

Lay-flat hoses – self promoted micro-irrigation systems

In much of the groundwater belt that stretches across the Terai plains, south of the Himalayas in South Asia, lay-flat tubes have become popular. They convey water from the numerous shallow tubewells, that have come up in the last two decades. The rapid spread of lay-flat hoses in Northern Uttar Pradesh, Northern Bihar and North Bengal mirrors that in Northern China during the 1980's. However, intriguingly there are also areas where this type of micro-irrigation is not known at all.

Lay-flat hoses are typically between 100-300m long. Beyond this range the backpressure on the pumps is too large to handle. Polyethylene tubes are the most widely sold lay-flat hoses. Depending on their diameter they weigh between 8.5kg (65mm diameter) to 16kg (100mm diameter) per 100m. The 100mm diameter tube is the most popular variety, as even 300m of this tube is portable at 48 kilogram and requires little storage space. The cost for a 100mm diameter tube in the Indian Terai is US \$ 0.35/meter. They usually last one irrigation season only, as sunlight and movement of water make them brittle and they are easily punctured. They are made of recycled scrap, but can be resold as scrap too, at approximately 25% of their original price. The alternative is polyvinyl chloride tubes – which are more durable, but also two and half time the price and five times the weight. As a result they are less popular.

The popularity of the lay-flat hoses comes in response to the substantial conveyance losses from groundwater irrigation and the cost involved in additional pumping because of this. Water losses from tubewells are often higher than they are in surface irrigation system. Often the makeshift earthen field canals are undersized and water losses are more than half of the flow. Yet even without such overtopping, conveyance losses from groundwater irrigation are significant. First there are losses resulting from the seepage from the porous earthen channels – a particular problem in the Terai where soils are generally coarse. In small-scale lift irrigation, where flows are usually between 6-15 l/s, such steady state losses can take up a considerable portion of the flow. The second group of losses is the 'start-up' losses. Each time groundwater is applied it will take time, before the perimeter of the channel is wetted and water will start to flow. Obviously, start up losses depend on the duration and number of watering applications, but they are usually of the same order of magnitude as steady state losses. Between the two conveyance losses from shallow tubewells typically stand at 15% per 100m.

Apart from reducing water loss close to zero, several other advantages explain the popularity of the lay-flat hoses - the tubes avoid right of way problems and moreover farmers can defeat gravity and irrigate higher lands. The drawback of the tubes is that in comparison to open channels, they increase the delivery head of the pump. The result is a higher consumption of diesel per volume of water lifted. The attachment of 100m of polyethylene tube of 100mm diameter to the delivery pipe of a pump set (most delivery pipes have a diameter of 65 to 80mm) requires 11% more diesel per cubic meter of water lifted. This is, however, more than compensated by a reduction in the hours of pumping, because water losses even in well-prepared channels are 15% per 100m.

The beauty of the lay-flat hoses in the Indian Terai is that they are a completely self-promoted micro-irrigation system. The plastic tubes are sold off-the-shelf from local hardware shops at any length one requires. Their usage is very visible and there is a lively market in renting lay-flat hoses for a day – at US \$ 0.05-0.10 for a 300 meter tube. This has increased their popularity. Smaller diameter tubes are also tried on manual pumps, working well as the conveyance losses on the very small flows (1-2 l/s) are proportionally even higher than they are for shallow tubewells.

The intriguing part of the popularity of the polyethylene lay-flat hoses is their short life. It appears that for poor farmers operating in a high risk environment (such as vegetable cultivation) low cost disposable system have a clear advantage – they are within purchasing power and they avoid that meager financial resources get tied in things that one may not use the next year.