

Hose basin for field crops

In this system, the hoses cannot cross the basins because they may damage the crop. The size of the small basins is usually 12 x 12 m, 6 x 12 m or 6 x 18 m. The laterals are placed at a closer spacing than for trees, in relation to the basins' dimensions and arrangement. The hoses can be of any kind, soft PVC or LDPE, in the appropriate lengths (18–24 m) and sizes (25 mm–1¼ inch). For example, with basins 6 m wide and 12 m long, the lateral lines are placed along the slope direction 24 m apart (every four basins). The 24 m hoses are connected to the laterals every three basin lengths (36 m), irrigating four basins upstream, two on each side, and eight basins downstream, four on either side, for a total of 12 basins, in an area of approximately 865 m². The hose spacing in this example is 24 x 36 m. However, it can vary as required. The hoses can be moved from one basin to another either by dragging them backwards or by carrying them.

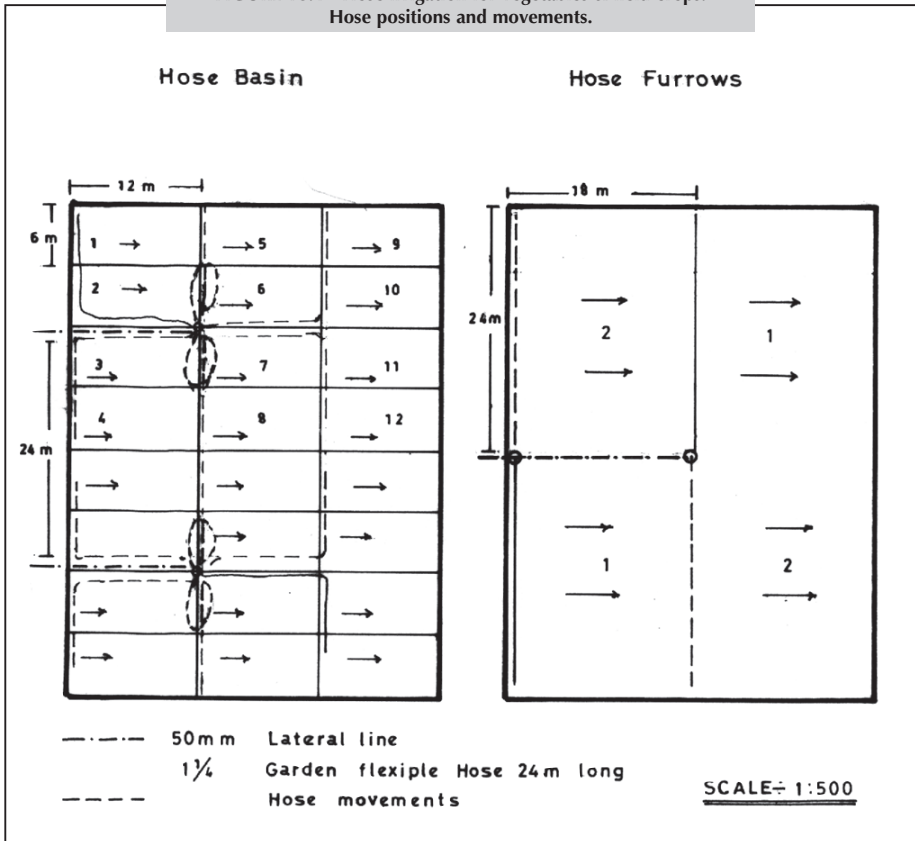
Hose furrow for vegetables

Similar to the hose basin for vegetables, here the lateral lines are placed along the slope with the hoses connected at the head of the furrows. They are extended perpendicular to the lateral on either side delivering water to a number of furrows, as a drag system. The hoses are generally 25–32 mm soft black LDPE or 1¼ inch soft PVC garden hoses. The spacing of the hoses along the lateral is the same as the length of the furrows. The length of the furrows depends mainly on the type of soil, the slope, and the size of flow. With these systems, the furrows are usually short, 18–30 m long, 15 cm deep and about 1 m apart. The factors that influence the furrow layout are: farming practices; size and shape of the field; and irrigation application depth. The lower the depth of application and the size of the flow, the shorter the length; and the steeper the slope, the longer the furrow. In sandy soils, the furrow is shorter than in heavy clay soils. In medium texture soils, the following approximate relationship between slope and size of flow (Table 18.2) can be considered:

TABLE 18.2 - Slope and size of the flow

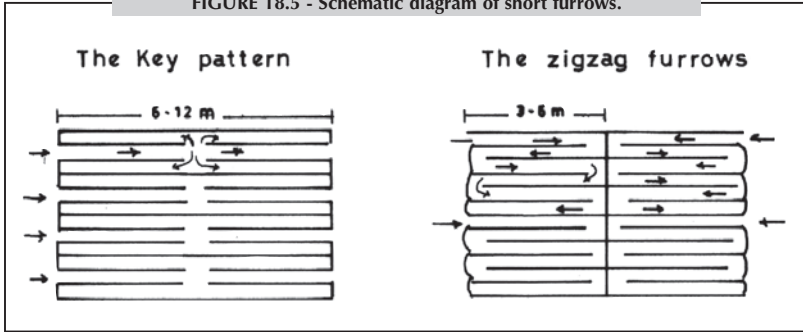
Slope %:	0.3	0.6	1.0	1.3	1.5
Size of flow m³/h:	8.0	4.0	2.25	1.75	1.5

FIGURE 18.4 - Hose irrigation for vegetables & field crops.
Hose positions and movements.



In small basins, the flow can be the minimum, while in large ones, the flow should be the maximum possible as the rate of application is proportional to the irrigation requirements. In sandy soils with high infiltration rates, the small discharge hoses can be moved from one place to another in the basin itself during the irrigation if necessary to ensure uniform distribution of water. It is common for farmers to subdivide the basins into smaller ones, or to construct short furrows within the basins in order to achieve ideal results. Several furrow layouts are applied (zigzag pattern, key pattern, etc.) in both types of systems. When the hose discharge is highly pressurized, some informal techniques are exercised on the spot by the farmer, such as the use of a tin vessel at the hose outlet, or a plastic bucket to avoid soil erosion and destruction of the ridges (Figure 18.4).

FIGURE 18.5 - Schematic diagram of short furrows.



COST

Although hose irrigation systems are classed as semi-permanent installations, the water delivery hoses are the only movable component. However, the cost for a complete installation is very low compared with any other improved closed pipe technique. The average cost for all types of hose irrigation systems is about US\$660/ha. Moreover, many years of study and observation have shown that the operating costs to the farmers, in terms of out-of-pocket money, are much lower than for any other system (Figure 18.5).

FIGURE 18.6 - Women irrigating young trees with hose basin system.



ADVANTAGES

- High application efficiencies of about 75 percent, resulting in considerable water savings.
- Low-cost improved irrigation installation.
- Simple technology easily managed by small children and old women.
- Gainful employment of available labour in small communities.
- Utilization of small water flows and quantities.
- Low energy (fuel) consumption.

DISADVANTAGES

- High labour requirements for system operation.

EXAMPLE DESIGNS – Hose basin with trees: conventional and drag types

Area and crop

The field dimensions (for design purposes) are taken as 140 x 72 m (about 1.0 ha) with mature trees planted in a spacing of 6 x 6 m. There are 24 rows with 12 trees in each row for a total of 288 trees (Figure 18.6).

Soil, water and climate

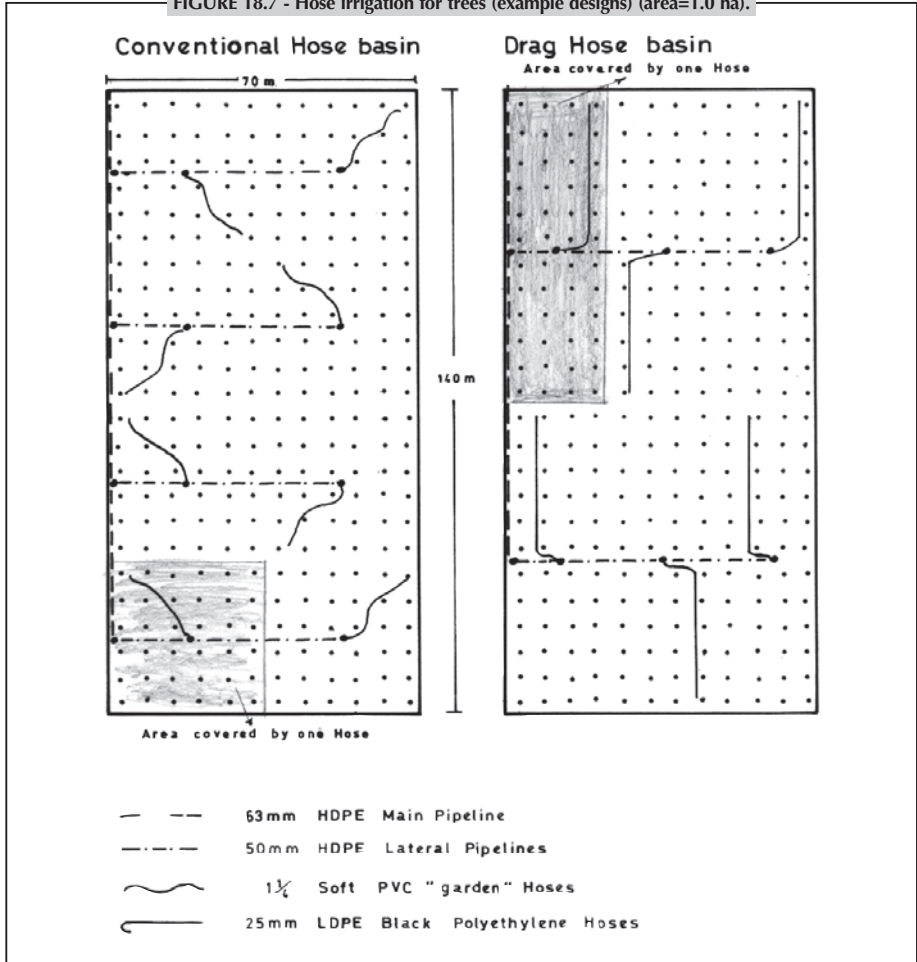
Medium texture soil of good structure, with good infiltration and internal drainage. Soil available moisture: 150 mm/m depth. The water is of good quality with no salinity or toxicity hazards; the source is a high-level reservoir. The peak irrigation demand is in July; the evaporation pan average readings are 7 mm/d.

Crop water requirements and irrigation scheduling

The 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 canopy is 70 percent and for calculation purposes this 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 75 percent, the gross daily irrigation requirements are: $2.48 \times 100 \div 75 = 3.3$ mm (33 m³). If irrigation takes place every ten days, the gross irrigation dosage is: $10 \times 33 = 330$ m³.

The maximum permissible irrigation interval in July on a 50 percent moisture depletion for a trees root depth of 0.6 m is: $150 \times 0.6 \times 0.5 \div 3.0$

FIGURE 18.7 - Hose irrigation for trees (example designs) (area=1.0 ha).



= 15 days. The irrigation frequency depends on many factors and in no case should exceed the maximum permissible irrigation interval.

Layout performance and hydraulics

In both the conventional and drag hose basin systems, a 63 mm HDPE or PVC main pipeline is placed along the border of the field with 2 in offtake hydrants, four for the conventional type and two for the drag type.

Laterals of 50 mm LDPE are laid perpendicular to the mains, four and two respectively, connected to the hydrants. The hose arrangements of the two systems differ. In the conventional type, the hose spacing is 36 x 36 m with two 24 m-long 1 ¼ inch garden hoses per lateral. There are four laterals and eight hose positions. Thirty-six trees can be served from each hose position. In the drag system, the hose spacing is 24 x 48 m with three 36 m-long 25 mm LDPE hoses per lateral. There are only two laterals and six hose positions. Forty-eight trees can be irrigated from each hose position. The general characteristics (Table 18.3) of the systems are as follows:

TABLE 18.3 - Conventional and drag hose basin

	Conventional hose basin	Drag hose basin
System flow	16 m ³ /h	16 m ³ /h
Hoses	Soft PVC, 1 ¼ in, 24 m	LDPE, 25 mm, 36 m
Hose discharge	4 m ³ /h	2.7 m ³ /h
Basins dimensions	5 x 5 m	5 x 5 m
No. of basins per hose	36	48
Irrigation frequency	10 days	10 days
Irrigation dosage	330 m ²	330 m ²
No. of hoses operating simultaneously	4 (double shift)	6
Time to fill a basin	17.4 min	26 min
Time to complete one irrigation	20.8 h	20.8 h
	bars	bars
Pressure losses in the hoses	0.2	0.7
Pressure losses in the laterals	0.3	0.4
Pressure losses in the main line	0.5	0.4
Minor local and other losses	0.5	0.5
Total dynamic head	1.5	2.0

Equipment for system installation

TABLE 18.4 - Conventional hose basin system (trees)

Item	Description	Quantity	Unit price US\$	Total price US\$
	System distribution network			
1.	63 mm HDPE pipe, 4.0 bars	125 m	1.80	225.00
2.	50 mm HDPE pipe, 4.0 bars	220 m	1.20	264.00
3.	63 mm PP compression end plug	1 pc	5.00	5.00
4.	50 mm PP compression end plug	4 pcs	3.00	12.00
5.	63 mm x 2 ½ in PP compression adaptor	1 pc	5.00	5.00
6.	50 mm x 2 in PP compression adaptor	4 pcs	3.00	12.00
7.	63 mm x 2 in PP clamp saddle	4 pcs	1.30	5.20
8.	50 mm x 1 in PP clamp saddle	8 pcs	1.10	8.80
9.	2 in brass gate valve	4 pcs	8.00	32.00
10.	1 in brass gate valve	8 pcs	3.00	24.00
11.	2 in nipple	4 pcs	0.80	3.20
12.	1 in nipple	16 pcs	0.40	6.40
13.	1 ¼ in tap hose adaptor	4 pcs	0.70	28.00
14.	1 ¼ in soft PVC garden hose, 24 m long	4 pcs	30.00	120.00
	TOTAL COST			750.60