

TABLE 12.2 - Maximum number of minisprinklers on the lateral and length of lateral on level ground. Minisprinkler flow rate at 2.0 bars

Lateral size and spacing (metres)	70 litres/h		120 litres/h		150 litres/h		
	Max. no. of minisprinklers	Lateral length (metres)	Max. no. of minisprinklers	Lateral length (metres)	Max. no. of minisprinklers	Lateral length (metres)	
16 mm	3	10	30	7	21	6	18
	4	9	36	6	24	6	24
	5	8	40	6	30	5	25
	6	8	42	5	30	5	30
	8	7	56	5	40	4	32
20 mm	3	16	48	11	33	9	27
	4	15	60	10	40	9	36
	5	14	70	9	45	8	40
	6	13	78	9	54	8	48
	8	11	88	8	64	7	56
25 mm	3	25	75	18	54	15	45
	4	22	88	16	64	14	56
	5	20	100	15	75	13	65
	6	19	114	14	84	12	72
	7	18	144	12	96	11	88

Note: All pipes are LDPE, 4.0 bars, to DIN 8072.

FIGURE 12.2 - Minisprinklers in trees.



COST

The total cost for the installation of the system on 1.0 ha, as in the example design, is US\$1 634. A cost analysis shows that the head control unit costs US\$470, i.e. 26 percent of the total. The same unit can serve an area of at least 3.0 ha. The most important cost item is the PE pipes (tubes), i.e. the system network, at US\$864. This is 55 percent of the total cost for a 1 ha system. For a 3 ha complete installation, the pipes represent about 65 percent of the total cost.

ADVANTAGES

- High irrigation application efficiency. The amount of water is precisely controlled and only a partial area is wetted. No losses occur due to evaporation, deep percolation or runoff.
- Salinity control. The water movement through the soil profile is vertical downwards and the accumulated salts in the root zone can easily be leached to deeper layers.
- Flexibility and adaptability. It is the most flexible micro-irrigation system and is easily adopted and managed by farmers. The technology is simple and the range of equipment relatively low.
- Low labour requirements.

DISADVANTAGES

- High initial purchase cost.

EXAMPLE DESIGN – Minisprinkler with citrus lemon trees

Area and crop

The plot is 85 x 120 m, i.e. about 1 ha, planted with mature (12-year-old) citrus lemon trees in rows at a spacing of 6 x 6 m (Figure 12.3). There are 20 rows with 14 trees in each row for a total of 280 trees. The slope of the plot is 0.5 percent from west to east and from north to south.

Soil, water and climate

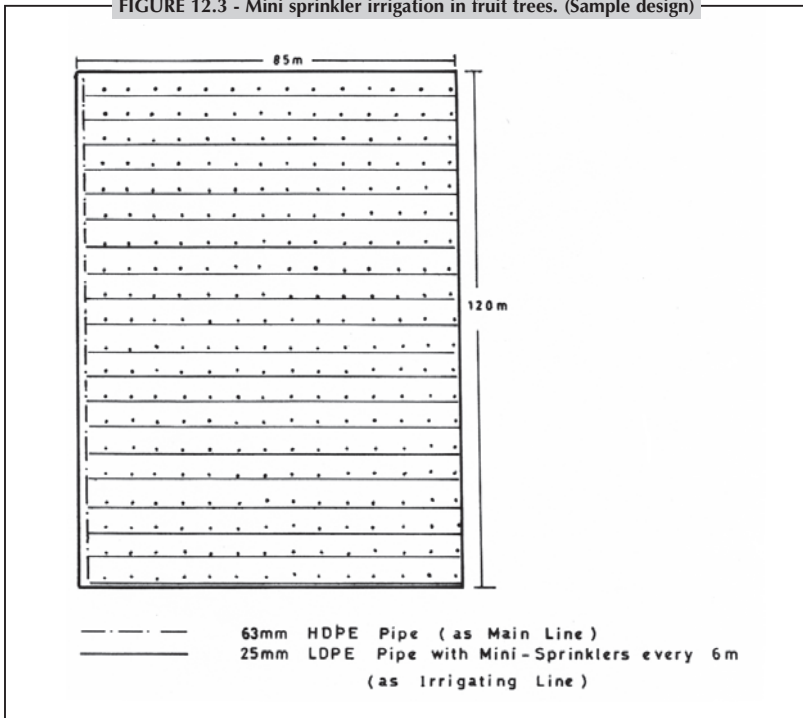
The soil is of medium texture with a permeability of approximately 4 mm/h, a water holding capacity of 22 percent, and soil available moisture of 150 mm/m depth. There are no salinity or toxicity hazards. The source of water is an existing tube-well with a safe output of 5 litres/s (18 m³/h).

The water is of good quality with the electrical conductivity of the irrigation water $EC_w = 1.5$ dS/m total salinity. The evaporation pan average readings in mid-July are 7.0 mm/d. The irrigation season is from April to October.

Crop water requirements and irrigation schedule

A pan reading of 7.0 mm/d multiplied by 0.66 (pan correction factor) gives an ETo of 4.65 mm/d. The crop factor k_c is 0.65. Thus, $ET_c = 4.65 \times 0.65 = 3.0$ mm/d. The area shaded by the tree canopy is 70 percent and for calculation purposes it is taken as 82 percent. Therefore, the daily water requirements are: $3.0 \times 0.82 = 2.48$ mm/d net. With a system application efficiency of 80 percent, the gross daily irrigation requirements are: $2.48 \times 100 \div 80 = 3.1$ mm (31 m³). If irrigation takes place every 10 days, the gross irrigation dosage is: $10 \times 31 = 310$ m³.

FIGURE 12.3 - Mini sprinkler irrigation in fruit trees. (Sample design)



The maximum permissible irrigation interval in July with a 50 percent moisture depletion for a tree root depth of 0.6 m is: $150 \times 0.6 \times 0.5 \div 3.0 = 15$ days. The irrigation frequency depends on many factors and in no case should exceed the maximum permissible irrigation interval.

However, as mentioned, the common practice is to irrigate every seven days. The seven-day interval accumulates gross irrigation requirements of 217 m^3 , i.e. the irrigation dosage at peak demand in July.

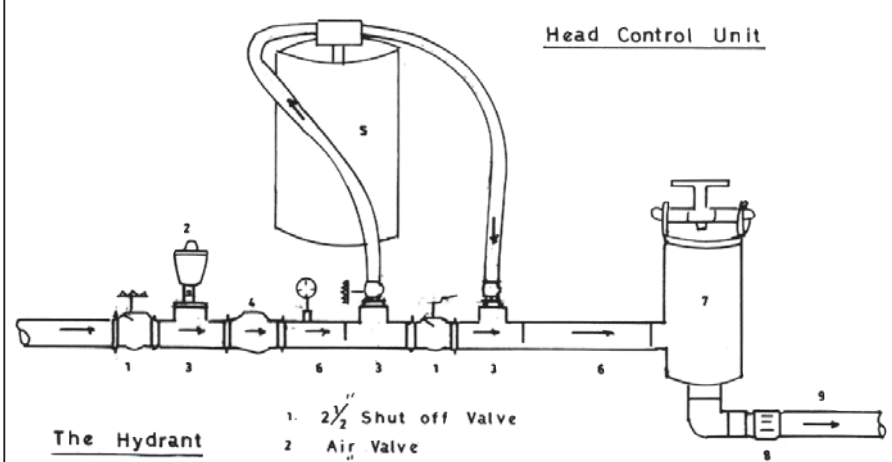
SYSTEM LAYOUT, PERFORMANCE AND HYDRAULICS:

- One lateral irrigating line of 25 mm LDPE pipe, 81 m long, is laid along each row of trees, with one minisprinkler per tree, i.e. 14 minisprinklers per line. The laterals lines are connected directly to the main line, a 63 mm HDPE pipe laid along the plot boundaries, which also serves as a manifold (Figure 12.4).
- Minisprinkler performance: 120 litres/h flow rate full circle, 2.0 bars, 60 mesh, filtration required (Tables 12.3 and 12.4).
- Number of minisprinklers per lateral line: 14
- Lateral discharge: 1 680 litres/h
- System discharge: 17–18 m^3/h
- Total number of laterals: 20
- Maximum number of laterals operating simultaneously: 10
- Number of shifts per irrigation: 2
- Duration of irrigation application per shift: 6.2 hours approximately.

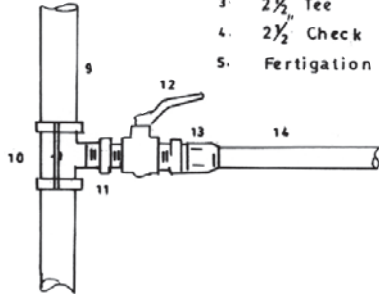
TABLE 12.3 - System's operating pressure

	bars
Pressure required at minisprinkler operation	2.00
Friction losses along the lateral line	0.35
Friction losses along the main line	0.25
Friction losses in the head control unit	0.50
Minor local losses	0.20
Sub-total	3.30
Difference in elevation	- 0.15
Total dynamic head	3.15

FIGURE 12.4 - Minisprinkler system jointing techniques.

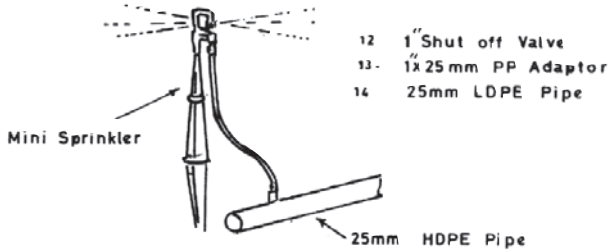


The Hydrant



- 1. 2 1/2" Shut off Valve
- 2. Air Valve
- 3. 2 1/2" Tee
- 4. 2 1/2" Check Valve
- 5. Fertigation System (optional)

- 6. 2 1/2" Threaded Pipe
- 7. 2 1/2" Filter Screen
- 8. 2 1/2 x 63mm PP Adaptor
- 9. 63mm HDPE Pipe
- 10. 63mm x 1" Clamp Saddle
- 11. 1" Nipple



- 12. 1" Shut off Valve
- 13. 1x25mm PP Adaptor
- 14. 25mm LDPE Pipe

TABLE 12.4 - Equipment required for the system installation

Item	Description	Quantity	Unit price US\$	Total price US\$
System distribution network				
1.	63 mm black HDPE pipe, 6.0 bars	120 m	1.80	216.00
2.	25 mm black LDPE pipe, 4.0 bars	1620 m	0.40	648.00
3.	63 mm x 2 ½ in PP adaptor	1 pc	6.00	6.00
4.	25 mm x ¾ in PP adaptor	20 pcs	1.00	20.00
5.	63 mm PP end plug	1 pc	6.00	6.00
6.	63 mm x ¾ in PP clamp saddle	20 pcs	1.30	26.00
7.	¾ in brass shut-off valve	20 pcs	2.30	46.00
8.	Minisprinkler full circle, 120 litres/h, 2.0 bars	280 pcs	0.70	196.00
	Sub-total			1164.00
Head control				
9.	2 ½ in brass check valve	1 pc	15.00	15.00
10.	2 ½ in brass shut-off valve	2 pcs	13.00	26.00
11.	¾ in brass shut-off valve	2 pcs	2.30	4.60
12.	2 ½ in galvanized iron nipple	2 pcs	1.00	2.00
13.	¾ in galvanized iron nipple	2 pcs	0.25	0.50
14.	2 ½ in galvanized iron tee	3 pcs	3.50	10.50
15.	1 in air valve automatic single	1 pc	12.00	12.00
16.	2 ½ in filter (screen or disk type) 60 mesh	1 pc	180.00	180.00
	Sub-total			250.60
	TOTAL COST			1415.00