9.0 OBJECTIVES

After completing this practical exercise, you should be able to:

- outline the principle of drip irrigation; and
- explain the components of the system and its operation.

9.1 INTRODUCTION

Drip irrigation is also a pressure system of irrigation suited to widely spaced crops particularly orchards. It requires relatively low pressure less than 1.0 kg/cm² and is capable of saving a considerable amount of water as water is applied at the tip of the roots resulting in wetting of only part of the area. It overcomes the problems of wind velocity and evaporation to a great extent. The saline water can safely be used with minimum detrimental effect on crop growth. It not only results in considerable saving in water, an increase in yield but improves the quality (appearance as well as juice content) of produce considerably.

9.2 EXPERIMENT

9.2.1 Theory

In drip irrigation, also known as trickle irrigation, water is delivered at or near the root zone of plants, drop by drop under low pressure. As shown in Fig.9.1, the system comprises of plastic components such as pipes (main line and laterals) and drippers in addition to filter and fertilizer applicator. Unlike sprinkler irrigation system which wets the entire area, only part of the area is wetted in this method. Depending up on the crop spacing, as much as 50% of the area remains dry. This results in considerable water saving eventually enhancing irrigation command. The salt build up due to the use of saline water is minimum near the plant due to the movement of salt to the periphery of the wetted circle minimizing its adverse effect on crop growth. As fertilizers and pesticides are applied through drippers, their efficiency is even higher than sprinkler irrigation. The system remains fixed at the same location for the entire crop growth period unlike sprinkler irrigation which allows movement from one place to another. One of the biggest limitations of the system is its initial cost which should be justified by the economic returns from that particular crop. Most of the investment accounts for the cost of drippers.
Wider is the row and plant spacing, less will be the drippers’ cost. The most important criteria for the uniformity of water application is the hydraulic performance of the drippers. The efficient drip system applies water uniformly to the entire crop. It can be expressed in terms of emission uniformity ($E_u$) which relates to variation in flow rate among drippers (high). Dripper plugging and uneven pressure distribution are the major factors contributing to system inefficiencies. The emission uniformity of a drip system can easily be measured. It is used to evaluate system design and maintenance. The discharge variation between the drippers should not exceed 20% to ensure uniform application of irrigation water.

$E_u$ can be expressed as:

$$E_u = \left(1 - \frac{\sum X}{mn}\right) \times 100$$

Where,

$m =$ average value of all flow rate of the dripper, litre/hour (LPH);

$n =$ total number of drippers; and

$X =$ numerical deviation of flow rate of each dripper from the average flow rate, LPH.

9.2.2 Requirements

- Drip irrigation system with pump or overhead tank;
- Watch; and
- Measuring flask.

9.2.3 Procedure

- measure the volume of water from each dripper in the given time;
• compute discharge of each dripper by dividing the volume of water collected with time;
• compute the average discharge by dividing the total discharge from all the drippers with total number of cans;
• compute numerical deviation by subtracting the discharge of each dripper from the average discharge; and
• compute the emission uniformity coefficient using above equation.

9.3 OBSERVATIONS AND CALCULATIONS

Example 9.1

A drip irrigation system was installed with a spacing of 1 m by 1 m and operated for an hour. The volume of water collected from each dripper was measured and discharges in LPH were computed as given below:

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**Calculation**

Average (LPH) = \[
\frac{4.1 + 3.9 + 3.7 + \ldots + 3.2 + 2.9 + 2.8}{24}
\]

\[
= \frac{83.3}{24} = 3.47 \approx 3.5
\]

**Numerical Deviation**

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Total Numerical Deviation (\(\sum X\)) = 0.6 + 0.4 + 0.2 + \ldots + 0.3 + 0.6 + 0.3

\[= 6.7 \text{ LPH} \]

\[E_u = \left(1 - \frac{\sum X}{mn}\right) \times 100\]
Drip Irrigation System

\[
E_u = \frac{1}{\frac{6.7}{3.5 \times 24}} \times 100
\]

\[
= (1 - 0.8) \times 100
\]

\[
= 92 \%
\]

Exercise 9.1

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9.4 RESULTS

Emission coefficient = ................. %