SUMMARY, PhD study research on
Increasing Crop Water Productivity in Vulnerable Production Systems in Central Mozambique through Conservation Agriculture

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The potential of Conservation Agriculture (CA) to reduce the risk of crop failure and improve crop water productivity under rainfed and low input agriculture in central Mozambique will be assessed under the long-term trial in Sussundenga agrarian station. The trial was established in the year 2006 under the principle that CA is the agriculture production system based on no-tillage and the maintenance of a cover on the soil surface. The local climate in Sussundenga is wet semi-arid, average annual rainfall 1155 mm and potential evapotranspiration 1386 mm. The dominant soil type in the trial plots is haplic lixisol and soil texture is loam. The trial is a randomised blocks design with four replications, one conventional treatment with sole maize, using the mouldboard plough, and nine CA treatments utilizing different seeding technologies and crop rotation of sunflower, beans and maize. The set of data being collected include meteorological data, soil characteristics of layers 0-10, 10-20, 20-30, 30-60, 60-90 cm depth and crop management.

The results from the long-term trial in Sussundenga will be supplemented with research in the existing CA plots in the farmer's fields and compared to traditional practices for selected soil quality characteristics and productivity.

The main objectives of the study are:

- To monitor soil water balance partitioning and soil fertility parameters in on-station experiments under CA and assess different strategies to increase maize and beans yields under rainfed agriculture in Central Mozambique;
- To use soil water and crop model (APSIM) supported by on-station experimental and field research results to assess development scenarios of improved production technologies under CA.
- To Assess Soil Hydraulics Properties and Crop Water Productivity under Rainfed Agriculture in Central Mozambique

Specific objectives of the study are to assess and simulate on the study area the long-term effects on:

- Soil water balance partitioning under CA
- Soil water balance partitioning under CA to mitigate dry spells
- Soil hydraulic properties under CA that improve rain water balance partitioning in rainfed agriculture

- The impact of CA on sustainability of rainfed agriculture;
- The impact of CA on yield stability and crop failure risk reduction;
- The effect of Mulch on soil evaporation.

DATA AND MEASUREMENTS, ON-STATION TRIAL

Four main categories of data are to be collected in the on-station experiment, see also table 1: (i) Site, (ii) climatic, (iii) soil and (iv) crop and crop management data.

From the soil types of the Sussundenga, the main soil layers depth expected from the experimental site are: 0-20, 20-50 and, 50-100 cm. From the APSIM model, the recommended soil layer depth structure are: 0-10, 10-30, 30-60, 60-90, 90-120, 120-150, 150-180 cm, thought, the near surface area layers are more important. So, it was adopted the structure presented in **figure 1** for the overall soil measurements in the trial plots in Sussundenga.

Sampling profile and measurements per plot

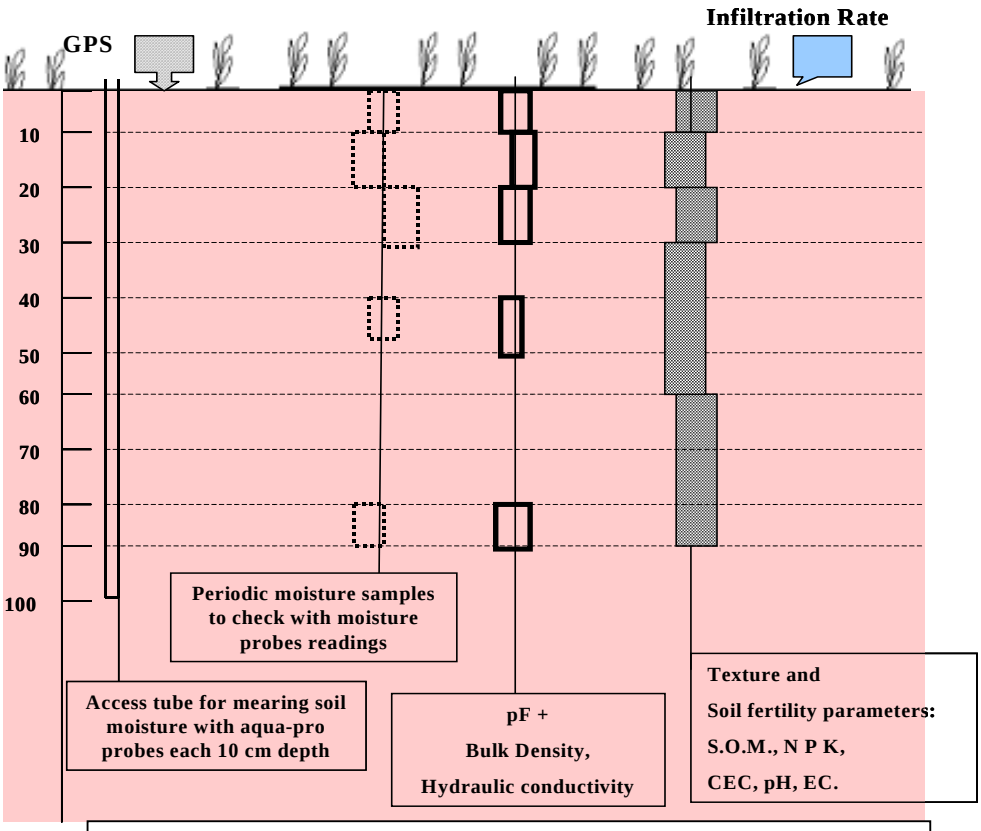

Figure 1: Sampling profile and measurements, on-station trial, Sussundenga

From figure1, access tubes for soil moisture were not yet installed, this will be installed in the treatments 1 to 4; and so, periodic moisture samples were not taken; soil samples for pF, bulk density and hydraulic conductivity were taken at (0-10, 10-20 and 20-30 cm). For the next season it is expected that to have all the measurements in place.

Table 1: Type of data being collected in the on-station C.A. trial in Sussundenga

Type of Data		Method used/ to be used
(1) Site (location of the trial site)		
Latitude	*	GPS
Longitude		
Altitude		
(2) Climatic data		
Daily maximum and minimum temperature	*	Automatic Meteo station
Daily solar radiation	*	Automatic Meteo station
Daily rainfall	*	Automatic Meteo station
(3) Soil data (physics and fertility)		
General data		
Soil type (texture) and depth	*	
Slope (%)	*	
Slope length (m)	*	
Soil physics data (beginning of the season)		
Soil water retention on a layer basis, especially for field capacity and mulching point;	*	Lab-pF
Bulk density	*	Lab.
Infiltration rates		Rainfall simulator
Saturated hydraulic conductivity		Lab., permeameter
Soil moisture		Aqua-Pro probes
Soil fertility data		
Total N (for top soil layer) and extratable P (for soil layers)	*	Lab.
NO_3-N for soil layers and soil water at sampling time	*	Lab.
Total Potassium		Lab.
Soil organic carbon	*	Lab.
Cation exchange capacity, soil salinity (EC), soil acid reaction (pH)		Lab.
(4) Crop and crop management data		
Crop phenology		
Crop type and cultivar	*	
Average duration to flowering	*	Field observation
Data of 50% flowering and total number of leaves	*	Field observation
Crop Growth		
Total biomass at harvesting	**	
Grain yield	**	
Final plant population	*	Field observation
N and P concentration in plant components		
Surface residues		
Crop type	*	
Amount added as dry weight (Kg/ha)	*	
Total C, N and P content (%)	*	
Indication of % ground cover		Field observation
Management		
Date of all operations (tillage, sowing, 50% crop emergence, thinning, weeding, fertilizer application, harvest)	*	Field observation
Fertilizer application – type, content of NH-4, NO-3 and ureia-N, depth of incorporation	*	Field observation
Tillage – type, depth.	*	Field observation

**** Requires for APSIM model as imput data***

***** Required to test the accuracy of the simulations***

DATA AND MEASUREMENTS ON FARMER'S FIELDS

In order to assess traditional production system vulnerability and the potential of CA to enhance soil properties and them increase Crop Water Productivity (CWP) field study will be conducted in Central Mozambique. Selected soil properties will be studied to compare existing CA plots and traditional practices. Figure 2 presents the soil properties to be measured in the farmer's fields, and comparative studies will consider soil type, climate, and cropping system.

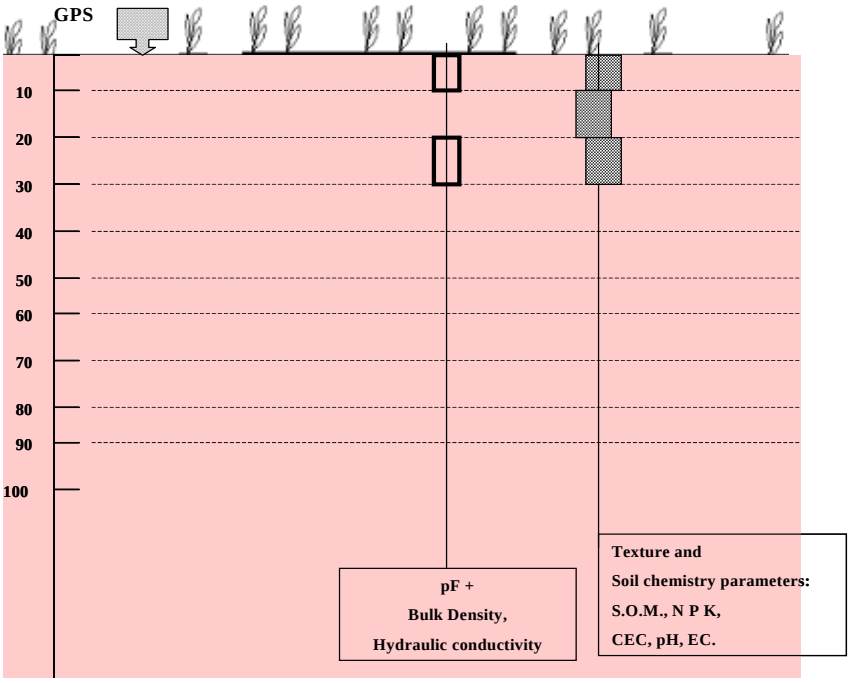

Figure2: Sampling profile and measurements in farmer´s fields

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