



Mung bean (*Vigna radiata* L.): Protein-rich legume for diet diversification and malnutrition reduction in the Casamance, Senegal

Sukaabe Janngo II

Report for Q4 (August/September) – 2022

Introduction

Counterpart International (CPI) in collaboration with Virginia Tech will be engaged in a new Food for Education Program in the Casamance region of Senegal. The five-year project will be similar to the project CPI implemented in the St. Louis Region of the country from 2019-2021. As such, we will use lessons learned from St. Louis to strengthen the capacity of communities to produce mung bean and other crops in ecologically and climatically diverse regions of Senegal (Figure 1). We expect the growing conditions and cropping systems in Casamance to be drastically different from the northern region of Senegal where CPI successfully implemented a mung bean pilot project between 2019-2021. Some of the obvious differences are rainfall amount and duration, the length of the growing season, and soil types. In the St. Louis region, which forms part of the Sahel, the rainfall ranges from 300-400 mm while in the Casamance, up to 1200 mm rainfall is possible. The rainy season takes place roughly between July and November and lasts up to six months in the Casamance vs less than three months in St. Louis region. Agricultural production is heavily dependent on the annual rainfall in the Casamance compared to the St. Louis region where irrigation is the main water source for agriculture.

Figure 1. Map of Senegale showing the diverse ecological and vegetation zones

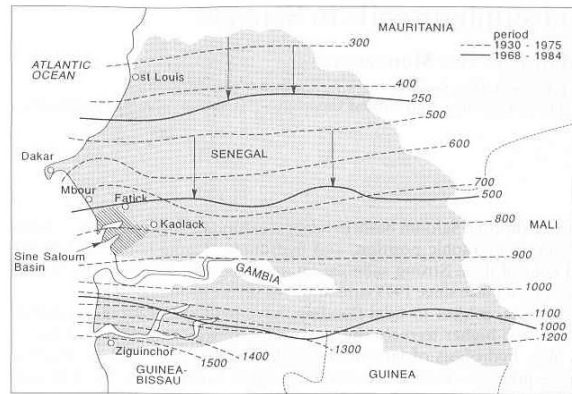
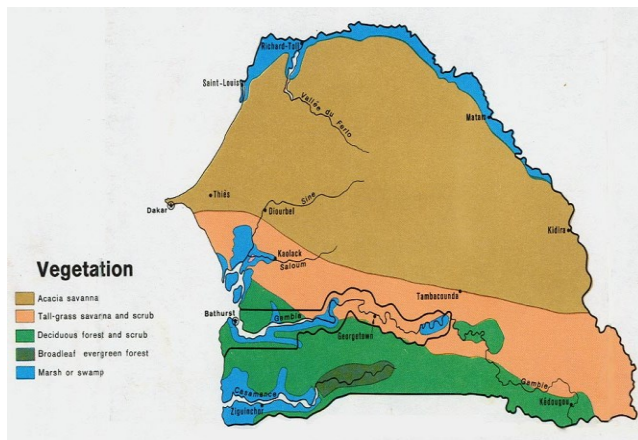


Figure 1 Location of the Sine Soloum Basin, Isohyets showing decreasing rainfall in Senega

Introduction of mung bean in the Casamance – August/September, 2022

In August, 2022, we visited 16 villages, nine in Kolda, and seven in Sedhiou. The overall objective was to establish baseline information to determine the suitability of the communities/schools to initiate the mung bean project associated with the school feeding programs.

Specific objectives included:

1. To conduct a baseline survey of target areas, farmers, and communities to gather data on land and water resources, labor, production practices, cropping systems, the staple diets.
2. Introduce mung bean to the selected villages/schools and discuss the potential use of mung bean and all aspects of agronomic practices.
3. To determine communities/private farmers responsible for growing and donating mung bean to school feeding programs.
4. To gather baseline information about Agriculture Education and STEM Learning (with a focus on agriculture and mung bean)
5. Based on data from #4, develop a user-centered learning approach by creating collaborative learning between teachers in each of the villages through a teacher training focused on developing experiential learning teaching skills, hands-on STEM learning, and linkage to existing lessons and materials.

The region of Kolda

Selection of schools and source of mung bean for school feeding programs

Before we visited the villages and schools, we met with member of the Inspection de l'éducation et de la Formation (IEF) at each department (Kolda, Velingara, and Medina Yoro). The visit with IEF members gave insights to how the schools and communities are organized and function. Most of all, we learned about the individual villages, and the level of collaborative engagements. Erika Bonnett (Virginia Cooperative Extension Specialist-4-H, and ESTEM education) was able to learn the gaps in lecture-based education and hands on experiential learning experiences. All the IEF we visited express a great deal of interest in implementing teacher training program, STEM education, and experiential learning models and tools. Following our meetings with the IEF, we visited 10 preselected villages/schools for the mung bean program (Departments of Kolda, Velingara, and Medina Yoro Foulah) (Table 1). Within Kolda, we will have a mixture of both elementary and pre-schools totaling 2150 students.

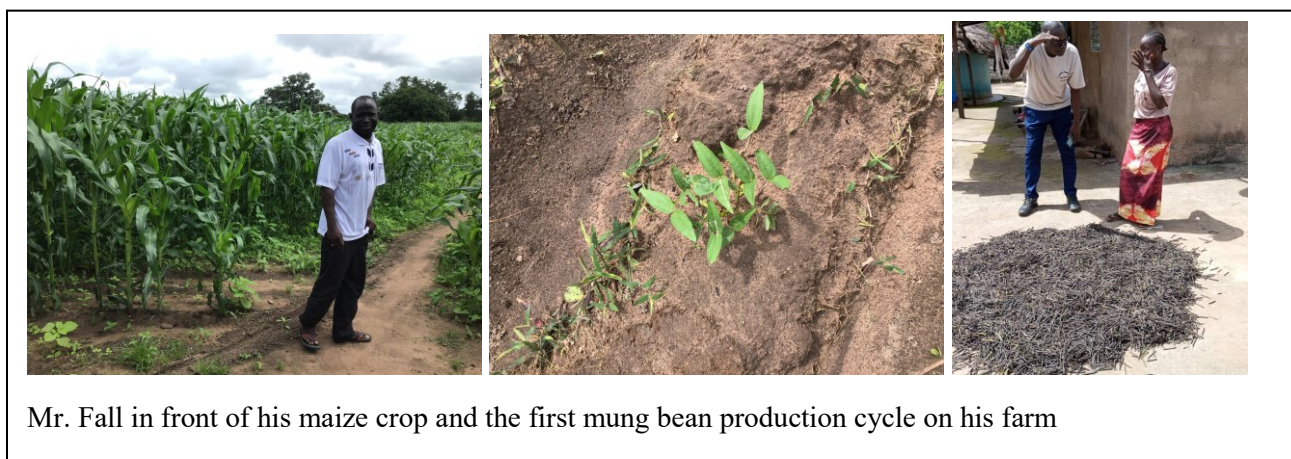
Table 1. Villages selected to implement the mung bean project – Kolda (11 schools)

2022-2023 target schools	Region/ Department	Grade level/ Education	Number of students	Mung bean contribution to the school feeding program through:
Sare Sara	Kolda	EE	182	Community garden/farm
Thiara	Kolda	EE/CTP	235	Community garden/farm
Bantankountou Maounde BantaKountou Yel	Kolda	CTP	90	Private producer* (Mamadou Fall) 2 private farmers
Sare Samba Tchika	Kolda	EE/CTP	262	Private producer*
*Saré Moussa Ndour (female head master) 11 teachers	Kolda	EE	414	Community garden
*Nemouratou (Erika Balde is great head master) (new)	Kolda	EE	146	
Sare Yoroyel	Velingara	CTP	159	Community garden/farm
*Niandouba	Velingara	EE	244	Community garden/farm

Sare Coly Salle	Velingara	CTP	62	Private farmer – Mamadou Mbamlo
*Temento Aladie	Velingara	EE	169	Community garden/farm
Number of students	1963			

* Private producers will provide mung bean to the school - not selected by CPI – we will provide general trainings – curriculum

Mung bean contribution to the school feeding programs will be through community gardens and private producers. One of the private producers from Bantankountou Maounde is Mr. Mamadou Fall. He is a large-scale maize grower. Based on our interaction with him, he will be an outstanding collaborator. He is highly engaged and understands the value of the school feeding programs. Mr. Fall discussed his production/cropping systems including fertilizer, labor inputs as well as challenges associated with crop production. He stressed the value of the organic matter he returns to the soil in reducing his total fertilizer needs. For example, he said: It is recommended that he uses seven bags of NPK (15-15-15 analysis) on 2.5 hectare of maize. Because he is using organic matter, he said he only uses four bags of chemical fertilizer (NPK) reducing his chemical fertilizer use by at least 40 percent. It is one of our overall goals to emphasize the use of organic soil amendments to reduce dependency on purchased chemical fertilizers. The long-term sustainability of agricultural production in the Casamance can only be realized if agricultural inputs are managed to include alternative fertilizer sources like compost, organic matter, crop rotation, and incorporation of crop residues into soils. Incorporation of crop residues like maize, sorghum,



Mr. Fall in front of his maize crop and the first mung bean production cycle on his farm

millet and other crops has a potential to provide a balanced supply of plant nutrients. We can utilize Mr. Fall’s farm to pilot several projects like composting, the use of crop residues for livestock and add organic matter to the soil, etc. Mr. Fall also becoming an early adopter of the mung bean project. He already planted and harvested mung bean.

In addition to the mung bean that would be grown in community gardens and by private producers, we will promote the production of mung bean by women’s organizations for school meal programs and household consumption.

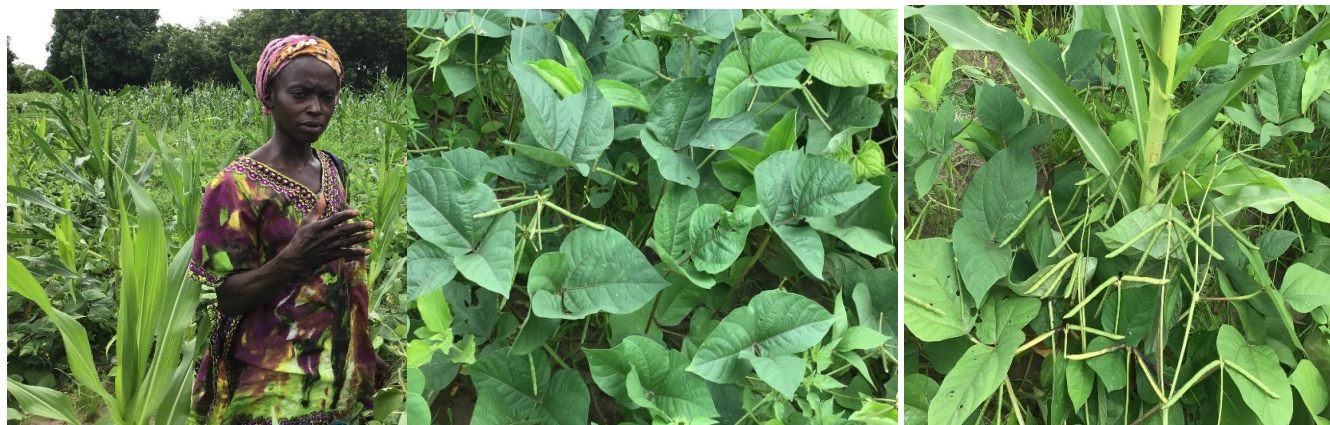
The Region of Sedhiou

Similar to Kolda, in Sedhiou, before we sited the villages and schools, we met with members of the Inspection de l’éducation et de la Formation (IEF) at each department (Sedhiou, and Bounkiling). The individuals we met from IEF were very helpful not only in identifying villages that are potential

collaborators for the mung bean related projects, but also offered to help CPI-VT advance the school feeding programs. We visited seven villages/schools across the two departments. The schools were mainly elementary with a total of 2,283 students (Table 2). Although the mung bean contribution to the school feeding programs at Sedhiou might be mostly through community garden/farm, we have several potential private farmers and women’s organizations interested in growing and providing mung bean to school feeding programs. One example of private farmer is Mme Fatou Binetou. She is currently growing mung bean in association with maize. Fatou is also linked to the local schools and women’s organization. We will be working with Fatou closely to develop women-centered programs like food safety, recipes, and others.

Table 2. Villages selected to implement the mung bean project – Sedhiou (9 schools)

Village 2022-2023 target schools	Region/Department	Grade level/Education	Number of students	Mung bean contribution to the school feeding programs through:
*Bona	Sedhiou/Bounkiling	EE	458	Community garden/farm
*Faoune	Sedhiou/Bounkiling	EE	372	Community garden/farm
*Boungary	Sedhiou/Bounkiling	EE	297	Community garden/farm
*Medina Demba Gano (EF)		EE	284	
*Tuba Moude (EF)		EE	338	
*Keur Habibou	Sedhiou/Sedhiou	EE	241	Community garden/farm
*Tourecounda	Sedhiou/Sedhiou	EE	210	Community garden/farm
Massaria	Sedhiou/Sedhiou	EE	291	Community garden/farm
Nguindir	Sedhiou/Sedhiou	EE	414	Community garden/farm
Number of students	2,283			



Mme Fatou Binetou from Sedhiou produced mung bean in association with maize - 2022

Conversation with the community to identify need-tailored solutions (Kolda and Sedhiou)

Other topics discussed during the meetings included learning about the community including their cropping systems and the type of crops they grow (Table 3). Table 3 shows the crops commonly grown and consumed in both regions. During our conversations with the communities, it was evident that their diet is based on cereal crops (mainly rice and maize) and some vegetables. Although some of them grow cowpea during the rainy season, cowpea is not one of the main crops that the communities depend on as a staple crop. Also discussed were the seasons they grow certain crops, and the time of the year when they experience food scarcity (hunger period). Most of the community members we visited said August/September are the two months where they have minimum supply of grains. One person said, “the hunger period is the entire rainy season.” We talked about the potential benefits of growing mung bean (short cycle crop) in reducing the hunger period. To the question “what are the major constraints to agricultural production?” in most cases, the communities discussed issues associated with soils and soil fertility, lack of fertilizer (both amount and timely supply), and lack of quality and high-yielding crop varieties. Our initial conversation with the communities in Kolda and Sedhiou about finding “a room” for mung bean production in their existing agricultural systems was very positive and, in most cases, they immediately understood the benefits of diversifying both their cropping systems and benefiting the school feeding programs.

Table 3. The main food crops (row and vegetable crops) grown in the Casamance regions of Senegal .

Vegetable crops grown in most villages	Fruits	Cereal grains	Grain legumes	Spices and herbs	Meat/milk/eggs
<ul style="list-style-type: none"> ● Red and yellow onions (for household consumption and cash) ● Potato ● Sweet potatoes ● Cassava ● Squash ● Cucumber ● Carrots ● Cabbage ● Eggplant ● Tomato ● Okra ● Hot peppers of all kinds, including Pema. ● Bell peppers ● Leafy greens – several types of lettuce 	<ul style="list-style-type: none"> ● Mangos (lots) ● Watermelon ● Melons ● Bananas ● Lemon ● <i>Tamarindus</i> 1 eaves and fruit pod 	<ul style="list-style-type: none"> ● Maize (primary cereal grain) ● Rice ● Mille ● Sorghum ● Phono 	<ul style="list-style-type: none"> ● Peanuts ● Cowpea ● Mung bean (new crop) 	<ul style="list-style-type: none"> ● Garlic ● Ginger ● Chive ● Mint ● Parsley ● Leaves of several plants cowpea, and mung bean?) 	<ul style="list-style-type: none"> ● Beef ● Chicken ● Fish (fresh and dried – more common) ● Lamb ● Goat
Vegetable oil, mustard, catchup, mayonnaise, salt, black pepper, Guedge (smoked, dried fish) and yete (fermented snails)					

The conversations we had with the communities will be very helpful in “custom tailoring” the mung bean programs to fit the community’s needs. Here is more information we gathered from the communities in Kolda and Sedhiou.

- Community understands the need for canteen, but does not have the resources to have canteen. The reasons for school canteen:
 - Some of the students walk 3-4 kilometers to get to school.

- If they go home for lunch, they may not come back due to the distance, resulting in low attendance. If they do come back, they come late.
- The community mentioned the danger the children often face on the road to-and-from home.
- Communities will collaborate to implement the CPI model of school feeding programs. The community said “we are engaged and ready” to implement the school meal programs.
- Specially in Sedhiou, women expressed a great deal of interest in the mung bean project (total engagement from planting to consumption of mung bean).
- One woman in Sedhiou expressed the importance of education associated with a school feeding programs (nutrition, sanitation, and food safety).
- Communities discussed the lack of clean water for drinking and sanitation.
- In Sedhiou, several communities, as evidence of high community engagement, told us that they had invested and provided water supplies for the school, repaired and built desks for the school, and built a fence around the school parameters.
- Overall, the communities showed great deal of interest for all aspects of the mung bean project.

Focus on Curriculum – teaching and learning using experiential learning models (Erika Bonnett)

During my 10 days in the Casamance in the regions of Kolda and Sadhiou we were able to meet with educational directors for each of the departments in which we would be working. These meetings were important to the success of the project because not only did they give us a chance to let the educational directors know about the school-based education part of the project but also introduce Erika. They also gave us an opportunity to get feedback and buy-in from the educational directors, listen to training needs that align with our project and the curriculum, and create a plan of work based on the needs of the schools and educational directorates. These meetings also gave us an opportunity to meet and facilitate discussion with some school masters to get information about the individual schools, sizes of classrooms, and numbers of teachers. All this information went into melding the original training plan that was piloted in the Saint Louis region to one that we will use for the Casamance Region. The idea is to facilitate training and networking with headmasters and educational directors first, then introduce lessons to cohorts of teachers in areas of schools that make sense. The goal is to create groups that can work with each other and share ideas of what works and doesn't work throughout the project. The information and discussions during our visits were very influential in tweaking and creating the plan of work for the November/December visit.

Challenges as Opportunities

The visit to the Casamance to seek community engagements for the introduction, production, and utilization of mung bean revealed both challenges and opportunities. In the St. Louis region where we successfully implemented the mung bean project, we run the programs through the School Management Committee (SMC). In fact, the key success of the programs centered around the SMC that linked the schools and the community effectively. In Casamance, although the structure of SMC exists, it appears that the farmer organizations would be the linkage between the school and community. The advantage of having the farmer organization as a linkage between the school and the community would be:

Opportunities

- The farmers' organization can provide access to a wide range of groups such as: commodity-oriented organizations; organizations that focus on specific sub-groups such as women's organizations, youth organizations, and youth clubs; organizations that are cooperative in nature and more.
- We will be able to benefit from the infrastructure and networks in place by the farmers' organizations.

- The members of farmers organizations described the main agricultural constraints as being fertilizer (the lack of and untimely supply), and lack of high-quality seed varieties. With continuous farming systems, involving single crop, year after year, new systems of soil management are needed to build the soil that is devoid of organic matter and soil nutrients. We will have the opportunity to provide educational program that will strengthen the farmers ability to implement farming practices that promote sustainable agricultural production systems. Some of the practices can include:
 - Increasing agricultural productivity (maize/corn) through improved soil management and quality and new seed varieties.
 - Understanding that even if new and improved crop varieties are available, the yield potential of the improved seed variety cannot be realized without the adequate and timely supply of fertilizer
 - Restoring the fertility of the soil that has been over-farmed and over-exploited for centuries is the immediate need.
 - Employing strategies to build soil organic matter to improve soil nutrient supply through several mechanisms:
 - Opportunity to increase yields (maize and mung bean) through crop diversification (increase the number of crops that can be grown within the rainy season).
 - Provide education about crop residue management. The farmers must learn the importance of returning crop residues to the soil in order to build soil organic matter. In Casamance where livestock production is as important as crop production, a compromise must be made between using crop residue for livestock and build the soil organic matter.
 - Conduct workshops to train farmers on how to make high quality compost (use crop residue, manure, and other household by products), and introduce low-cost composter.
 - By providing programs that benefit farmers organizations, we can help the organization increase membership and foster farmer empowerment, improve food security, and aid in poverty alleviation and advancement of farmers and the rural poor.

Challenges:

- In addition to providing educational programs and implementing strategies to advance the mung bean project, the farmers organizations will expect more comprehensive educational programs that include a wide range of crops and even livestock.
- Since the farmers organizations' overall objective is to improve the livelihood of their members by increasing access to information and resources, we may have to make our program more diversified to include other crops (mainly maize) and even livestock.

Next steps (FY 2022-2023)

In December, 2022, we start implementing all mung bean related activities. Specific activates activities including but not limited to:

- Identify soils that are most suitable for the production of mung bean.
- Select community farms that are preferably located near schools. Plus
 - Include women managed gardens or farms, and
 - Privately owned and operated farms possibly associated with the farmers organizations
- Work with women's groups to promote mung bean as a vegetable for home gardens.

We will focus on soils as primary places of practicing sustainability

In Kolda and Sedhiou, according to the communities we visited, most of the constraints to agricultural production are associated with soil fertility and soil health. So, how do we mitigate soil fertility

issues? We know that dependency on chemical fertilizer sources is not sustainable. A focus on building soil organic matter, increasing soil carbon, and any other means to repair and build the soil would be the best strategy to increase agricultural production.

- Training farmers on composting (sources/types of organic materials - crop residue, plenty of manure)
- In terms of using crop residue to build soil organic matter, the farmers may need to compromise between feeding livestock vs building soil organic matter.
- Recruit graduate students from Senegal (University of Ziguinchor) to work on compost quality (effect on microbial population, soil chemical and physical properties, and more)
- Propose strategies to reduce dependency on chemical fertilizers.
- Visit ISRA Bambey to assess progress towards releasing mung bean varieties for Senegal.

Introduce community/school-based curriculum for the introduction, production, and consumption of mung bean in the Casamance.