Technical note

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

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Abstract

The total annual fixed and operating costs of a drip-, micro- and furrow-irrigation system were estimated, as well as the marginal factor cost of water applied. An existing centre-pivot irrigation cost-estimating procedure was used. The type of irrigation system data needed are specified. The assumptions about the salvage value and expected lifespan of the system components are given. The total investment cost of the drip-, micro- and furrow-irrigation system is R200 000, R277 586 and R132 012 respectively. The total annual fixed and operating costs of the drip-, micro- and furrow-irrigation system are R28 509, R39 817 and R17 763 (fixed) and R36 957, R38 980 and R106 375 (operating) respectively. The marginal factor cost of water applied for the drip-, micro- and furrow-irrigation systems is R2.00/mm·ha, R1.90/mm·ha and R2.20/mm·ha. The proper estimation of irrigation costs is critical for irrigators to be able to evaluate efficient water use techniques.

Keywords: irrigation system costs, drip-/micro-/furrow-irrigation, cost-estimating procedures

Introduction

The first step in the analysis of the economics of irrigation is to estimate the costs of the irrigation system. The procedures should illustrate how the total annual fixed and operating costs of the system are estimated, as well as the marginal factor cost of applied water.

A monograph (AAEA, 1998) was prepared by a task force organised by the American Agricultural Economics Association (AAEA) to recommend standardised practices for generating costs after a careful examination of the relevant theory and the merits of alternative methods. Among other things the task force developed procedures to estimate irrigation operating costs. Extension economists in the arid west of the United States of America developed useful guides to estimate irrigation system costs (Selley, 1997), and to evaluate different irrigation distribution systems (Llewelyn et al., 1998). In South Africa, a comprehensive *Irrigation Design Manual* (Agricultural Research Council, 1999) was published in 1996 and revised in 1999. The Water Research Commission (WRC) funded a research project in which a cost-estimating procedure for centre-pivot irrigation was developed and illustrated (Oosthuizen, 1991). The cost-estimating procedure was subsequently extended for dragline irrigation systems in another WRC-funded project (Oosthuizen et al., 1996; Breytenbach, 1994). A computer program and guide were developed to illustrate the cost-estimating procedures for centre-pivot and dragline irrigation systems with WRC funding (Meiring et al., 1995).

The purpose of this note is to illustrate that the cost-estimating procedures for centre-pivot and dragline irrigation systems (Meiring et al., 1995) can be extended to include drip-, micro- and furrow- irrigation systems. The objective is to use the existing cost-estimating procedure to calculate the total annual costs of drip-, micro- and furrow-irrigation systems. The next step in the analysis of the economics of irrigation is to estimate the economic profitability and financial feasibility of the irrigation systems using the net present value method which is not the focus of this note.

Methodology

A WRC-funded research project was carried out in the Onderberg region of Mpumalanga Province to analyse the economics of the most important irrigation systems (Oosthuizen et al., 2005). A survey was conducted among 74 farmers to gather farming and financial data to compile farm case studies. A total of 32 irrigation system combinations were identified, including 3 farm sizes and 12 crop combinations. An agricultural engineer (Radley, 2002) designed the drip-, micro-, centre-pivot and dragline systems, while another engineer (Stimie, 2002) designed the furrow irrigation system. The crop water requirements for sugarcane under furrow irrigation and for orchards (oranges) were estimated with the SAPWAT-model (Van Heerden, 2002).

The specifications of the drip-, micro- and furrow-irrigation systems are given in Table 1. The furrow irrigation system was designed to irrigate 25.2 ha sugarcane on a loam soil. The pump rate is 100 m^3/h. The electric motor size is 7.5 kW. The balancing dam capacity is 1 300 m^3.

The drip- and micro-irrigation systems can irrigate 24.8 and 24.9 ha respectively. Each system consists of a 15 ha and 10 ha unit. Each unit consists of six blocks. The pump rate is 48 m^3/h for drip- and 90 m^3/h for the micro-irrigation system. The electric motor sizes are 7.5 kW (drip) and 15 kW (micro).

Table 1 summarises the assumptions about repair and maintenance costs, and gives the investment cost as well as the costs of water, electricity, insurance and labour.

Only cost items that are directly associated with the relevant irrigation system are identified. Costs related to crop produc-

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