5 Emitter Selection and Placement

An important factor in the design of a trickle irrigation system is the selection and placement of emitters. Trickle irrigation systems are installed in a variety of ways; buried underground, laid on top of the ground, laid underneath plastic mulches and strung above the ground suspended on plant support systems. The mode of installation selected will depend on farm management, crop growth, and the type of emitter used.

Selecting the right emitter is the first step to ensure that the best system performance can be achieved. Emitter spacing and placement of the emitter with respect to the crop's roots are important considerations for maximizing growth potential and productivity.

5.1 Emitter Selection

The following should be considered to ensure that the emitter selected will provide optimum performance:

1. **Type of crop** – An emitter must be selected to match the type of crop. The emitter discharge rate and placement is related to crop spacing and water requirement. The emitters must be capable of supplying peak water requirements as well as wet an adequate portion of the plant root zone.   Seasonal crops such as vegetables are more suited to inexpensive linear tape systems while perennial crops may require more permanent systems.
2. **Water Quality** – The emitter orifice size dictates the filtration requirements necessary. In areas of very poor water quality it may be beneficial to select an emitter that doesn't clog easily, thereby reducing the filtration requirements.
3. **Farm Management** – Crop harvesting methods, tillage, cover crop control and other cultural practices determine which type of emitter may be more suitable. The emitter system must be durable enough to withstand any physical abuse from farming operations. (e.g. Mechanical harvesting).

4. **System Installation** – Trickle systems can be suspended in the crop, laid on the ground or buried. Buried systems are not easily checked, making it difficult to see if the system is working properly. Flow meters should be considered mandatory for these type of installations to ensure system performance is maintained. In-line emitter systems are much easier to install for row crops or buried systems. Plug in type of emitters are better suited to installations that are very plant specific, where emission points must be accurately located with respect to the plant rooting area.
5. **Operating Characteristics** – It is recommended that the system is designed so that each zone does not operate for more than 12 hours per day. A trickle irrigation system should be operated on an intermittent basis to reduce algae growth in the lateral lines and allow air movement into the soil. The peak water requirements for each zone must therefore be supplied in 12 hours or less.
6. **Cost** – A trickle system may use between 500 to 1000 emitters per acre. The cost of the emitter is therefore a significant portion of the overall system cost.
7. **Topography** – Elevation variances throughout the field may require turbulent flow or pressure compensating emitters to maintain a good trickle irrigation system uniformity. See Chapter 4.
8. **Manufacturer's Variance Coefficient** – Flow rate variations will occur due to manufacturing variances in emitter construction. The manufacturer's variance should be determined and analyzed to ensure that the resulting flow variations will not severely effect system uniformities. See Chapter 4.
9. **Emitter Characteristics** – Emitter size, construction and colour may determine resistance to insects, rodents and other pests. Rodents and insects may be attracted to certain colours. Ensure that the emitter has a warranty that is sufficient for the conditions of the site. Discharge flow rates can vary greatly for products that have a very short life span.

5.2 Emitter System Types

Although the method of pressure reduction may vary, emitters can be classified into three separate categories; line source or linear tape, point source and spray.

Linear Tape System

Linear tape systems have an emitter or discharge orifice inserted into the drip tubing during the manufacturing process. Drip tape refers to products that have thin wall thicknesses, and have an orifice constructed into the tape at a preset spacing at the factory. Polyethylene tubing can also be purchased with emitters inserted inside the pipe, but these systems are a more rigid product and usually considered line source systems. These system types are covered in the next section.

Drip tape refers to products that use soft hose tubing with wall thicknesses ranging from 4 mil to 25 mil. The very thin walled product is used in cropping cycles where the tape is discarded after each cropping cycle. Thick walled tape is used in situations where the tape must last 5 years or longer. Figure 5.1 shows different types of drip tape products. The recommended operating pressure will depend on the wall thickness of the tape. For a wall thickness of 15 mil or greater an operating pressure of 15 psi is suggested. For tapes less than 15 mil the suggested operating pressure is 12 psi.

Linear tape systems have orifices spaced at regular intervals along the lateral to supply water to the plants. The flow rate for the system is often measured by the lateral length rather than each individual orifice. Linear tape systems are available in both high flow and low flows products. See Appendix B. Flow rates can vary from 30 gph – 60 gph per 200 feet of length. Spacing of the discharge orifices, operating pressure and tape size will determine the product flow rate. Spacing of the emitter orifice can range from 4 – 24 inches (10 – 60 cm). Linear tape systems are not usually fully pressure compensating.

Linear tape systems are normally used for row crops such as tomatoes, strawberries and vegetables. Lateral water movement in the soil from these types of systems is similar to point source emitter systems. See Table 5.3. The amount of lateral movement achieved will vary with the operating time. Row crops irrigated with a linear tape system that have a close orifice spacing will usually have a wetted strip develop along the entire row. Table 5.1 shows the amount of linear tape that is required per acre for various row spacings.

Weeping or porous wall type systems are often marketed as linear tape type systems. These systems are not considered an agricultural product. These products, often made from recycled tires, contain micropores throughout the entire hose. The water slowly oozes out of these micropores. These systems can plug easily and are difficult to clean. Porous wall systems are not recommended for agricultural installations as the uniformity of application is very poor.

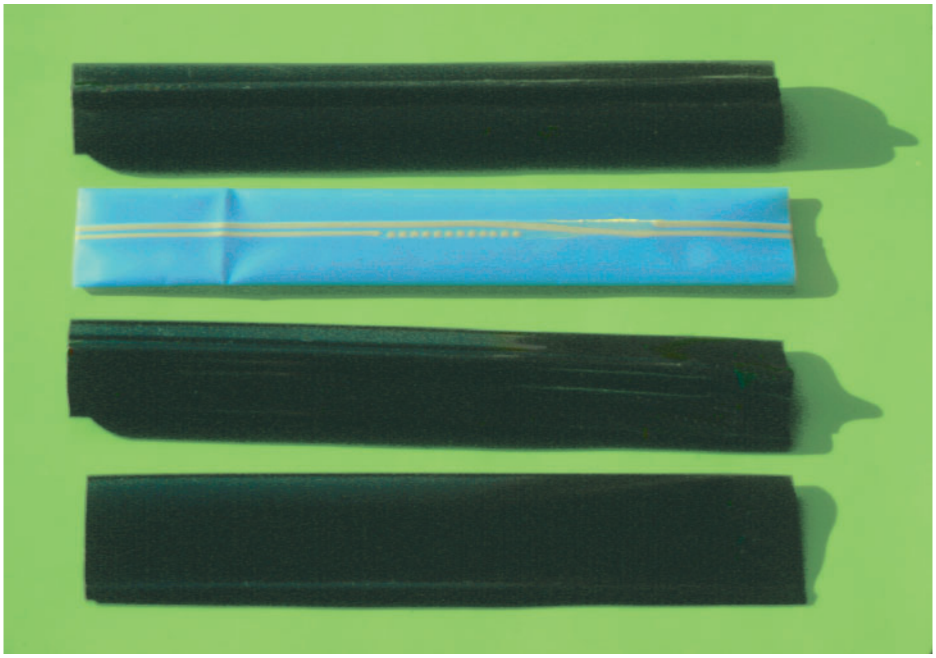


Figure 5.1 *Linear*

The maximum length for each linear tape lateral will depend on:

- diameter of the tape
- emitter spacing
- flow rate chosen
- emission uniformity desired
- manufacturer's variance coefficient (C_v)
- discharge exponent (x)

The last two factors are discussed in more detail in Chapter 4. To properly select a tape system some trade offs between the manufacturer's variance coefficient (C_v) and the discharge exponent (x) must be made.

- Systems with short laterals (less than 300 ft) on small downhill slopes or level fields will have small pressure changes through the zone. The emitter discharge exponent will not be a big factor in maintaining system uniformity. For these systems chose a tape system that has a low manufacturer's variation coefficient.
- Systems with long laterals (greater than 300 ft), have steep or undulating terrain are subject to larger pressure variations. For these situations the emitter discharge exponent should be the primary factor in tape selection as a small exponent will reduce the variability in emitter discharges due to pressure changes. The Cv factor should be a secondary consideration.

Table 5.1 provides the amount of tape required per acre. The actual amount may be less or more, depending on the amount of stretching that occurs upon installation of buried systems and slack left in the tape for above ground systems.

Table 5.1 Length of Tape Per Acre

Lateral Spacing inches	Length of Tape per Acre	Lateral Spacing cm	Length of Tape per Hectare
	ft		m
30	17,424	80	12,500
32	16,335	90	11,110
34	15,374	100	10,000
36	14,520	110	9,090
38	13,756	120	8,333
40	13,068	130	7,692
42	12,446	140	7,143
44	11,880	150	6,661
46	11,363	160	6,250
48	10,890	170	5,882
54	9,680	180	5,556
60	8,712	190	5,263
66	7,920	200	5,000
72	7,260	210	4,752
84	6,223	220	4,546
96	5,445	230	4,348
120	4,356	240	4,167

From: Rainbird®

Figure 5.2 *Linear Tape Under Plastic Mulch*

Point Source Emitter System

Point source systems usually contain emitters that discharge a low flow rate through a drip or spitter pattern. Point source systems can be differentiated from linear tape systems as they use hard hose polyethylene for the lateral piping. Unlike linear tape systems which have orifices constructed in the lateral, point source systems use an emitter to regulate the discharge flow rate. The emitter is a separate component from the lateral tubing.

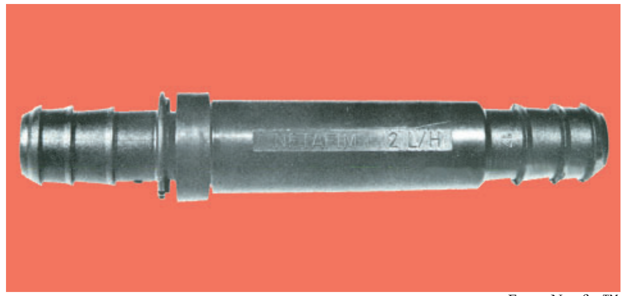
Barbed emitters can be plugged into the lateral line after the lateral has been installed in the field. The installer can then position the emitters on the lateral at a location that will ensure maximum wetting of the crop root zone.

Lateral lines can be purchased with the emitter already installed in the pipe during the manufacturing process. Older technology required the tubing to be cut for the emitter to be installed. Most suppliers now provide laterals with the emitters inserted inside the tubing during the extrusion process. See Figure 5.3. These types of systems are often referred to as line source systems. The emitter flow rate and spacing can be ordered in many different combinations to match the irrigation design specifications. In line emitter laterals are easier to install and remove from the field than barbed emitter systems. Figures 5.4 and 5.5 show applications of barbed and in-line emitters in the field.

Point source emitters operate in the flow range of 1L to 4L per hour (0.5 gph – 2.0 gph) and at operating pressures ranging from 10 to 20 psi. Pressure compensating emitters are usually point source emitters, and can operate in pressure ranges from 10 to 50 psi. A pressure range of 15 to 40 psi is normally recommended. Table 5.3 provides information on the lateral spread of water from point source emitters operating above the soil surface.

Barbed Emitter

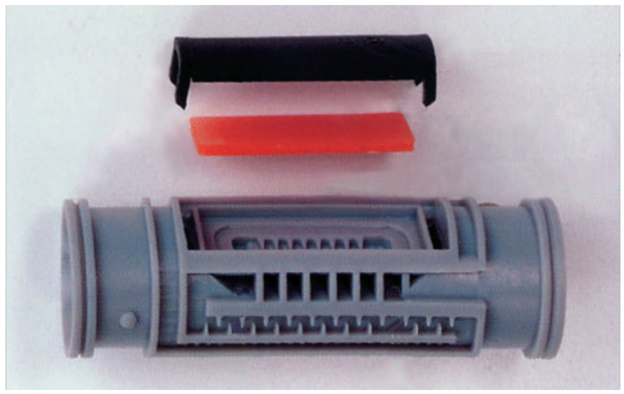
From: Netafim™



From: Netafim™

In-line Emitter

Inserted Emitter



From: Rainbird

Figure 5.3 — *Point Source Emitters*

Figure 5.4 — *Line Source Emitter System*

Figure 5.5 *Barbed Point Source Emitter System*

Spray Emitter Systems

Spray emitters use a wetted diameter to distribute water throughout the plant root zone. If operated long enough, lateral movement of water will also occur. Spray emitters discharge from 1L to 20 L per hour (4gph – 60 gph) at operating pressures ranging from 15 to 30 psi. Optimum performance is achieved in the 20 to 25 psi range. Spray emitters specifications will be similar to those shown in Table 5.2, although the values will vary with different products. Check manufacturer's literature to ensure that flow rates and throw diameters used are accurate.

Table 5.2 Spray Emitter Specifications

Orifice Diameter	Pressure (psi)	Discharge (gph)	Spray Pattern			
			40° Dia (ft)	180° Rad (ft)	280° Dia (ft)	360° Dia (ft)
.03"	15	4.9	8.0	5.0	10.0	10.0
	20	5.6	10.0	6.0	12.0	11.0
	25	6.3	11.0	7.0	13.0	11.5
	30	6.9	12.0	7.5	13.5	12.0
.04"	15	8.9	13.0	6.0	12.5	14.5
	20	10.5	14.0	6.5	13.0	15.5
	25	11.8	17.0	7.5	15.0	16.0
	30	12.8	18.0	8.5	16.0	17.0
.05"	15	14.0	16.0	7.0	14.0	15.0
	20	16.0	18.0	7.5	16.0	18.0
	25	18.0	20.0	8.0	18.0	19.0
	30	19.9	22.0	9.0	19.0	20.0
.06"	15	20.2	18.0	9.0	17.0	20.0
	20	23.5	22.0	9.5	18.5	22.0
	25	26.5	24.0	10.5	20.0	24.0
	30	29.1	26.0	11.5	22.0	26.0
.07"	15	32.1	22.0	10.0	19.0	24.0
	20	37.1	24.0	11.0	22.0	26.0
	25	41.8	27.0	11.5	25.0	31.0
	30	46.1	28.0	12.0	26.0	32.0

From: Maxijet Inc., Florida

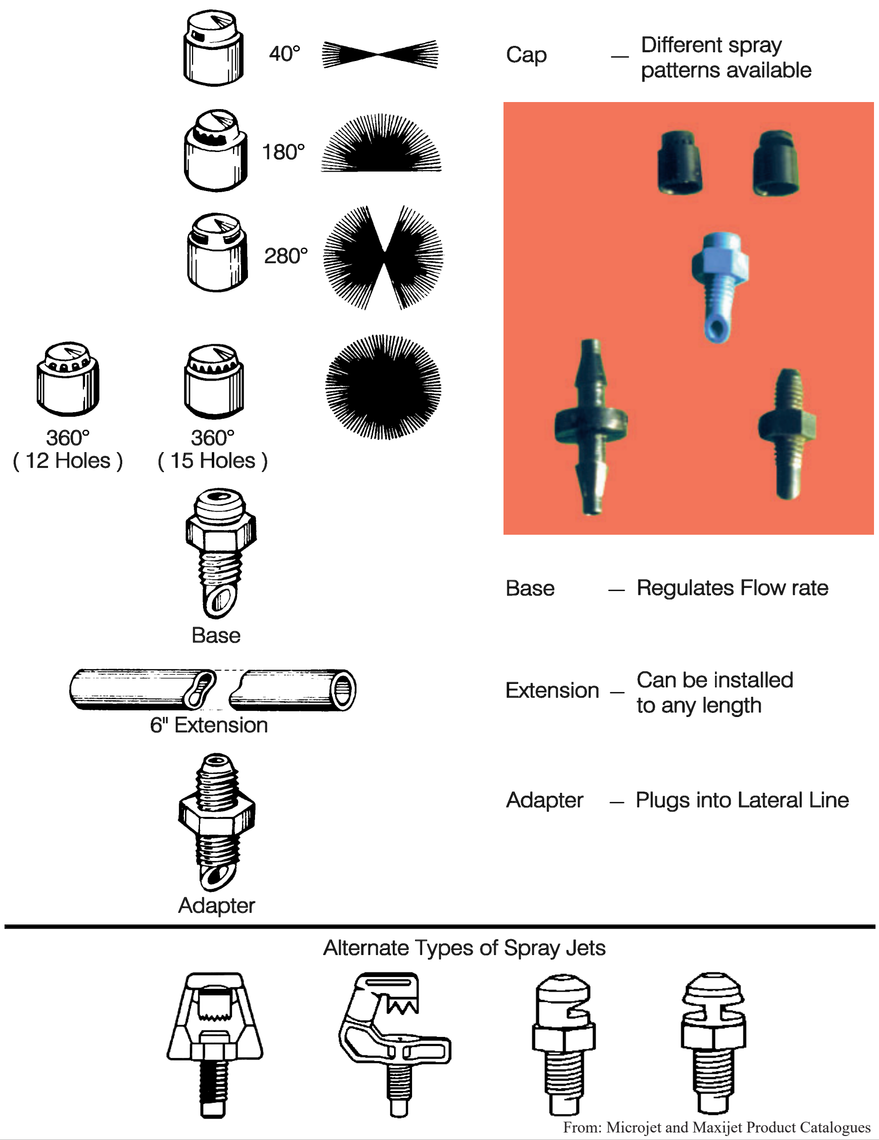


Figure 5.6 *Spray Emitter System Components*

The components of a spray emitter system are shown in Figure 5.6. Parts may vary somewhat depending on the product configuration. The cap and base are often molded as one unit and may look different than what is shown.

Spray emitters have larger orifices than point source emitters. Flow rates are therefore much higher but the emitter is also less susceptible to clogging. However, the spray emitter orifice sizes used in the drip irrigation industry (0.03” – 0.05”) still require a fine screen mesh filtration system. Smaller jet orifices are usually used in the agriculture industry to allow for longer lateral lines. Spray emitters are not pressure compensating. The radius of throw may also be increased or decreased depending on the installation technique. Spray emitters that are hung from a lateral line installed higher in a tree row may have larger throw diameters than emitters installed close to the ground. Figures 5.7 and 5.8 show different installation methods.

Spray Emitter vs Microsprinkler

There is often confusion about the differences between a spray emitter and microsprinkler system. Spray emitters do not have any moving parts and have a spray pattern of 5 ft (1.5 m) or less. Water is applied to the plants only.

Microsprinklers usually have a moving spinner which increases the diameter of throw to 20 ft (6.5 m) or more. Water is applied to the entire field, much like a sprinkler system. Microsprinkler design should follow the same principles as regular sprinkler design. See the BC Sprinkler Manual for proper design procedures.

Figure 5.7 *Staked Spray Emitter System*

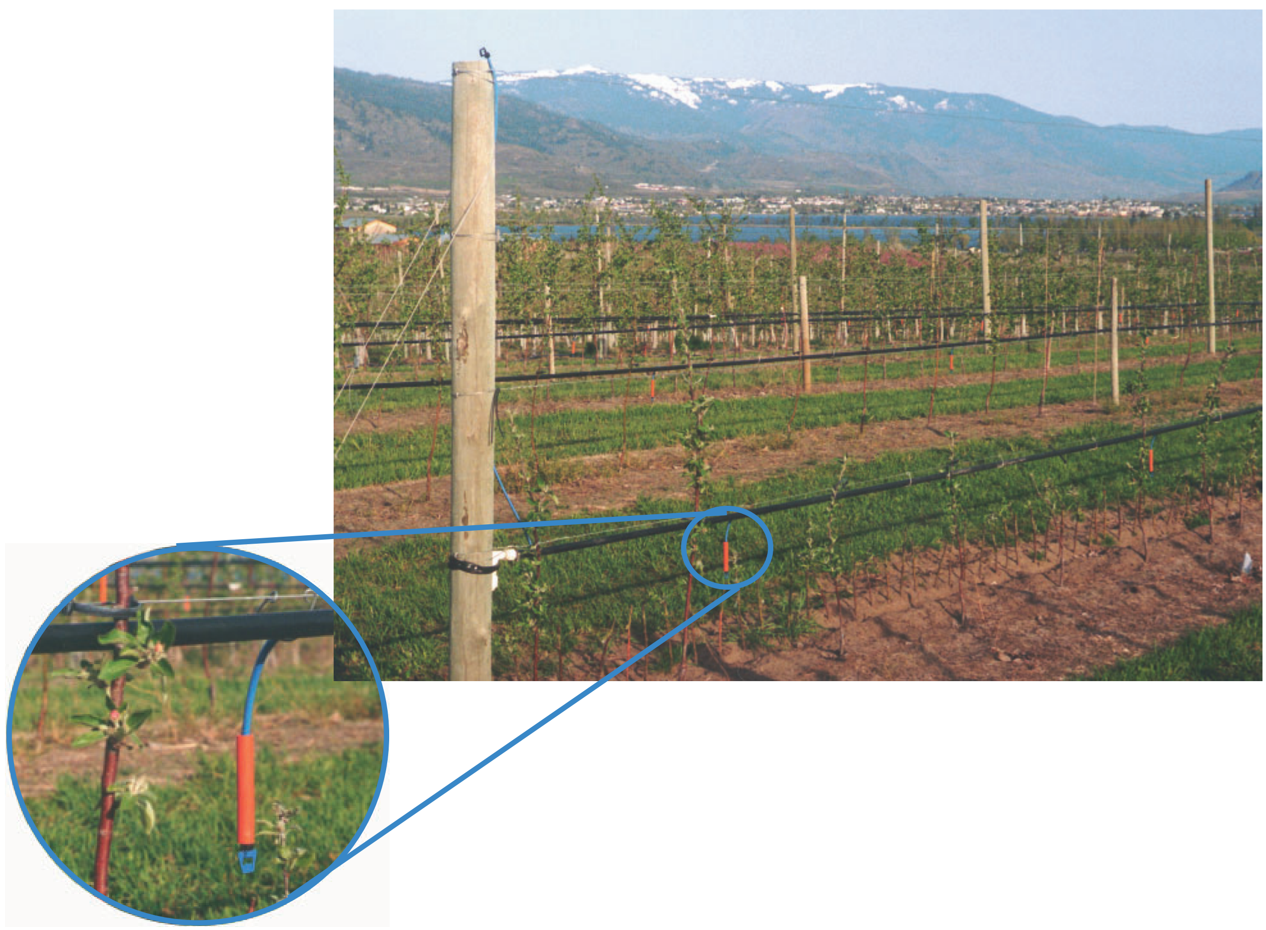


Figure 5.8 *Suspended Spray Emitter System*

5.3 Determining Lateral Water Movement from the Emission Point

Linear tape and point source emitter systems rely on the combined forces of gravity and capillarity to move water laterally and downward through the root zone. It is important that enough emitters, appropriately spaced, are provided for plants with extensive root zones.

Sandy soils tend to have deep, narrow wetted patterns. Clay soils tend to have shallow, wider wetted patterns. Lateral water movement in sandy soils can be increased by using higher application rates. Downward movement in clay soils may be increased by saturating the soils for a brief period. Care should be taken to ensure that heavy soils do not become waterlogged.

The amount of lateral movement achievable will be determined by the rate and duration of application. To obtain the lateral movement desired it may be necessary in some instances to apply sufficient irrigation that extends the moisture depth beyond the crop's rooting depth. However if this is continually the case the system design should be changed to reduce excessive leaching.

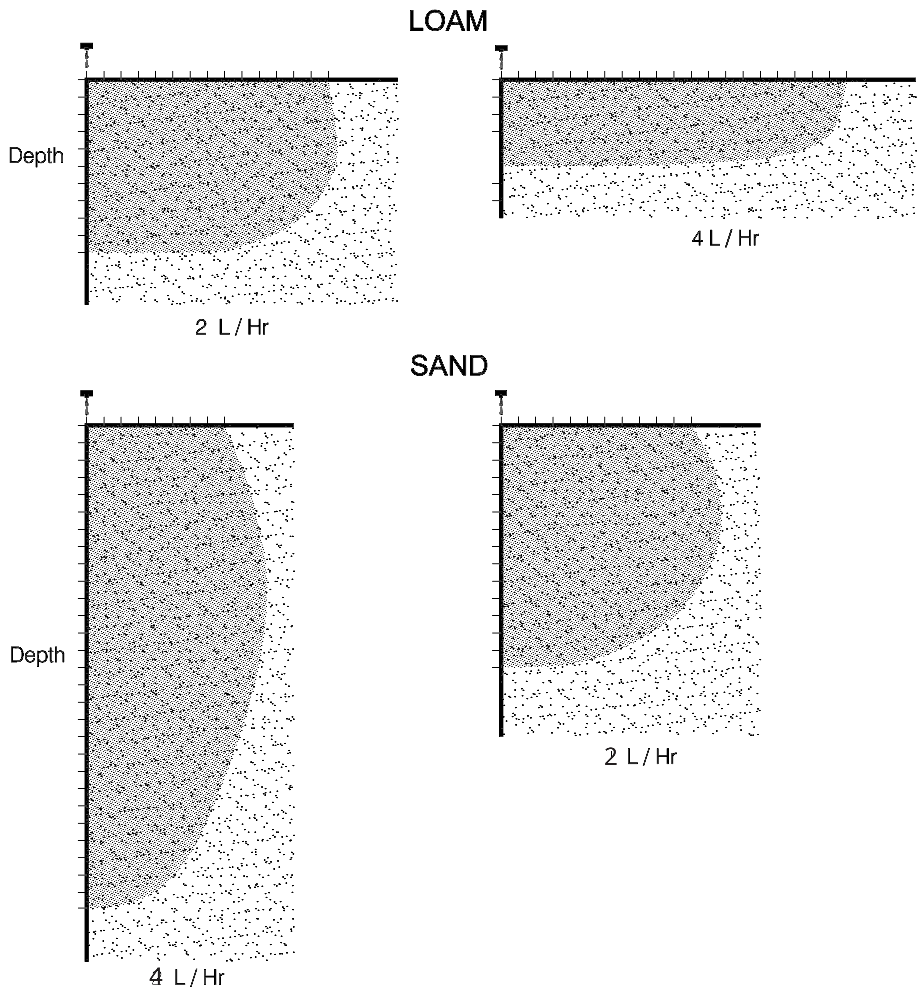
Shallow rooted crops with wide spread root zones require closer emitter spacings to ensure that enough of the root volume is watered. Spray emitter systems should be considered for these types of situations.

The values of lateral water movement in Table 5.3 are for point source systems operating on the surface. These are maximum values assumed for deep rooted crops with the right combination of application rate and duration. The numbers shown are very general and should be verified by field experience. Soil boundary layers such as hardpans may increase the lateral spread while other conditions may reduce it drastically. The designer may have to adjust emitter spacings for specific site conditions.

Figure 5.9 graphically depicts water movement in the soil from a point source system operating above the soil surface. Note that emitters with higher flow rates will tend to move water further laterally in heavier soils than lower flow rate emitters. In lighter soils the lateral movement between different emitter flow rates is not as significant.

Table 5.3 Lateral Water Movement in Soils from Surface Point Source Emitters

Soil Type	Lateral Movement			
	Shallow Soil < 2 ft		Deep Soil > 2 ft	
	ft	m	ft	m
Coarse sand	0.5	0.15	1.5	0.46
Fine sand	0.75	0.23	2.5	0.76
Loamy sand	1.0	0.31	3.0	0.91
Silt, silt loam	1.0	0.31	3.0	0.91
Sandy loam, loam	1.25	0.38	3.5	1.06
Clay	1.5	0.46	4.0	1.22



From: Rainbird

Figure 5.9 *Soil Water Movement from a Point Source System*

Surface vs Subsurface Systems

A subsurface emitter applying the same amount of water over the same duration as a surface emitter will have a greater wetted soil volume. Less of the soil volume will therefore be saturated, leaving more of the soil volume with an acceptable air - moisture ratio. Figure 5.10 shows the difference in soil wetted volume that can be obtained for an emitter installed on the ground compared to one installed below the soil surface.

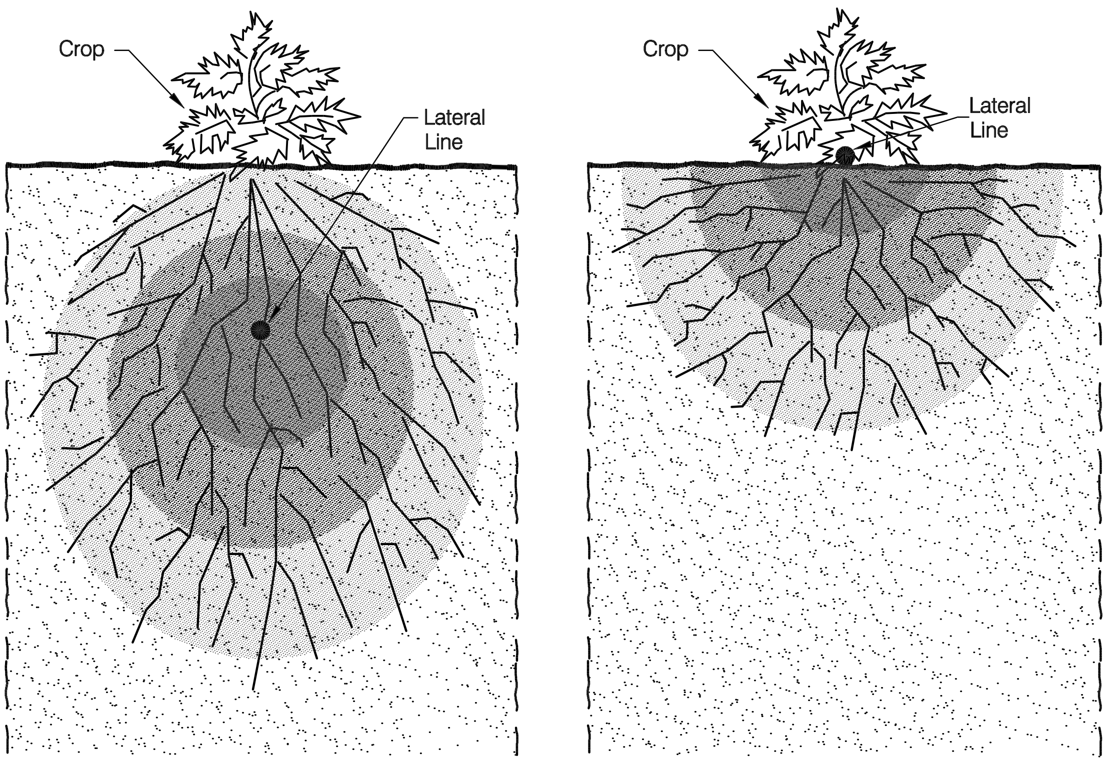


Figure 5.10 *Comparison of Wetted Soil Volume for a Surface vs Subsurface Emitter*

Chapter 6 provides more detailed information on subsurface drip irrigation systems.

5.4 Determining the Number of Emitters Per Plant

Determining how many emitters should be used per plant will depend upon:

- **Wetting pattern of the soil from the emitter used.** The wetting pattern that develops depends on the emitter discharge rate, emitter spacing and soil type. The diameter of the wetted soil volume will generally increase with an increase in the soil clay content or an increase in emitter discharge rate. Table 5.3 provides information on lateral spread of water from point source emitters. Figure 5.9 chapter shows the ideal situation where the wetted volume from one emitter will reach the other to form a continuous wetted band along the crop row. Note how a soil boundary layer may effect the soil wetted volume. In clay soils the soil wetted volume depends mainly on soil capillary forces while gravitational forces have a greater effect in sandier soils. The wetted volumes in sandy soils are less, therefore requiring closer emitter spacings.

  A trickle irrigation system should wet a soil volume that is at least 50% of the plant's root volume that would be developed under a conventional sprinkler irrigation system.

- **Maximum duration of application**. The duration of application should not exceed 12 hours at one time. Once the peak crop water use rate has been calculated and the irrigation interval determined the trickle system must be able to apply this amount of moisture within the 12 hour interval. The number of emitters per plant may have to be increased to accommodate the maximum 12 hour application duration or the emitter flow rates must be increased.

- **Type of crop and plant spacing**. The type of crop and plant spacing can be used to determine the type of emitter, emitter discharge rate and emitter location. See Table 5.4.

It is important that enough orifices, appropriately spaced, are provided for plants with extensive root zones.

Selecting the number of emitters required per plant will be dependent upon the plant root volume, rooting depth and the lateral spread of water. When converting from a sprinkler irrigation to a trickle irrigation system at least 50% of the existing root volume must be wetted. The same criteria should be used when designing a trickle system for newly planted crops. Enough emitters must be installed so that an adequate root system develops. If not, the crop may suffer during peak conditions. One consequence of inadequate watering for perennial crops is underdeveloped root systems that may cause the plant to tip or fall over as it matures.

Selecting emitter placement for tree fruits presents additional problems. A minimum of 50 - 60% of the tree root volume should be watered in a symmetrical fashion to ensure that a sturdy tree is developed. Poor tree stability will only be detected in eight or more years after planting if the water is inadequately distributed. In valleys that have a prevailing wind direction it is particularly important that the trees are properly anchored.

Crop Type	Minimum Number of Emitters
Vegetables (single row)	Linear tape (line source) system. Orifice spacing not to exceed 1.5 times the plant spacing along the row.
Vegetables (double row)	Linear tape system. Orifice spacing not to exceed the plant spacing along the double row.
Vegetables (beds)	Linear Tape System. - 1 lateral per bed - 2 laterals per bed width of 1 m or greater
Grapes	Point source or line source emitters. Recommend 2 emitters per plant. In sandy soils emitters should be spaced closer together.
Strawberries	Linear Tape System. Orifice spacing should not exceed 24 inches. A 12 inch spacing is recommended.
Raspberries	Point source emitters to be spaced every other plant. Emitter spacing may be up to 5 ft apart in heavier soils. Line source emitters to be spaced at one per plant. in drier climates use two emitters per plant.
Blueberries	Use point source emitters. Emitter spacing to match plant spacing.
Tree Fruits (Double Row Planting)	Tree spacing in row is 6 ft or less. Space point source emitters half way between trees. Line source should have two emitters per plant. Each row should have a lateral line. See Figure 5.15.
Tree Fruits (Dwarf Trees)	Tree spacing is approximately 8 ft apart. • Use two point source or line source emitters per plant. Emitters to be spaced 2 ft from the tree trunk. • Use one microjet per tree. Microjet to be spaced halfway between trees (360° head) or at the base of each tree using a 270° or 180° head.
Tree Fruits (Semi Dwarf)	Tree spacing greater than 8 ft apart. • Use a minimum of two point source or line emitters per plant. For tree spacings exceeding 15 ft, use three or more emitters per tree. Emitters to be 2.5 ft from the tree trunk. • Use two microjets per tree. Microjets to be installed at tree with two 180° heads discharging away from tree trunk.

* Number of emitters indicated per plant should be considered minimum. Site specific conditions for soil type and plant spacings may require closer emitter spacings and more emitters per plant.

5.5 Emitter Location and Installation

Vegetables

Eggplants, peppers, tomatoes, cantaloupes, squash and strawberry crops all do well with a properly installed trickle irrigation system. These can be grown in single rows or double rows with and without mulches. Mulches offer the grower an opportunity to increase crop yield, control weeds and target certain production dates to increase profitability. The use of plastic mulch can also improve quality when combined with drip irrigation. The plastic mulch controls soil moisture and nutrient levels in the soil profile as rainfall cannot leach nutrients out as quickly.

Linear tape trickle irrigation systems are normally used with these types of crops. These line source lateral lines can be placed adjacent to the crop rows, below the ground surface or beneath the plastic mulches. Figure 5.11 illustrates the installation of line source emitters on row crops above ground and under plastic mulches.

It is best to keep the linear tape system as close to the crop row as possible. For seed germination the lateral should be no further away than 6” and should not be further away than 12” for transplants.

If double row cropping is used the lateral can be placed between the two rows as shown in Figure 5.12. Placing of the laterals may be important in situations where mechanical tilling, hoeing, pruning or other operations are done while the lateral is in place.

Benefits of Mulches

Mulches offer many benefits including:

- reducing evaporation loss
- increasing the surface wetted area of soil under the mulch
- reducing weed problems
- reducing fertilizer leaching
- reducing soil compaction
- making fumigation more effective
- eliminating excess water from the raised bed
- increasing soil temperature

Black polyethylene mulches are most commonly used for tomatoes, peppers, strawberries, eggplants, etc. The lateral line should be laid out first with the mulch placed overtop at a later date. Holes are then punched into the mulch to plant the crop. Care should be taken to ensure the lateral line will not be in the way of the planting process.

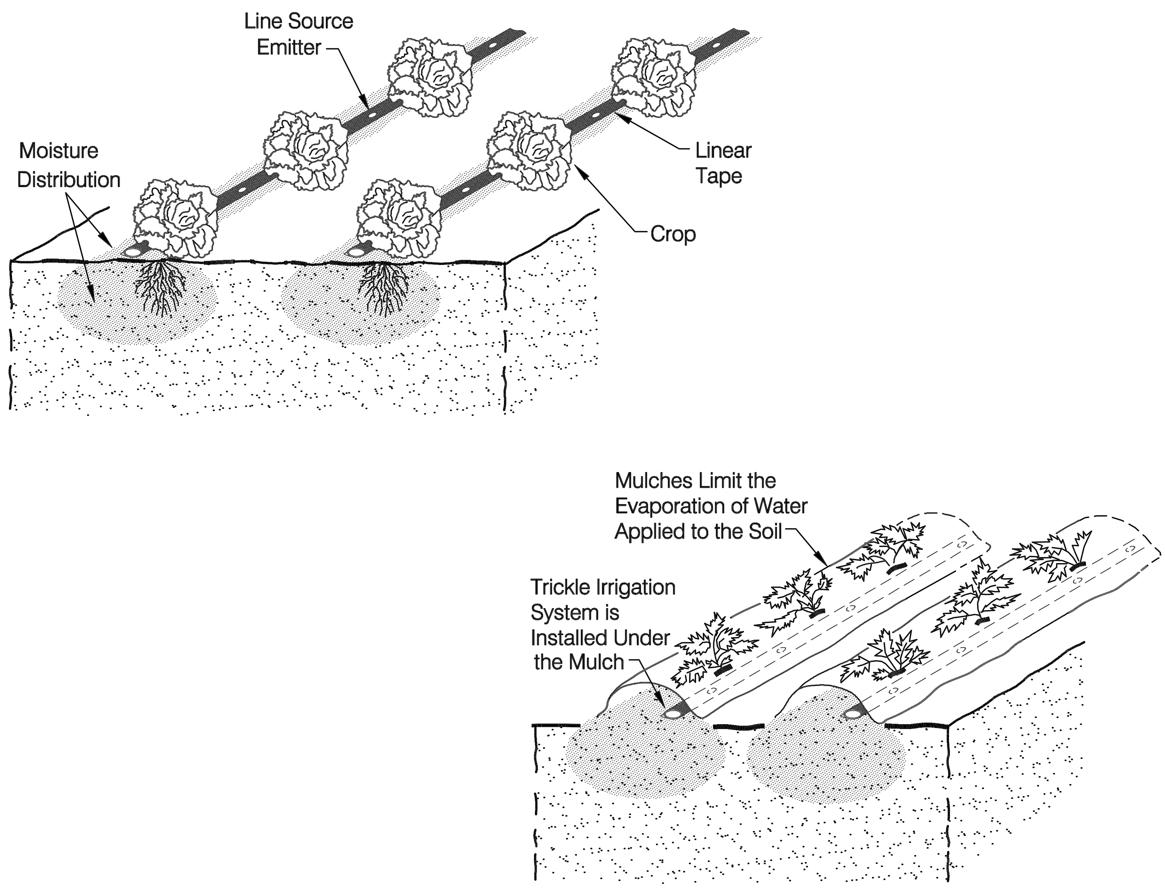


Figure 5.11 *Linear Tape Installation for Single Row Cropping*

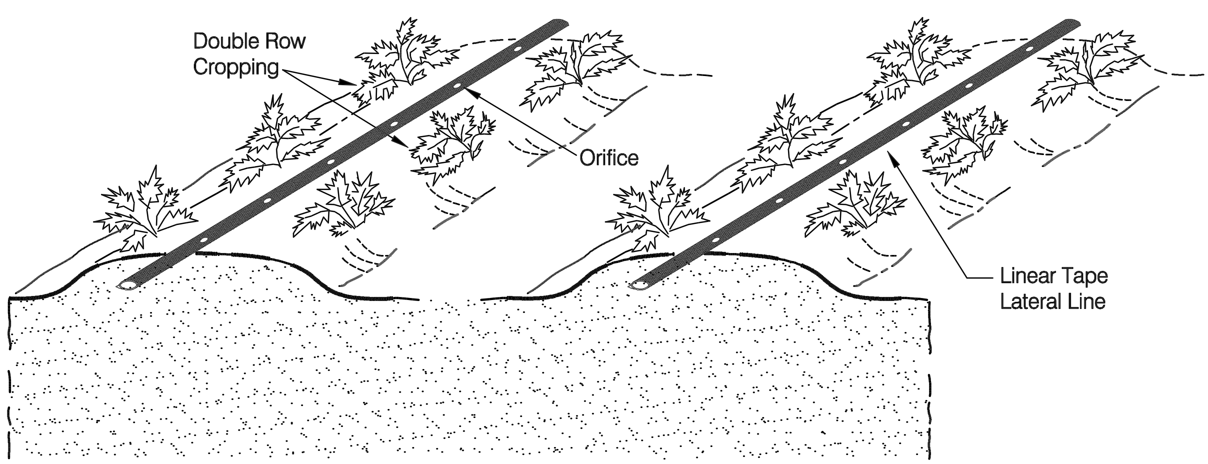


Figure 5.12 *Linear Tape Installation for Double Row Cropping*

Berries and Vines

Berry and vine crops can use linear tape, point source or spray emitter systems. With these crops linear tape systems should be buried below the surface for protection. Point source and spray emitter systems are usually placed on the surface or suspended on the trellis wires. Emitters should be spaced so that the wetted pattern from each emitter join to form a continuously wetted band along the crop row.

The location of the drip point is critical to ensure good distribution uniformity. To ensure that emitters are installed at the correct location with respect to the plant, barbed emitters should be installed after the lateral line has had time to acclimatize to the field.

Lateral lines suspended on the trellis wire always have some sag along the line. Water discharged from emitters will tend to flow along the lateral and drip at the sag points. In line emitters are more susceptible to this than barbed emitters. Barbed emitters should be installed on the underside of the lateral whenever possible to ensure that the emitter applies the water at the intended location. It is also important to support the lateral as often as possible to reduce the amount of sag. Figure 5.13 shows the installation of a lateral line for grapes or berries with a trellis wire.

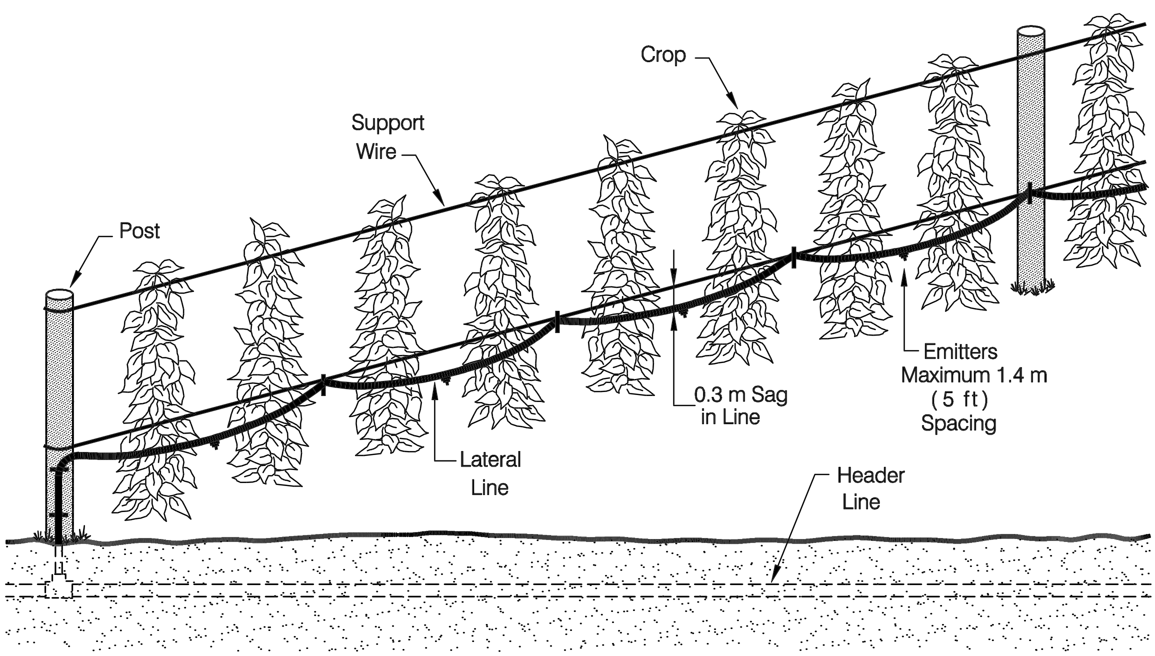


Figure 5.13 *Lateral Installation for Berry or Vine Crops With a Trellis Wire*

Tree Fruits

Tree fruits can use both point source and spray emitter systems. The type of emitter system selected may depend upon water supply, water quality, plant spacing, soil type and farm management.

Point Source Emitter System

Emitters should be placed in line with the tree row but at the outer edge of the plant canopy for young trees and approximately one third to half the distance to the outer edge of the plant canopy for mature trees. In soils that are prone to developing crown rot, the emitter should be spaced a minimum of 1.5 to 2 feet (0.45 – 0.60 m) away from the trunk for mature trees. Figure 5.14 shows common emitter installation and desired moisture distribution for point source systems on tree fruits.

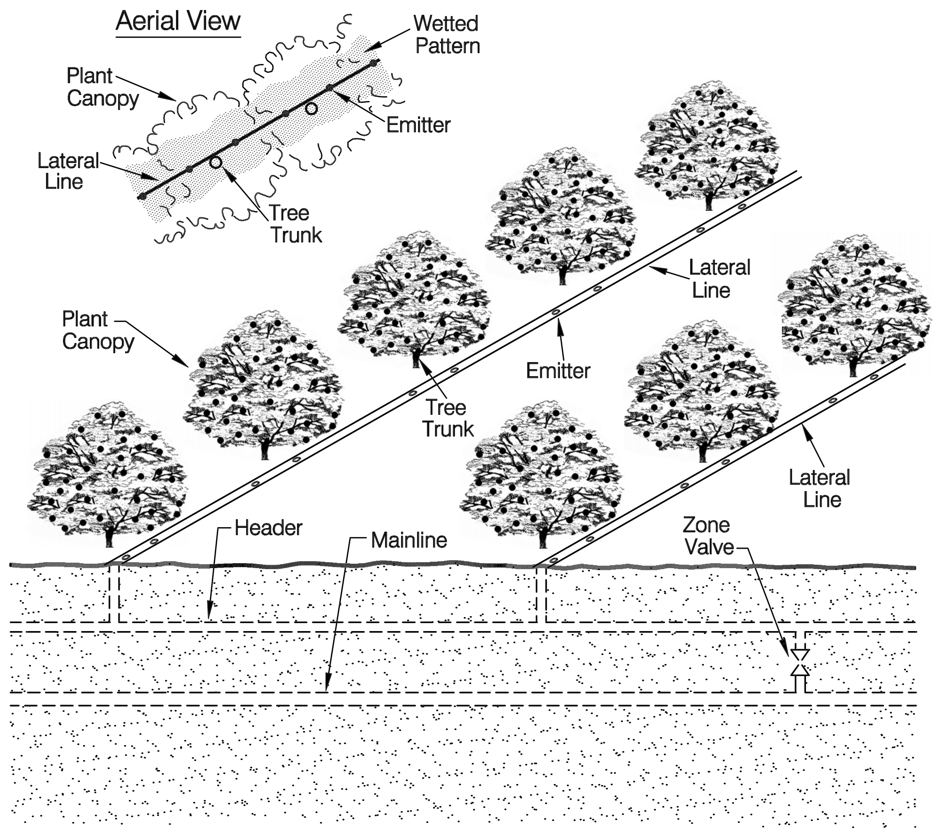


Figure 5.14 Point Source System Layout and Moisture Distribution for Tree Fruits

For high density double row cropping point source emitters should be placed adjacent to the trees for very young trees. As the trees mature the lateral line can be shifted so that the emitters are spaced half way between the trees. Shifting the lateral is important to ensure that the plant develops an effective rooting area. Roots will only extend further out if they need to seek water.

If a lateral with built in emitters is used, it will be difficult to position each emitter the same distance from each plant.

Note that each mature tree will receive moisture from three emitters if the tree spacing in the double row planting is staggered. This should be taken into consideration when preparing an irrigation schedule. Figure 5.15 shows a point source emitter system for a high density double row tree fruit plantings.

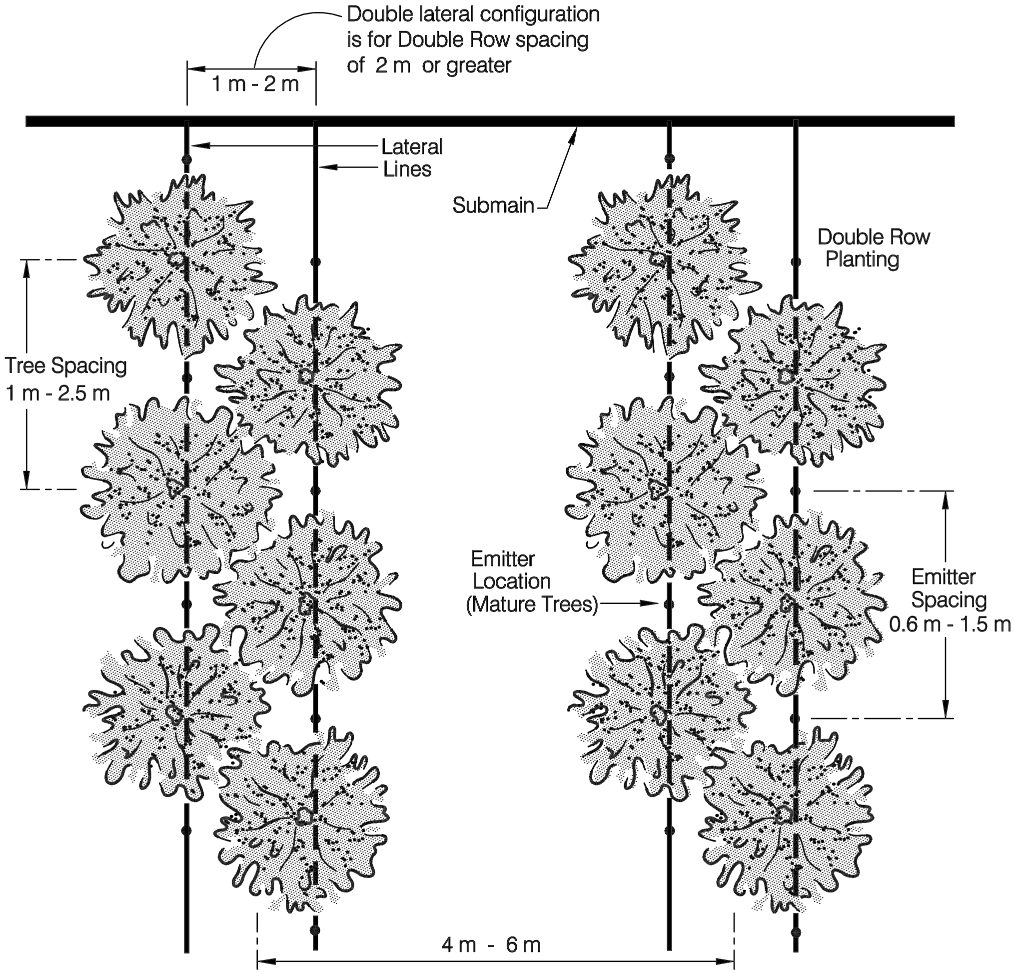


Figure 5.15 *Emitter Layout for High Density Double Row Planting*

Spray Emitter System

Tree fruits and berry crops can effectively use spray emitter systems. Spray emitters have the benefit of irrigating a larger portion of the root zone. To obtain maximum diameter of throw it is better if the spray head is fixed. Stapling the spray head to a stake obtains best results. Do not staple spray head to the tree trunk or plant stem, as the staples will eventually cut through the transfer tubing with trunk growth. Figure 5.16 illustrates proper spray head installation on laterals that are installed either below ground or on the soil surface.

Spray emitter systems can also be suspended from the trellis wire providing a weight is used to keep the emitter stable. If a uniform spray pattern cannot be maintained the spray emitter system should be modified to a drip system with a higher discharge rate. Figure 5.17 provides details on the proper method of suspending a spray emitter system. Figure 5.7 provides a photo of this type of installation.

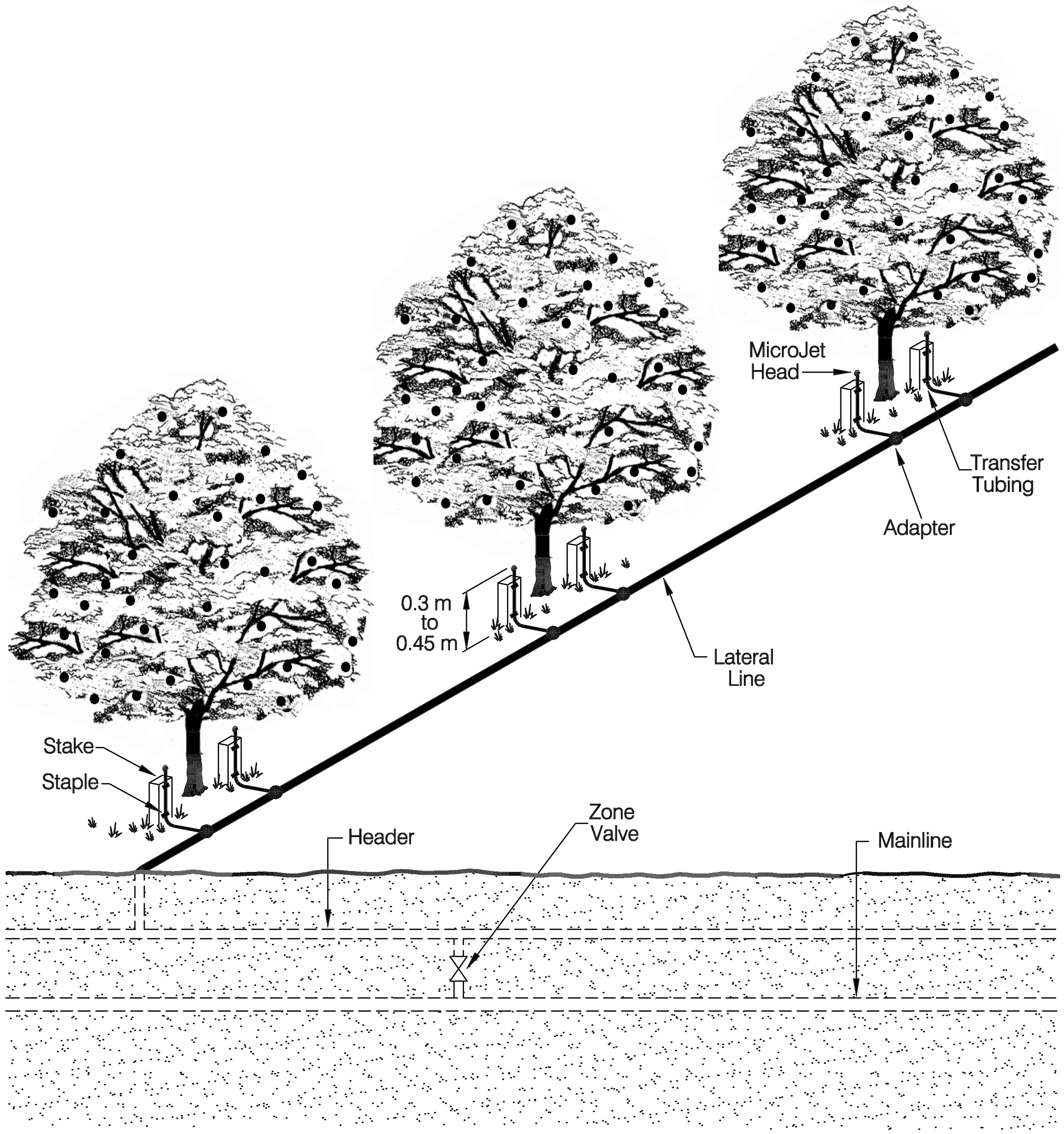


Figure 5.16 *Spray Emitter System Installed on the Ground*

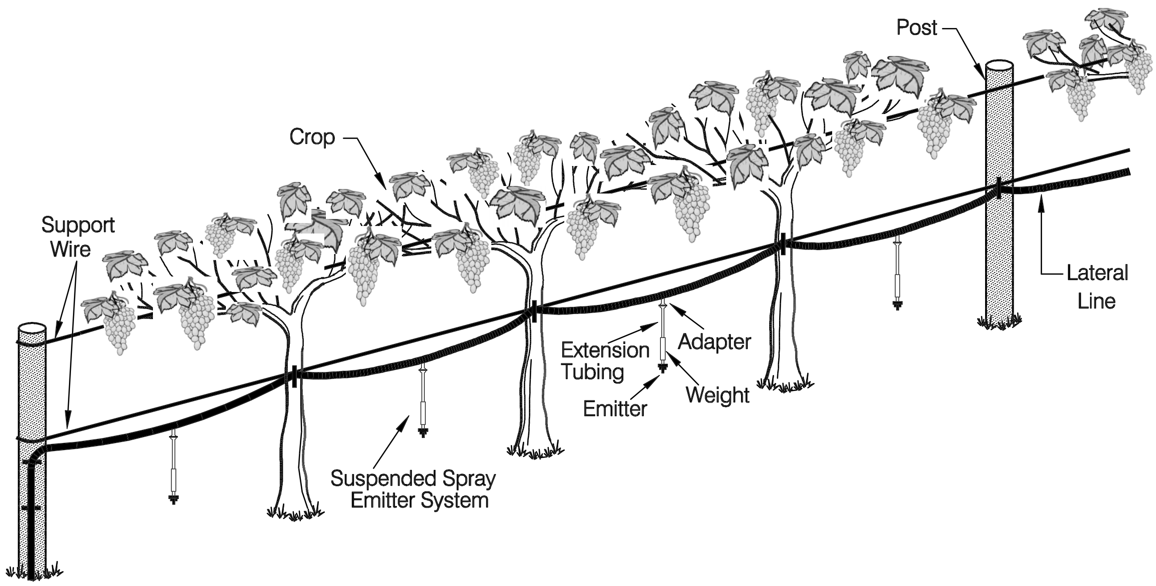


Figure 5.17 *Spray Emitter Detail for a Suspended Lateral*

5.6 Drip Installation for Container Grown Crops

Nursery crops are often grown in the soil but can also use soilless media such as sawdust in pots or bags. Both spray and point source emitters can be used for these types of installations. Figure 5.18 shows how point source emitter systems are set up for nursery containers. It is important that at least two emitters are installed in each pot to ensure the plant will get some moisture should one emitter get plugged. For very small pots where only one emitter per pot is used careful filtration and monitoring of the irrigation system will be required.

Spray emitter systems can be used in large pots to ensure good moisture distribution occurs throughout the entire media. The spray pattern should be directed so that the water application stays within the pot. See Figure 5.19.

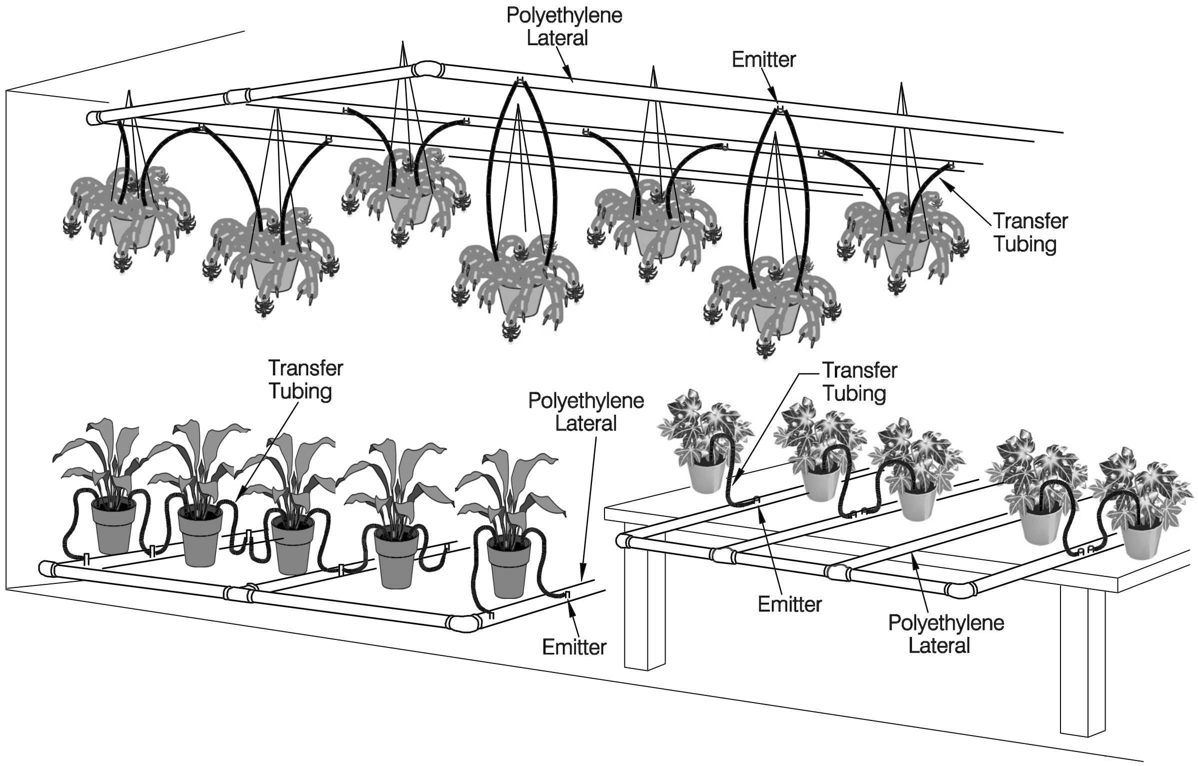


Figure 5.18 *Drip Installation in a Pot System*

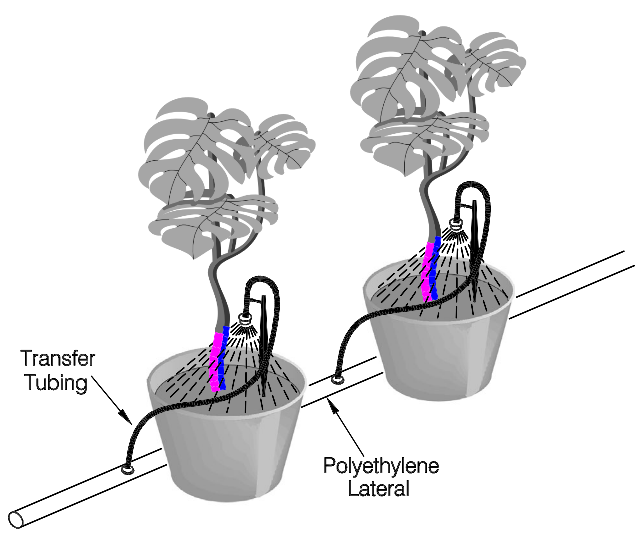


Figure 5.19 *Spray Emitter System Installation in Containers*