



UPS 1a: Rainwater harvesting for improving smallholder farmer's sole and intercrop yields under a rain-fed farming system

JÖRN GERMER, LUDGER HERRMANN, HENRY MAHOO, ELIREHEMA SWAI, FRIEDER GRAEF, FREDERIK KAHIMBA, FOLKARD ASCH, SIZA TUMBO, BASHIR MAKOKO, ANTHONY KIMARO, MEIKE SCHÄFER, PAUL SAIDIA, EMMANUEL CHILAGANE

KEY OBJECTIVE To conserve soil moisture in the field and to increase crop production in sub humid and semi arid areas. To reduce runoff and soil erosion for sustainable soil fertility management and crop productivity.

FVC COMPONENT(S)

Natural Resources, Crop Production

KEY CONSTRAINT ADDRESSED

In semi arid and sub humid areas, low soil moisture is a major production constraint for crop production. These areas are characterised by having low amounts of rainfall, which is poorly distributed. The rate of evapotranspiration is higher than the precipitation especially for semi arid areas. Flat cultivation, a common farm practice, resulted in poor soil water management, runoff, poor land husbandry, and low crop production.



DESCRIPTION

Rainwater harvesting (RWH) technologies promote crop production and have been used for generations in Tanzania. There are three main types of RWH technologies: (1) in situ; (2) micro-catchment; and (3) macro-catchment RWH. In situ RWH involves harvesting the rainwater directly as it falls on the field, or collecting and concentrating runoff water within the fields and reducing soil erosion at the same time. It includes technologies such as tied-ridges, infiltration pits, micro-basins, ripping, deep tillage, and mulching. Tied ridges of 75-80cm between ridges and 20cm high as well as cross-ties of 1.5m apart and 15cm high are constructed to create mini-basins. In case of light rainfall, the water accumulates, remains and infiltrates into the mini-basins. When rainfall is heavy, the water runs off over the cross-ties along the contour, because the cross-ties are lower than the furrow ridges and the furrows are built at an angle to the contour. Thus, overtopping, i.e. excess water flowing over the ridges, is prevented. The cross-ties reduce the speed of the water flow within rows.





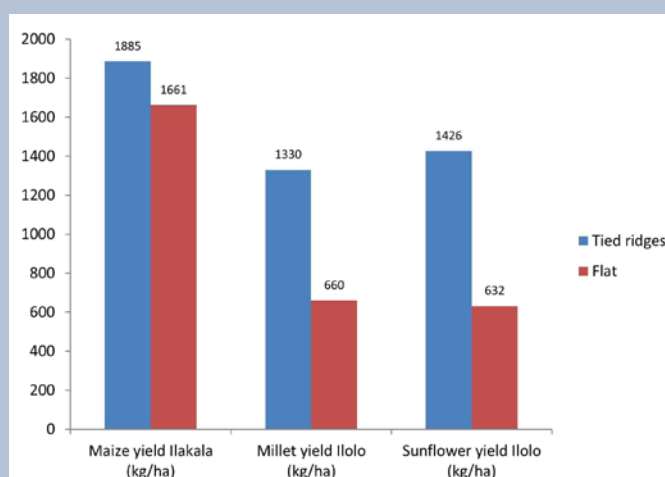
PROVEN SUCCESS IN TZ AND BEYOND

Rainwater harvesting (RWH) technologies to promote crop production have been in widespread use for generations, including in Tanzania. Research specifically carried out in semi arid areas of Africa, including some parts of Tanzania, showed that in situ rain water harvesting technologies can transform faming communities in areas prone to dryness from being food insecure to food secure by increasing their crop yields. Research by Mudatenguha et al. (2014) in Rwanda showed that maize yield can increase from 1593 kg/ha under flat cultivation to 3233 kg/ha under the tie-ridging technique. Moreover, the field study conducted at Dodoma by Kabanza and Rwehumbiza (2007) of soil moisture management practices reveal that tie ridges increased sorghum yields from 0.4 to 2 tons/ha. Mahoo et al. (2012) reported that micro-catchment RWH is widely adopted in the Kilimanjaro Region. The so called Majaluba system of RWH practised in the Lake Victoria Regions of Shinyanga, Mwanza and Tabora is another success story. The system is used to produce rice.



PROVEN SUCCESSFUL BY TRANS SEC

This research was conducted in a sub humid area characterized by rainfall between 800 and 1400 mm per year and in a semi arid area with rainfall ranges between 400-600mm per year. Tied ridges conserves soil moisture up to 20% longer than flat cultivation when there is a short term drought of a week or two weeks in sub-humid and semi-arid areas. It was also observed that in sub-humid climates, tied ridges improved maize yield by 224 kg/ha, while in semi arid regions millet yield soared by 670 kg/ha and sunflower yield by 794 kg/ha.



Effects of tied ridges on maize, millet and sunflower grain yields in sub- humid and semi-arid Tanzania



TECHNICAL SPECIFICS, DIMENSIONS

The spacing and size of tied ridges depends on landscape, slope, and soil types. Tied ridges do well in a wide range of soil types (texture); except for loose and easily erodible sandy soils. In addition to moisture conservation, tied ridges reduce soil erosion; therefore it is suitable in areas with gentle slopes up to 11%.

Farmers were trained on the proper construction and maintenance of tied ridges and infiltration pits. The distance between ridges depends on recommended crop spacing, height of the ridges should be at least 20 cm for better root penetration and crop anchorage. Cross furrows, known as ties, should be 15 cm high and between 1.5 and 2 m apart. Construction of tied ridges is labor intensive when compared to flat cultivation: tied ridges require 107.6 hours per person per acre (4500m²), which is equivalent to two weeks of a person working 8 hours per day. In comparison, flat requires only 24.3 hours equivalent to 3 work days. Additionally, tied ridges can result in better crop development and yield when integrated with fertilizer microdosing. To increase land use efficiency, tied ridges can be used in intercropping system at different ratios.

TYPE OF FOOD CROPS APPLICABLE

Tied ridges are suitable for all cereal crops grown in semi arid and sub humid areas. This includes maize, rice, millet, and sorghum. It also suits other crops like sunflower, sesame, legumes, and vegetables.

POSSIBLE LIMITATIONS

Possible limitations: These technologies are limited to areas with certain degree of slope and soil types (not suitable on very loose sandy soils that are highly erodible). The performance of technology is also limited by severe drought and/or excessive rainfall. It is tedious to implement as it takes four times more labor, but yields are higher.

LINKAGE TO OTHER FVC COMPONENTS

Natural resources: Tied ridges resulted in reduced soil erosion hazards by preventing run-off, lowering sediment load in surface waters, increased ground water replenishment, and increased nutrient demand due to leaching. Crop production: tied ridges resulted in increased labour demand (per unit of land area) and higher investment costs during implementation. Processing and marketing: tied ridges increase crop production and, hence, higher infrastructure requirements, improved processing capacity, and increased storage demand. Consumption: tied ridges resulted into increased yields, lower staple food prices, and increased food security.





CONSIDERATIONS & CRITERIA FOR UPS OUTSCALING

Training of trainers and farmers' groups can be carried out focusing on the importance and practices of soil moisture conservation in the field for increased crop yield in areas prone to drought. Introduction of special workshops on promoting on soil moisture management practices for resource poor farmers located in dry prone areas. This technology is suitable in the areas with wide ranges of soil types, except in easily eroded sandy soils. Annual crops such as maize, sorghum and millet are well suited to this technology compared to perennial and deep rooted crops.

KEY LESSONS LEARNED

Tied ridges are good at conserving soil moisture during short term droughts, ranging between one and three weeks. Integration of in-situ rainwater harvesting and fertilizer microdosing is an alternative that helps increase the food security of pro-poor farmers in sub-humid and semi-arid areas.



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