FIELD METHODS FOR MANAGING RAINWATER

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PRESENTATION OUTLINE

- Introduction
- Definition and importance of RWH
- Challenges
- Field practices-Mechanical and biological

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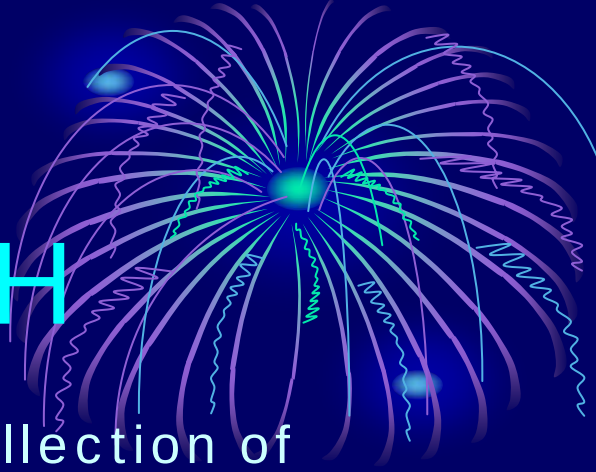
Introduction

- Rainwater harvesting for purposes of agriculture started in the early civilizations of Mesopotamia (now Iraq) and ancient Egypt about 7000 years ago. However, in those early days, harnessing of rainwater was being done without following recommended scientific methods. Today, significant progress has been made countrywide on how rainwater can best be utilized. This follows after realizing that serious land degradation had taken place due to uncontrolled runoff; runoff that could be properly utilized once it is harnessed and stored *in situ* or in storage structures. With this realization, the Malawi Government through the Department of Land Resources Conservation of the Ministry of Agriculture conceived the idea of forming the Rainwater Harvesting Association of Malawi (RHAM) to champion the need to properly harness rainwater.

Definition and importance of RWH



- Rainwater harvesting involves the collection of water directly from rainfall and runoff through the construction of collection, conveyance and storage structures, from which it is directed for various uses ranging from domestic (drinking and cooking) and non-domestic (feeding animals and small-scale irrigation)
- Rainwater harvesting is quite important for Malawi as it offers alternative agricultural opportunities to the smallholder farmers. Malawi experiences uni-modal pattern of rainfall which translates into one rainfed growing period per year. But, when rainwater is properly harnessed one or two “growing seasons” could be added leading into increased agricultural productivity.

Challenges

- Extraction of water from the lakes and rivers for agricultural development has been noted to be a costly venture such that with the meager resources, it is becoming increasingly difficult.
- Little research has been made in rainwater harvesting in Malawi. The data the country is using is from elsewhere such that it may not be adaptable here. Learning institutions e.g. the University of Malawi and Natural Resources College etc have just included rainwater harvesting in their curriculum in a bid to promote it. The technology is relatively new.
- Construction of dams again for agricultural development has been possible but not to the extent of satisfying the needs of all the farming communities due to the high cost of construction.
- Declining amounts of water resources to meet the demand for domestic needs, industrial, crop production, irrigation and livestock requirements.

Mechanical methods of RWH

- **Contour ridging**

  Contour ridging is a low-cost technique where ridges are constructed following a contour bund. This method ensures that rainwater is retained in the field and allows water to infiltrate into the soil hence improving soil moisture conditions for crop growth and development. Contour bunds are pegged by using different equipment such as a line level, an A Frame, and a Phiri lino Frame. In cases where fields are large, a dumpy level is used because it accomplishes the task faster.

Contour ridges

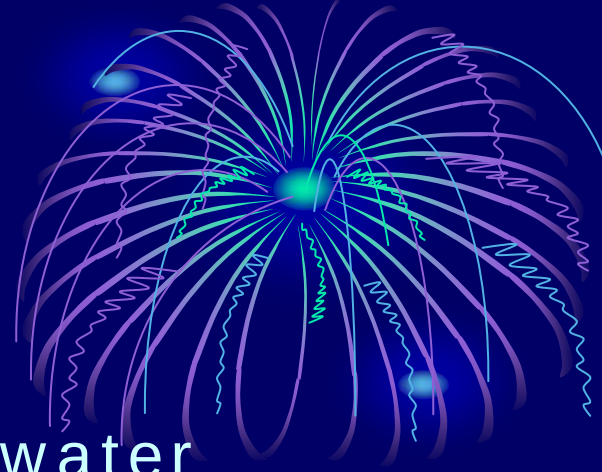
Negarims

- These structures are constructed 45 degrees to the contour line mainly to collect runoff to the lowest corner of the square. Trees or annual crops are planted at that lowest point to take advantage of the moisture which accumulates there. A typical negarim consists of a catchment area and an infiltration pit, the crop is planted is in the infiltration pit. The pit depth should not exceed 40 cm to avoid loss of water due to deep percolation. Areas with low rainfall such as 150-200 mm per annum are suitable for this technique.

Infiltration pits

- Infiltration pits are a very effective measure of rainwater harvesting used specifically for gully control. Observations in Malawi have shown that a gully of 1 metre deep by 1 metre wide disappears within two rainfall seasons.
- The normal practice is that these pits are dug 5 metres apart on a steep slope (>12%); 10 metres apart on moderate slope (5-12%); and 15 metres apart on a gentle slope (0-5%). The pits are dug inside the gully by throwing the earth upslope and when rains come, runoff fills the pits while at the same time earth slowly fills the gully. Eventually the whole gully fills.
- During the dry season, the pits are used for making manure.

Terracing



- Terraces are an important rainwater harvesting technique particularly in areas with steep slopes. In Malawi, bench terraces have been successfully used in tea and coffee fields. For smallholder farmers, fanya juu (throw up) and fanya chini (throw down) terraces are commonly used due to their ease of construction. These terraces are constructed following contour lines to retain rainwater where it falls to allow crops to make maximum use of it.

Fanya juu terrace

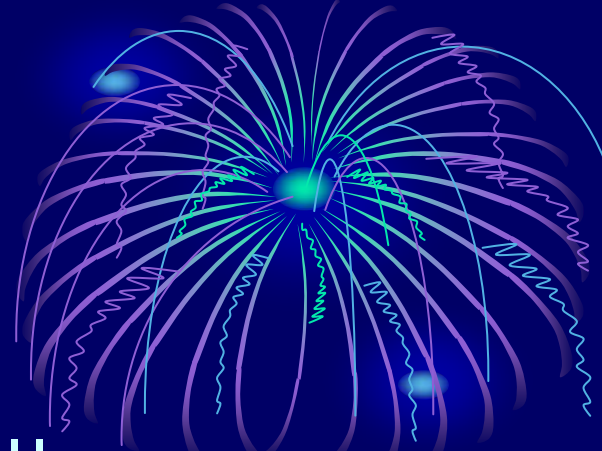
Planting pits

- Pit planting is common among farmers who cultivate shallow soils in drought- prone areas but the technology is also suitable for other areas as well. The dimensions of planting vary depending on the farmer's needs. The example shown in table 2 is typically used in one of the districts in the centre of the country.

Planting pits cont'd

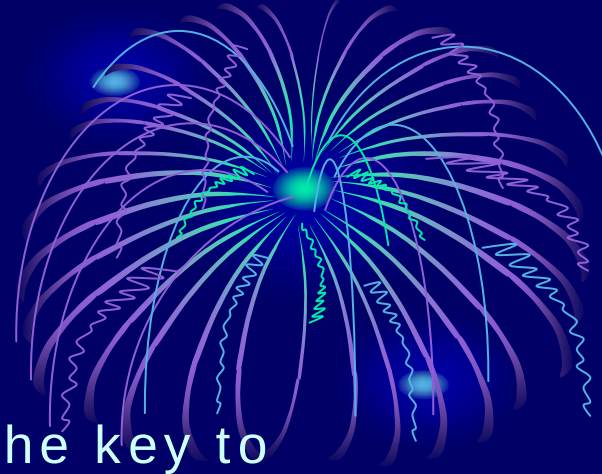
- At this spacing, there shall be 15,850 pits/hectare with 5 maize plants/pit giving a total population of 79,250 maize plants/hectare. Pits are very effective in retaining rainwater thereby allowing crops to utilize most of it. When manure is added, it increases water retention capacity within the pit therefore giving better yields.

Stone bunds



- Stone bunds are used in hilly areas; with shallow soils where soil cannot be easily scooped. Crop ridges are constructed following the stone bunds to allow water infiltration *in situ*. They have the same function as contour bunds. In the case of stone bunds, vetiver grass is not easily established.

Earth dams



- It is a well-known fact that water is the key to agricultural development hence its storage is fundamental. Water that is stored is used at the time that it is required. Earth dams, with less engineering skills have been constructed either for irrigation or for feeding livestock. Those dams meant for irrigation give farmers more income as crops are grown three times in a year.
- The advantage of small earth dams is that, apart from the fact they require low cost items, they can be sited near to cultivated fields to enable ease of water extraction.

Sand bunds

- Sand dams are masonry barriers constructed across seasonal streams. Sometimes sand bags are used as an alternative to dam the seasonal stream. Runoff is trapped by the dam and is used for agricultural projects.

Check dams

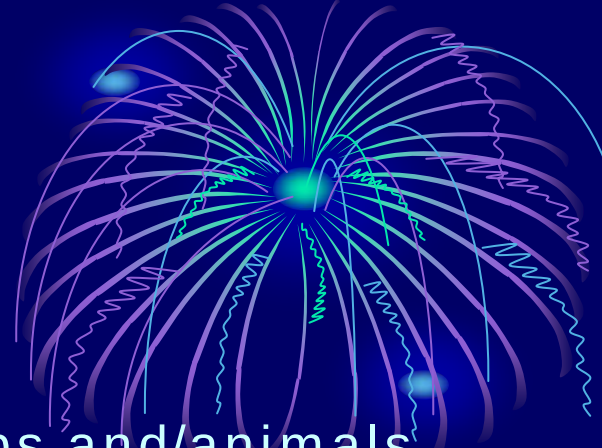
- Check dams used are of three types; brushwood check dams, stone check dams, and live check dams. All the three types of check dams are constructed across the gully and have one common goal i.e. to reclaim gullies. The horizontal distance of the dams follow the same principles of the magnitude of the slope as stated in sections a and e.
- Brushwood check dams are constructed by using dead vegetative materials. The objective is to trap sediments, slow down runoff, allow more runoff to infiltrate into the soil.
- The construction of stone check dams require stone collection and that of live check dams require the planting of trees across the gully.

- Brushwood checkdams

Flood diversion and flooding

- This technique involves diversion of runoff and floodwater from a gully or a river into cultivated fields to supplement rainfall that might not be adequate. When the water reaches the fields it is spread onto cultivated fields for purposes of irrigation.

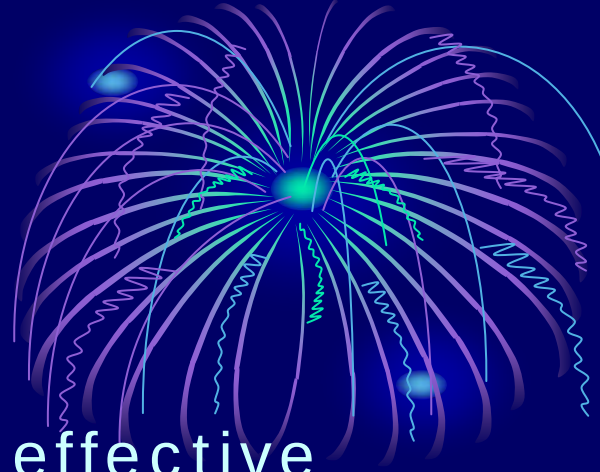
Agroforestry



- Agroforestry is a practice where crops and/animals are integrated with perennial tree crops on the same piece of land. This ensures that all rainwater that falls is used within the farming system, all excreta from the animals is turned into manure and the final user of all this is the crop and the farmer as the ultimate beneficiary. Through literature and by observation, all forested areas are very rich reservoirs of water and form important watersheds. On the other hand, all bare areas (denuded lands) are devoid of water; in most cases they are gullied and unproductive unless conservation measures are undertaken.

Agroforestry field

Use of manure



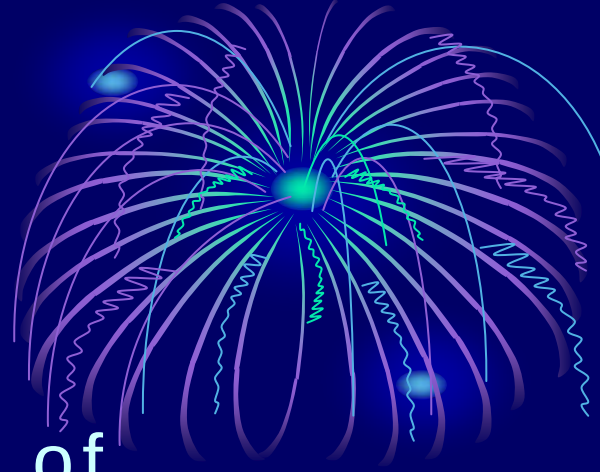
- Use of manure is one the most effective ways of harnessing rainwater. In Malawi, crops that are applied with manure do not suffer from water stress because manure stores moisture like a sponge. There have been cases where droughts of up to one month have taken place and crops applied with chemical fertilizers have at times reached permanent wilting point. Under the very same conditions those crops applied with manure have apparently not shown signs of moisture depletion.

Use of manure

Vegetative contour strips

- This is an old technology in the country where grasses are planteds along contour bunds to control runoff. In some areas of the country, farmers started using hyparrhnia grass (tsekera) runoff before independence in 1964. Lately, in the 1990's vetiver grass, particularly vetiveria zizanoides has been used along contour bunds. Vetiveria zizanoides does not compete with crops for light and nutrients and has therefore been found to be more appropriate under smallholder farmer's conditions. Its relative, vetiveria nigritana, whose seed has been known to be viable by some scientists, is also used, but with caution as more research is being conducted on it.

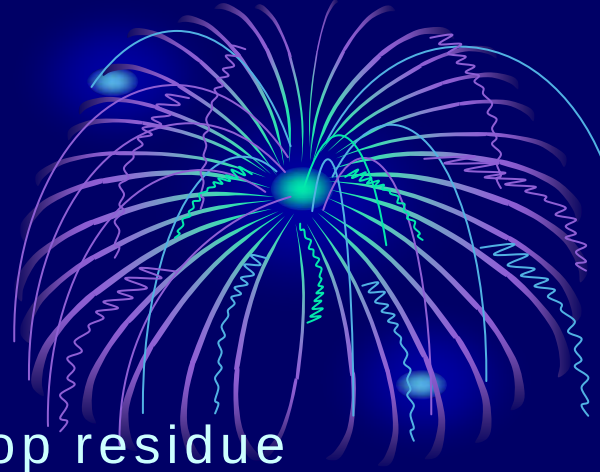
Mulching



- Mulch is a protective layer of vegetative material that is spread on top of the soil to reduce evaporation, conserve moisture, allow *in situ* infiltration, reduce erosion, regulate soil temperature around plant roots, and control growth of weeds. This is a very simple low-cost technology that does not require external inputs.

Mulching in maize

Crop residue management



- There have been instances where crop residue incorporation has been compared to manure utilization. The two technologies might serve the same purpose of improving soil fertility status of a particular soil but manure has a comparative advantage in the nutrient composition. The reason might be attributed to the fact some animal dung or chemical fertilizer is added during the making of manure. Incorporation of crop residues allows the retention of moisture which crops need for growth and development.
- However, crop residue incorporation is also recommended as it too improves the physical properties of the soil particularly soil structure which refers to how soil particles are arranged into groups or aggregates.

Intercropping/crop rotation

- Intercropping (planting of more than one crop on the same piece of land) follows the principle that when rain falls it cannot easily evaporate because the ground is covered. It is recommended to mix legumes with cereals because their nutrient uptake is different.
- In areas where the land holding size is big, crop rotation is recommended to maintain soil fertility. The disadvantages of cultivating the same crop year by year (monoculture) create many problems that range from infestation of pests and diseases, soil erosion, decreased crop yields etc.

Conservation agriculture

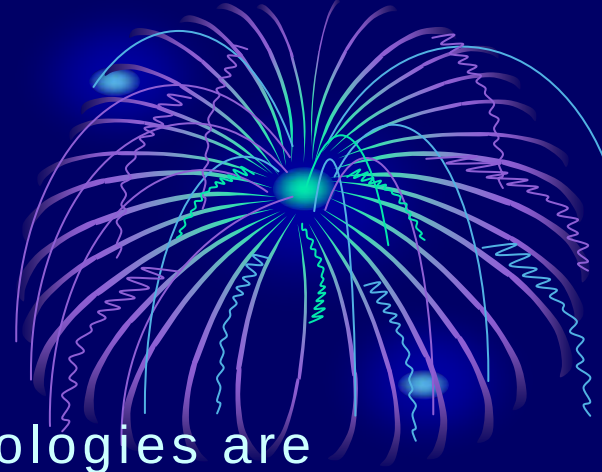
- Conservation agriculture embraces the principles of minimum soil disturbance, permanent soil cover and crop rotations and associations. These three principles conserve soil and soil moisture, enhances crop and fodder production, improves the quality of rural livelihoods, and reduces poverty. It is a practice that integrates the management of soil, water and plant regimes. It has many advantages that include the following:
- Evaporation of water from fields is reduced;
- Crusting and compaction are reduced;
- Lateral movement of water is reduced thus minimising soil erosion and improving infiltration;

Conservation farming plot

Conservation agriculture cont'd

- The impact of raindrops to detach soil particles is reduced due to the mulch left on the surface;
- Temperature extremes are moderated protecting seedlings fro extreme heat or cold;
- A better root system develops closer to the surface facilitating efficient fertilizer use and allowing more oxygen to become available to the roots.

Conclusion



- Although rainwater harvesting technologies are relatively new in Malawi, tremendous strides have been made particularly with the proliferation of so many donor-funded projects and programs. Most of the donor-funded projects; IRLADP, FIDP, FAO, etc have huge components addressing rainwater harvesting. The Rainwater Harvesting Association of Malawi as an NGO simply oversees all these attempts.
- With the realization that the land is currently seriously degraded, efforts to harness rainwater are seen as some of the options the country can take to mitigate droughts. It is now a serious matter to ensure that all rainfall and runoff should be utilized in a profitable manner so that agricultural productivity could be sustained.

END OF PRESENTATION

- ZIKOMO KWAMBIRI
- Asanta sana
- Shalom