Managing floods: quintessential adaptation to climate change and variability

LEADERSHIP COURSE IN FLOOD-BASED FARMING SYSTEM & WATER HARVESTING

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Objectives

- Learn flood management for increased crop growth and adapting to climate change
- Discuss various techniques and practices that can be used take advantage of floodwater and runoff water for crop growth
- Understand the technologies, the factors that influence adoption and successful out-scaling

Introduction

Agriculture in LDCs:

- An important component of rural income and livelihood
- Dominates the economy and livelihood of majority of smallholders in Asia and Sub-Saharan Africa (80%)
- Main source of employment (70+%)
- Contributes to countries GDPs

Introduction

- Despite its significance, the agricultural sector in SSA and SA is affected by inadequacy, seasonality, and unreliability of rainfall
- Mostly rainfed farming
- Periodic floods and droughts
- Countries in these regions have been experiencing food shortages, mainly due to bad weather

Introduction

Agriculture: Key Challenges

- Floods
- Droughts
- Changing climate
  - Unreliable and erratic rains, increased dry spells, new pests and diseases, changing seasonal start and end dates, rising temperatures
- Civil wars
- Leading sector with higher water use (70%) and having economic and water use inefficiency (IFAD, 2007)

Maize in semi-arid areas without WHT

Maize in semi-arid area with WHT

Introduction

Technologies for managing floods and droughts

- Spate irrigation
- Night storage microdams (*ndivas*)
- Infield and off-field RWH
- Excavated bunded basins (*majaruba*)
- Charco dams
- Water lifting devices
- Sand dams for livestock
- Terracing
- Infiltration pits (e.g. *ngoro, chololo* pits in Tz)
- Tied ridging, etc

The need for flood management

- Erratic rainfall and unexpected flush floods, if not properly managed will always cause crop damages and field losses, resulting in lower crop yields

- Improper management of floods and rainfall runoff in gullies can also be regarded as missed opportunity of harvesting, storing, and utilizing rainwater water for improving crop production

Spate irrigation a WuT for flood management & adaption to climate change

Issues to be looked at:

- Technical descriptions
- Geographical spread/suitable locations
- Physical setting
- Institutional setting
- Alternative coping strategies
- Opportunities and constraints to adoption
- Factors for upscaling

Community water/river diversion (CRD) / spate irrigation

- System of diverting flash floods from the riverbed via canals to bunded fields that may be located some distance from the water source
- Art and science of water management that is unique to semi-arid environments.
- "Spate" refers to flood water from episodic rainfall in the upper part of river catchments, which in the lower part is diverted from both ephemeral rivers and gullies and spread over agricultural land

Spate irrigation

Community water/river diversion (CRD) / spate irrigation

Flood management by spate irrigation

- Traditional irrigation method that could potentially be improved and expanded
- Often characterized by poor infrastructure, poor water management, and low yields
- Managed by the communities
- No permanent infrastructure for diversion, exploiting concentration of water from drainage works, entirely farmers efforts
- Limited availability of runoff, as no associated storage capacity is assumed

Spate irrigation as a holistic system

Experience from Tanzania

Spate irrigation: experience from semi-arid Tanzania

Uplands

Midlands

Lowlands

Experience from semi-arid Tanzania: Uplands

Experience from semi-arid Tanzania: Uplands

- Higher rainfall (1000-2000 mm pa)
- Steep slopes
- Prone to erosion
- No incentive for water conservation except for soil conservation/erosion prevention
- Higher crop production, income and social status
- Wet and dry season farming possible

Community Agreement: Upland community to use water during daytimes and release water at night for midland and lowland areas

Experience from semi-arid Tanzania: Midlands

- Moderate rainfall (500-800 mm pa)
- Gentle slopes
- Prone to erosion
- Experience occasional water scarcity during wet and dry season
- Conserves both water and soil
- Good crop production under supplemental irrigation
- Wet and dry season farming with supplemental irrigation
- Use Night storage Microdam (ndivas) to store water released by upland community at night and irrigate during day times

Experience from semi-arid Tanzania: Midlands

Microdam night storage structures

Microdam (ndiva)

Traditional ndiva

Improved ndiva

Experience from semi-arid Tanzania: Midlands

Lined canals to convey water from microdam to fields with min water losses

Transition from Midland soil and water conservation to lowland spate irrigation

Lowland areas

Experience from semi-arid Tanzania: Lowlands

- Low rainfall (300 – 500 mm pa)
- Gentle to flat slopes
- Prone to siltation by flooding
- Experience severe water scarcity during wet and dry season
- Main focus is to conserve soil moisture
- Selective seasonal cropping systems (drought resistant crops)

Flood gauge on bridge piers to predict extent of flooding in the lowlands

Floodwater overtopping railway bridge due to backflow from spate irrigation infrastructure

Lowland fields without spate irrigation

Participatory construction of spate irrigation infrastructures

Participatory approach

- Researchers conceptualized RTD intervention with beneficiaries
- Stakeholders inception workshop to agree on level of participation
- SUA (Project):
  - topo survey, pay for all shop materials and car hires
  - Pay skilled laborers
  - Deal with researchable issues

Participatory approach

- Community:
  - Labor force for breaking and loading stones, bringing sands and water for construction
  - Supervision of construction
- Same DC:
  - Design of spate irrigation infrastructure, and day to day construction supervision

Participatory construction of spate irrigation infrastructures

Participatory construction of spate irrigation infrastructures

Results of spate irrigation

Spate irrigation: coping with uncertainties of spate-irrigated agriculture,

- Diversification of the household economy (multiple sources of income)
- Households having different plots of land with high and low probabilities of spate irrigation
- Saving of surplus grains from one year with crop surplus to bridge the gap to the following year
- Investment in easily disposable property, such as livestock, in good years with crop surplus to be sold in a lean year

Spate irrigation: coping with uncertainties of spate-irrigated agriculture…

- Wage labour and off-farm income-generating activities
- Exploitation of locally available natural resources, e.g. trees for charcoal, firewood and timber
- Migration of male household members in search of labour
- Remittances and borrowing money from relatives, suppliers and/or money lenders.

Factors influencing adoption of spate irrigation

- Soil conditions and topography - most suited to gentle slopes with sandy loam or loamy sand soils
- Assured harvest under spatter irrigation
- Farmers need to be trained on proper diversion of water construction of the spate irrigation infrastructures
- Land ownership – people who hire land normally no not invest in permanent spate irrigation infrastructures such as construction of lined water diversion boxes

Approaches for scaling up of SI

- Spate irrigation has not received the same attention from scholars, governments, non-governmental development organizations and the donor community
- More attention is needed at all levels to ensure the technology is up-scaled
- farmers exchange visits
- farmer-to-farmer training using farmers field schools

Factors influencing adoption of flood management and other WUTs by smallholder farmers

- Adoption factors can be grouped into three main categories:
  - farm/farmer based
  - technology based
  - institutional related

Factors influencing adoption by smallholder farmers

- Farm/farmer based:
  - Positive perception of farmers regarding the potential of technology in increasing crop yield
  - Farmer's choice of crop with high water productivity and returns per drop
  - Gender of a decision maker in the household
  - Education
  - Secured land tenure
  - Family wealth

Factors influencing adoption of WUTs by smallholder farmers…

- Technology related:
  - low initial capital investment
  - less labour requirement
  - locational suitability (e.g. topography, soil type)
  - simplicity of technical and design requirement.

Factors influencing adoption of WUTs by smallholder farmers…

- Institutional factors:
  - availability of credit to farmers
  - extension services
  - technical support.

Approaches for scaling up

- *Local planning scale:* improving community awareness and build the capacities of farmers on WUTs through training approaches such as FFS and exchange visits; and farmers' secured access to land.

- *Sub-national planning scale:* increase public investment in WUTs through different agricultural funding mechanisms e.g. the District Agricultural Development Plans (DADPs), District Irrigation Development Fund (DIDF) and development partner funding.

Approaches for scaling up

- *National planning scale:*
- Formulate, harmonize and implement policies to promote potential WUTs in different agro-ecological zones and mobilize strategic public investments.

Key recommendations

- Policies address water management holistically. They need to focus on promoting spate irrigation in addition to the conventional irrigation.
- Adequate mechanism for enforcing policies, regulations and by-laws.
- Where farmers and pastoralists co-exist, conflicts always arise over water and grazing/farmland.

Policy recommendations…

- Crop enterprise choice is critical to ensure returns on investment from different WUTs are optimized.
- Farmers need to be capacitated to be able to undertake such choices from a range of crops that can be grown on their lands given WUTs.
- For proper adoption, WUTs should be promoted as a package with other technologies e.g. improved seeds, use, and appropriate crop choice.
- Promotion of WUTs should not be gender-blind, ensure participation of women and youth in implementation of WUTs.
- Avoid insecure land tenure among women.

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Thank You/Ahsante sana!