



Cotton Production and Kwashiorkor

Could Organic Cotton Bring Back an Available Source of Protein?

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Introduction

Kwashiorkor, malnutrition caused by a lack of any of the essential amino acids in the diet, affects many people in Africa. Kwashiorkor mainly affects children, especially after weaning. The people of the village of Sanambele, Mali have identified kwashiorkor as their second major constraint (after malaria) to achieving their desired quality of life. In 2008, the health center of Sanambele identified 23% of the 0 to 3 year old village children either at-risk for or with kwashiorkor. Those of the team who lived there noticed the children's typical diet was missing essential amino acids tryptophan and lysine. Some of the best sources for tryptophan produced in the village are red meat, dairy products, bananas, soybeans, and nuts.

Sanambele is a small Malian village in West Africa with a population of around 1200 people. Now there is a major concern that these village children have lost an important source of protein, grasshopper snacks, because of the use of pesticides on the cotton crops. Mothers in the village have told their children not to eat the grasshoppers anymore for fear of poisoning from grasshoppers ingesting pesticides on the cotton crops. Without this source of protein, the children are finding it difficult to ingest enough complete proteins to remain healthy. Sanambele farmers grow several food crops such as millet, sorghum, corn, and rice all of which have some tryptophan in them, but not enough to prevent kwashiorkor (Turley 2011).

Mali is one of the top cotton producers in Africa. Cotton production in Mali has declined recently because of the high cost of inputs and low gains made from the crop (Coulibaly 2011). The main pest Sanambele farmers deal in their cotton crops is the cotton bollworm and is the most problematic during the larval stage when it feeds on the reproductive structures of the cotton plant. The main method of dealing with the pests is the use of pesticides. Since many of the crops grown by the Sanambele farmers are grown for food, cotton is an important crop because it can be exported into the world market and the farmers receive money. Even with the high cost of the inputs, cotton production is still a major part of the Mali economy and a possible cause for an increase in the number of children that are affected by kwashiorkor.

Hypothesis

A crop associated barrier strip around the cotton fields will reduce the amount of pest damage where Sanambele farmers will not have to use pesticides, and the children will be able to eat the grasshoppers.

Methods

- Intensive peer reviewed article research exploring cotton production, pests that infest cotton crops, Mali grasshoppers, and nutritional properties of the grasshoppers, with the search engine CAB Direct.
- Keriba Coulibaly, a scientist of L'Institut d'Economie Rurale Sikasso, Mali, has regular correspondence with the Sanambele village. Keriba and I have exchanged several e-mails over the semester.
- The authors of the AGSC 465R course readings and various internet websites provided valuable information about cotton, grasshoppers, holistic goals, and how others have addressed problems in Africa.

Results

There has been a recent decline in cotton production in Sanambele because of high cost of inputs and low yields and price of cotton. According to Keriba, it was discouraging for the farmers to put so much effort and receive so little in return (Coulibaly 2011). The Malian government is trying to encourage farmers to grow cotton by reducing the cost of fertilizer and increasing cotton prices.

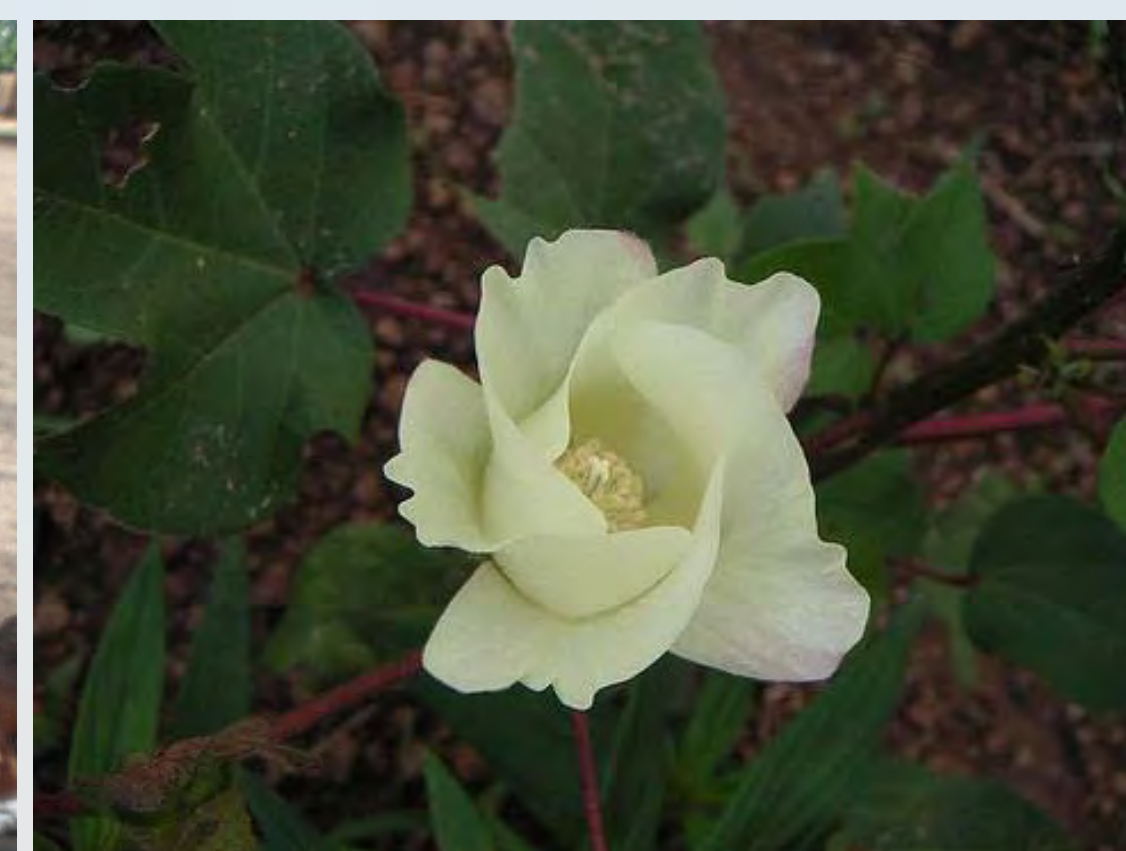
Mali's economy is heavily based on agriculture due to its large rural population. Cotton and livestock make up a large part of Mali's exports (Martin et. al. 2005). Pests such as the cotton bollworm feed on the flowering parts of cotton, the damage could destroy a crop. In the past chemical such as DDT/ endosulfan/ methylerithion mixtures were used to control the pests (Martin et. al. 2004). Today, Mali uses more organophosphorus pesticides, not nearly as harmful as past mixtures.

Crop associated barriers have shown reduced infestation rates of cotton bollworms (Ratnadass 2009). A barrier trap strip of sorghum was planted around cotton fields and it was found that pests infested the barrier strip instead of cotton. Another method that has helped reduce pests in cotton is manual topping, cutting shoot tips on cotton plants. The study showed significant reduction in bollworm infestation on plots that had been manually topped (Renou et. al. 2011). Growing organic cotton is becoming more prevalent in Mali because the cost of inputs is greatly reduced.

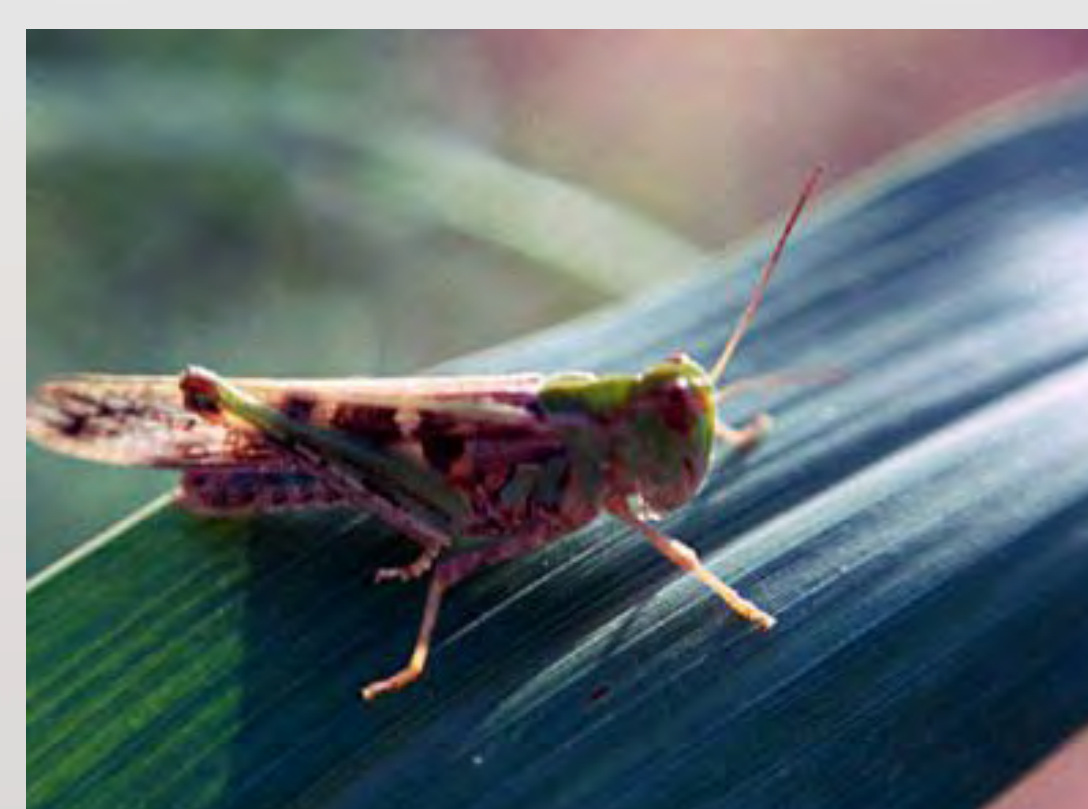
Grasshopper snacks provided a healthy treat for children and helped with the lack of tryptophan in the diets. The two main species of grasshoppers are *Kraussaria angulifera* and *Oedaleus senegalensis*. Children ages 4-6 require up to 24 grams of protein per day. The people of Sanambele are very active, working from the time the sun rises until it sets, with such an active lifestyle both adults and children need more protein and carbohydrates to stay healthy. The villagers grow almost all the food they consume. Their major food crops, are millet, sorghum, rice and corn, all excellent sources of starches and fiber. Cowpeas and peanuts are an excellent source of protein that the children have access to, and some meat. Without all of the essential amino acids, kwashiorkor has an increased chance of setting in.



Sanambele children eating a grasshopper snack.



Reproductive structure of a Mali cotton plant.



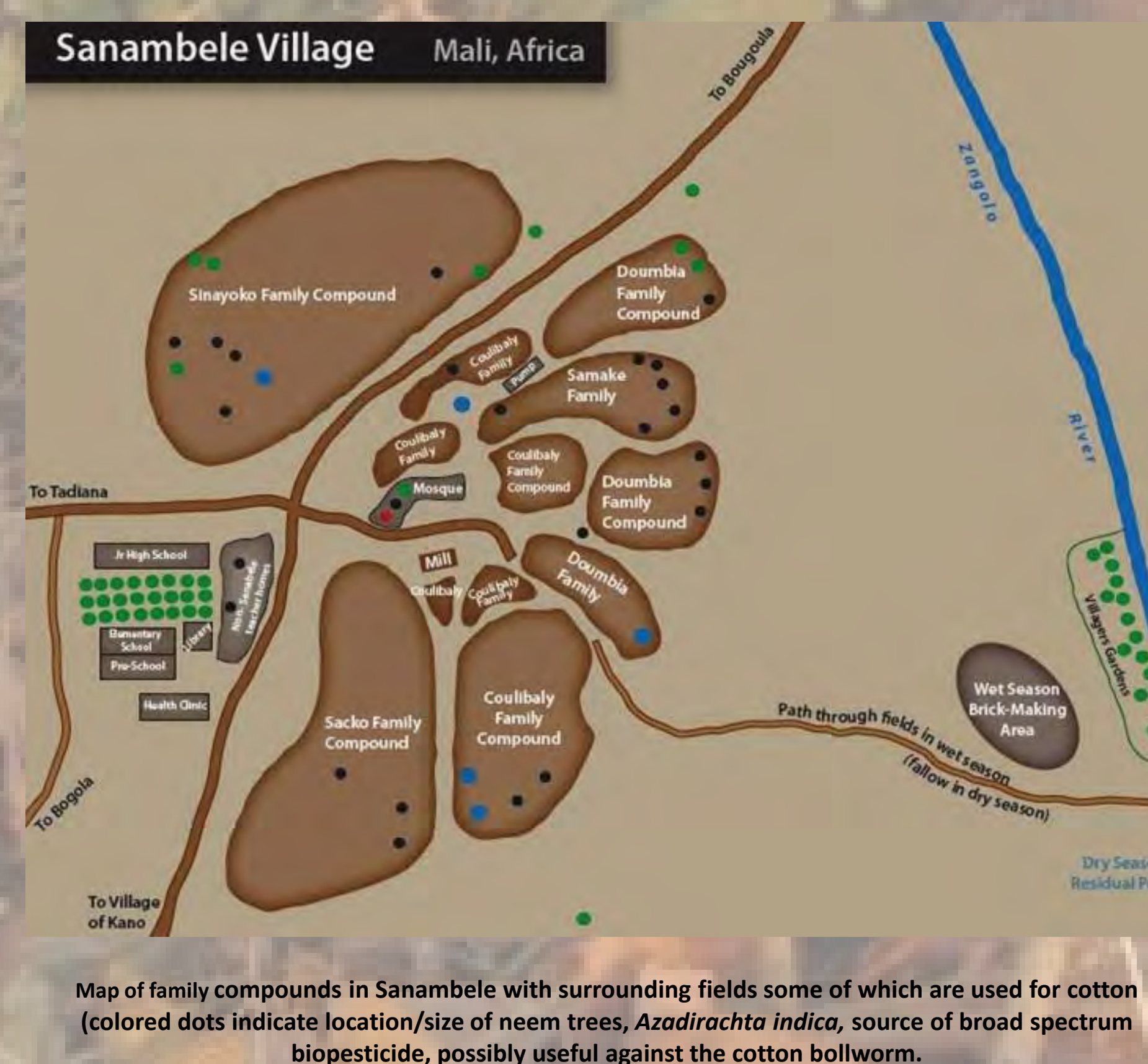
Senegalese grasshopper, *Oedaleus senegalensis*



desert locust, *Schistocerca gregaria*



Cotton harvesting in September in Sanambele, Mali



Map of family compounds in Sanambele with surrounding fields some of which are used for cotton (colored dots indicate location/size of neem trees, *Azadirachta indica*, source of broad spectrum biopesticide, possibly useful against the cotton bollworm.

Discussion and Conclusion

Cotton is an important resource and is important for farmers to grow a large and healthy crop. Regular use of pesticides pests are developing a resistance (Martin et al 2005) and polluting the grasshoppers as a snack food and the children have lost a source of protein.

Grasshoppers are very good sources of protein, around 20-25 grams of protein for medium to large insects. The children would need to eat large amount of grasshoppers to gain the required amounts of protein in their diet (Fejes 2009). Grasshoppers are eaten as a snack when the children are out helping in the fields.

Grasshoppers are not the only source of protein available. Peanuts and cowpeas are also an excellent sources. Organically grown cotton could help with many problems. The use of pesticides, a major part of the cost of inputs, and would reduce the amount of cost cotton requires (Boyer 2005). A crop associated barrier strip would reduce pests in the cotton, pesticides would decrease and an excellent protein source would be available to the children. Some organic cotton production is already used parts of Mali and has been grown successfully.

Pesticides are a common part of growing cotton. The pesticides can be absorbed through skin, eaten with grasshoppers that have. While grasshoppers are a readily available source of protein and a fun activity for the children to catch, pesticides have rendered them unfit to eat.

Cotton production has become one of the most important areas of export for Mali. Cotton is not a food crop and only provides the people of Sanambele with financial gain. The research that I have done indicates that it is possible to grow a profitable amount of cotton for export without using pesticides. Organically grown cotton could help with many issues that are caused by the use of pesticides. By using a crop associated barrier strip around the field, farmers would not feel the need to use as much pesticides. Manual topping could also help keep the pest infestation rates down. With an organic crop, the farmers could expect more income off of their crops without the costs of using pesticides to manage the pests.

The village of Sanambele has all of the necessary resources to stop kwashiorkor from being a problem. However, with their current traditions and management practices, kwashiorkor is a real threat. The villagers do not need to lose their traditions to fix this problem and all that is needed is a shift on the management techniques that could help improve goat kid survival rates, or on the processes of growing cotton to reduce the use of pesticides. With some outside help to point them in the right direction, the villagers could solve the problem in their own way.

Recommendations

- Use meter square plots testing different crop associated barrier strips. With a successful barrier the need for pesticides would be reduced and the children would be able to eat grasshoppers again.
- Shift time children eat grasshoppers to the time before pesticides are needed.
- Different insect for a protein snack such as ants. Using a sticky trap of honey or sugar would be effective in catching them in quantities that could be useful.
- Lengthening the time of breastfeeding. A method of birth control would need to be available to ensure the proper length of breast feeding time.
- Raising a herd of goats and cattle for the children to eat would provide a source of protein. This idea has already been talked about by the Women's Association.

Acknowledgments

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