EXECUTIVE SUMMARY

INTRODUCTION

Drip irrigation is considered as the most efficient irrigation system, but there is proof from literature that this system can also be as in-efficient as any system, due to bad water quality, mismanagement and maintenance problems. Clogging of the emitters is one of the most serious problems associated with sub-surface drip irrigation and various approaches in preventing the clogging of emitters include filtration, flushing, chemical treatment of the irrigation water and chemical treatment of the soil surrounding the dripper lines, as well as the chemical treatment of the lateral polymers. Through this project, guidelines were developed to enable irrigators with sub-surface drip irrigation systems to apply good management and maintenance schedules to enable them to adhere to the conditions of the National Water Act regarding the efficient and beneficial use of water in the public interest.

OBJECTIVES

The National Water Act (Act 36 of 1998) makes provision for water to be protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner to the benefit of all people in South Africa. Currently, sub-surface drip systems account for about 7 500 hectares of the total of 140 000 hectares of drip irrigation in South Africa. To assist the users to utilise their systems effectively, the research was carried out with the following objectives:

- Determine the blockage potential of different types of emitters under field, as well as laboratory conditions.
- Establish guidelines for the choice and management of sub-surface emitters, to prevent blockage and root intrusion.

METHODS

An extensive literature study on all facets that can influence the different types of emitters under field conditions was undertaken. Aspects that are addressed in this study include water quality, water treatment methods; inherent factors that effect emitter performance, filtering, system maintenance, system installation and design.

Three drip irrigation companies' drip irrigation equipment was used in the research project. The companies are Agriplas, Netafim and T-Tape. The performance of these new emitters, five models in total, was evaluated under controlled conditions in the hydro laboratory of the ARC-Institute for Agricultural Engineering.

With regard to the field evaluation, two areas in southern Africa were identified, namely the Mpumalanga Lowveld and Swaziland. In these areas, a total of five systems were identified. These systems' performance was evaluated in the field on one occasion and

the farmers were contacted again after three years to obtain their experiences. Apart from the performance evaluations, data was also collected of the maintenance schedules. Water samples were taken for water quality analysis. Questionnaires, which were completed with the farmers, supplied most of the background information.

RESULTS

New emitters

The new regular emitters' coefficient of variation (CV_q) varied from an 2.1% to a 2.4% with an average of 2.2%. The pressure compensated emitters' average CV_q was 3.2%.

Experimental site

- Untreated blocks
  In the Treflan treated blocks, the emitters showed 74% less root intrusion than the untreated blocks. The untreated blocks were 29.3% root intruded against the 7.5% of treated block and there was also a significant increase of root intrusion of 505% over the 42 month period in the untreated blocks. The impact of the clogging in the untreated blocks was evident with the 16% decrease in emitter delivery rate and the worsening of the coefficient of variation (CV_q) from an excellent 3.04% to a very poor 56.36%. There was also an average 34% of the emitters that were not functional after the 42 month testing period.
- Treated blocks
  With the treated blocks, root intrusion could not be prevented completely and after the 42 month period, 16% drippers were not functional (that is, however, 27% better than the untreated blocks). The impact of the clogged drippers was that the CV dropped from an excellent 3.04% to a poor 32.30% which was still 43% better than the untreated blocks. However the average emitter delivery rate stayed fairly constant.

Conclusions and recommendations

Proper installation and maintenance are of utmost importance for the successful long-term operation of any sub-surface drip irrigation system.

It is recommended that water quality analysis be carried out to identify the potential clogging problems due to water quality. This will assist in emitter type and filter selection and to develop proper preventative measures. The use of a root growth inhibitor is also of critical importance with a sub-surface drip system to prevent root intrusion.

Details are given for solutions of specific clogging problems, choice and management of equipment, to help ensure effective water utilisation. Design principles, operation and maintenance information for best management practices, are recommended. The

importance of a complete design report with details of the system's specifications, maintenance requirements and installation guidelines is emphasized.

No formal capacity building in terms of postgraduate students took place, but through the study the research team's knowledge was enhanced tremendously and a fair amount of capacity building within the industry and that of producers took place through interaction.

The following aspects need further attention:

- Technology transfer and training of irrigators with practical demonstrations.
- The compilation of a user's guide, which describes the complete development process of an irrigation system at farm level, as well as norms for minimum acceptable standards for irrigation equipment and services.
- A further investigation is recommended where the water treatment methods for water sources with a high clogging hazard are practically and experimentally tested.
- A user-friendly manual regarding the maintenance of sub-surface drip irrigation systems should be compiled for the use by irrigators.
- Development and refinement of the installation methods and equipment to ensure accurate placement of the laterals in the underground is recommended.
- The establishment of the causes in variation of emitter performance, between sub-surface and surface applications.
- Influence of different soil types and installation depths on emitter types.
- The influence of lateral flushing methods in terms of clogging, e.g. individual lateral flushing versus manifold based flushing.

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Dr A. Sanewe	:	Water Research Commission (Chairperson)
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Dr GR Backeberg	:	Water Research Commission
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Mr J Taljaard	:	JTPSec (Committee Secretary)

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