Evaluate the survival rate and growth of planted fodder/fruit trees for degraded land restoration as a function of planting hole size

Introduction

Climate variability and extremes as well as climate changes expressed through increase temperature, more severe droughts, abnormally wet periods, floods and other extreme climate events are challenging for Sub-Saharan Africa particularly for the Sahel region due to the dependence of rural populations on climate-sensitive sectors such as rain-fed agriculture. In light of these challenges, maintaining perennial woody vegetation is increasingly an important priority for preventing aridification/desertification and for providing much-needed tree products (food, fuel, fodder, or fiber). In Mali as in most the Sahelian countries, large tree plantations have started after the severe drought of the 70s. The high cost of plantation associated with low survival and low productivity has been the main impediment to large success. Farmer managed natural regeneration (FMNR) which is based on the regeneration and management of trees and shrubs growing from living tree stumps, roots and seedlings is now being promoted and can be implemented in farmland, forest or grazing land. It is very low cost, rapid and scalable method of re-greening. It is based on pruning technique which can made a tremendous impact across the farmlands. However, this is based on wild grown plants which might not be of the choice of the farmers. Therefore, FMNR should be complemented with enrichment planting using improved plant material such as grafts and better planting practices by bigger size holes, protection, manure application and irrigation to enhance their survival and biomass or fruit production.

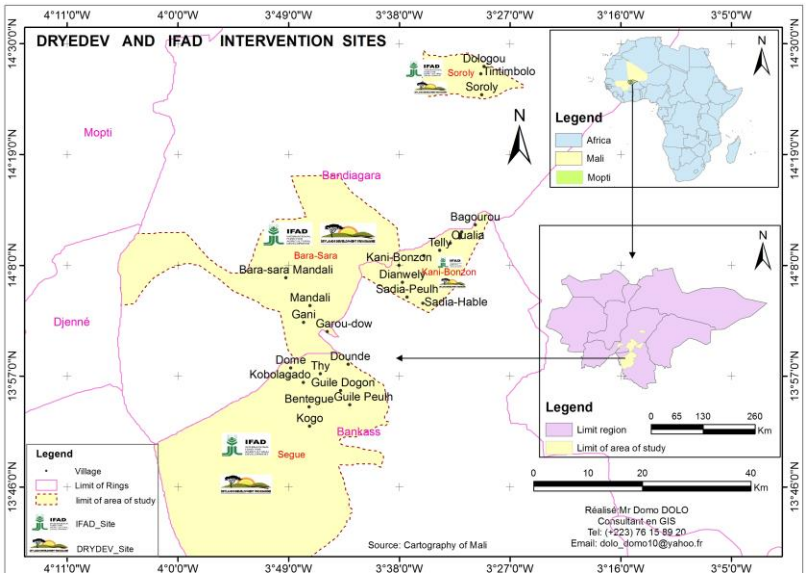
This participatory learning activity with 1600 volunteer farmers from three region Mopti, Sikasso and Ségou in Mali is aimed at identifying opportunities to improve trees and shrubs availability to meet the nutritional needs and to improving farmers' understanding as well as policy through testing different options of plantation. The specific objectives are to: i) Assessing survival and growth of planted seedling and the best options by context; ii) the constraints and conditions for implementation and; iii) the contextual variables of success for scaling.

Method

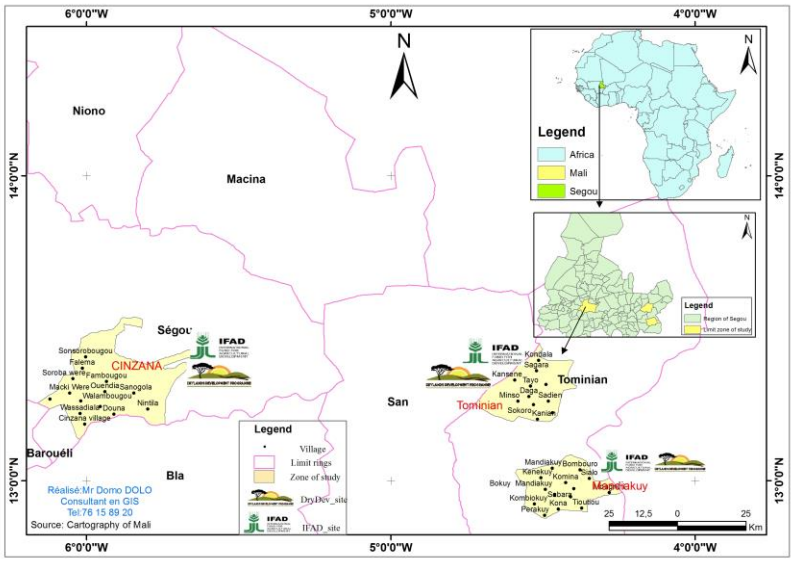
Site description

This participatory learning activities on tree planting was undertaken at Drydev/EC-IFAD site in *Sikasso, Segou and Mopti Region*s the southern-most region of Mali (see Figure 1).

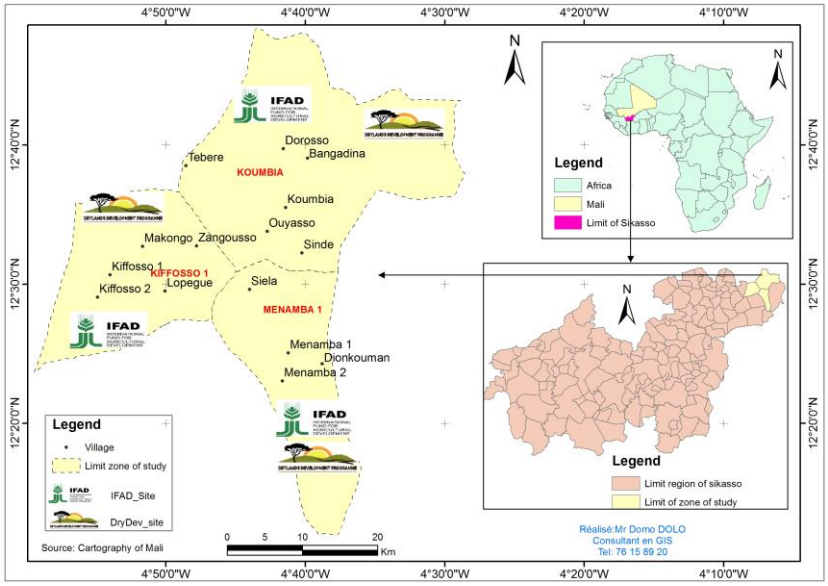
Figure 1. Site for the participatory learning activity on contour bund management
a. Mopti region



b. Segou region



c. Sikasso region



Study design

Question or objectives	**What is the question for the learning priority?**	**Evaluate the survival rate and growth of planted fruit trees as a function of planting hole size**
Hypothesis	What is the premise?	Fruit tree/shrub survival rate and growth depend on planting practices (planting hole size)
Options to compare	What are the alternative ways of implementing the options in order to answer the question?	- small size planting hole (30 x 30cm) vs. big size planting hole (60 x 60cm)
Contexts to compare	Under what conditions will the options be undertaken?	- Land use types - Dominant soil types - Farm location (compound field, village field and bush field) - Land slope - Social status (wealth class, ethnic group, autochthone / migrant, etc.), - Household size - Gender (men / women)
Study units	Where will the measurements be taken?	- On the plantation site of each volunteer farmer - Plot or farm, individual tree
Responses to measure	What will be measured?	1. Measurable by farmers - Narrative feedback from farmers - Survival rates - fruit production - Cost benefit ratio (effort, labour required): farmer assessment of the benefit, trade-off (ranking) 2. If student available - Survival rates, rate of establishment - Plant growth increment: height, diameter, crown - Biomass production
Roles of farmers	What will the farmers do to implement the PC??	- choice of plantation location - Production or sale of nursery plants - Hole digging for different dimensions - Planting and maintenance of the stands - Watering each plant according to the agreed quantity and frequency - Farmer keeping record (document their own measurable response variables)
Roles of other actors	What will the other actors do to implement the PC?	Implementation partners (grassroots organization) - Information and awareness raising - Selecting volunteers producers

		- Participatory site selection - Monitoring and capitalization of the lessons Lead organization (Sahel Eco and Implementing partner) - Provides logistics, coordination and funding - Sharing the results (lessons learnt, gaps ...) Researchers (ICRAF, IER focal persons) - Contribute to the development of protocols, set up of planned comparisons, data collection and analysis - Contribute to training - Students: document Survival rates, rate of establishment - Plant growth increment: height, diameter, crown - Biomass production
Study/experimental design	How will the PC get laid / rolled out? How are the farmers going to be selected How many treatments, how many farmers, how many sites combine de sites?	- Participatory selection of the sites by the farmers - Number of sites, treatment per farm (still need to be defined with partners; ideally consider large number of sites covering different contexts to be compared) - Selection of tree species based on farmers' preferences for superior accessions of indigenous tree species *Grafted Ziziphus* cultivars (Umran and Gola) Number of trees per treatment and per farmer: 10 Number of farmers: minimum 10 per village Selection of volunteers farmers: - voluntarily base selection - Consideration of the geographic diversity within the same village - Consideration of gender (at least 10 % should be women) Set up: implementation by grassroots organizations of other actors
Suggested timing (start and end)	When will the PC start and end	Start April 2017 – End December 2018
Data collection sheet	Annex the data collection sheets for farmers and any additional for more rigorous data	Data collection

Approach

Using the planned comparison approach within the framework of DryDev and EC-IFAD land restoration project we helped farmers identifying suitable planting practices to ensure greater survival and growth rate and later production. To get a quick response, two improve cultivars (Umran and Gola) of *Ziziphus mauritiana* are propagated and planted in Mali. In total 1600 volunteer farmers planted 10 grafted seedlings each in

their own context. Half of the seedlings were planted in small size holes (60 cm diameter x 30 cm deep) and half in bigger size holes (60cm x 60 cm) combined with manure. Monitoring and evaluation consist mainly of i) assessing survival, growth and fruiting of planted plants and the best options by context; ii) the constraints and conditions for implementation and; iii) the contextual variables of success for scaling. The field tests were implemented in farmer's fields, back yard or garden. Each participating farmer will test the different options. Farmers were trained and assisted by the facilitator of the project on the technical aspects of the options they selected. The team organized farmers, gather the inputs required and set the timing for the establishment and ensure effective set up of these trials. The following steps were followed:

1. Community meetings were held in the sites to present the potential options to be tested;
2. Farmers volunteer to apply options on their field
3. Provide a refresher training on options and the treatment design to volunteer farmers, via the village-level facilitators;
4. Visit the fields to lay out the design by determining the size of the plots based on availability of land;
5. Support acquisition of the inputs (specially grafted seedling),
6. Each group of volunteer in each village to maintain and monitor the trial with technical support each time required. Monitoring involve farmers, innovative focal farmers (those who can write), agricultural extension service technicians of the area or a student in internship if available;
7. Data analysis and lessons sharing through the established communities of practice (village facilitators, innovative focal farmers, etc). The same actors flesh out the key messages to be shared as well as organizing the knowledge sharing events jointly with the project national team.

Monitoring and data collection

Given the fact that very few number of farmers are able to read and write, monitoring will be led by the village-level facilitators and students in close collaboration with the innovative focal farmers involving students will contribute to national capacity building at the same time ensure quality data collection. A data collection form will be developed in ODK or IFormbuilder and the village-level facilitators will be responsible for the data collection.

Data management and analysis

The baseline / contextual variables is being collected on tablets using open data kit and will be uploaded to a local database. The field monitoring data will also be collected using tablets and open data kit. Yearly data will be encoded and keyed in using an excel sheet and later cleaned before analysis. Collected data will be subjected to appropriate univariate or multivariate statistical analysis. Various communication means will be deployed to easy farmers understanding of the analyzed data.

Data collection tool

https://www.dropbox.com/s/xou9xsdo6au9vx0/Ke_Tree_planting_PC_Mali.xls?dl=0