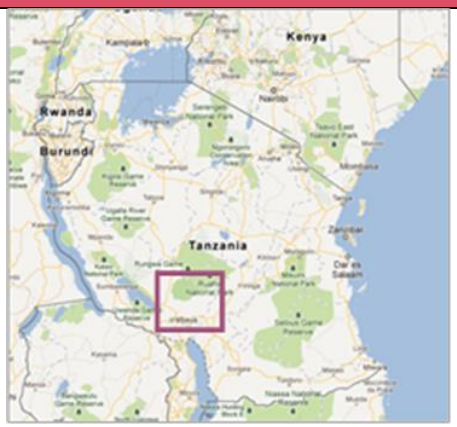
coffee & climate
enabling effective response

Case study – Income Diversification with Conservation Agriculture

Case Study Background Data		
Tool Category: Adaptation on the farm		**Detail:** Planting Density: n.a. Soil Type: Loamy soil Shade Regime: no shade Farming System: Pure stand maize Yield Range (kg maize/ ha): 2,000 - 4,000 ⦸ rain: 900-1800 mm/y
Variety: Maize		
Climatic Hazard: • High temperature • Seasonal drought • Unreliable rain		
Expected Outcome: • Reduced soil erosion • Better rainwater infiltration • Improved ability for crop to withstand seasonal drought		
Implementation Date: 01.08.2014 – to date	**Altitude**: 1402.55m **GPS:** 8.55S 33.20E	**Slope of plots:** gentle slope (> 10%)
No. farmers: 200	⦸**Area under maize**: 0.25ha/farmer	Tested with smallholders

Results

The conservation agriculture practices have been tested with smallholder adopters and shown practical results including:

- Maintaining the soil structure by preventing soil erosion
- Yield increase of 25% to 100% in the first season
- Diversifying farmer income, reducing the risk of crop failure and ensure food security while promoting climate resilient agriculture
- Spillover of soil conservation practices from coffee e.g. mulching
- Reduced loss of top-soil leads to a long-term perspective for cultivation

Pros & Advantages + Learnings	**Cons & Disadvantages + Things to take into account**
• Precise timing of the activities based on experience (early land preparation to be prepared for the planting rains) • Less labor intensive • Cost and time efficient • Accuracy (spacing, fertilizer/ herbicide usage)	• Unconventional practices hence farmers are hesitant to adopt in the beginning • Access to genuine inputs (fertilizer and herbicides) needs to be guaranteed

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?

Description of climatic hazard and associated problem: Through the triangulation process, prolonged drought periods, unreliable rainfall and extreme weather have been identified as major climatic risks for smallholder farmers which adversely affect their coffee production as well as their food security in Mbeya rural. Taking into consideration that coffee production may be less profitable in future, income diversification is one coping strategy for smallholder farmers. The conservation agriculture program offers farmers the opportunity to increase their productivity, adapt more effectively to adverse climatic conditions and improve soil fertility through various techniques like minimum tillage, no ploughing, no burning of residues, timely land preparation before the first rains, and crop rotation with legumes to fix nitrogen and improve soil fertility.

Description of expected outcome: Conservation agriculture refers to a number of practices that in combination conserve soil, moisture, fertilizer, seeds, energy, time and money. Minimum tillage is used to plant the crop and other techniques are applied and farmers benefit from:

- Timely land preparation, which allows for early planting at the onset of the rains, which is critical for success and also permits early weeding.
- Accurate placement of fertilizers and seeds which reduces wastage and allows optimal use by the crop.
- Improved soil fertility, reduced soil erosion, improved infiltration, reduced soil temperatures and water loss, through retaining residues on the field and minimum soil disturbance.
- Cost efficient in the long run, since for hand hoe practices there is no need for purchasing any additional capital equipment by the smallholder and the weed population gradually declines since the inter-row is never ploughed.

This will lead to higher production, higher gross-margin as well as improved food security for the smallholder farmers in Mbeya rural. Conservation agriculture minimizes crop loss in drought years and improves food security.

How is the adaptation option applied?

Nr.	Step	Picture
1	**Hand hoe land preparation** A rope is used to mark out where to dig the planting basins on the field. The basins are spaced at 70cms along the row and the rows are 90cms apart. There will be 15,850 basins per hectare. The basin should be 20cms deep, 30cms long and the same width as the blade of the hoe. The maize is sown into the basins, correct amounts of fertilizer or manure is added and the basins are backfilled with soil.	
2	**Land preparation for oxen farmers using ripping (ADP)** The ripper (Magoye) needs to be attached to the plow beam in the correct way. The ripper needs to be adjusted to achieve the correct depth of about 15-20cms. (photo shows a field, which is ripped for the first season)	

3	**Land preparation with tractor rippers (TSP)** The ripper (Ngume) needs to be attached to the plow beam and adjusted in the correct way.	
4	**Precise fertilizer application and planting** The way of fertilizer application and planting depends on the way of land preparation. However, precise measurements with basic equipment (e.g. soda tins for manure, bottle caps for fertilizer) are most important.	
5	**Weeding** Early and continuous weeding is a critical element. If weeds are not allowed to seed, the population of weed seeds in the soil will gradually decline. Weeding can be done by hand or using herbicides. Herbicides need to be applied in a correct and safe way.	

Implementation framework

The case study is implemented within the pilot project of the initiative for coffee & climate in Mbeya rural, Tanzania since end of 2012. As part of the national program implemented by the Hanns R. Neumann Stiftung (HRNS) in Tanzania, the c&c pilot project is targeting 1,300 coffee farming households. Besides facilitating discussions on the impact of climatic changes on coffee production, HRNS is supporting the implementation on conservation agriculture in cooperation within the Conservation Agriculture Regional Program which is coordinated by the Conservation Farming Unit (http://conservationagriculture.org). Conservation Farming involves very little soil disturbance to benefit from the natural ecological processes to conserve moisture, enhance soil fertility, and improve soil structure, and to reduce soil erosion and the presence of diseases and pests. Conservation agriculture land preparation practices also contribute to enhancing the soil moisture storage by breaking of subsurface hardpans.

Implementation of conservation agriculture has shown immediate benefits to the adaptors and crop yields have increased significantly relative to convention practices. During the first season in 2013/14 conservation agriculture was tested on demo plots that farmers could learn and see the results, e.g. that crop resilience during the dry spell is much higher due to rainwater capture and soil moisture retention compared to conventional practice.

Measurement strategy for effectiveness

Indicator	Higher production by applying conservation agriculture practices
Definition	Increased yields for pure stand maize per hectare and increased gross-margin per kg of produced maize compared to the baseline data with conventional practices
Purpose	Due to adaption conservation agriculture practices farmer expect higher yields and more income from their maize production. Further effects like increased soil fertility, reduced soil erosion, improved infiltration, reduced soil temperatures and water loss need to be monitored with a long term perspective on landscape level.
Baseline	Baseline survey was conducted in December 2013 with an average production of pure stand maize of 2,542 kg/ha and an average gross-margin of TZS 582,597 for 1 ha of pure stand maize.
Target	The target is that the yield (kg/ha) will double and the gross-margin will show a significant increase.

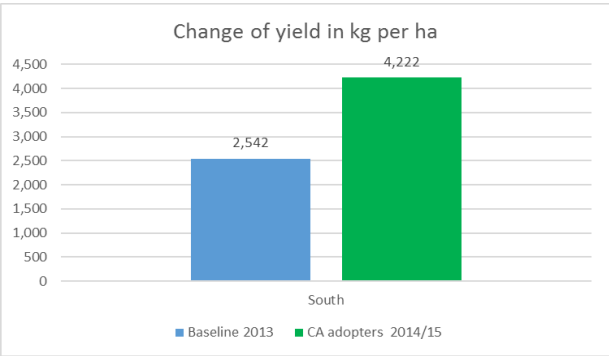
Data Collection	Gross-margin interviews with a sample of 15-20 adopters producing pure stand maize in Mbeya rural.
Tool	Structured questionnaire covering areas like observation of land and soil management practices
Frequency	After each harvesting season
Responsible	Data collection and analysis by HRNS field staff
Reporting	The results of the gross-margin will be discussed with the farmers during data collection and after analyses.
Quality Control	Training on gross-margin calculations for the responsible field staff as well as cross checking of farmers information during the gross-margin interviews

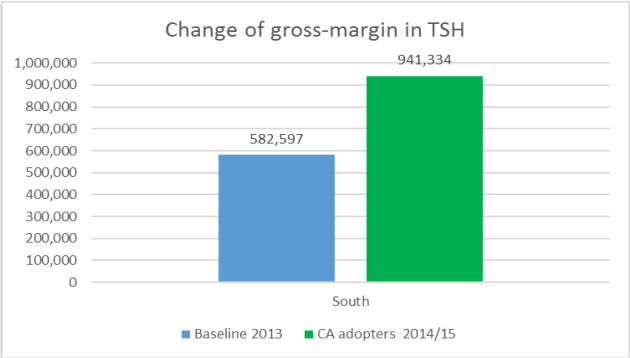
Measurement strategy for acceptability, affordability, timing & urgency

The findings regarding the criteria acceptability, affordability and timing & urgency of the adaptation option conservation agriculture have been collected during group discussion with farmers of the respective groups.

Main findings of case study

Conservation agriculture is an unconventional practice and most farmers initially hesitated to try it out since they want to see positive results before they adopt it. Therefore the conservation agriculture practices were first introduced on demo plots to showcase the positive effects of the land preparation techniques and how that supports the resilience against drought and intermittent rain in the field. In addition comparing the yield and the gross-margin using traditional practices with the conservation agriculture show direct and tangible benefits. HRNS has conducted gross-margin interviews with 20 CA adopters in Mbeya region this season 2014/15. The interviewed farmers were randomly selected by HRNS field staff taking into consideration the different types of land preparation (Hoe, ADP and TSP), as well as gender. The data from the interviewed sample farmers was compared to the Baseline data from 2013. In the Baseline all farming households were still implementing traditional practices. The graphs below shows the impact of CA practices on yield and maize income. For the gross-margin calculations an average price of 350 TSH per kg in the South for produced maize was assumed, since most of maize is used for home consumption and farmers do not indicate prices.





The data shows a clear increase of yield through CA practices as well as an increase in the gross-margins compared to the Baseline data. Besides these direct economic effects for the farmers, long-term environmental effects of conservation agriculture will be monitored including improved soil moisture, soil fertility, and soil structure, as well as reduced soil erosion and the presence of diseases and pests.

Acceptability					
Leading Question: To what extent did farmers readily accept this tool as useful for implementation and implement it as planned?					
High	X	**Low**		**Don't Know**	
High: Farmers readily accepted this tool for implementation and continue to implement it as planned.					
Please Comment:					
If there was resistance to adopting this tool, why?	No resistance				
If farmers discontinued tool implementation later on in the process, even though they initially accepted it, Why?	After seeing the benefits on the demo plots, farmers have started to implement these practices in their fields.				
Did this tool have any external issues or impacts (positive or negative) which influenced its acceptability? (Community, value chain?)	Degraded soils are revitalized and farming can continue on the same land for generations without the need to migrate.				
Any other comments:	-				

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 initial investment and the maintenance costs of this tool are affordable to farmers from their regular operations and the time it takes to recover the investment is reasonable to farmers.					
Please Comment:					
Are there any external costs?	Low and flexible labor requirement				
If costs are high because inputs are not available, what inputs? And why?	Basal inputs are easily available, calculated and planned in advance				
Any other comments:	Fertilizer and seeds can be used more efficiently due to precise planting and application.				

Effectiveness					
Leading Question: Does the tool provide the expected benefits to farmers?					
High	X	**Low**		**Don't Know**	
High: The objective of the tool has been met for the farmers.					
Please Comment:					
What benefits did farmers expect from this tool?			Higher yields and better gross-margin on the economic side, as well as reduced soil erosion, better rainwater infiltration, improved soil structure, and soil fertility on the ecological side.		
If the objective has not been met, why?			n.a.		
Have there been any significant external issues which influenced the effectiveness (positive or negative) of this tool? Please explain.			Accurate land preparation, application of basal nutrients, and herbicides requires proper training as well as continuous backstopping, since these practices are new to the farmers.		
Any other comments about effectiveness:			Significant results could be observed from residues on the field showing improved rainwater infiltration and better drought tolerance.		

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: The tool takes a reasonable amount of time to implement (taking into account the coffee growing season, inputs necessary, preparation time and implementation time); *And* this tool accrues the effects expected within a reasonable amount of time.					
Please Comment:					
If implementation takes too long why?			Maize is a seasonal crop, therefore immediate results can be observed.		
Any other comments about timing:			Timing and planning of the activities is very important for the correct application of the conservation agriculture practices. Land preparation needs to start before the first rain season to be ready to plant with the first planting rains.		