

## AN IRRIGATION SYSTEM FOR A FIVE-ACRE COCONUT PLANTATION

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Of the one million acres under coconut cultivation in Sri Lanka, 29% of the area are in the dry zone while 51% are distributed in the intermediate zone. During the last decade or so, the rainfall distribution pattern in Sri Lanka has distinctly changed. Prolonged droughts are now more frequent. The recurrent drought have affected the coconut production very adversely.

In a previous issue of the *Coconut Bulletin* (please see *Coconut Bulletin*, 1987 Volume 4(2) pages 6-12), one of the authors described the harmful effects of drought on coconut production, and the possibility of using irrigation to overcome these effects. The feasibility of supplementary irrigation of coconut lands has been widely discussed, and the necessity to irrigate coconut lands, particularly those in the dry and dry intermediate zones, had also been recognized.

Several systems of irrigation are available to the coconut grower. Of particular interest are systems such as (a) basin irrigation, (b) furrow/flood irrigation, (c) pitcher irrigation and (d) drip irrigation system. Notes on these system are given in a previous article cited in the earlier paragraph.

The Coconut Research Institute installed a pipe-borne irrigation system at its 350 ac Isolated Seed Garden, Ambakelle, Rajakadalawa. In this system, water is pumped direct into a network of pipes. "Riser pipes are located at convenient places and flexible hoses are attached to them for manual irrigation of palms. This system has been in operation for some time, and we have observed that the diesel pumps transmit vibration along

the pipeline during direct pumping. This vibration has caused leaks in pipes, particularly in those closer to the pumps. The other main drawback of this system is its dependence on a large labour force. About 30 labourers are required every day, and a considerable amount of time is spent on laying and coiling of the flexible hoses.

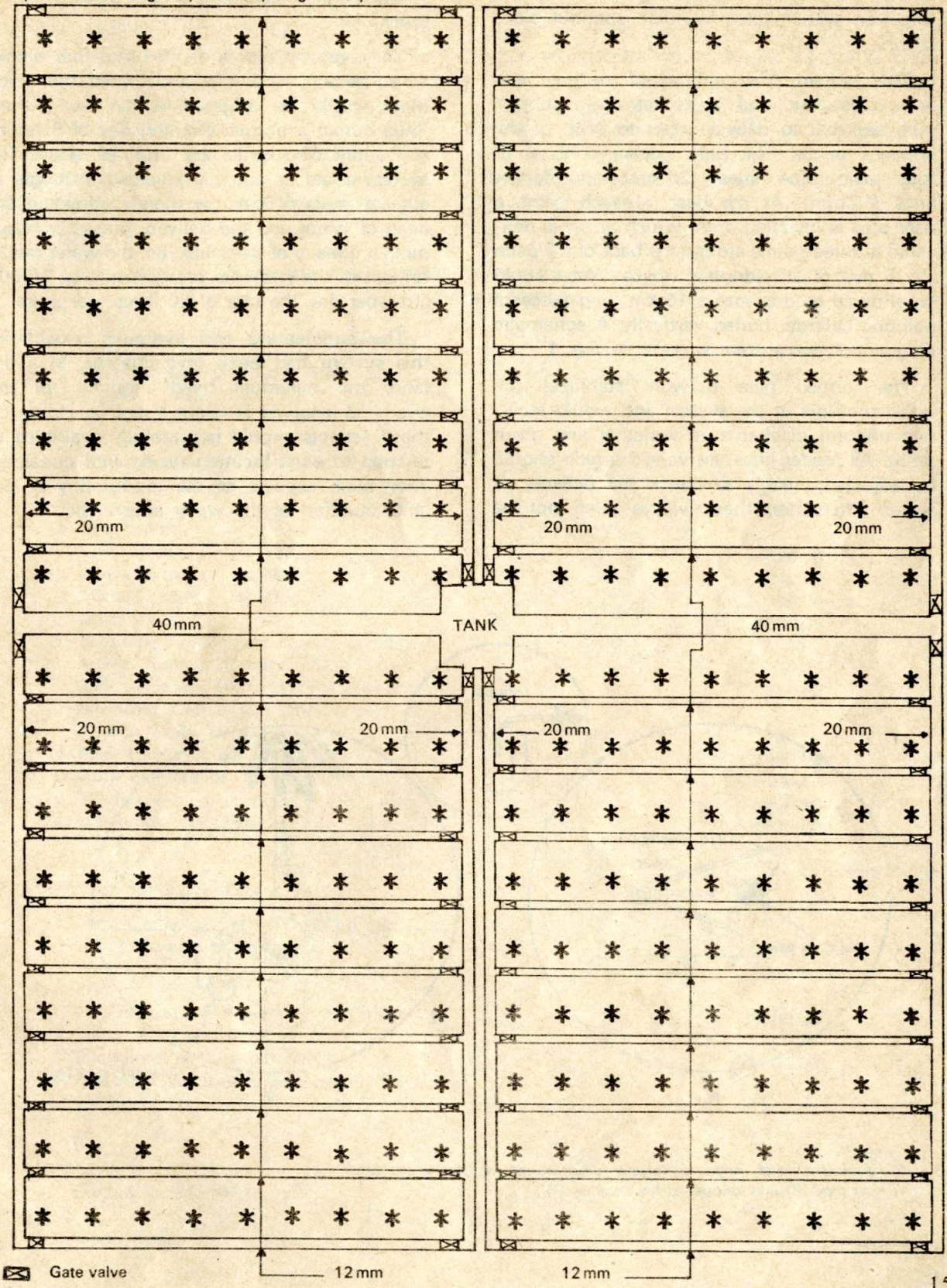
A gravity-flow drip irrigation system appears to be the most cost-effective and convenient method, which has advantages such as minimum water use, less labour requirement, reduced nutrient leaching, and the possibility of adding fertilizer to irrigation water.

Reports on irrigation of coconut indicate that a mature coconut palm requires supplementary irrigation ranging from 20 to 160 litres per day during dry periods. The amount of water required depends on many factors such as effective rainfall, soil moisture status, soil-plant-atmospheric factors etc. Considering the available data, it is reasonable to assume the daily average water requirement of an adult coconut palm to be about 50 litres in many areas.

Not many coconut growers use supplementary irrigation. In general, there appears to be a lack of interest on coconut irrigation primarily because of the rather heavy capital investment required for an irrigation system and due to the lack of a demonstrable system. The beneficial effects of irrigation are well documented and have been well demonstrated. The yield increase due to irrigation depends on a number of factors such as soil types, climate etc. However, a minimum of 30% increase in coconut production could easily be obtained with supplementary irrigation.

Several estates in Sri Lanka have drip irrigation systems. It has been possible to study their performance and evaluate them considering the constraints faced by coconut growers. In this

Fig. 1 – Schematic diagram of the subterranean pipe system of a 5 acre coconut plantation for a gravity-flow drip irrigation system.



- ⊠ Gate valve
- \* Coconut palm

article, we propose a simple gravity-flow drip irrigation system for a five-acre coconut plantation.

This system is comprised of an overhead water reservoir and a subterranean looped pipe network to deliver water to each of the coconut palms. The pipe system consists of four main pipe lines (20mm) and feeder lines (12mm). At the base of each palm, a riser pipe is installed, from which water is delivered to three points around the base of the palm by 6 mm plastic 'dripper' hoses. Water could be allowed to drip into a 15 cm long piece of bamboo cylinder buried vertically. A schematic diagram of this system is given in Fig. 1.

The looped pipe network stabilizes the water pressure in the system and would facilitate uniform discharge of water at any given point. All feeder lines are valved which should be adjusted initially to check the delivery of water. Thereafter, these valves need not be

manipulated except to shut off feeder lines for repairs etc.

The five acre plot is divided into four blocks of equal size, and it is anticipated that each block could be irrigated within two hours. Thus during a normal working day of 8 hours, the entire 5ac could be irrigated daily. The system could be suitably adjusted for larger or smaller areas of land by merely adjusting the head of water and the delivery pressure. Assuming a density of 64 palms/ac, the water requirement of the five-acre block would be 16,000 litres per day the rate of 50 litres per palm.

The engineering and hydraulic aspects of this system had been investigated. In a flat land, the minimum head required for the overhead reservoir is about 4 metres. However, these aspects should be carefully evaluated in relation to each location taking into consideration such aspects as the topography of the and situation of the water source etc.

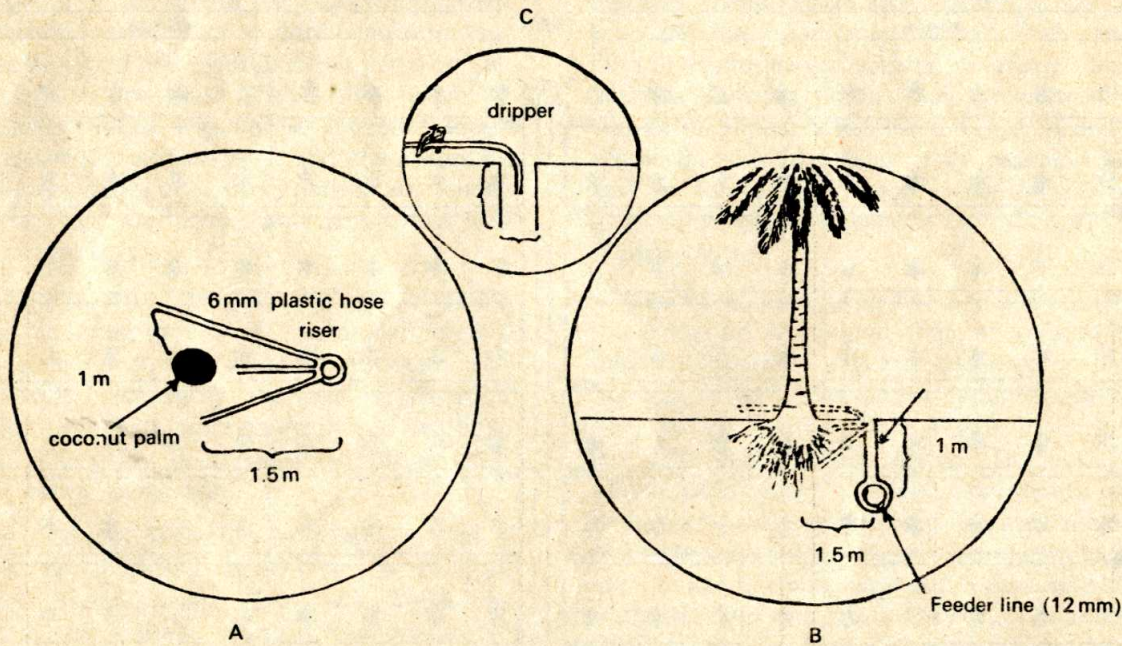


Fig. 2 – Arrangement of "drippers" (plastic hose) around the base of the palm (A), riser pipe (B) and 'dripper' in the bamboo (C).

The approximate cost of the pipe network and the ancilliary fixtures for the five-acre land and the cost of infrastructure are given in Table 1. The annual maintenance and operational costs of the system is estimated at about Rs. 1000.00 per acre.

Increase in yield due to irrigation depends on several factors such as the condition of the palms, their nutrition, soil factors, climate

etc. A very nominal increase of 25 nuts per palm per year due to irrigation alone would give an increase of income of Rs. 3,200/- per acre per year, assuming an average price of Rs. 2/- per nut. Other benefits of irrigation would be the possibility of incorporating fertilizer into the irrigation water thereby reducing application costs, and opportunities for intercropping.

**TABLE 1 COST OF IRRIGATION SYSTEM FOR 5 ACRE COCONUT PLANTATION**

<b>A — Cost of pipes and related fixtures</b>			
1. Overhead tank to ground 75mm—5m	..	..	1000.00
2. Pipes			
140 m of 40 mm ( Rs. 50/-)	..	..	7000.00
140 m of 20 mm × 4 ( Rs. 10/-)	..	..	5600.00
140 m of 12 mm × 18 ( Rs. 12/-)	..	..	30240.00
3. Risers .. .. .	..	..	3840.00
4. Drippers .. .. .	..	..	12000.00
5. Gate valves			
2 Nos 40 mm ( Rs. 160/-)	..	..	320.00
4 Nos 20 mm ( Rs. 60/-)	..	..	240.00
2 Nos 12 mm ( Rs. 45/-)	..	..	90.00
Other values .. .. .	..	..	5000.00
6. Reducing T joints (overhead to outlets)			
4 Nos 75 mm / 20 mm ( Rs. 175/-)	..	..	700.00
2 Nos 75 mm / 40 mm ( Rs. 175/-)	..	..	350.00
7. Reducing T Joints (20 mm/12 mm)			
72 Nos ( Rs. 10/-) .. .. .	..	..	720.00
8. Riser T joints .. .. .	..	..	1600.00
9. Other pipe fittings .. .. .	..	..	2000.00
10. Manholes .. .. .	..	..	8000.00
11. Labour charges (10%) .. .. .	..	..	7870.00
			<hr/>
			<b>86,570.00</b>
<b>B — Cost of infrastructure</b>			
1. Cost of over head tank (5×4×1.5 m)			
5 metres above ground .. .. .	..	..	25000.00
3. Water pump .. .. .	..	..	10000.00
3. Well			
1.75 m Diameter, 10 m deep, concrete rings	..	..	30000.00
4. Simple Filter system			
(Coir fibres at Tank outlet) .. .. .	..	..	5000.00
5. Pipe from well to over head tank 2" PVC pipe			
(20 m) × (Rs. 80.00) .. .. .	..	..	1600.00
			<hr/>
			71,600.00
Total (A+B) .. .. .	..	..	<b>158,170.00</b>
Contingencies (10%) .. .. .	..	..	15,757.00
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Grand Total .. .. .	..	..	<b>173,927.00</b>
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