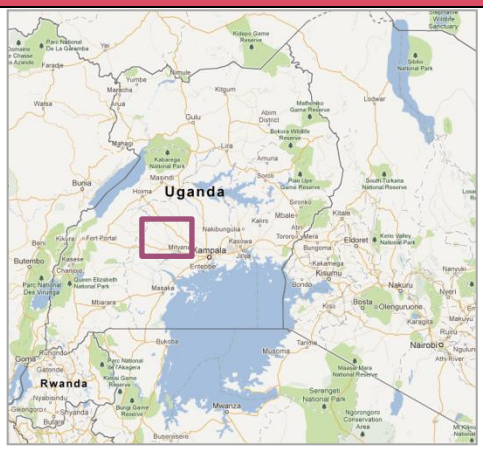
Case Study - Mulching

Case Study Background Data		
Tool Category: Adaptation on the farm **Variety:** Robusta **Climatic Hazard:** • Prolonged dry spells **Expected Outcome:** • Reduction in soil moisture loss through evaporation.		**Details:** Plant Density: ⦸ 1,082 /ha Soil Type: Loamy soil Shade Regime: - Farming System: Coffee Banana farming system Yield (kg cherry/ha): 2,060 ⦸ rain: 900 – 1300mm/year
Implementation Date: Oct. 2014 –Dec. 2015	**Altitude:** 1,074 m **GPS:** 0.831087°N 32.496865°E	**Slope of plots:** Modest to flat slope ⦸ **Age of trees:** 5 – 10 years
No. farmers: 5 demo plots	⦸ **Area under coffee:** on average 0.8ha/farmer	Tested with smallholders on demo plots

Results

An experiment on mulching a coffee plot with dry plant materials was done with the objective of conserving soil moisture by reducing moisture evaporation losses from the soil surface to prevent drought stress on coffee trees during the dry season. This tool was tested by comparing mulched plots and not mulched plots.

According to farmer observations, it was discovered that soil in the mulched coffee plots with dry plant materials had higher moisture levels than the control plot which was not mulched. Coffee trees in the mulched plot also had more vigorous and dark green leaves compared to the coffee trees in the plot that was not mulched. Farmers also observed that mulching stopped soil erosion. During morning hours the coffee leaves in the mulched plots had water vapour on the surface which was not the case with un-mulched plots. Soils at 5cm depth appeared to be black with numerous coffee fibrous roots which were not visible in the un-mulched plot. Soil in the mulched plot felt to be colder than the un-mulched plot. There were more soil organisms (earthworms and termites) in the mulched plot.

Pros & Advantages + Learnings	**Cons & Disadvantages + Things to take into account**
• Decomposition of mulching materials improves soil structure and fertility • There is improved soil water holding capacity • Mulch keeps the soil underneath moist longer than bare soil • Controls soil erosion by cushioning the impact of raindrops and by slowing runoff • Suppresses weeds by shading them out	• Mulching is labor intensive • Farmers complain about lack of sufficient mulching materials • There is a risk of fire during the dry season • Mulching materials are quickly destroyed by termites so need to be replaced from time to time • May harbor pests like mealy bugs

Acceptability	High	**Effectiveness**	High
Affordability	High	**Timing / Urgency**	High

What is the objective of applying the adaptation option and how do we expect the objective to be met?

Through focus group discussion in the FFS, prolonged dry spells were identified as the major climatic hazards affecting smallholder coffee farmers in Luwero District. Prolonged dry spells cause wilting of coffee plants and hence affect their development and productivity. Mulching, the process of covering the soil surface with dead plant materials such as crop residue or straws to conserve soil moisture was one of the climate change adaptation options selected by farmers.

How is the adaptation option applied?

Nr.	Step	Picture
1	Focus group discussions in FFS identified the climatic hazard affecting coffee production in their area. They decide on a range of actions which they Could undertake to address issues relating to impacts of climate change to their coffee production. One of the adaptation options decided on is mulching their coffee gardens to reduce soil water loss through evaporation.	
2	Selection of host farmers and plots	

3	Weed control: Before mulching is done farmers have to first weed the plots to be mulched.	
4	Cutting, collection and spreading of mulching materials in the coffee garden. Maize straw were collected and applied as mulch. The mulch materials were spread to cover the soil leaving space around the plants of about 0.25m in radius.	
5	Observation, recording and discussion of the results during the dry season	

Implementation framework

The study was conducted in Luwero district at GPS 0.831087°N 32.496865°E and at an altitude of 1,074 m above sea level, under the Global Climate Change Alliance Project implemented by Hanns R. Neumann Stiftung Africa, funded by the European Union and coordinated by the Food and Agriculture Organization of the United Nations.
The area receives an average annual rainfall of between 900 – 1,300mm. The rainfall pattern is bimodal with long rains from March to June and short rains from September to December. The average annual temperature range is 17°C - 27°C. The soils are loamy, deep and well-drained.

The experiment was conducted during the dry season to determine the effect of mulching on soil moisture conservation in the coffee plots.
The already existing coffee plantation was used as a test plot. A layer of mulch was applied to the coffee field. The experiment was replicated five times on different farmer coffee plots. For each treatment, the plot size was 10m long and 5m wide, separated by 3m apart, each surrounded by 8 coffee plants. One plot was mulched with a thick layer of maize stovers, elephant grass, banana leaves and dry grass, and the other plot was not mulched to serve as the control. The different treatments were designated as: T_1 - Coffee + Mulch and T_2 - Coffee alone without mulch to serve as the control.

During the dry season, the host farmer together with the FFS members made monthly observations and collected data on the effect of mulching basing on soil moisture content, color of coffee leaves, rolling and wilting of coffee tree leaves on both the mulched and control plots. A final evaluation of the benefit of mulching was determined basing on the observations.

Measurement strategy for effectiveness

Indicator	Coffee phonological features and soil moisture content
Definition	Phonological features: i) Critical observation of rolling and wilting of leaves ii) Color of leaves. Use of the color chart to determine the different degree of greenness of leaves. Soil moisture content: Amount of water in the soil which involves observing and hand feeling the soil to determine the percentage of wetness of the soil.

Purpose	**Rolling and wilting – Helps to rate water stress by coffee plant during prolonged dry spell** **Color – Shows level of nutrient and moisture in the plant** **Soil moisture – Helps to show amount of water available for coffee plant root uptake for growth during the dry period**
Target	Reduced crop stress, healthier looking coffee plants and higher degree of soil moisture compared to those who are directly exposed to climatic hazards.
Data Collection	Host farmers and farmer group members make observations for indicators and a Field Officer interviews host farmers.
Tool	Designed data collection template
Frequency	Once a month
Responsible	Host farmer, Farmer Field School members and Field Officer
Reporting	The results of the comparison are discussed during Farmer Field School meetings and c&c trainings within the farmer groups on the demo plots.
Quality Control	Replication, close/regular monitoring, training of host farmer and farmer group on recording template, comparison of results from different farmers.

Main findings of case study

- First observation showed that coffee trees standing in the mulched plot looked healthier compared to those that were not mulched.
- Mulching help in controlling of soil erosion, regulation of soil temperature and suppression of weeds.
- Mulching significantly improves soil moisture conservation as mulched plot contained higher soil moisture content throughout the entire period of growth when compared to un-mulched plot.
- Mulching increased earthworm and termite activities

Therefore, on the basis of the above findings, it can be concluded that applying a layer of mulch during the dry season help to conserve soil moisture thereby sustain coffee production. Thus, it is recommended to apply a layer of soil mulch in order to increase coffee yield and sustain coffee productivity in the event of climate change.

Acceptability					
Leading Question: To what extent did farmers readily accept this tool as useful for implementation and implement it as planned?					
High	×	**Low**		**Don't Know**	
High: Farmers were already aware of the benefit of mulching on soil water conservation and were willing to implement it.					

Please Comment:	
If there was resistance to adopting this tool, why?	Some farmers feared that their gardens may be set on fire during the dry season, other farmers complained about the scarcity of mulching materials.
If farmers discontinued tool implementation later on in the process, even though they initially accepted it, why?	The tool is already being implemented by some farmers.
Did this tool have any external issues or impacts (positive or negative) which influenced its acceptability? (Community, value chain?)	There are fears by some farmers that their coffee fields may be set on fire once mulched especially during the dry season.

Affordability					
Leading Question: Are the costs of the tool affordable to farmers taking into account the initial investment, maintenance costs and the availability of inputs?					
High	X	**Low**		**Don't Know**	
High: The mulching materials can freely be obtained by most of the farmers. In case a farmer has to buy the mulching materials, no big costs are involved**.**					

Please Comment:	
Are there any external costs? (to society or environment?)	No external costs
If costs are high because inputs are not available, what inputs? And why?	
Any other comments:	Farmers who cannot readily get mulching materials can explore an option of planting the mulching materials in form of napier grass.

Effectiveness					
Leading Question: Does the tool provide the expected benefits to farmers?					
High	X	**Low**		**Don't Know**	
High: Soil in the mulched plot had a higher moisture percentage than the soil in the plot which was not mulched and the coffee trees in the mulched plot had more green leaves and looked healthier than the un-mulched plot.					

Please Comment:	
What benefits did farmers expect from this tool?	Increasing coffee yield and quality by preventing coffee tree drought stress during the dry spell
If the objective has not been met, why?	The coffee yield and quality from the plots has not yet been quantified however observations show healthier coffee cherries from trees, meaning the results will be positive.
Have there been any significant external issues which influenced the effectiveness (positive or negative) of this tool? Please explain.	-
Any other comments about effectiveness:	For effectiveness, other climate change adaptation technologies like trenches on top of GAPs need to be incorporated as well.

Timing / Urgency					
Leading Question: Is the amount of time that this tool takes to implement (from starting implementation until benefits accrue) reasonable to farmers?					
High	X	**Low**		**Don't Know**	
High:					
Please Comment:					
If implementation takes too long why?		Implementation does not take long, as long as the farmer has the mulching materials.			
Any other comments about timing:		The mulch layer needs to be applied before the onset of the rain season for it to be able to trap and conserve the incoming rain water.			