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Method for Changing Water Application Rates In Trickle Irrigation Research Plots

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Trickle irrigation studies often require different water application rates. The design and construction of trickle systems for randomized studies can be difficult and expensive if they involve separate timers, solenoids, valves, and/or irrigation lines for each treatment. One possible solution to this problem is to design the system so that only the emitters are used to regulate the flow of water within each test group. Such a system can be controlled by a single timer with only one lateral line needed for each row.

By joining suitable types of emitters in series (Fig. 1), it is possible to reduce water flow from a single emitting point. This study was conducted to measure the water flow from several types of trickle emitters when joined in series at various lateral line pressures and to identify types of emitters suitable for use in controlling flow rates in trickle irrigation studies. Emitters tested included Hardie's E-2, Netafim's Woodpecker [both pressure compensating (pc) and nonpressure compensating (npc)], and Rainbird's EM-L10 and Lady Bird.

Six-millimeter plastic irrigation tubing cut into 20-mm lengths was used to join the emitters together, as illustrated in Fig. 1. The emitters were connected in such a way that water flow was only from the terminal emitter in each series. Lateral line pressure was controlled by an Ag Products Penn 700 water pressure regulator.

Water flow (ml·min^{-1}) was measured from a single emitter and from the terminal emitter of two, three, and four emitters in series at 34.5, 69.0, 103.0, and 130.0 kPa of water pressure. The reduced flows brought about by the addition of each emitter in the series are expressed as percentages of the maximum flow. Maximum flow from each type of emitter was obtained from the single emitter at each pressure tested.

Each test was replicated four times. All emitters were rated for 4 liter·hr^{-1} output, with the exception of Netafim's (npc), where both 4 and 8 liter·hr^{-1} emitters were tested.

Two of the emitters—Rainbird's Lady Bird and Netafim's (pc)—proved to be unsuitable for controlling water flow rates in trickle irrigation studies because they maintained relatively constant flow levels regardless of lateral line pressure used or number of emitters joined in series.

Hardie's E-2, Netafim's (npc), and Rainbird's EM-L10 gave suitable changes in flow at each pressure level when joined in series (Fig. 2). The 8-liter·hr^{-1} Netafim (npc) emitters could not be compared directly with others; however, they performed about like the Hardie E-2, except that the percent fow was slightly higher. The addition of the second, third, and fourth E-2 emitters reduced output to about 66%, ± 4%, 50% ± 5%, and 25% ± 3%, respectively, whereas the additional Netafim (npc) emitters reduced output to about 75% ± 3%, 55% ± 4% and 30% ± 3% of normal.

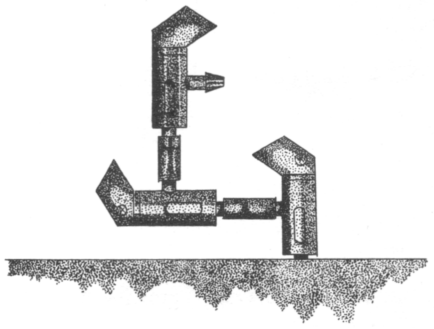

Fig. 1. Hardie E-2 emitters joined in series with 25-mm lengths of 6-mm-diameter plastic irrigation tubing.

Flow reductions using Rainbird's EM-L10 and the 4 liter·hr^{-1} Netafim (npc) emitters were not as great as with the E-2 or 8 liter·hr^{-1} (npc) emitters. The second EM-L10 emitter reduced flow to 75% ± 6%, the third to 60% ± 3%, and the fourth to 50% ± 2% of maximum, whereas the Netafim (npc) emitters reduced output to 80% ± 8%, 56% ± 6%, and 53% ± 3%.

By controlling water flow with the E-2, EM-L10, and/or Netafim (npc) emitters singly or in series, we were able to obtain a range of water application rates without the complex plumbing problems we have had in past years. We have used this method in trickle irrigation studies involving orchard crops and have also found it very useful in reducing water rates to replanted trees within the orchard and/or to blocks of young trees on the same mainline and timer as mature trees.

A wider range of flow rates can be obtained by not only using the emitters in series but also varying line pressures by the use of inexpensive pressure regulators such as the Penn 700 on each lateral line.

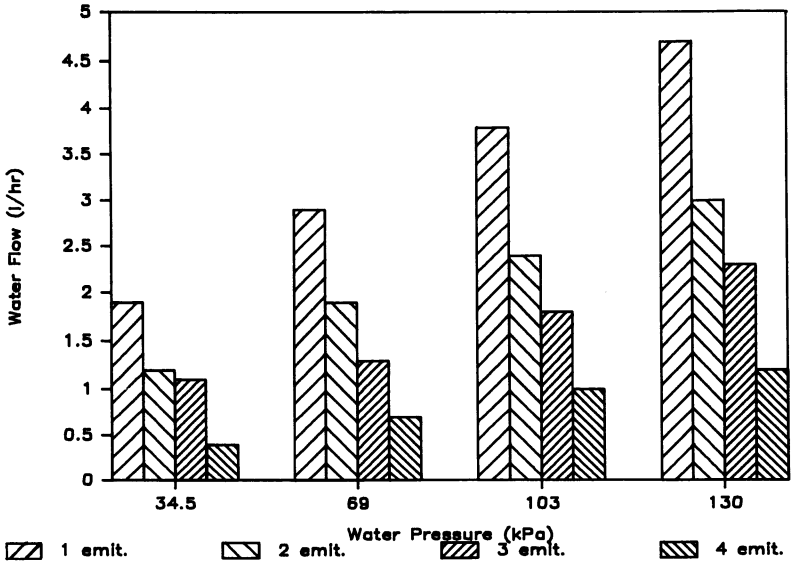

Fig. 2. Water flow (liters·hr^{-1}) from Hardie E-2 emitters in series.

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