WATER RESEARCH COMMISSION

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The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

TECHNICAL BRIEF

Small-scale Irrigation Farming

Best Management Practices on Selected Irrigation Schemes

Revitalising small-scale irrigation schemes through the introduction of best management practices – examples from Limpopo.

Revitalising smallholder irrigation

For many decades smallholder irrigation schemes have been considered to have the potential to generate economic development in poor and under-developed rural areas. However, to what extent smallholder irrigation schemes have been successful as development initiatives to date remains the subject of debate.

Recent assessments have mostly concluded that their success has been limited. Contributing factors have been identified as poor infrastructure, limited knowledge of crop production, limited farmer participation in the management of water, ineffective extension and mechanism services and lack of reliable markets and effective credit services.

The perception of smallholder irrigation schemes underperforming has produced revitalisation drives, such as Limpopo's Revitalisation of Smallholder Irrigation Schemes (RESIS) programme. In setting objectives for revitalisation, it is important to assess the success of smallholder irrigation not only from the economic perspective, but also from the perspective of plot holders and their livelihoods.

When viewed from a livelihoods perspective, smallholder irrigation schemes enable farmers to improve and diversify plant production, which can result in improved livelihood outcomes, either directly in the form of food or income for plot holders, or indirectly by providing full or partial livelihoods to people who provide goods and services in support of irrigated agriculture on these schemes. Since the importance of irrigated agriculture as a livelihood activity had previously not been adequately assessed, it was considered important to also address this knowledge gap as part of the quest for improved management practices on smallholder irrigation schemes.

Smallholder irrigation farming analysed

Appropriate research was consequently initiated in Limpopo using Dzindi Irrigation Scheme as the main case study, with Khumbe and Rabali Irrigation Schemes serving as sites for additional fieldwork to provide confirmation of findings. All three schemes were similar in size and used canal irrigation. They also shared a general production pattern that featured maize in summer and vegetables in winter.

To encourage active participation of plot holders in the project, the 'merging of communities of practice' approach was adopted. This entailed plot holders, researchers and other stakeholders revealing their individual sets of needs, values, goals and tools to one another, through facilitated dialogue and negotiation, constructing a mutually acceptable set of goals for the project.

These common goals were subsequently translated into research and development activities, taking into account the limitations imposed by the availability of financial and human resources. Besides the stakeholder negotiations, project activities included situation analysis as well as participatory technology development.

The focus of the situation analysis was on the livelihoods of plot holders, the role of farming in these livelihoods, diversity in farming goals and management practices, and collective action among farmers. Investigations were primarily at the level of the individual plot holders and of the irrigation scheme as a whole, with the world beyond, importantly, also receiving some but lesser consideration in the study.

Management practice: domain of the farm plot

Generally, plot holders on the three irrigation schemes displayed a diversity of livelihood types and farming styles. Nine livelihood types, based on principal source of income (cash and kind) were identified. These included pensioner households, skilled and unskilled wage-earner households, market-oriented farming households and subsistence farming households.

Total household income varied considerably among livelihood types: skilled wage-earner households had the highest mean total household income while subsistence farmer households had the lowest. Market-oriented farmers had the highest mean gross farm income and the mean gross margin of their plot enterprises was also the highest.

Overall, four distinct farming styles could be identified among farming households. One variation was farming mainly for market purposes, with profits being maximised by sourcing labour mostly from within the household. Another was risk-averse subsistence farming where, in summer, grain is produced and stored mainly for home consumption. In winter, production is limited to traditional vegetables on small areas and, overall, cash sales of produce represent only a minor source of total household income.

The implication of this observed diversity is that a 'one size fits all' approach is unlikely to be successful when developing and disseminating best management guidelines for use at the farm plot level. Categorising households into livelihood types and farming styles that share the same farming objectives thus proved to be a useful approach in tailoring best management practices to suit the specific objectives of farming households.

Management practice: domain of the irrigation scheme

The level of the irrigation scheme is the domain in which management determines access of farmers to irrigation land and water and facilitates improved access to both markets and services, such as land preparation:

- **Management of water and irrigation infrastructure** is of particular importance in smallholder canal irrigation. Research revealed that a system of simple rules governing the sharing of water among farmers and the routine maintenance of the canal system could form the appropriate basis for sustainable water management by plot holders with appropriate support of an external agency. This would ensure that water is shared equitably among farmers and that canals are kept clean and in good condition. A glaring weakness was the lack of adequate expertise to manage water flow in the canal system. Clearly, appropriate training for extension staff working on schemes that use canal irrigation systems is needed.
- **Access to markets** can be improved by voluntary cooperation among farmers at the scheme level. Institutional arrangements best suited to fostering collective action among plot holders would be those based on traditional forms of collectivism. The role of the State in this regard should be supportive rather than regulatory.
- **Access to land** continues to be governed by the historical Trust tenure system on many canal irrigation schemes. While most plot holders do not constantly cultivate their entire allotment, other, primarily those who run farm enterprises with a strong market focus, are in desperate need of additional land. This need could be met by opening the market for land exchanges on these schemes. This would require the development of a simple rule system to govern land exchanges, a register of plot holders (usually in place), the demarcation of the individual plots in the field, and the appointment of an external agency to intervene when conflicts arise.
- **Land preparation**, currently constrained by affordability and poor access to mechanisation, limits overall production on smallholder irrigation schemes. Poor subsistence farming households are most affected by this constraint. The option of re-introducing animal draught on smallholder irrigation schemes as a way of reducing variable costs and possibly limiting soil compaction associated with the use of tractors, warrants further investigation.

Management practice: commodity systems

Maize

The study of the maize commodity chain revealed that maize simultaneously serves as a high-value cash and food crop. The close proximity of densely populated areas ensures the availability of a sizeable market for green maize cobs, enabling smallholders to achieve much higher gross margins than by growing maize for grain alone. The over-riding importance farmers attach to the role of maize grain in the food security of their households is further reinforced by the proximity of the facilities to store grain and process it into maize meal for consumption.

Maize production practices in the case study area, using both modern and traditional technology, were found to address the key growth requirements of the crop, but the relatively low yields suggest that there is room for improvement. For green maize in particular, opportunities for increasing production were shown to lie in cultivar selection and use of appropriate planting densities.

Vegetables

Production during the winter season mainly involved vegetables. The types of vegetables that were grown differed widely among the three schemes. A detailed study of the smallholder vegetable commodity chain at Dzindi focused on two African leafy vegetables, namely Chinese cabbage (***Brassica rapa*** subsp. ***Chinensis***) and nightshade (***Solanum retroflexum*** Dun.) and two exogenous vegetables, namely Swiss chard (***Beta vulgaris*** L.) and white cabbage (***Brassica oleracea*** L. var. ***capitata***).

For each of these crops, farmers had developed, adapted or adopted comprehensive production systems. From a technical perspective, the heavy use of fertilisers (accounting for about 40% of the total variable costs of production of the two African leafy vegetables) was identified as an opportunity for improving the gross margins of production. Research to develop fertiliser guidelines was undertaken as a contribution to improved management of these two vegetable crops.

Integrated crop-livestock production systems

Animal production was virtually absent from the smallholder irrigation schemes under scrutiny, despite the potential advantages of integrating animal with crop production. These advantages include the creation of additional produce markets for crops to be used as animal feed, provision of animal products and production of animal manures for use in crop nutrition.

To realise the advantages, the introduction of broiler poultry production was investigated as a first step towards integrating farming systems on smallholder irrigation schemes. Although initial findings were that birds fed on a commercial diet grew faster and were ready for marketing one week earlier than birds fed on a diet produced on-farm, the economic performance of the enterprises based on the use of the different diets was not much different. The on-farm diet had the advantage of locating a larger part of the production value chain within the local agrarian economy.

Conclusion

The implication of the observed diversity in livelihoods and farming on the smallholder irrigation schemes is that best management practices for farmers on these schemes need to be tailored to the type of farming being done. The important guideline is that the development of best management practices must be based on a comprehensive analysis of the livelihoods and farming styles of participating farmers.

Further reading:
To obtain this report, ***Best Management Practices for Small Scale Subsistence Farming on Selected Irrigation Schemes & Surrounding Areas Through Participatory Adaptive Research in Limpopo Province*** **(Report No: TT 344/08),** contact Publications at Tel: (012) 330-0340; Fax: (012) 331-2565; E-mail: orders@wrc.org.za; or Visit: www.wrc.org.za