Action Research in Support of Better Water Management in the Limpopo Basin

In the semi-arid tropics, the Limpopo basin in Southern Africa is a hotspot for poverty and water scarcity. Here, agricultural production is hampered by poor soil fertility, inadequate or unequal access to water resources and low infrastructure development, among other factors. Rainfall is unreliable, falling mainly between October and March, with frequent dry spells during the crop-growing season. Integrated water resource management (IWRM) was considered appropriate to provide ways to address the water needs of agriculture and nature. The CGIAR Challenge Program for Water and Food (CPWF) project on IWRM Improved Rural Livellihoods was designed to help smallholder farmers adopt better water management practices; develop appropriate catchment management strategies based on principles of IWRM that incorporate the sustainable use of green and blue water resources; develop institutional models for water governance and build capacity among farmers, extension officers, water managers, and researchers at local universities in the Limpopo Basin and in southern Africa. The project covered three catchment areas within the Limpopo Basin -- the Mzingwane in Zimbabwe, the Olifants in South Africa and the Chokwe in Mozambique.

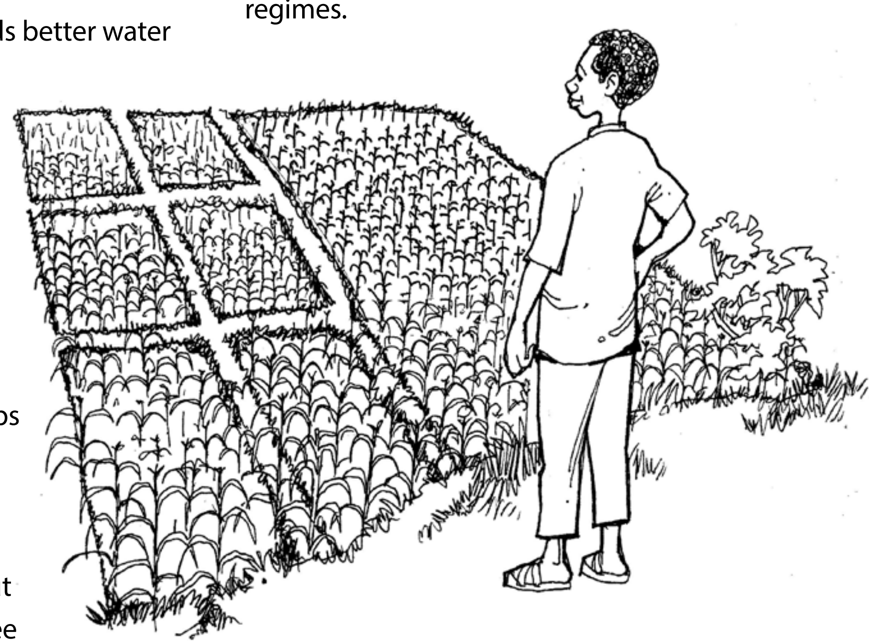
This article focuses on the experience of undertaking action research towards better water management in farmers' fields. The project started with a baseline assessment of water resources, agriculture and institutions in the basin. Issues addressed included improving crop productivity using low- input systems, such as conservation agriculture and improving water availability for crops through rainwater harvesting and supplemental irrigation.

This research project was carried out in three pilot catchments using three approaches:[1]

- Farmer field-based action research using technologies such as conservation farming and nutrient management to increase crop yield
- Water resource research where rain, surface water and groundwater flow partitioning were characterized
- Institutional research, which developed appropriate institutional models for water governance and strengthened institutions and policies for water productivity and risk mitigation

Farmer field-based action research

To identify successful innovations and improve household food security, farmers in Zimbabwe, Mozambique and South Africa were asked to evaluate conservation agriculture and rainwater harvesting and to participate in field testing of different nutrient and soil salinity management regimes.



Conservation agriculture

Conservation agriculture (no till and reduced tillage) practices help to concentrate rainfall in the root zone of plants and decrease runoff from the field. Practices include methods that simultaneously conserve soil and water resources, reduce farm energy usage and increase or stabilize crop production, such as tillage (single and double plowing), ripping, and use of planting basins or Zai pits. Studies showed that the best results are obtained when such methods are combined

[1] *This article focuses mainly on the first approach: farmer field-based action research.*

with fertility improvements (e.g., manure) or microdosing with fertilizers or mulching. Farmers in the Zhulube and Mnyabezi areas, Mzingwane in Zimbabwe, adopted some of the conservation agriculture technologies.

Rainwater harvesting

Rainwater harvesting (RWH), on the other hand, involves the collection and concentration of runoff for productive uses (crop, fodder, pasture or tree production, livestock and domestic water supply, etc.) either in-field (tillage techniques, pits, etc.) or off-field (micro-catchment or runoff farming and supplementary irrigation). Some of the common methods used by farmers were infiltration pits, tied furrows, dead level contours, contour ridges, potholing and fanya juus. These, and the use of plastic material to harvest rainwater in the field, were studied. Results showed that RWH improves soil moisture available to crops during the extended dry spell periods. A methodology flow chart can be used to systematically investigate the impacts of out-scaling rainwater harvesting (in-field and ex-field) techniques.

Supplemental irrigation

Supplemental irrigation involves the addition of small amounts of water to rainfed crops during times of insufficient rainfall to provide sufficient moisture for normal plant growth and to improve and stabilize yields.

Farmers practicing surface irrigation in Zimbabwe compared low-cost drip irrigation technologies with conventional surface irrigation systems in terms of water and crop productivity. NGOs were also asked to assess the impacts and sustainability of the drip irrigation program through interviews, focus group discussions and a survey.

Study results showed that low-cost drip kit programs can only be sustainable if implemented as an integral part of a development program (not short-term relief programs) and if they involve a broad range of stakeholders, including donors, implementing NGOs and beneficiaries. A first step in any such program, especially in water-scarce areas, would be to undertake a detailed analysis of the existing water resources to assess availability and potential conflicts prior to the distribution of drip kits. A protocol for the implementation of drip kit programs in the semi-arid regions was developed.

Lessons learned

- The rising frequency of mid-season dry spells suggests that there is reason for exploring rainwater management technologies and using short-season varieties to reduce the impact of dry spells on rainfed cropping systems.

- Significant opportunities exist for upgrading rainfed agriculture, thereby ensuring food security through timely and adequate supplementary irrigation to bridge and manage dry spells.

- Low-cost technologies (such as drip) rather than surface irrigation systems should be used in conjunction with good water and nutrient management if higher water and crop productivity are to be realized.
- Fertility amendments should be promoted alongside conservation tillage—microdosing is best suited to farmers' risk management needs as higher dosage levels represent a risky investment and expenditure.

- Smallholder farmer water conservation committees with women as leaders should be considered.

- Additional research at the basin scale is needed to identify the major sources of pollution in some communities. A follow-up study of cadmium (in the Limpopo Basin) is needed to determine the extent of the problem.

- Stress on water supply systems will drive the need to explore non-conventional water resources (e.g., sand dams) as potential water supplies.

- Existing geological maps can be used to predict suitable (low-seepage) areas for exploration of alluvial aquifers.

- It is important to consider the labor costs of any conservation agriculture intervention.

Conclusion

Studies among smallholder farmers in South Africa indicate a significant scope for improving water productivity in rainfed farming systems through supplementary irrigation combined with soil fertility management. Other studies show that shifting from exclusively rainfed agriculture to supplementary irrigation agriculture in the study area resulted in yield improvements due to timely application of water, reduction in water stress and greater availability of water for crops.

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Key Reference

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