Technology Fact Sheet for Adaptation

III. Efficient irrigation methods [i]

Introduction

There is growing evidence that changes in the hydrological cycles look likely to cause longer droughts and more intense rains making wet regions even wetter and arid areas drier in the near future. Changes in precipitation and the disappearance of glaciers will result in a considerable reduction of water quantity and quality for direct human consumption and agricultural activities. This in turn will affect agricultural production and food security leading to unforeseen famines in the near future over the world. Hence it is important to address the issue of irrigation in agriculture and design methods or technologies that would make the use of water for irrigation more efficient and sustainable.

Technology Characteristics

Efficient irrigation methods or technologies include the following advanced irrigation systems like sprinkler irrigation and drip irrigation. Sprinkler irrigation is a type of pressurized irrigation that involves applying water to the soil surface using mechanical and hydraulic devices that simulate natural rainfall. The goal of irrigation is to supply each plant with just the right amount of water it needs. Sprinkler irrigation is a method by which water is distributed from overhead by high-pressure sprinklers on risers or moving platforms. Today a variety of sprinkler systems ranging from simple hand-move to large self-propelled systems are used worldwide.

Drip irrigation is based on the constant application of a specific and calculated quantity of water to soil crops. The system uses pipes, valves and small drippers or emitters transporting water from the sources (i.e. wells, tanks and or reservoirs) to the root area and applying it under particular quantity and pressure specifications. Managing the exact moisture requirement for each plant, the system significantly reduces water wastage and promotes efficient use. Compared to sprinklers systems which can provide 75 per cent efficiency, drip irrigation can provide as much as 90 per cent water-use efficiency[1] (Tanji and Kielen, 2002)

Country Specific Applicability and Potential

Considering the fact that agriculture and forestry is the major source livelihood for Bhutanese, it is imperative that these climate sensitive sectors are safeguarded against the effects of climate change. Hence there is a need to incorporate efficient irrigation measures into Bhutan's over plan for bolstering its adaptation capacity.

Status of Technology in the Country

National Irrigation Policy (NIP) of the Royal Government of Bhutan (RGoB) intends to provide policy direction in the irrigation sub-sector to address its current and future issues. It provides clear direction on the measures that need to be adopted to increase the irrigated area and to improve irrigation water management and optimal utilization of national water resources for crop production In Bhutan, a three-year rainwater harvesting project aimed at safeguarding farmers from water shortages during dry periods and irregularities in the monsoon rainfall had a total budget of $850,000. The activities include small scale irrigation development based on rainwater harvesting technologies, strengthening farmers involvement and research and extension services, vulnerability assessment, land survey, rural credit, project management ,identification of areas vulnerable to dry spells and erratic monsoon rainfall, aerial surveys and evaluation of remote sensing images/photographs to determine areas suitable for ,water harvesting, assessment of available and proven rainwater harvesting technologies for adoption, technological adaptation to fit the needs and requirements specific to each vulnerable locations, economic analysis of rainwater harvesting techniques, etc. Using bamboo stems for drip irrigation during the dry season is a common feature in irrigation in Bhutan.

[1] Tanji, K and Kielen, N 2002, 'Agricultural drainage water management in arid and semi-arid areas', FAO irrigation and drainage paper 61 (Annex section), Food and Agriculture Organization of the United Nations, Rome

Benefits to economic, social and environmental development

Sprinkler irrigation

- Benefits from improved crop productivity include income generation, employment opportunities and food security
- Sprinkler systems eliminate water conveyance channels, thereby reducing water loss
- Sprinkler irrigation technology is well adapted to a range of topographies and is suitable in all types of soil, except heavy clay
- Sprinklers provide a more even application of water to agricultural land, promoting steady crop growth.
- The risk of soil erosion can be reduced because the sprinkler system limits soil disturbance, which can occur when using irrigation by gravity
- Sprinkler irrigation can provide additional protection for plants against freezing at low temperatures.

Drip Irrigation

- A well-designed drip irrigation system reduces water run-off through deep percolation or evaporation to almost zero.
- As water consumption is reduced, production costs are lowered. Also, conditions may be less favorable for the onset of diseases including fungus.
- Drip irrigation promotes irrigation scheduling to precisely meet crop demands, holding the promise of increased yield and quality.
- Agricultural chemicals can be applied more efficiently and precisely with drip irrigation, reducing losses.
- The drip system technology is adaptable to terrains where other systems cannot work well due to climatic or soil conditions.
- Drip irrigation technology can be adapted to lands with different topographies and crops growing in a wide range of soil characteristics (including salty soils). It is particularly efficient in sandy areas with permanent crops such as citric, olives, apples and vegetables

Climate change adaptation benefits

Efficient irrigation systems including sprinkler and drip systems provide a means for sustainable water use and management and strengthening the adaptive capacities of people living especially in economies that are heavily dependent on agriculture. Climate change is disrupting global rainfall patterns meaning some parts of the world are suffering from a drastic drop in precipitation leading to a fall in water levels in many reservoirs and rivers. Sprinklers, drip irrigation and rainwater harvesting allows for efficient use of water and represent an adaptation strategy against scarcity of water.

Financial Requirements and Costs

The cost of installing a sprinkler system ranges from US$ 600 to US$ 2500 per hectare, depending on the type of materials used and the amount of labour contributed by rural producers. The cost also depends on the specification and degree of automation of devices required. Financing for equipment may be available from financial institutions via leasing operations or through direct credit. Farmers usually cover installation, design and training costs that represent about 30 to 40 per cent of final costs depending on the size of the land, characteristics and shape, crops, and particular technology applied.

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[i] **This fact sheet has been extracted from TNA Report – Technology Needs Assessment and Technology Action Plans for Climate Change Adaptation – Bhutan. You can access the complete report from the TNA project website http://tech-action.org/**