Micro water harvesting integrated with agroecological practices: The case study of Re-Farm project

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Introduction

- Food production in Angola is concentrated in family farming, which relies **traditional cultivation methods**.
- Ongoing climate change is generating **frequent droughts and an expansion of the desertification frontier** in the country (Carvalho, 2016).
- Agriculture is rainfed, with **two production cycles linked to the seasonality of rainfall,** October-February and March-May. Dry spell occurs in January (Correia, 2024).
- RE-FARM is a research and cooperation project in Angola, funded by the European Union in the DeSIRA programme.
- The hypothesis is to verify the **effectiveness of innovations in production techniques** (agro-ecological practices and water harvesting techniques) in fostering a shift towards an agriculture that is more resilient to climate change.

Fig.2: Experimental field with the agro-ecological practice of diversified rotation and the ridge and furrow technique

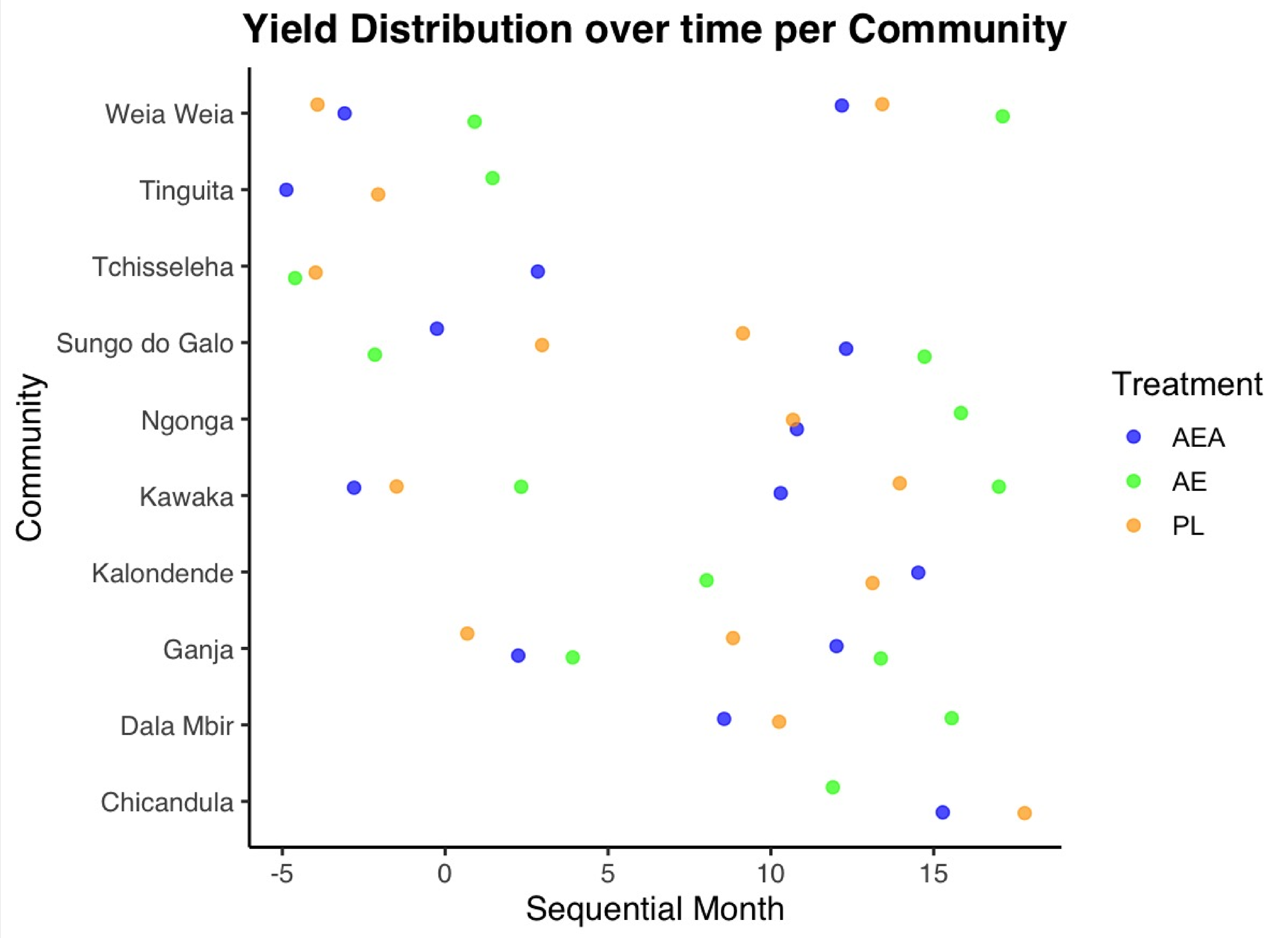

Figure 4: Maize yield (grams) at each harvest time

Figure 1: Experimental sites in Angola

Main data sets

- Soil moisture (Volumetric Water Content - VWC%)
- Yield per sample (grams)
- Yield total (grams)
- Number of grains per cob (unit)

Material and Methods

- We developed a participatory process in collaboration with local authorities to identify the farmers' communities.
- We designed a Latin square experimental field with three treatments and three replications.
- Treatments are set in:
  1) Agroecology practices combined with Water Harvesting techniques (AEA code)
  2) Agroecology practices (AE code)
  3) Control treatment (PL code) (traditional cultivation practices).
- From the literature, we pre-identified 14 water harvesting techniques and 4 agroecological practices to be tested in the field.
- Trough a participatory process with the farmers, we selected the techniques to be set in each community.
- 10 experimental fields with 4 agroecology practices and 6 water harvesting techniques were established. (Fig.2)
- We collected data on soil moisture, maize yield, number of grains per cob per sample, and total yield per treatment.
- We collected data over a period of 36 months, corresponding to three production cycles.
- The data were analysed using R software, applying a linear regression model.

Department	District	Community	Experimental design
Benguela	Cubal	Tinguita	Push-Pull + Furrow microcatchment
Benguela	Cubal	Muika	Push-Pull + Furrow microcatchment
Benguela	Cubal	Tchisselehã	Diversified rotation + Terrace bund with ditch microcatchment
Benguela	Ganda	Kalondende	Diversified rotation + Terrace bund with ditch microcatchment
Benguela	Ganda	Chicandula	Push-Pull + Furrow microcatchment
Cuanza Sul	Cela	Weia Weia	Agroforestry+Fruit + Ridge and Furrow
Cuanza Sul	Cela	Kawaka	Agroforestry+Fruit + Ridge and Furrow
Cuanza Sul	Conde	Ngonga	Agroforestry with nitrogen fixing trees + Hand dug Trenchs
Cuanza Sul	Ebo	Dala Mbir	Push and Pull + Contour Trench cum Bund
Cuanza Sul	Seles	Sungo do Galo	Agroforestry with nitrogen fixing trees + Semi circular bunds
Cuanza Sul	Seles	Ganja	Push-Pull + Contour Trench cum Bund

Results

- Preliminary results show a tendency for soil moisture to remain higher in treatments with water harvesting techniques as the dry season approaches.
- Water harvesting techniques are guaranteed to maintain soil moisture values for a longer period as the dry season approaches. (Fig. 3)
- Soil VWC data show no significant differences between treatments. (Fig.5)
- Maize productivity shows that Agrecology combined with water harvesting treatment has significant differences compared to Agroecology alone and Control treatments. (Fig. 6)

linear model: dry weight of maize cobs

treatment	mean value	standard error	t-value	p.value
Agroecology+ Water Harvesting	308.50	24.49	12.597	6.54E-29
Agreocology	-80.67	34.34	-2.349	0.0195
Control Plot	-71.16	33.89	-2.099	0.0367

- The differences range between 27% (Agroecology treatment) and 38% (Control treatment) lower productivity, depending on the Agroecology practices adopted.
- There is a tendency for increasing production yields in the two treatments compared to the control. (Fig. 4)
- The effectiveness of agroecology and water harvesting practices depends on the technical capacity to apply the techniques correctly.
- Communities with lower-quality technical support obtained unsatisfactory preliminary results.

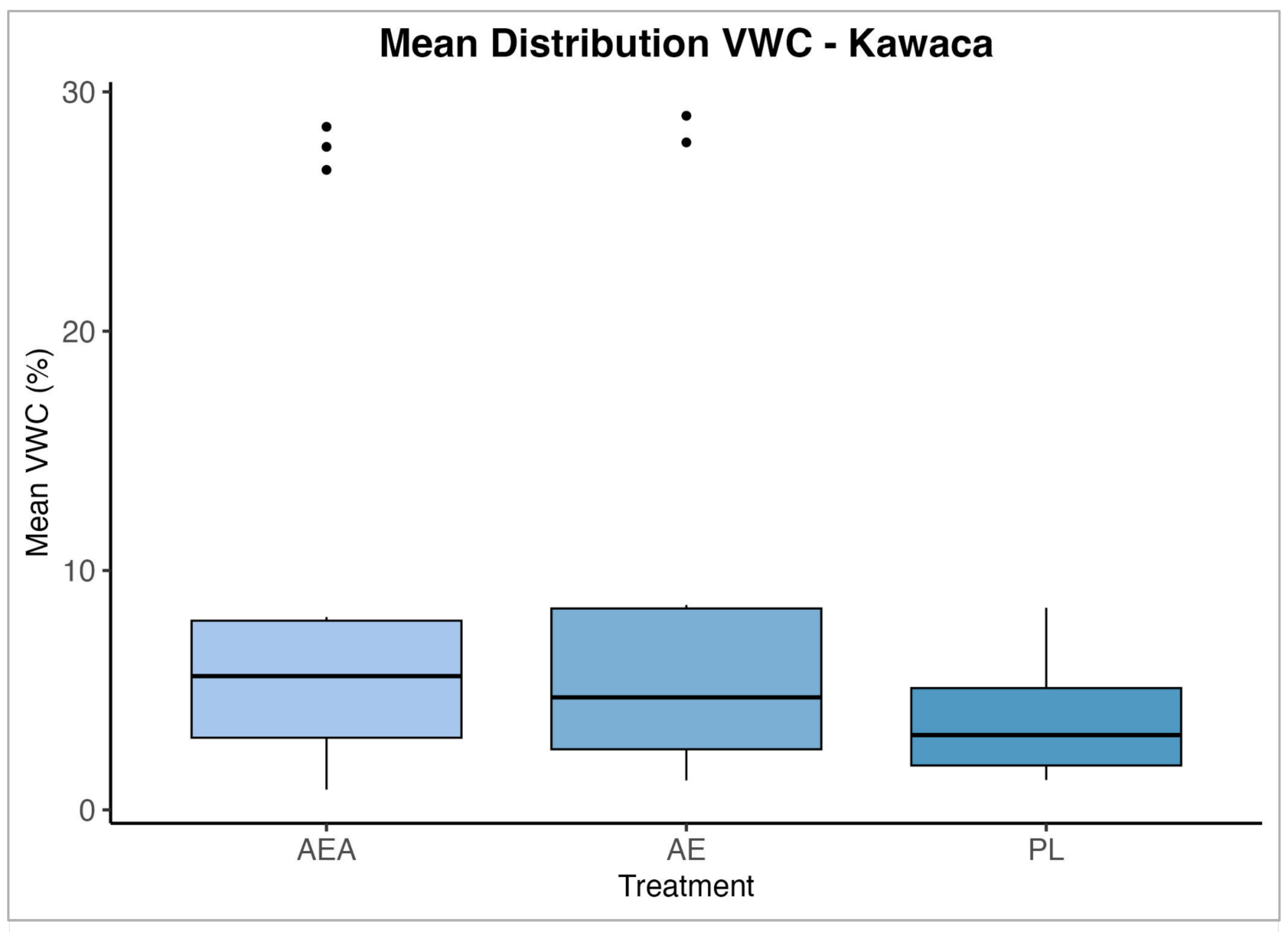

Figure 5: Soil moisture content (VWC%) under different treatments

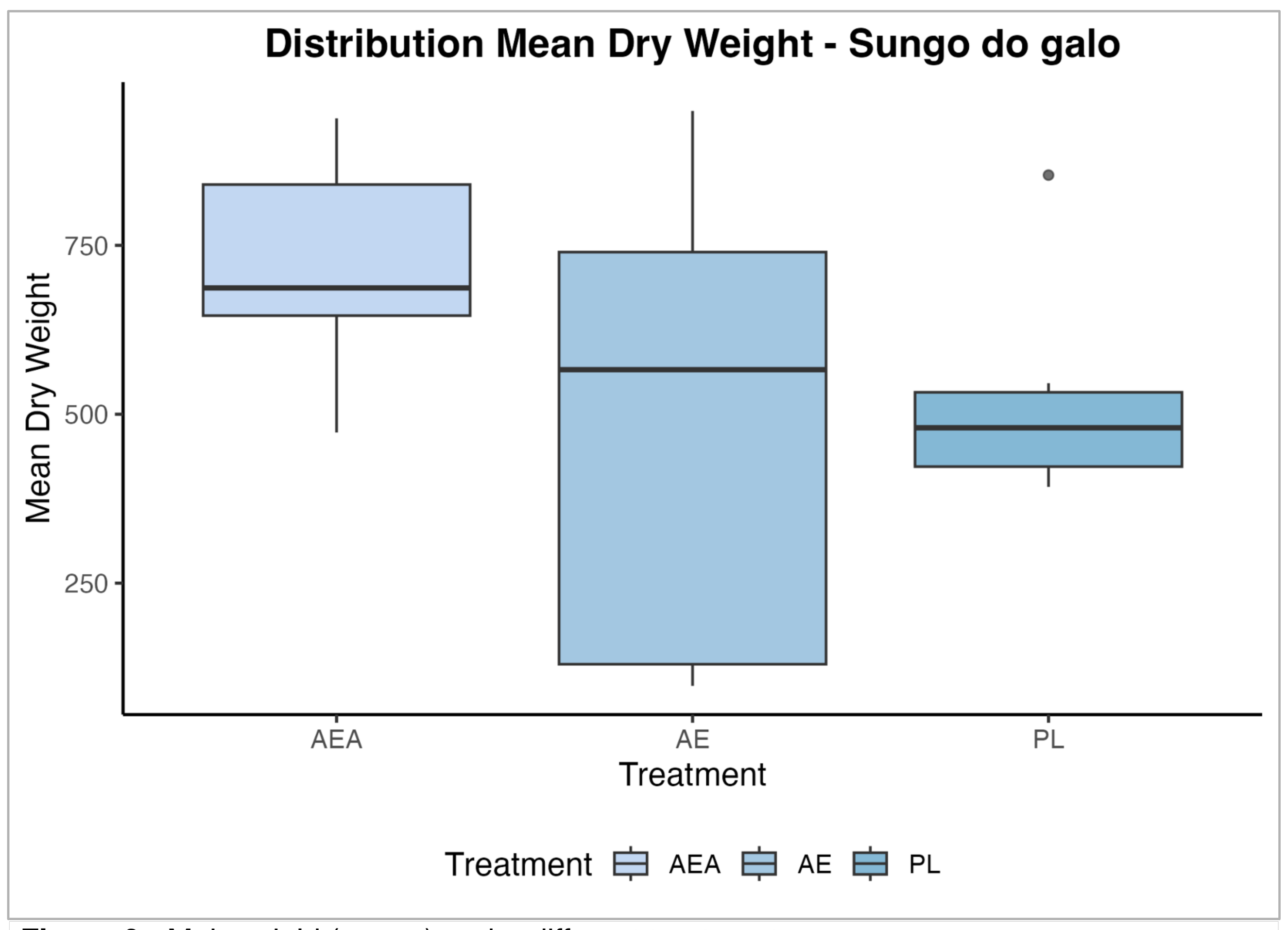

Figure 6: Maize yield (grams) under different treatments

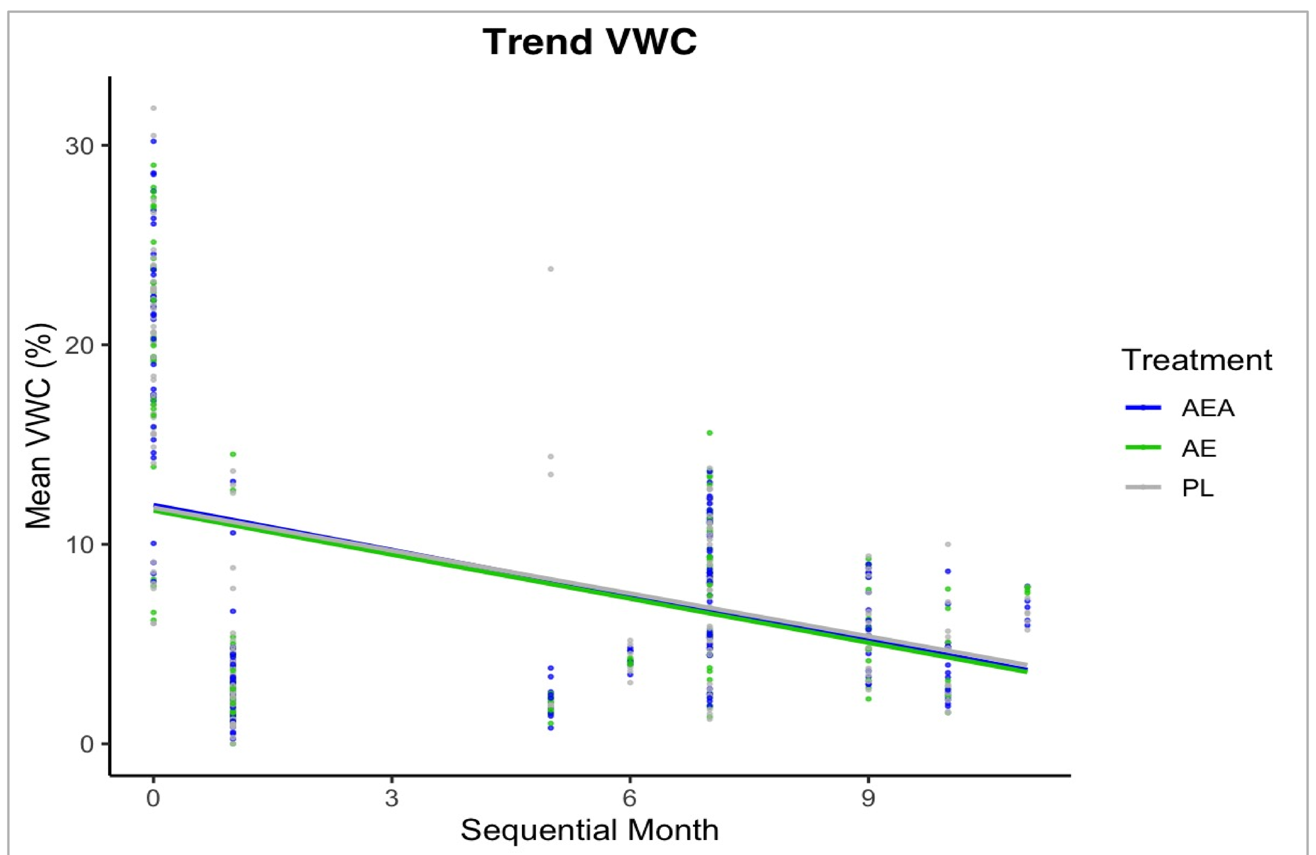

Figure 3: Dynamics of soil moisture content under different treatments

Conclusions

- The integration of agro-ecological practices with water harvesting techniques has been shown to engender favourable conditions conducive to the augmentation of production.
- In order to achieve optimal functionality and ascertain the impact of water harvesting techniques on the VWC, pedological studies must be undertaken.
- The impact of agro-ecological practices on agricultural productivity requires a longer period of experimentation to verify the differences in productivity compared to traditional practices and their ability to improve soil water retention due to the improved organic matter content.

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Disclaimer:
This research was carried out within the REFARM project, funded by the European Union Grant Contract Number No. FOOD/2021/429-168-RE-FARM I Angola
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Funded by the European Union