AN EVALUATION OF THE EFFICIENCY OF EXISTING AND LOW COST LOCALISED IRRIGATION SYSTEMS

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ABSTRACT

A minisprinkler irrigation system and six different drip irrigation systems (Biwall, Seep hose, Key emitters, John emitters and Engineering emitters) were evaluated and compared with basin irrrigation, using chilli, onion and banana grown at Kilinochchi, Sri Lanka.

Chillies irrigated by minisprinklers gave the highest yields of 3.1 t/ha dry pods, an increase of 48% over the basin irrigated chillies. The water use efficiency (WUE), in terms of yield per m^3 of water applied, was also highest with minisprinklers at 0.35 kg dry chillies per m^3. This WUE was six times greater than with conventional basin irrigation.

Onions irrigated with imported seephose or biwall tubing gave the highest yields of 18 t/ha, compared with local seephose and minisprinklers yielding 12 t/ha and basin irrigation yielding 11 t/ha. Biwall and imported seephose also gave the highest WUE with 6.7 kg/m^3 compared with 0.79 kg/m^3 for basin irrigation. Minisprinkler irrigation of onion resulted in lush growth but increased pest damage.

Bananas irrigated by Key emitters (Cameron) produced the highest yields with 35 t/ha of bananas over seven months. Irrigation with John emitters and Engineering emitters produced significantly better yields (31 and 27 t/ha) than basin irrigation (19 t/ha). The WUE of drip irrigated bananas varied from 10 to 13 times more than for the the basin irrigated bananas.

Minisprinklers fitted with pressure regulators gave adequate distribution of water where nozzles were spaced at 2.5 x 2.5 m apart on laterals up to 37.5 m in length. At the Kilinochchi site the maximum length of Biwall tubing possible without a greater than 10% drop in discharge was 92 m. Seephose could be used in lengths up to 10 to 30 m.

These hoses were very light, fragile and tended to be blown by the wind. Undulations in the soil surface and clogging of perforations adversely affected performance necessitating laborious cleaning every 14 days. Cameron Key emitters had a pressure compensating mechanism giving a uniform discharge at the rated pressure of 101 kPa and were found effective over lengths of 80m. The locally made John emitter was a higher discharge 'bubbler'type, where apertures could be varied to even out discharges along a lateral. Locally made Engineering emitters gave uniform emission but tended to clog easily. Nozzles smaller than 1.5 mm in diameter often clogged reducing discharge rates.

Investments in minisprinkler and drip irrigation systems were evaluated in comparison with basin irrigation using incremental benefit cost analysis. With chillies, minisprinklers gave the largest incremental benefit cost ratios and net present values. These were largest (2.69 and Rs 145670) in a 'financial' analysis, where not only the yield increment was assumed, but also the productive use of the saved water to irrigate additional areas of chillies. However, the yield increment alone was sufficient to justify a farmer investing in minisprinklers for the irrigation of chillies in place of basin irrigation. The irrigation of chillies with biwall tubing was only marginally advantageous under the most favourable assumptions. With onions, both biwall and minisprinkler irrigation was marginally advantageous under the most favourable assumptions, but these advantages were shown to be relatively fragile in a sensitivity analysis and the investment cannot be recommended. With bananas, very high benefit cost ratios and NPVs were obtained for Key emitter and John emitter systems, in comparison with basin irrigation. These were favourable on the basis

of yield increment alone, or the use of saved water to irrigate additional area, alone. The largest BC ratios of 8.70 (Key emitters) and 5.43 (John emitters) were obtained where both the yield increment and use of saved water were assumed in the financial analysis, and the results of the economic analysis were only marginally lower. It was concluded that an investment in any of the tested irrigation systems would be highly worthwhile for the irrigation of bananas.

Pan evaporation (Epan) and FAO/Penman reference crop evaporation (ETo) adjusted by FAO published crop coefficients tended to overestimate crop water requirements under minisprinkler and drip irrgation.