



## Furrow Irrigation of Lavender

C.E. Swift, Colorado State University Extension <sup>1</sup>

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### Introduction:

Surface irrigation includes flood, level basin, border basin, surge, and furrow irrigation. This publication discusses furrow (rill) irrigation only. This is an inefficient method of irrigation (25-60%) especially when compared to sprinkler (60-96%) and drip/micro irrigation (80-95%). If water availability is an issue you should consider drip/micro and sprinkler irrigation in lieu of furrow irrigation. Furrow irrigation, however, is the least costly method to use under certain conditions.

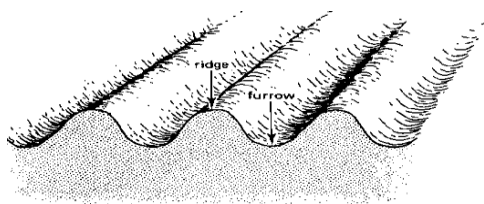


Figure 1 - Ridges and Furrows

### The keys to success with furrow irrigation include:

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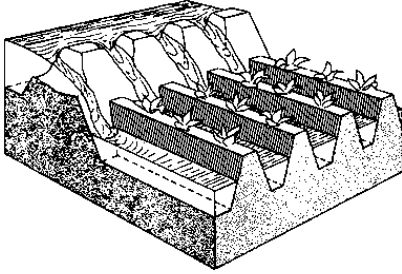
- A uniformly flat area
  - A slope between 0.05% (1/2 foot in 1000 feet) and no greater than 0.5% (1/2 foot in 100 feet)
  - Designing the beds/furrows spacing, depth and width based on the soil texture
  - Watering according to the water use of the plants and water holding capacity of the soil
  - Avoiding excessive tail water or deep percolation
  - Having access to an abundance of low cost water
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### The Delivery System:

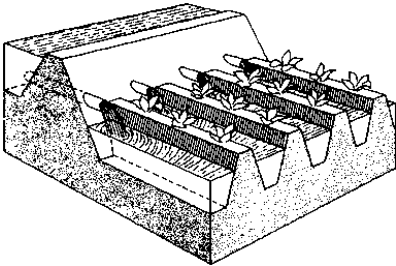
Canal systems typically deliver water to a head gate in the main canal and it is the property owner's responsibility to divert their share(s) of the water to their land. This

can be done using an open dirt ditch, one lined with concrete, or underground or above ground pipe. If you are planning a commercial agricultural venture check with the [USDA – Farm Services Agency](#) in your area to see if they have a cost-share program to help you install your irrigation system.

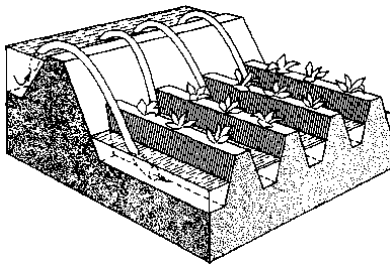
The following are different methods of delivering water to the furrows.



**Figure 2 - A breach is a cut in the channel embankment to allow water to flow into the field**



**Figure 3 - Spiles are small pipes buried in the ditch bank**



**Figure 4 - Siphons are small diameter pipes used to convey water over the channel embankment**

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**Figure 5 - Gated Pipe – the use of a sock at each gate will reduce erosion.**

### **Preparing the site:**

If the site is sandy, furrow irrigation may be impractical especially if water running down the furrows does not make it to the end before it disappears into the soil. With sandy soils the furrow length must be quite short as shown in [Table 1](#). Furrow irrigation works best on silt or clay based soils.

The area should be as uniformly level as possible to avoid ponding and dry areas. To correct these problems the land may need to be leveled by hand or with a laser-guided [tractor-scraper](#). The slope of the land should be at least 0.05% but no more than 0.5%. If the direction of the furrows runs down a slope greater than 0.5%, managing the water to avoid erosion will be very difficult if not next to impossible. If this is the case adjust the direction of the furrows to go across the slope instead of down the slope. You can also use blocks in the furrows to back up the water but this tends to increase deep percolation and wet flooded soil conditions. Deep percolation wastes water and moves nutrients well below the root zone.

When there are low spots in the field, water will pond in these locations. This will result in reduced yields due to the wet flooded soil conditions. The reduced plant vigor will also create conditions ripe for fungal root infections. Note however, these same results can occur when sprinklers or drip irrigation is improperly used. When there are high spots in the field, you will be tempted to overwater in order to supply enough water to plants in those elevated areas. If your field(s) are of this type, i.e. rough, consider using either drip or sprinkler irrigation. You will be able to apply water more uniformly with these methods of irrigation and will avoid the problems mentioned above when furrow irrigation is used.

The soil should be uniformly prepared to avoid areas of compacted clay or rapidly draining soils. If the soil is very sandy but you still insist on using furrow irrigation, working organic matter into the soil can increase its water-holding capacity. Keep in mind that some manures and composts can be quite salty and negatively impact your lavender. [Cattle and hog](#) are manures with the highest salt level.

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Each soil texture takes in water at a different rate. Soil texture also directly affects how quickly excess water drains through it and how much water it retains for plant use. Therefore each field should consist of a similar type of soil. If you have a different soil type in different fields or parts of a field, separate your irrigation system accordingly.

### Determining Soil Texture:

Soil texture is the percentage of sand, silt and clay in the soil. Your local Natural Resources and Conservation Service office may know what soil texture you have. Or you can determine this yourself using the [Jar Test](#).

### Forming the Planting Beds and Furrows:

The texture of the soil determines the spacing between furrows and beds, as well as the width and depth of the furrow as seen in these drawings. These recommendations are based on the water movement in the soil once it is absorbed. Using the improper depth or width of furrow can result in dry plants or water-logged plants, both of which can cause severe damage to lavender.

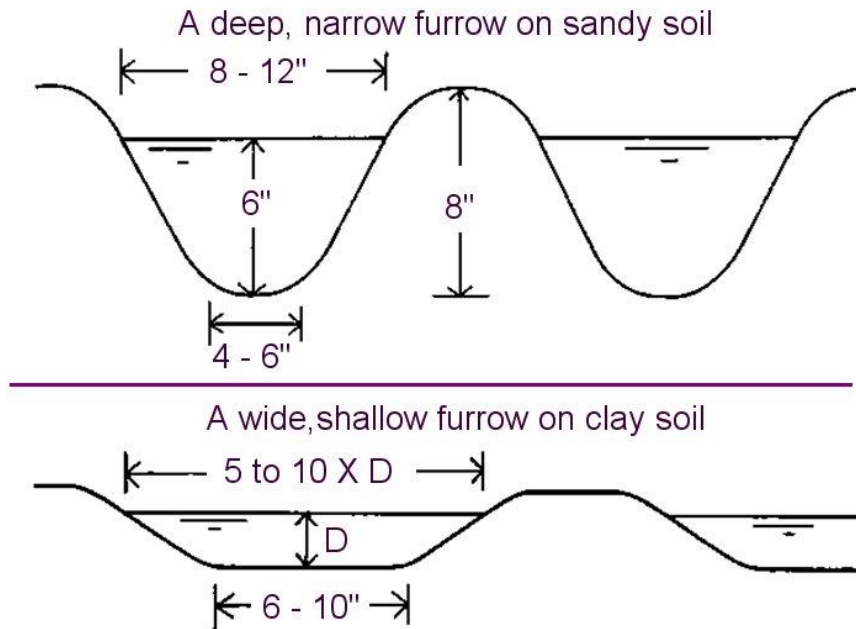


Figure 6

## How much Water Should I Run Down Each Furrow?

When you know the soil texture in your field you need to determine the size of the stream of water you should run down each furrow as well as the length of each furrow. This depends on soil type.

**Table 1**

Furrow slope %	Maximum stream size per furrow	Clay		Loam		Sand	
		Net Irrigation depth (inches)					
		2	3	2	3	2	3
		Length of furrow in feet					
0.0	47 gal/min	328	492	197	296	98	148
0.1	47 gal/min	394	558	296	410	148	197
0.2	40 gal/min	427	590	360	492	197	312
0.3	32 gal/min	492	656	427	558	246	361
0.5	19 gal/min	492	656	427	558	246	361

The amount of time required to fill a container of a known volume can be used to [measure small rates](#) of flow from individual siphon tubes, spiles, or individual outlets in gated pipe.

Once water reaches the end of the field, cut back the stream size by 1/3 to 1/2 so only a small, but continuous stream of runoff water exits out the end of the rill. The cutback in flow can be achieved by:

- adjusting the siphon tube setting or using two siphon tubes during the advance phase and removing one after the water reaches the end of the furrow;
- closing the gates in gated pipe part way;
- closing the spiles;
- blocking the breaches; or
- closing the valves part way when using buried pipelines with risers and adjustable valves.

## How Long should you Run Water down the Furrows?

When water is applied to soil the spaces between the soil particles fill with water. The larger the spaces the faster the water enters (infiltrates) the soil. The larger the pores the quicker the water percolates through the soil, the quicker excess water (gravitational water) leaves the root zone, and the less water is retained for plant use. Soils with fine particle sizes such as clay and silt soils hold more water but also don't drain as well as sand thus care must be taken to ensure the length of time water runs down the furrows is not excessive.

If the set (the time water runs down the furrow) is longer than nine hours root damage and death due to the unavailability of oxygen in the soil can occur. Some references indicate running water for longer than a few hours can cause root damage. Use your judgment. Check the soil around the plants. When the soil is moist one inch below the soil surface turn off the water flow. Try to keep the soil surface dry.

More oxygen is used by the roots when the soil is warm. Warm water warms the soil. For that reason the length of the set should be reduced when warm water is used.

## When should you Water Again?

You could use tensiometers, soil moisture meters, or other sophisticated technologies to determine the moisture content of your soil but many lavender growers find the easiest way to determine when irrigation is needed is by feeling the soil in the zone where most of the roots are located.

If your planting is young, the roots will be in the upper two to three inches. As the plants mature you will need to check the moisture content at a depth of three or four inches. Take a handful of soil from the proper depth and squeeze it into a ball. [The feel and appearance of the moisture](#) on your fingers and palm when you open your hand will tell

### Soil Water Holding Capacities

Soil Class	AW in/in	AW in/ft	Intake Rate in/hr	MAD %
Clay	0.17	2.04	0.10	30
Silty Clay	0.17	2.04	0.15	40
Clay Loam	0.18	2.16	0.20	40
Loam	0.17	2.04	0.35	50
Sandy Loam	0.12	1.44	0.40	50
Loamy Sand	0.08	0.96	0.50	50
Sand	0.06	0.72	0.60	60

**AW** = Available Water

you the moisture content of your soil.

Take the soil between two plants. You don't want to use the soil close to the plant as you will disturb its roots.

The texture of your soil determines when you should irrigate again. The following table lists the Managed Allowable Depletion (MAD) for different soil textures. This is the targeted percentage of moisture you can allow the plants to remove from the soil before

you have to water again.

While there will still be moisture in a loam, sandy loam or loamy sand soil at the fifty percent level your plants may not be able to pull it away from the soil particles. Allowing the soil to become too dry kills roots and reduces plant health and yield.

Since clay soil holds water tighter than sand, clay soil must be watered when only 30% (MAD) of available water has been removed from the root zone.

If your area publicizes the daily evapotranspiration (ET) rate you can use it to schedule your irrigations.

### **Watering to Improve Winter Survival:**

Watering before winter sets in is important especially in those areas where snow cover is sparse and humidity is low. In high desert areas soils and roots dry out during the winter due to these conditions. This results in unthrifty plants and reduced yields the following growing season.

Specific roots supply water and nutrients to specific stems, leaves, and buds. When a root is injured by drought (or oxygen deficit) the connection to its leaves and stems is disrupted. This may explain why growers experience varying lengths of flower stems on the same plant after a particularly harsh winter.

Experience with other woody plants indicates the lack of soil moisture in early spring can result in the plant breaking winter dormancy earlier than normal and thus being more susceptible to spring frosts. A final watering just before your irrigation system is shut down for the winter helps prevent spring frost damage.

If possible check the soil moisture content of your lavender field in February or March and if the soil appears dry apply water. Watering may not be possible due to lack of irrigation water, but if possible, especially if you don't expect spring rains, this supplemental irrigation will help maintain root health. Never water when air temperatures are below freezing and never water past 3 p.m. as a layer of ice may form on the soil surface and suffocates roots.

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### **References:**

[Irrigation Water Management](#): Training Manual #5; Irrigation Methods, FAO publication  
[Surface Irrigation Systems, EM4828](#). Washington State University  
[Irrigation Water Measurement](#). Oklahoma State University

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<sup>1</sup> Curtis E. Swift, Ph.D., Area Extension Horticulture Agent, Tri River Area, Grand Junction, CO. Contact Info: [Curtis.Swift@colostate.edu](mailto:Curtis.Swift@colostate.edu); 970 244-1840.

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