DRIP IRRIGATION AS AN EFFICIENT WATER SAVING PRACTICE

FB Reinders, ARC- Institute for Agricultural Engineering, reindersf@arc.agric.za
GR Backeberg, Water Research Commission, gerhardb@wrc.org.za
South Africa

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Introduction

Drip irrigation is considered as one of the most efficient irrigation systems but it should be management and maintained properly to keep it to perform at its best to enhance crop growth and water productivity.

Performance testing of different types and ages of drippers under different water quality conditions under typical farming conditions was carried out.

Agriplas's Drip-In Regular and Agridrip Pressure Compensated and Netafim's Ram Pressure Compensated drippers were selected, as they were the most commonly used drippers for surface drip in South Africa.

Drippers that were tested

Agriplas
- -Drip-In Regular
- -Agridrip Pressure Compensated

Netafim
- -Ram Pressure Compensated

Research was carried out by the ARC-Institute for Agricultural Engineering (ARC-IAE), South Africa on two drip irrigation companies' drip irrigation equipment to determine the performance of the individual drippers. Evaluations were carried out on new drippers under controlled conditions in a laboratory and it was complimented by testing of installed drippers under farming conditions.

Laboratory testing of drippers

Laboratory tests on drippers

The new drip lines with emitters were tested in the laboratory for average discharge ($\bar{q}$) and for the manufacturing coefficient of discharge variation (CVq).

$$\bar{q} = \frac{1}{n}\sum_{i=1}^{n} q_i$$

$$S_q = \left[\frac{1}{n-1}\sum_{i=1}^{n}(q_i - \bar{q})^2\right]^{1/2}$$

$$CV_q = \frac{S_q}{\bar{q}} \times 100$$

Where: q_i = emitter discharge rate (ℓ/h);
n = number of emitters of the sample;
$\bar{q}$ = mean of all the measured discharge rates (ℓ/h);
S_q = standard deviation of the discharge rate of the emitter; and
CV_q = coefficient of variation of discharge rate of the emitters (%).

Criteria for CVq		
Classification	ASAE EP 405.1 (1997)	Classification
Excellent	<5	Excellent
Average	5 – 7	Good
Marginal	7 – 11	Fair
Poor	11 – 15	Marginal
Unacceptable	>15	Poor

NEW EMITTER TEST RESULTS		
Dripper tested	Dripper CV_q (%)	Average q (ℓ/h)
Super Typhoon	2,1	1,7
Drip-In Light	4,2	2,2
Ram 17L	2,1	1,6
DIS PC Lite	4,4	2,0

Field evaluation of drip systems

A complete system evaluation was done according to the procedure described in ASAE EP 458 (1997) where five dripper lines were evaluated at five positions. Apart from the and CVq, the statistical discharge uniformity (Us) were also calculated as shown as equation :

$$Us = 100 - CVq$$

Where: U_s = Statistical uniformity of emitter discharge rate (%).

A Us value of 80% or higher is normally considered as an acceptable criteria (ASAE EP 458, 1997).

The field emission uniformity (EU') was also used to judge the uniformity of emitter discharges within an irrigation block and is shown as equation :

$$EU' = 100\,\frac{q'_{min}}{\bar{q}}$$

Where: EU' = field emission uniformity (%);
q'_{min} = Measured mean of lowest ¼ of emitter discharge (l/h); and
$\bar{q}$ = Measured mean emitter discharge (l/h).

Comparison between U_s and EU for design purposes (ASAE EP 458, 1997)		
Classification	U_s (%)	EU (%)
Excellent	95 – 100	94 – 100
Good	85 – 90	81 – 87
Acceptable	75 – 80	68 – 75
Poor	65 – 70	56 – 62
Unacceptable	<60	<50

Field evaluation of drippers

Field evaluation results								
Site	EU %	Eu_a %	Us %	CV_q %	q_{max}	q_{min}	q_{ave}	FV %
Inyoni	90,9	89,1	90,9	9,1	1,3	1,0	1,1	20
Savan	81,3	80,6	83,3	16,2	2,0	1,3	1,6	70
Simu1	93,8	89,0	83,1	16,9	1,9	1,5	1,6	40
Simu2	61,6	61,6	57,2	42,8	2,9	0	1,8	290

Conclusion

In the laboratory the new regular emitters' average coefficient of variation (CVq) was an excellent 2,2% and the pressure compensated emitters' average CVq was a good 3,2%.

With the farm site evaluations the coefficient (CV) varied from a marginal 9,1% to a poor 42,8%. The emission uniformity (EUa) varied from a good 89,1% to an unacceptable 61,6%.

If drip irrigation systems are management and maintained properly to keep it to perform at its best to enhance crop growth and water productivity it is considered as one of the most efficient irrigation systems.

References

F B Reinders, B Grové, N Benadé, I van der Stoep, A S van Niekerk. Technical aspects and cost estimating procedures of surface and subsurface drip irrigation systems. Water Research Commission, 2012. WRC Report No. TT525/12. ISBN No. 978-1-4312-0274-4.