these crops were sold, the sales would generate significant income. For example, selling 3,000 cabbages at $2,000 TSH each would bring $6 million TSH in sales.

2. Expected impacts/results

The farm will be able to produce a larger crop of vegetables during the dry season when water resources are limited. They will produce enough for the school and will be able to sell the excess to help pay for the project and for the cost of the additional labor.

3. Recommendations[1]

St. Amedeus Secondary School should hire a farm manager to take responsibility for the vegetables, animals, and the other 240 acres around the school. This person should have farming experience, managerial skills, and some education. He will have to spend time studying, networking, and learning new techniques. The right person will bring enough of an increase in productivity that the farm will more than pay for his salary. The right person will be difficult to find.

St. Amedeus School join the Tanzanian Horticultural Association in order to receive assistance with the design and installation of the drip irrigation project. TAHA will also train the farmers in how to use the system.

1.2.2 Objective 2 in your SOW

To increase the long term soil fertility

1. Progress with the objective

During my project in 2015 and 2017, I conducted soil tests for over 30 fields and farms. My test provided information about PH, Phosphorus, and Potassium. Most of my tests were conducted on vegetable and maize fields in the Kilimanjaro region but they also included one test from a field west of Longido. After completing these tests, I visited the Selian Agricultural Research Institue of Tanzania and the ECHO International Farm. Both of these are in Arusha. I spoke with several people about soil fertility including a soil scientist, Rama Ngatoluwa, at Selian. They both confirmed that my findings were consistent with what they knew and we shared some ideas about how to recommend improvements.

The test results show some trends and some variations. In every soil that I tested, I found high levels of potassium of at least 180 lb\acre. Most of the soil tests showed low levels of phosphorus

at 20-70 lbs/acre. Farmers who were using the best practices occasionally were able to raise their phosphorus levels to 100 or more lbs/acre. These practices meant large amounts of aged manure applied to fields over many years. The PH levels in my tests had the most variability and my findings showed a range between 6 and 8. This is a very important piece of information because it determines what steps a farmer should take to improve his soil and crops.

The best practice that any farmer can do to improve his soil and to grow better crops is to apply as much aged manure as possible every year. In order to do this effectively the farmer must think about how he treats the manure. Cow, goat, sheep, pig, and chicken manure should be collected and formed into a pile. A source of carbon should be added to the pile. This means dead plant material such as corn stalks, brown banana leaves, or other leaves. The pile should be aged for 4-6 months. When it rains, it is important to cover the pile so that the rain water does not wash nutrients out of the manure. At planting time, the manure can be applied around every plant. Large quantities are needed to improve the soil and most farmers will not be able to get enough manure for their fields.

Another effective way to raise low phosphorus levels in the soil is to apply soft rock phosphate in a granular form. Minjingu sells this product in bags and it is available to farmers. An application of 100 KG per acre on two different years will provide a good start toward increasing phosphorus levels. It is very important to know that this can only be accomplished with acidic soil. Soil that has a PH over 7 is alkaline and the soft rock phosphate will not be available to the plants with that PH. A farmer can lower the PH of a soil by applying large amounts of sulphur and by yearly applications of NPK fertilizers. A farmer can raise the PH of the soil by applying lime.

An even greater problem that low phosphorus levels is the low levels of organic matter present in most agricultural soils in Tanzania. Organic matter is the basis of healthy soil fertility and without it soils cannot be healthy and produce good crops. The only way to produce crops in soils with low organic matter is to apply large amounts of chemical fertilizers. The farms that I have visited would have to increase their fertilizer applications by a factor of between 2 and 10 times the amount in order to reach the levels applied by highly productive farms. This practice has many harmful consequences which are largely ignored by modern farmers.

Tilling the soil reduces the level of organic matter and farmers must make a great effort in order to change this trend. Organic levels in the soil can be increases and soil fertility can be restored by using several important practices. First, farmers can rotate between annual crops for harvest and crops that are planted that improve the soil. After a maize or vegetable crop is produced, a field should be planted with another crop that builds soil health. It could be a grass crop that grows for a year or a legume crop that grows for 6 months. These crops are called cover crops or green manures and they will accomplish great things for a farmer's soil.

Both the Selian Agricultural Research Institute of Tanzania and the ECHO farm are conducting trials with some of these crops. The crops include cannavalis, macuna, lablab, and others. Each of these crops has different benefits and uses. These crops add nitrogen to the soil and when used properly can eliminate the need to purchase nitrogen fertilizers to grow crops such as maize. If these crops are worked into the soil, they will add large amount of organic matter to the soil and will dramatically improve soil health. Rama Ngatoluwa spoke enthusiastically about the benefits of macuna and said that if a farmer would test this crop in one field, his farm would be changed dramatically. Small amounts of seed for these crops are available at the ECHO farm in Arusha. Please see the document "Green Manure Options for Tanzania" for more information.

2. Expected impacts/results

Improving soil fertility would create more profitable farms that would be able to grow more than enough food for their needs. The crops would have increased nutritional value and disease resistance. Soils would retain more water and less fertilizer would be needed.

3. Recommendations

I have not found a way to overcome the obstacles to beginning this process. This is a job for a farmer who has the skills to read, plan, communicate, manage, and who will give his attention to this process over a long period of time. This farmer must have prudence and fortitude and faith and hope and love. The best option would be for St. Amedeus School to hire someone to manage the farm.

The best way to make changes in farming practices is to grow experimental plots. These plots could use cannavalis, macuna, and lablab to supply nitrogen and to build soil quality. Several farms should start trials and they should speak with each other to coordinate plans. Farms will have to share seed and ideas. I have given these varieties of seed to the Kilacha brothers to use at the friary farm. The first step is for them to plant the seed in order to produce more seeds. I have also left cannavalis seed with St. Amedeus. Other schools can be included once more seed is available. This is not a short term project but this is what will bring long term results.

1.2.3 Objective 3 in your SOW

To reduce the use of chemicals and to use them properly

1. Progress with the objective

The farmers at the school use a mix of chemicals for insect and disease control. These include mancozeb, copper, abamectin, cypermethrin, and profenofos. I am not sure what quantities that the farmers use but they did not seem to be using them according to the safety recommendations. Sprays are used without any protective gear and the farmers do not observe the 3 day no entry rule after spraying. I am also certain that the 14 day harvest interval is not observed. This presents a danger to both the farmers and to the people eating the food. Even if the food is adequately washed, it will not remove the chemicals.

While in Arusha, I visited the Tropical Pesticide Research Institute. I spoke with the director and he confirmed that these chemicals must be used according to the safety recommendation and that they will damage the human nervous system. Every spray has directions about how many days to wait between the final spray and harvest. This is called the harvest window and these dates must be observed.

Several techniques can be used to reduce the use of these sprays. The first is building the soil fertility. Second, the farm should learn how to use natural sprays such as soap, neem, and utupa. Third, chemical sprays should be only used when necessary and only according to the recommendations. Please see the document “Natural Sprays” for more information.

2. Expected impacts/results

The long term health of the farmers and of the consumers will improve.

3. Recommendations

Schedule a yearly training session provided by TAHA or another organization.

1.2.4 Objective 4 in your SOW

To teach the school students about soil fertility and natural practices.

1. Progress with the objective

Success in agriculture affects everyone in Tanzania. All people are connected to the farms in some way. If the fertility of the soil would improve and if farmers would be able to produce better crops and to reduce chemical use, everyone would benefit. There are great challenges to overcome in order to see this happen and everyone must help in this effort.

Schools have an important role to play in this process. Teachers and students have opportunities to learn chemical and biological processes that most farmers do not have a chance to study. Chemistry students could learn the nutrients required to build a healthy soil. Biology students could learn how nutrients are absorbed and used by plants and what happens when these nutrients are absent. Students could learn about the harm that chemical sprays can cause. There are many ways in which this learning could happen naturally during class time or when the students are helping in the fields. This knowledge can be used in service to the farmers.

I have taught a chemistry teacher how to use the soil test kit and have let it for use in the school lab. There are approximately 20 tests that can be completed with the kit. I have also collected email addresses for teachers in the biology, chemistry, and English departments. I will send them some information to help them learn more about the needs of the soil. I will ask them to begin thinking about how to integrate some of this knowledge into classroom instruction.

2. Expected impacts/results

Teachers should start to consider how they can better use their education in service to others – espially farmers. They have opportunities for learning that farmers often do not have. Their knowledge could be used to assist agriculture. Students also may be able to gain some knowledge that they can share with others or they might think about how their future career might assist farmers.

3. Recommendations

Students should be instructed in the basics of balancing soil nutrients and in the importance of soil organic matter. This knowledge requires both chemistry and biology and could be taught in either or both classes. At least two teachers should spend time studying these things so that they will be able to instruct other teachers, students, and maybe even farmers. I am willing to remain available through email to be of assistance. I can send materials for study and answer questions as needed.

TAHA has an interest in some classroom instruction and could be used as a resource. Erick Joseph has expressed a desire to be involved with the students.

1.3 Recommended future volunteer assignment

Plan training sessions for the community

1.4 Action Plan

Recommendation	Specific Action	Responsible person	By when
1.Join TAHA	St. Amedeus School should become a member of TAHA and continue to consult with Erick Joseph. Erick will help with the installation of the drip system as well as the implementation of the vegetable plan.	Brother Charles	
2. Apply soft rock phosphate to increase phosphorus level	St. Amedeus School should apply 100 KG of soft rock phosphate per acre to all of the vegetable fields that will be in production next year. Additional soil tests should be completed next January with the assistance of TAHA.	Brother Charles	
3. Train farmers about chemical use	A training should be scheduled with TAHA in order to instruct farmers in the safe use of pesticides.	Brother Charles	
4. Experimental plot	A small experimental plot should be set up in order to grow cannavalis and produce additional seed. The plot will be less than ¼ acre.	Brother Charles	
5. Select teachers	Several teachers should be selected who could begin learning the principles of healthy soil fertility. This should include crop rotations, green manures, soil nutrients, and organic matter. I will leave materials for study and will be available to send other resources.	Brother Charles	
6. Hire a farm manager	In order for the farm to achieve productivity and increased fertility, there should be someone who can effectively manage the farm	Brother Charles	

	activities. This person could also take responsibility for the animals and maize.		

1.5 Number of people Assisted

1. Through formal training - 10
2. Through direct hands on practical assistance - 12
3. Out of these above, number of host staffs - 2
4. Training/assistance by field

Category	**Total**	**Males**	**Females**
Members/ owners		2	
Employees			1
Clients/ Suppliers		20	
Family Members			
Total		22	1

1.6 Gender

1. What gender roles did you recognize in your host community? Did these roles play a part in your assignment? How?

Women performed tasks such as cooking, cleaning, animal husbandry, farm work, secretarial work, and teaching. I spoke with women who were scientists, school board members, agricultural consultants, and sales people. Men were teachers, watchmen, builders, maintenance workers, drivers, and farmers.

2. How might CRS or the host organization improve opportunities for the women in this host or host community?

1.6 Value of volunteer contribution in $

1. Hours volunteer spent preparing for assignment - 10

2. Estimated value of all material contributions volunteer contributed to host during assignment -

1.7 Value of hosts' contribution in $ (Please consult the host as well)

1. Meals $322,000 TSH

2. Transportation $360,000 TSH

3. Lodging

4. Translation

1.8 Host Profile Data:

Did you obtain any data that supplements or corrects the data in the existing host information as detailed in the SOW? Please list it.

The school is within a walled area of about 40 acres. The school grows up to 40 acres of maize on their land. They allow other farms to use land on the perimeter to prevent the neighbors from taking maize from the school. The area set aside for future vegetable production is about 5 acres. The priest assigned to the school has changes. Brother Charles Lekule is the headmaster and his email address is charleslekule@yahoo.com.

1.9 Recommendations for CRS: