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Water Harvesting: a Water Security Strategy for Mitigating the Impact of Drought in Ethiopia

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WATER HARVESTING: A WATER SECURITY STRATEGY FOR MITIGATING THE IMPACT OF DROUGHT IN ETHIOPIA

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LIVING WITH DROUGHT

The outside world knows Ethiopia because of its drought. This is simply because (i) drought (rainfall failure) prevails more frequently in the country, (ii) Over 90% of the food supply comes from rain fed small- holder agriculture, and (iii) rainfall failure means loss of major food supply which always results in massive food deficit. When this situation prevails consecutively for two or more years, famine occurs. The 1984/85 droughts and famine are still fresh in our memories. One has attributed most, Ethiopia's management of its natural resources was dangerous, and it has not yet changed much.

Unlike this undesirable situation, Ethiopia is still endowed with enormous land and water resources potential that can be transformed into a dependable source of energy and food supply. It is still known as the water tower of Eastern and Northern Africa, and it is the source of Blue Nile and several other trans boundary rivers. It contributes 85% of the total flow of the Nile. The total annual run off is estimated about 110 Billion M^3, and ground water potential is at 2.6 Billion M^3.

In technical terms (agronomic view), Ethiopia presently requires 57 Billion M^3 of water (nearly 50% of the existing potential) to produce enough food (sufficient) to feed its 65 million people with adequate per capita calorie requirement (2200 kcal). However, the means and know how to harness available water resources into productive use remains a difficult task. With the present practice and trend, water resources management remains challenging. With more time taking to act, situations at farm level are changing. The amount of water that can be stored in the root zone to that of the rain fall input (engineering view) is extremely low and dwindling particularly in the highlands of Ethiopia, which constitutes 45% of total area of the country and which produces 85% of the country's food supply. Land degradation has already left shallow soil depths with soil moisture holding capacity less than 25mm per meter depth. Moreover in most drought prone areas, dry spells during grain filling stage reaches up to 15 days, which often cause crop failure.

The population affected by drought and needing food assistance is increasingly growing and becoming a serious concern. For instance the population at risk in 2001/02 and 2002/03 were estimated at 1,724,800 and 14,273,600 (22%, the highest ever recorded).

The strategy pursued by the Government to cope with the challenges of drought and food insecurity is broad based, but one appears prominent, "Rainwater Harvesting", and at present it has received wider acceptance by policy makers. But technological and investment options are limited, and the desired holistic approach to water security to meet the growing food need on a sustainable basis is still along way, and remains a difficult and challenging task ahead.

WATER HARVESTING

The history of water harvesting in Ethiopia dated back as early as the pre- Axumite period (560 BC). Harvested rainwater was used for agricultural and water supply purpose. Water harvesting set up is till visible in the remains of one of the oldest palaces and its environ in Axum; the palace of the legendary Queen of Sheba. Other evidences include the remains in one of the oldest castles in Gondar (Fasiludus) constructed in the 17th century which used to have a sophisticated water harvesting set up with a flume used for transporting water to the palace pool at the time used for swimming and religious rituals by the kings. With such a history in Rainwater Harvesting, the big question is why then water harvesting technologies and practices did not develop so much in Ethiopia?

RUN OFF FARMING

Every bit of rainfall runoff from the farm and its surroundings is harvested and directed back to the farm to provide supplementary irrigation. This practice is widely used in the highlands of Hararghe. The technique involves diversion of runoff from the farm, run off from roadsides, foot trails and farm boundary grass waterways. Under exceptional conditions runoff diversion is made to a temporary storage facility such as embanked gully, and the water will be used for supplementary irrigation, and crops most grown are high value crops such as Chat (Chat edulis), coffee and fruit trees. Farmers are, therefore, improving their productive performance and earning more income. This technique is well adapted in areas with altitude between 1700 and 2500 m.a.s.l and 700 to 900 mm annual rainfall.

During the early part of the season, one or two runoff irrigations improve crops establishments and stand, and the last season runoffs (again three or four irrigations) will bring the crop to full maturity. The technique is traditional and quite simple and the interception ditches are done manually by local tools, and may require one or more additional labour. The practice is now improving crop harvest even under highly erratic rainfall condition.

FLOOD SPREADING

Flood spreading technique is similar to the one described above, runoff farming, and both employs rainwater without temporary water storage facility. However, it is different in the source of water and size of the stream, and the environment (terrain, climate) under which it is practiced. The runoff originates from the highlands and it is appearing as flash flood at the lowland downstream where the rainfall is low, unevenly distributed and most often inadequate for crop production. The flash flood is diverted using temporary structures to small individual farmlands located along the riverbanks, and the diverted water is spread into the field as supplementary irrigation. The flood, depending upon the rainfall situation in the upland areas, stays in the riverbed for half to one hour. Three four irrigations at late part of the season (at critical period, flowering and grain filling stages) will bring the crop to full maturity, and crop yields are dramatically increased relative to the traditional practice where crops most often fail.

In Hararghe in 1998, one farmer increased his crop yield from 0.3 ton to 0.8 ton in nearly one hectare land and another farmer got a bumper harvest using the same technique, yield increase

from 0.8 to 2 tones of sorghum from approximately the same size of holding. The higher yield in the latter was due to the use of improved seed (variety). The crop stable remains green for longer period with new shots due to residual moisture and provides pasture for livestock.

PONDS

Traditional ponds have been used in Ethiopia for millennium; some estimates it as early as 560 BC (Fattovich, 1990). They are used to harvest rainwater for both human and livestock watering, particularly in the arid and semi arid rural areas where annual rainfall is less than 700 mm. They are major sources of water in the rift valley where ground water is deep and other sources of water are not feasible. There are over 8000 traditional ponds (including Birkas) and this is quite insignificant to the potential and needs of the country.

Ponds are simple to construct and the community can manage it. The most common type of pond is the excavated type. The size of the ponds range from 650 M^3 to several thousands, and they serve for 3 to 6 months and largely during the rainy season.

DUG WELLS

Dug wells (3 to 15 meters) are major sources of water both for domestic water supply and agricultural uses and they are widely used in wetland areas, sand river beds and valley bottom lands in the Ethiopian highlands. Their potential at times is very low and get dry during the driest period of the year; March April. Shallow wells equipped with a 200 liter barrel and small scale drip irrigation on approximately 0.1 ha supported the production of high value crops. Sales from a one time crop harvest reaches USD 300, though market still is a constraint

ELAS

Elas are other types of traditional wells (5 to 10 meters) widely used for livestock watering in Borena, southern Ethiopia. Water is lifted through a human chain lined up along the wall of the well each standing on a terrace like structure, and the lifting of water is continuous using two or more containers at one time; one container going up with water, the empty one down. A three to five meters livestock-watering trough extends near the edge of the well and lifted water is emptied into the trough.

ENSET LEAF

Enset (Ensete ventricosum) is a plant grown in Southern Ethiopia, and it is a staple food crop for approximately 6 million people, and annual rainfall is 900 to 1100 mm. It is most often planted at the back yard, and it has broad and clean leaf. Women during the wet season bend one of the leaves and direct its tip to a container and harvest clean and safe drinking water at her back yard, and this practice is widely used.

SOIL MOISTURE CONSERVATION

In -situ water harvesting using open and tied ridges in moisture stress areas improved land and crop productivity by 100%, and farmers are increasingly using them in drought prone areas. Constructing level terraces has also been a well-established tradition for hundreds of years for the Konso people in Southern Ethiopia. Sorghum [Sorghum bicolor (L.) Moench] is grown under extremely harsh environment; unreliable rainfall conditions. It is in deed one of the wonders of this country, and a symbol of struggle for survival against the adversaries of nature.

ROOF WATER HARVESTING

In the highlands where the terrain is rugged, and the villages and hamlets are scattered, and large scale and modern water supply schemes are difficult and expensive, roof water harvesting seems a better development option. It is also found to be the only option in areas where ground water is not feasible, perennial streams/rivers are not existing. As a result roof water harvesting from schools, churches and individual houses with corrugated roof are being tried in Ethiopia and the results are encouraging. It provides adequate water during the rainy season, a period when the rural people are busy with the farm activities and when there is shortage of labor with in short distance. In earlier times, roof water harvesting practices were confined to urban areas only. However, these days its use in the rural areas are increasing as more people in the rural areas are starting to have corrugated roof houses

The cost at household level for 2 to 3 m^3 capacity set up will cost in the range between US$ 75 and 88. For example a 20-m^3 capacity circular Ferro cement tank with its accessories will costs approximately US$ 1500 (Alem, 1999).

UNDER GROUND CISTERN (CHINA TYPE)

A Chinese designed under ground cistern for runoff storage is now being introduced for farmers in drought prone areas in Ethiopia. The under ground cistern is two types, the first type is a closed system having a bottle shape, and the second type is a half circular or hemispherical. The first type cistern is made from reinforced concrete, and it is circular in shape, 100-120 cm diameter circular at the top, and bulges out immediately at a depth of 300 cm depth (neck of the structure), and the diameter increase to 380 to 400 cm, and the total height of the structure is 780 cm. The structure is built using the soil first curved out (mold) in the shape of the cistern. The existing experience is it may be a bit difficult to construct by the farmer, and it is also expensive, each worth USD 760, while the second one is USD 412.

The hemispherical cistern is much easier to construct. The soil is removed maintaining exactly the shape of half circular, and the surface is covered with polyethylene or concrete plastering to avoid seepage loss. A plastic or thatched roof is also placed above the ground to reduce evaporation and protect birds, and animals to have direct access to the water.

Both structures have a silt trap connected to an entrance pipe to the cistern. The capacity of each structure is 60,000 liters. The primary objectives of the cisterns are to provide domestic water

supply and support crop production efforts in drought prone areas, and they are targeting individual farmers.

CONCLUSION

Ethiopia still has a big potential for benefiting from rain fed agriculture even in drought prone areas. However there is a strong need for extensive training of farmers and effective and serious investment at smallholder farmers level.

In the 21st century, the strategy is, therefore, to increase water productivity through harvesting available water, conserving and utilizing efficiently for crop production, and it should be developed as an integral part of the Agricultural Development Program Package, and the Ethiopian government is now doing this.

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