

Hydraulics of venturi in micro-irrigation

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ABSTRACT

Laboratory experiment was conducted to study the hydraulics of venturi in micro-irrigation. Three venturi of different make were tested in the laboratory. Experimental results indicated that as the head loss across the venturi is increased, suction rate increased whereas discharge through main line decreased. The horse power required to initiate the suction of liquid for venturi A, B and C was found to be 0.18, 0.14 and 0.17, respectively.

Key words : Micro-irrigation, Fertigation, Venturi

Micro-irrigation system offers special advantage of applying water soluble fertilizers with water through the network of main, submain and lateral pipes to the plants. Fertilizer is injected in the main pipeline at a point before the filter attachment by using venturi or fertilizer tank. The process of adding fertilizer to the irrigation water through micro irrigation is an increasingly common method of fertilizing crops. Through fertigation nutrient are applied directly into the wetted volume of soil immediately below the emitter where root activity is concentrated and consequently fertilizer use efficiency can be improved over the broad cast application (Michael and Ojha, 1996).

Venturi injection method is one of simple and inexpensive method of fertilizer application. This method ideally suited for continuous mixing functions, require no secondary blending device. It is powered by the motive fluid, therefore, no external energy is required for most of the installations. However, it has some disadvantages such as high-pressure loss across the venturi, about 1/3 of the operating pressure. Due to this operating pressure of system is reduced and so the discharge rate of emitter. Literature reviewed reveals that no study has been so far conducted to study hydraulics of venturi used in micro irrigation. This paper presents the effect of pressure loss on suction rate of venturi and discharge rate of main line. Horse power requirement for operating the models of various venturies was also determined.

METHODOLOGY

The laboratory experiment was conducted for the testing of venturi. Three venturies of different makes were procured from the market for testing and were named as venturi 'A', venturi 'B' and venturi 'C'. Venturi 'A' and

venture 'C' have inlet and outlet diameter $\frac{3}{4}$ inch and suction port diameter $\frac{1}{4}$ inch where as venturi 'B' has inlet and outlet diameter 1.25 inch and suction port diameter $\frac{1}{4}$ inch. Experimental set up was consisted of i) storage tank, pump, main line, venturi and pressure gauge.

A 3 HP monoblock centrifugal pump was used to lift the water from storage tank. The delivery pipe of the pump was connected to the main line. Main line was consisted of G.I. pipe of 32 mm diameter inlet and outlet of venturi was connected to main line at points before and after the control valve installed on the main line near the delivery pipe and pump. Control valve was used to direct the flow into the venturi and to create the pressure difference between its inlet and outlet side. Pressure were connected at the inlet and outlet side of the valve. Data on head loss, suction rate of venturi and flow of main line were recorded where control valve was fully open, 25 % closed 50 % closed, 75 % closed and 85 % closed.

RESULTS AND DISCUSSION

Venturi suction rate was measured at different positions of control valve on main line. Data of head loss and suction rate of venturi is presented in Table 1.

From Table 1, it was observed that there was no head loss when valve was fully open and 25 % close. Suction of liquid also not initiated for this position. This might be due to insufficient motive flow directed into the venturies A, B and C. As the valve position changed from fully open to 50 % close, the head loss of 2m for venturi 'A' and 1 m for venturi 'B' and 'C' was observed without initiation of suction of liquid. In case of venturi 'A', the suction of liquid started when the head loss was about 4 m. As the head loss increased from 4 m to 6 m, the suction