Drip irrigation system
(Gravity force operated)

What is drip irrigation system?

A drip irrigation system delivers water directly to the root zone of a plant, where it seeps slowly into the soil one drop at a time. Almost no water is lost through surface runoff or evaporation, and soil particles have plenty of opportunity to absorb and hold water for plants. It also means very few nutrients leach down beyond the reach of plant roots. Furthermore, since drip irrigation delivers water directly to the plants you want to grow, less is wasted on weeds. The soil surface between the plants also remains drier, which discourages weed seeds from sprouting.

Where to use the system

a) Suitable crops

Drip irrigation is most suitable for leafy vegetable crops (e.g.; cabbages, lettuce, spinach etc.) and vine crops (strawberry, grapes, sweet gourd, groundnut etc.) where one or more emitters can be provided for each plant (Brouwer, *et al.*, 1990).

b) Suitable soils

Drip irrigation is suitable for most soils. On clay soils water must be applied slowly to avoid surface water ponding and runoff. On sandy soils higher emitter discharge rates will be needed to ensure adequate lateral wetting of the soil (Brouwer, *et al.*, 1990).

c) Suitable water

One of the main problems with drip irrigation is blockage of the emitters. All emitters have very small waterways ranging from 0.2-2.0 mm in diameter and these can become blocked if the water is not clean. Thus it is essential for irrigation water to be free of sediments. If this is not so then filtration of the irrigation water will be needed (Brouwer, *et al.*, 1990).

Blockage may also occur if the water contains algae, fertilizer deposits and dissolved chemicals which precipitate such as calcium and iron. Filtration may remove some of the materials but the problem may be complex to solve and requires an experienced engineer or consultation with the equipment dealer.

Drip irrigation is particularly suitable for water of poor quality (saline water). Dripping water to individual plants also means that the method can be very efficient in water use. For this reason it is most suitable when water is scarce.

Advantages of drip irrigation system

1. Fertilizer and nutrient loss is minimized due to localized application and reduced leaching.
2. Water application efficiency is high.
3. Field levelling is not necessary.
4. Fields with irregular shapes are easily accommodated.
5. Recycled non-potable water can be safely used.
6. Moisture within the root zone can be maintained at field capacity.
7. Soil type plays less important role in frequency of irrigation.
8. Soil erosion is lessened.
9. Weed growth is lessened.
10. Water distribution is highly uniform, controlled by output of each nozzle.
11. Labour cost is less than other irrigation methods.
12. Variation in supply can be regulated by regulating the valves and drippers.
13. Fertigation can easily be included with minimal waste of fertilizers.
14. Foliage remains dry, reducing the risk of disease.
15. Usually operated at lower pressure than other types of pressurised irrigation, reducing energy costs.

How to install Drip Irrigation System (gravity feed):

Basic Components used in drip irrigation:

1. **Water tank:** Water source in an estimated height from where water will be dripped.
2. **Control head:** The control head consists of valves to control the discharge and pressure in the entire system. It may also have filters to clear the water. Common types of filter include screen filters and graded sand filters which remove fine material suspended in the water. Some control head units contain a fertilizer or nutrient tank. These slowly add a measured dose of fertilizer into the water during irrigation. This is one of the major advantages of drip irrigation over other methods.
3. **Main and submain lines and Laterals:** Mainlines, submains and laterals supply water from the control head into the fields. They are usually made from PVC or polyethylene hose and should be buried below ground because they easily degrade when exposed to direct solar radiation. Lateral pipes are usually 13-32 mm diameter.
4. **Emitters or drippers:** Emitters or drippers are devices used to control the discharge of water from the lateral to the plants. They are usually spaced more than 1 meter apart with one or more emitters used for a single plant such as a tree. For row crops more closely spaced emitters may be used to wet a strip of soil. Many different emitter designs have been produced in recent years. The basis of design is to produce an emitter which will provide a specified constant discharge which does not vary much with pressure changes, and does not block easily.

In gravity feed irrigation systems water takes the path of least resistance. If the distance is long enough, water may not reach the last holes on the line. Distance could be as long as 50 feet or as little as 10 feet. This will depend on the height of the bucket/barrel, the pressure available, the size of the pipe and the flow uniformity of the system.

Gravity feed systems using drip irrigation need a minimum pressure to operate. To gain pressure in gravity feed systems, following calculation can be used):

For every 1' (12 cm) of elevation above the system there is a gain of .433 PSI[1] (.030 bar). This means that-
if the water source is 10 feet (3m) above the system there is a pressure of 4.33 PSI (.30 bar) at the start of the system (.433 x 10 = 4.33). Low pressure (less than 4.33 PSI) will lead to:

1. Limited distance to the layout
2. Reduction in the flow rate
3. A drastic drop in uniformity

[1] Pounds per square inch

Installing gravity feed drip irrigation system using a 50-gallon water container

10 x 12 foot gravity feed system with 5 rows, each 10' long using a 1/4"drip line with pre inserted drippers every 12" (30 cm):

The chart below is for a gravity feed drip irrigation system using a 1/4" drip line with drippers every 12" (30 cm). This design uses a 10 gallon (38L) bucket with 9 gallons (30L) of water at a pressure range less than 1 PSI on flat terrain.

Barrel Size	Height above the drip system	Length of drip line run	Dripper Flow rate	Container close to empty in:
50 gallon	8"	10'	.034 GPH 1.28 l/h	Around 2.50 hours
50 gallon	12"	10'	.036 GPH 1.36 l/h	Around 2.40 hours
50 gallon	12"	14'	.041 GPH 1.55 l/h	Around 2.30 hours
50 gallon	16"	14'	.042 GPH 1.58 l/h	Around 2.20 hours

(http://www.dripirrigation.com/drip_irrigation_chapters/9/drip_irrigation_pages/40)

Steps (Figure 1 to figure 15) for installing a gravity feed drip irrigation system

Figure 1. Drill a 3/4" hole in the barrel about 1" from the bottom (if no outlet).

Figure 2. From inside the barrel insert a 3/4" x 1" nipple with o-ring

Figure 3.From the outside of the bucket, thread a 3/4" adapter to the nipple.

Figure 4. To the adapter connect a 3/4" filter

Figure 5. To the filter connect a ball valve

Figure 6. To the ball valve connect a 4" to 10" section of the 1/2" drip tubing

Figure 7. To the drip tubing connect a 1/2" elbow

Figure 8. From the elbow to the ground add another section of 1/2" drip tubing

Figure 9. To the end of the 1/2" drip tubing add an additional elbow

Figure 10. From the elbow lay out the drip tubing to the garden and connect to the elbow

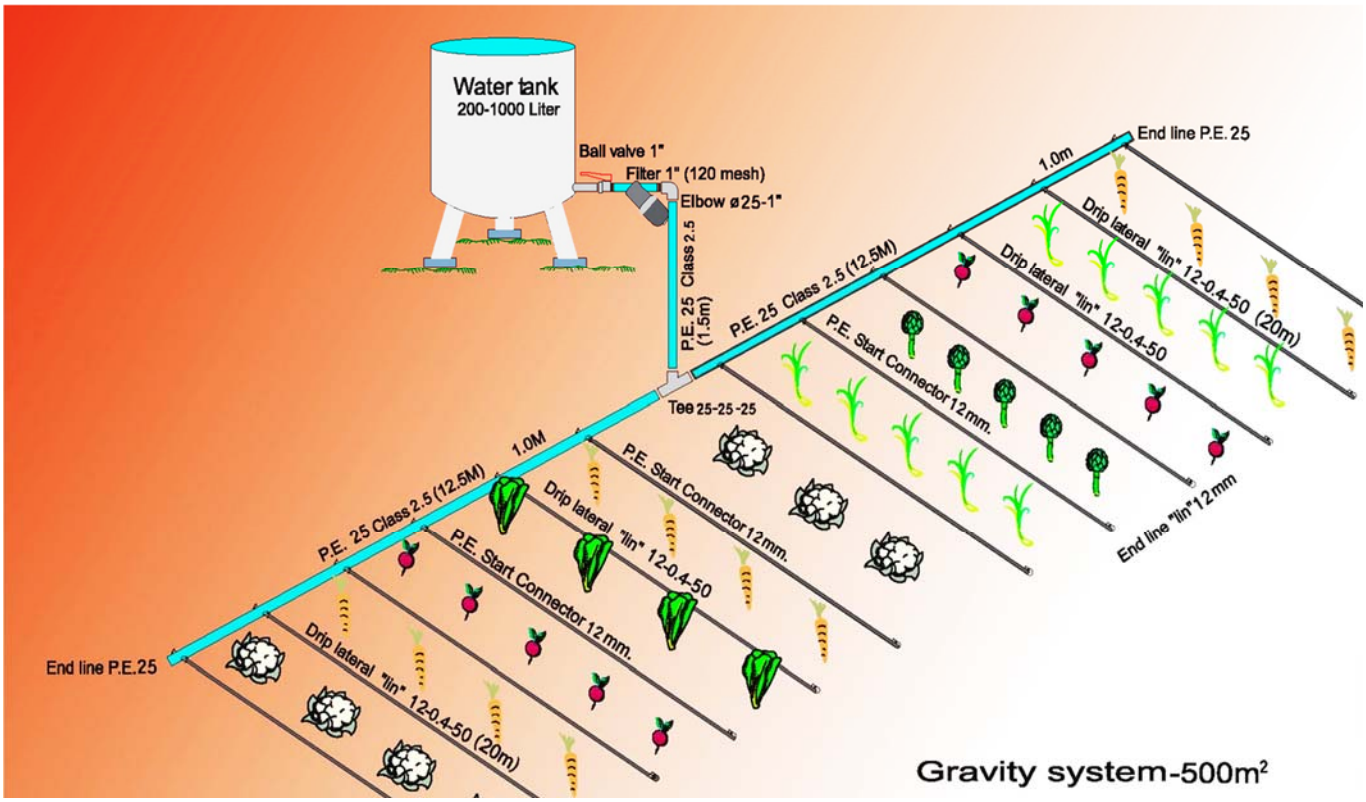
Figure 11. Near each row of plants punch a hole in the 1/2" drip tubing and insert a 1/4" barb

Figure 12. To the barb connect 10' of 1/4" drip line with drippers every 12"

Figure 13. To punch the hole in the 1/2" drip tubing use punch.

Figure 14 Fill the barrel with water and turn the ball valve on to flush the line, and as the water is running, close the end of the 1/2" drip tubing using hose end.

Figure 15. Close the end of the 1/4" drip line using the small side of the goof plug,



The disadvantages of drip irrigation are:

1. Waste: the sun can affect the tubes used for drip irrigation, shortening their usable life.
2. Clogging: if the water is not properly filtered and the equipment not properly maintained, it can result in clogging.
3. Drip irrigation might be unsatisfactory if herbicides or top dressed fertilizers need sprinkler irrigation for activation.
4. Drip tape causes extra cleanup costs after harvest. Users need to plan for drip tape winding, disposal, recycling or reuse.
5. Waste of water, time and harvest, if not installed properly.
6. These systems require careful study of all the relevant factors like land topography, soil, water, crop and agro-climatic conditions, and suitability of drip irrigation system and its components.

References

Brouwer, C. Prins, K. May, M. Heibloem, M., 1990. *Training manual no 5 Provisional edition.* FAO Land and Water Development Division, FAO - Food and Agriculture Organization of the United Nations.

http://www.dripirrigation.com/drip_irrigation_chapters/9/drip_irrigation_pages/40 the page accessed on 01/10/2014.