

**COST ESTIMATING PROCEDURES FOR
MICRO-, DRIP- AND FURROW-IRRIGATION SYSTEMS AS WELL AS
ECONOMIC ANALYSES OF THE RELEVANT IRRIGATION
SYSTEMS FOR LARGE- AND SMALL-SCALE FARMERS
IN THE ONDERBERG/NKOMAZI REGION**

1. INTRODUCTION

An irrigation farmer needs to consider many technical, economic and financial factors when choosing or evaluating different irrigation systems. This research project proposes methods to estimate costs for various combinations of irrigation systems in the Onderberg and Nkomazi areas. The research further demonstrates methods to analyse the profitability and financial feasibility of the various irrigation systems on a whole farming level.

The goal of the research was to analyse the most important irrigation systems in the Onderberg/Nkomazi areas on a whole farming level for both large-scale and small-scale farms economically and financially.

The specific project objectives were:

- (a) Development of cost estimating procedures for micro-, drip- and furrow-irrigation.
- (b) Identification of irrigation methods used by small-scale irrigators.
- (c) Analyses of the profitability of the relevant irrigation systems with available financing options.
- (d) Economic analyses of typical combinations of irrigation systems on whole farming level.
- (e) Economic and financial analyses of the relevant irrigation systems on whole farming level for both large-scale and small-scale farmers.

2. RESEARCH METHOD

The total area under irrigation in the Onderberg/Nkomazi region was estimated to be about 50 000 hectares. The most important crops are sugarcane, orchards, bananas and vegetables. The most common irrigation systems are overhead sprinkler, micro- and drip-irrigation. Some flood-irrigation still occurs in the Nkomazi district for mostly vegetables. The irrigated areas are situated within pumping distance from the rivers. Of the approximately 50 000 hectares under irrigation, 7 500 ha are farmed by about 960 farmers on 17 projects/schemes in the Nkomazi area.

This research focuses on both large-scale and small-scale irrigation farming. The small-scale irrigation farming includes five independent case study farmers in the region, as well as 24 project farmers on three irrigation projects, namely Madadeni (7 ha plots under dragline irrigation), Mbongozi (5 ha plots with centre pivots), and Walda (10 ha plots under floppy irrigation). The data for the large-scale irrigation farming were collected from 74 farmers.

Various research methods were used to complete the study. The SAPFACT questionnaire was adapted to collect data from the five independent small-scale farmers with the aim of drawing up crop enterprise budgets and financial statements. The same farming and financial data for the 24 scheme farmers were collected by one of the project advisors. Structured questionnaires were used to collect the farming data for the large-scale farmers ($n = 74$). A total of 32 case study farms with different irrigation systems/crop combinations were compiled. Experts were contracted to design micro-, drip-, furrow-, dragline- and centre pivot-irrigation systems in different combinations for the 32 case study farms. The crop water requirements were estimated with the SAPWAT model. Cost estimating procedures were developed (Chapter 3) for micro-, drip- and furrow-irrigation, as well as any combination of these systems, to estimate irrigation costs. The Net Present Value (NPV) method was used to analyse the economic profitability and financial feasibility of the various irrigation systems on whole farming level. Monte Carlo simulation was used to incorporate yield and price risk in the analyses.

3. RESULTS AND CONCLUSIONS

The value of the research lies, firstly, in the cost estimating procedures which were developed for drip-, micro- and furrow-irrigation systems; secondly, that any combination of the abovementioned irrigation systems together with centre pivot- and dragline-irrigation systems can be analysed; thirdly, that the economic analyses were done on a whole farm level, taking risk into account, for small-scale farmers on irrigation schemes, independent small-scale farmers as well as large-scale farmers. The universal result was that cash flow is the biggest problem for all the farmers to different degrees. For the small-scale farmers the challenge is to survive financially and for large-scale farmers it is to finance expensive irrigation systems and long-term crops such as orchards.

The major results are presented according to the chapters of the report.

3.1 Cost estimating procedures for micro-, drip- and furrow-irrigation

Cost estimating procedures were developed for micro-, drip- and furrow-irrigation to estimate the annual fixed costs and operating costs of these systems, as well as the cost of applying an extra cubic metre water pumped. The cost estimating procedures

were also developed to estimate irrigation costs for any mix of micro-, drip-, furrow-, dragline- and centre pivot-systems. The use of these cost estimating procedures will lead to better economic analyses of irrigation farming.

3.2 Economic evaluation of independent small-scale farmers in Nkomazi

It was found that the independent farmers are part-time entrepreneurs/farmers who followed a progressive learning and growth path. They started their farming businesses with finance they got from different activities and sources. Their critical success factors are their business orientation, entrepreneurial spirit, hard work, dedication, diversification, and their ability to read and interpret economic changes and taking risk.

The farmers can improve the financial survival of their farms with better production methods and financial, risk and marketing management.

3.3 Profitability and feasibility evaluation of small-scale farmer irrigation projects

The 7 ha draglines (Madadeni), 5 ha centre pivots (Mbongozi), and 10 ha floppies (Walda) are all profitable and financially feasible.

However, it was also found that for all three systems there are deficit years in which the farmers do not generate enough cash to cover an assumed living cost of R24 000 per year. The amount which was available varied among the systems.

The three crucial factors in the feasibility analysis were the initial subsidy of the irrigation systems, the plot sizes, and the well-established sugarcane market.

3.4 Whole farm profitability and feasibility analyses of large-scale irrigation farming

All the irrigation system combinations on all 32 case study farms are profitable, taking risk into account. Important factors are economies of size as well as the combination of crops and irrigation systems.

The financial feasibility of these farms differs depending on the timing of capital replacement such as the orchards and irrigation systems.

4. RECOMMENDATIONS

4.1 Advisors and farmers

- The cost estimating procedures for micro-, drip-, furrow-, dragline-, centre pivot-, and mainline pipe-systems should be included in the irrigation design sheets of irrigation firms and other irrigation organisations because the procedures are economically and technically soundly grounded.
- The cost estimating procedures should be used to estimate the total fixed and operating costs of the major irrigation systems. These procedures are suitable for on-farm use by irrigators and advisors to decide over the long run which irrigation systems to buy, and in the short run how to manage the operating costs which are directly linked to the decisions of how much, how and what to produce.
- The procedures can also be used to consider changes in a current irrigation system or to evaluate the feasibility of switching to a more water-efficient system. It also may be useful for research regarding the economic viability of various irrigation systems, because it provides a systematic way to determine the annual total costs of the systems.
- Business plans of irrigation farming should include the effects of business and financial risks on survival.
- Reliable crop enterprise budgets for all the relevant crops under irrigation should be developed and maintained for small-scale irrigators.
- Small-scale farmers should be assisted to keep farm records and to use them in planning their farming operations.
- Advisors and farmers should be trained to compile crop enterprise budgets and how to use these budgets in farm planning.
- Advisors should have a broad business approach when giving extension advice to farmers which includes advice on production methods, financial issues and marketing strategies.
- Part-time small-scale farmers should be assisted with extension services.

4.2 Policy-makers

- Part-time farming should be encouraged by providing tax benefits for part-time small-scale entrepreneurs.

- The extension services to small-scale farmers should be improved.
- Policy-makers should see to it that sound financial incentives are accessibly put in place to help small-scale farmers.
- The public sector has a major role to play in providing subsidy for new irrigation development projects.
- New projects should take cognisance of the crucial financial effects of plot size and reliable product markets.
- The COMBUDS of the National Department of Agriculture should be extended to include crop enterprise budgets for typical crops under irrigation.
- A land tenure reform policy in tribal areas is needed to encourage investment and development on these farms. An efficient land market should be developed based on security of property rights and low transaction costs.
- Government institutions could promote and facilitate the development of a land rental market in tribal areas. Institutional changes are needed in existing government organisations to assume responsibility for holding and enforcing land rental contracts.