

Farmer Co- designed strategies to reduce post-harvest residue removal for household use and restore soil fertility

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Introduction

Soil resource depletion and land degradation are key contributing factors to food insecurity in Sub-Saharan Africa (SSA). Novel conservation agriculture practices (CAP) encourage smallholder farmers to leave post-harvest residue in the field for the purpose of soil organic matter (SOM) restoration and soil water conservation. Many farmers understand the importance of crop residue retention for soil fertility. Due to resource limitations and everyday demands, retaining residues is often impossible because farmers remove crop residue primarily for household cooking and livestock feed (Kushwaha and Singh, 2005).

Agroforestry initiatives in Kenya, addressing crop fertility issues, are not being adapted by subsistence farmers (Kristjanson et al, 2012). This is due to daily pressures associated with this variety of farming and to the varied socio – cultural frameworks under which small scale farmers operate. It is important to understand the amount of fuel and fodder necessary to sustain subsistence farming as well as the challenges faced by smallholder farmers and their own ideas for solutions. It is through this understanding that a multifaceted approach to alternative resources may be understood and adapted.

Statement of the Problem and Prediction

The main goal of this project is to *quantify the impact of limited post-harvest residue removal in conjunction with establishing an agroforestry plantation on SOM retention and soil fertility recovery by smallholder farmers*.

It is predicted that this project will reveal the quantity of biomass used for subsistence by smallholder farmers daily and the point at which the added treatments will mitigate the farmer's need to remove crop residue.

References

- Kristjanson, P. 2012. Are food insecure smallholder households making changes in their farming practices? Evidence from East Africa. *Food Security* 4: 381-397.
Kushwaha, C. P., and K. Singh. 2005. Crop Productivity and Soil Fertility in a Tropical Dryland Agro – ecosystem: Impact of Residue and Tillage Management. *Expl Agric* 41: 39-50.



Site Information

Location: Ndivisi and Nalonda District, Kenya

Growing season: 2 seasons / year

Plot Layout: 3 smallholder farms ~ 1 acre

Field Treatments: five species (*Sesbania sesbania*, *Markhamia lutea*, *Calliandra Calothyrus*, *Pennisetum purpureum*, and *Tithonia diversifolia*)

Study Duration: 18 months

Objectives

This research is expected to:

- (1) **quantify** the amount of post-harvest biomass needed for multiple use by a smallholder household
- (2) **identify** locally available low costs agroforestry resources known to farmers that can be incorporated into the farming system,
- (3) **monitor** the transition in farmers practices and the rate of success, and
- (4) **provide a preliminary** foundation of understanding for future research to-assess the impact of locally used and available plant species incorporation in terms of soil fertility, crop yields, and food security in smallholder farmer systems.

Preliminary Data

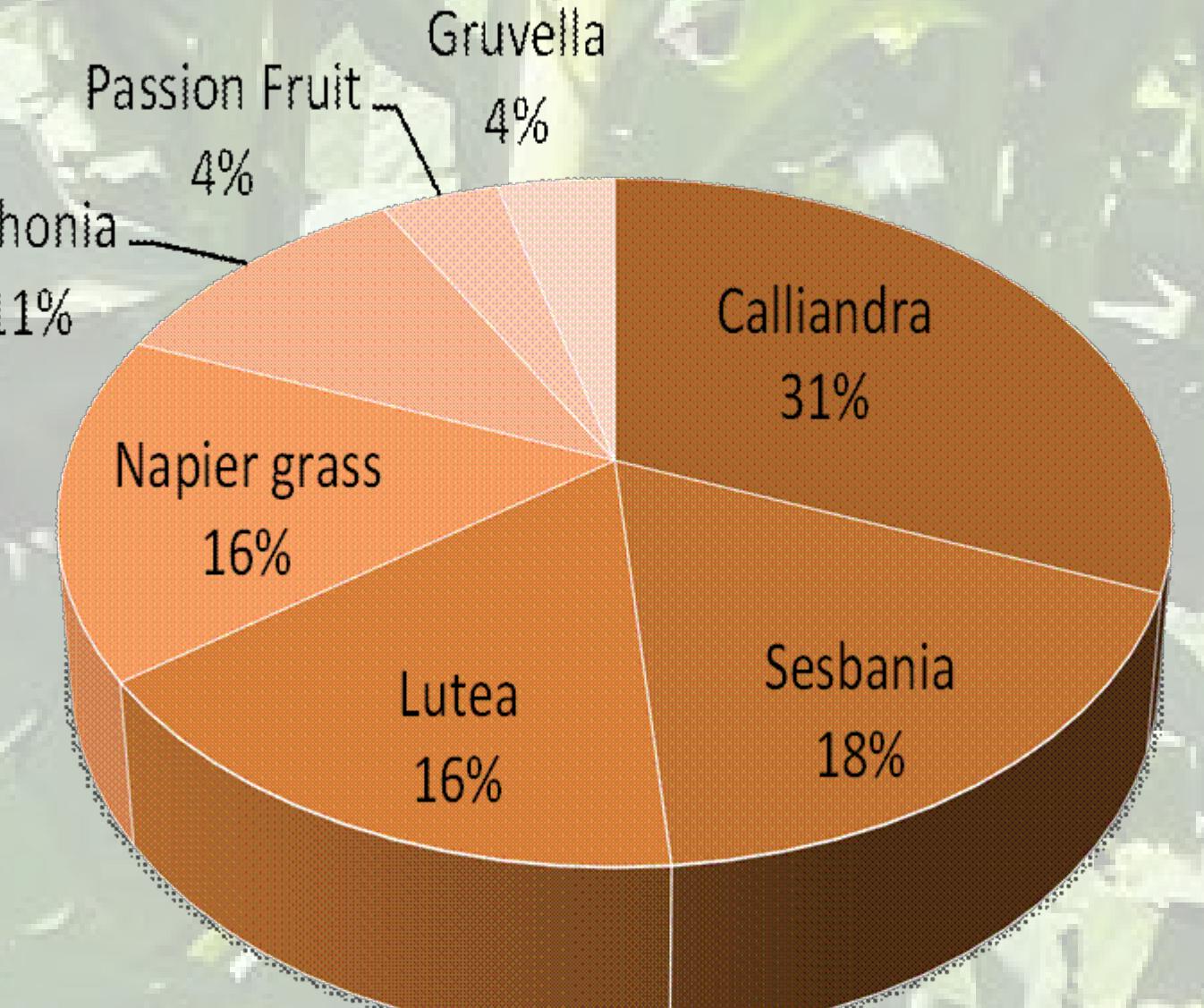
A series of interviews revealed that when asked "what alternatives to crop residue are you using to sustain"? Five species were identified as the most used:

- *Calliandra Calothyrus*
 - *Sesbania sesbania*
 - *Markhamia lutea*
 - *Pennisetum purpureum* (Napier Grass)
 - *Tithonia diversifolia* (false Sunflower)
- Over a 39 day period (23 August 2012 – 30 September 2012) preliminary data reveals that the largest pull of residue is for cooking fuel (38 kg / day) and the least amount of residue use is for mulching (0.08 kg / day). These results reveal that very little residue is being returned to the system.

Residue Use / Day (Average over 39 days)



Farmer Identified Alternative Plant Species To Crop Residue for Use



- Although these results are only from one research site they give an insight into (1) where the residue is being used and (2) how much is being used on a daily basis.
- Preliminary data indicate that 71.08 kg of residue is used / daily.
- If the current trend is consistent and continues across all three sights, it is predicted that approximately 26,000 kg of residue will be used on a 1 acre farm in one year's time.

In Process

May 2012:

- Eleven farms visited throughout western Kenya.
- Farmers and neighbors interviewed in an informal discussion focused on resources used for fuel and fodder.
- Locally familiar, readily established plant species of grasses, shrubs, and trees as alternatives to crop residue revealed.
- 3 farms identified for data acquisition. (Ndivisi and Nalonda district of Kenya)

August 2012:

- 5 plant species established in Ndivisi site.
 - One grass [Napier grass (*Pennisetum purpureum*)]
 - One shrub [false sunflower (*Tithonia diversifolia*)]
 - Three agroforestry tree species [*(Sesbania sesbania*, *Calliandra Calothyrus*, and *Markhamia lutea*)]
- Data acquisition began.

- Data is expected to reveal:
 - Amount of residue required to sustain farm and household.
 - Where residue is procured from.
 - Purpose of R residue.

Through December 2013:

- Residue use weights will continue to be taken and analyzed.
- Ndivisi site data will be analyzed to establish if *farmer's need to remove crop residue will be mitigated* the added treatments.

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