

The most frequent questions: How to use Deep Root Irrigation and how it fits with your existing system.

1. What is DRI?

DRI means Deep Root Irrigation. It is a simple, affordable device that inserts easily into the ground to deliver water and fertilizer directly to the root zone. It attaches directly to your existing emitter. DRI has been tested and shown to use 61.51% less water compared to surface drip irrigation, while allowing more water to be available to the roots of the plant.

2. What is the most important thing that DRI offers that other forms of irrigation do not?

The DRI system offers more control: more control over your water and fertilizer delivery, more control over your maintenance costs, and more control over your ability to monitor when your tree or vine needs water.

3. How does DRI reduce irrigation water use?

Controlled testing confirms that direct delivery of water to the root zone is profoundly more efficient than are traditional surface watering methods. Surface watering loses a lot of water to evaporation and runoff. DRI does not. A six-hour saturation test comparing DRI with drip

showed that DRI almost stopped emitting water once the soil column around the unit was fully saturated. Flow of water is significantly reduced once a full level of saturation has occurred in the column of soil, resulting in 61.51% savings of water versus standard drip.

4. How does DRI dramatically reduce maintenance costs?

Consider how many of your maintenance costs are actually created by surface watering:

- **Energy.** The biggest cost of irrigation is energy. If you cut your water consumption by 61.51%, you will effectively reduce the energy required to pump it by 61.5%.
- **Soil amendments.** Many orchards are spending, on average, 135 USD per acre, every year, for soil amendments intended to enhance the soil's ability to absorb water and fertilizer. That cost translates to about 27,000 USD each year for a 200-acre orchard. This cost could be completely eliminated because DRI delivers water and fertilizer directly to the root zone. Soil pH can be achieved in a liquid form through DRI.
- **Weed abatement.** Weeds are a by-product of excessive surface watering.

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- **Pest abatement.** Insects and rodents are attracted to the food and water source provided by surface watering.
- **Clogged emitters.** Some vineyards and orchards are replacing thousands of drip emitters every year because of mineralization clogging due to evaporation. This form of calcification clogging does not happen with DRI because the DRI unit seals off the air flow from the drip emitter, thereby preventing evaporation. Minerals in the water remain soluble and pass through the emitter and DRI into the ground, becoming food for the plant.
- **Fungus.** Fungus thrives in areas of high humidity. The use of DRI can represent considerable savings in the cost of fungicide and saving of crops lost to fungus-related problems. By using DRI, you eliminate high humidity caused by surface irrigation and evaporation.
- **Fertilizers.** With DRI, you should see a significant reduction in use of fertilizers because they are delivered directly to the root zone instead of displaced on the ground surface and lost to evaporation and runoff.

5. How long does DRI last in the ground?

The DRI units are made from materials that have been used in the irrigation industry for decades. Manufacturers of the soaker hose used for DRI report that soaker hose installed in subsurface irrigation in the mid 1990s still is operating at full flow rate today.

6. Will DRI units clog?

DRI manufacturers are in their 5th year of field testing the DRI units. Regular inspections for possible clogging due to sediment back flow, root intrusion, and mineralization buildup have shown no clogging of the DRI unit.

- **Silt.** Silt from surrounding soil has no way of entering the DRI unit because of the positive pressure coming from inside the unit, which will not permit back-flow of silt into the DRI.
- **Calcification.** Mineral buildup is a by-product of evaporation. The DRI unit is not affected by evaporation because it is sealed off from air flow.
- **Root Intrusion.** At the point from which water is released from the supply tube inside the DRI, there is a copper element that acts as a root deterrent for capillary roots. Copper screening has long been used as a root control for roots from bamboo and other invasive landscape plants.

7. Is DRI pressure compensating? Do I need to use pressure compensating emitters?

DRI units need to be attached to pressure compensating emitters when pressure compensation is necessary, such as for hillside planting and long runs of irrigation hose where the friction coefficient is a factor.

8. How many DRI units should I use?

We recommend using one DRI unit per



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vine in the vineyard and two per tree in orchards. One DRI unit per tree is recommended for saplings. Consult your arborist for large heritage trees which might require more than two units per tree. Some larger orchard trees, such as walnuts, also might require more than two units per tree. Consult your crop advisor.

9. With sprinklers and drip irrigation I see water, but how do I know if the DRI units are working?

You should see a 4- to 6-inch wet spot where the quarter-inch tube of the DRI enters the ground.

10. What if I don't see the wet spot on top of the ground during irrigation?

If you don't see the wet spot, check first to make sure the top of the soaker hose is buried about 3 inches below the surface of the ground. Then check to make sure you've closed the hole where the DRI unit enters the ground. This is important to ensure necessary compaction that will cause the water to build up pressure to rise to the surface.

If that doesn't work, check your emitter to make sure water is flowing. It is likely that, if water is not flowing, you have a clogged emitter. Flag emitters can be cleaned out individually while others may need to be replaced. Your main line may need to be flushed.

Depending on soil profile, you may need to change emitters to increase or reduce rate of flow.

11. Can I fertilize through the DRI unit?

Yes, you can run any liquid through the DRI that you can run through your emitter.

12. How will the DRI system affect evapotranspiration monitoring?

If the intent of evapotranspiration monitoring is to assess how much water the plant, tree, or vine needs, then DRI will provide a more realistic reading because there will no longer be the ambiguity caused by the evaporation of excessive surface watering.

13. What size emitter should I use?

Emitter size will depend on your soil type. Heavier clay soils require a slower-flowing emitter like a half-gallon- or one-gallon-per-hour emitter. The more porous and sandy soils will use two- to four-gallon-per-hour emitters. The objective is to complete saturation at the root zone and still see that 4- to 6-inch wet spot on the ground, which tells you that the DRI is working. If the wet spot becomes excessive too quickly, it means you're putting water into the ground more quickly than the ground can absorb it. In such a case, you need to reduce to an emitter with a slower rate of flow.

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14. Can I just use a coupler instead of a flow-regulating emitter to connect my DRI unit to the irrigation supply line?

No, in all soil types you need to regulate flow. Otherwise, you will create excessive, uncontrolled flow, resulting in too much water being lost by perking to the surface.

15. Is DRI compatible with my micro sprinklers?

Yes, many growers are turning to DRI as their only method of irrigation, but keeping their micro sprinklers to use for winter season frost control.

16. If I use DRI, will I need to change my irrigation cycle?

You might need to reduce irrigation frequency. We have found a high probability that heavier soil types, when irrigated with DRI, hold water for a longer period of time than they did with surface drip.

17. Can DRI be used to control salt concentration at the root zone?

Yes, you can run fresh water through the DRI to flush the salt concentration from the root zone.

18. How is DRI more environmentally friendly than traditional forms of surface irrigation?

Using DRI reduces energy used to pump water. DRI significantly cuts

water and fertilizer use. And it dramatically reduces the need for herbicides, pesticides, and fungicides.

One scientist with whom we spoke was enthusiastic about the idea that using DRI would significantly lessen the nitrous oxide emissions that are a by-product of ground surface fertilizing. Also, that a fertilizer delivered directly to the root zone is less apt to end up in our rivers, streams, and lakes.

It is also important to note that the soaker hose part of DRI is made from recycled tire rubber.

19. I just bought a sulfuric acid machine. Can I run sulfuric acid through DRI?

Yes, you can run sulfuric acid through DRI. You can run anything through DRI that you've been running through your existing irrigation system.

20. What if a coyote or rodent bites a DRI unit?

Spraying a little chlorine bleach on the DRI typically will repel animals forever. In addition, delivery of liquid fertilizers, fungicides, and sulfuric acid through the DRI unit will make the root zone unpalatable to gophers.

21. Can I reuse the DRI units?

Yes, just irrigate an hour or so before pulling the DRI unit up in order to moisten the soil around it, and then it should pull up just like a carrot.



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22. DRI claims to promote downward root growth. How do I know that's what I want?

From an engineering standpoint, a deeper root system makes for a structurally stronger tree or vine. In the right conditions, trees and vines will create both a downward growing and lateral root structure. But roots tend to grow toward water, and if the water is coming from the surface of the ground, the roots will be more inclined to grow toward the surface of the ground. This creates conditions like J-root that make the tree or vine more susceptible to disease. A tree or vine with a deeper root, like those that are dry farmed, will be less vulnerable to disease and more drought resistant.

23. How is DRI different from other forms of subsurface irrigation?

There have been many attempts by growers and irrigation manufacturers to increase water penetration to the root zone. Buried inline emitters is one way growers have attempted to accomplish this. They bury the lines 6 to 8 inches below the surface of the ground. This can't be done in mature orchards and vineyards without damaging existing root structures because it would require trenching through a mature root system. Also, buried inline emitters are prone to clog and there's no way of knowing whether the system is working.

Growers have also run the drip tubing into perforated p.v.c. pipe that they've inserted into the ground. But this method actually accelerates evaporation at those points of water delivery.

Also, manufacturers have made products with subsurface delivery that are vaguely similar to DRI, but these products are more labor intensive to install and are 7 to 15 times more expensive.

24. How do I install a DRI unit?

On the average, we can install one DRI in 30 to 60 seconds, using a simple tool with a $\frac{3}{4}$ -inch-thick steel rod. This tool was adapted from a 4 foot long foundation stake that can be bought at any lumber yard.

After making a hole about 22 inches deep, we straighten the DRI unit and insert it into the hole until the top of the soaker hose is buried 3 inches below the surface of the ground. The $\frac{1}{4}$ -inch tubing that extends up from the ground is then attached to the existing 'woodpecker style' or flag emitter. Try to avoid large loops in your $\frac{1}{4}$ -inch tubing that can easily be caught with tools.

It's important to remember to compact dirt into the hole where the DRI unit was inserted into the ground.

25. How much does a DRI unit cost?

The DRI units vary in price based on size and quantities purchased. Please ask us for a quote.

26. How should I store the DRI units?

We actually prefer that you don't store them. We prefer to deliver them to you when



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you're ready to install them. If you need to store DRI units for a period of time, please store them in a cool shaded area.

Do not leave them exposed to sun or extreme heat, such as in a vehicle or the bed of a truck. Sun and heat will damage DRI. Once installed underground, the DRI units will last indefinitely.

27. Can I use DRI with my inline emitters?

No. The inline hose will need to be replaced with standard hard wall hose, and Woodpecker type or flag emitters will need to be installed.

28. Will using DRI affect my pumps?

No. The DRI system uses the same principles of physics as buried drip. As with any other form of subsurface irrigation, farmers have not found the need to change or recalibrate their pumps. Nor have they experienced damage to their pumps.

29. Which DRI model should I use?

Recommendations:

- **DRI-3.** Potted plants, tomato plants, etc.
- **DRI-6.** All shrubs and bushes
- **DRI-12.** All vines and tree crops
- **DRI-18.** Large Heritage type or landscape shade trees

30. Are there any special considerations for installing DRI on a hillside?

We recommend installing the DRI units to promote more water flow to the uphill side of the tree or vine.

31. Does the soil type affect DRI's effectiveness?

DRI has been tested at over 500 locations, all with varying soil types and environmental influences. DRI always provides more water to the root zone while demonstrating significant savings in water use over standard drip irrigation.

32. How often does the DRI unit require maintenance?

Once your DRI unit is properly installed, it should last for the life of your plant. Your drip hose, however, should be flushed at the beginning of each season to remove sediment that might clog your emitters.

33. Would the excellent saturation achieved by using DRI create a climate conducive to wet root disease like Phytophthora or Pythium?

No. The most obvious advice to folk concerned about too much water is to water less. The tendency of people who have been surface watering for years is to believe that "more is better," but that is not true with DRI. Because DRI provides an immediate and targeted delivery, you have more control in water (and fertilizer)



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delivery than you have ever had. With DRI, you can irrigate as much or as little as you want.

With vines, the DRI unit is installed at an angle in order to offset the bulb of saturation so the roots are not sitting in constant saturation. This allows the roots to get the oxygen they need and still have a continuous water source available. Similarly in orchards, although DRI is installed vertically on two sides of the tree, there is enough water available to the tree without compromising oxygen availability. Roots are drawn to the closest source of water, but they are particularly attracted to that zone at the edge of the bulb that contains oxygen.

34. Now that I'm using DRI, my existing emitters may not provide the correct rate of flow for my soil profile. Do I absolutely need to change them?

No. You do not need to change them, but for optimum performance you will want to change your irrigation cycle. You are no longer competing with the ground as you were when you were surface watering. Because DRI provides an immediate and targeted delivery, you are going to use half the water in a considerably shorter period of time.

To determine the amount of time needed for irrigation cycles, you can use Sentek™ probes and monitor the IrriMAX Live images online. Another way is to document the amount of time it takes

for the 4- to 6-inch wet spot to start expanding where the ¼-inch tubing enters the ground. If, for example, the 4- to 6-inch wet spot begins growing after 2 hours, then you will know that either you have reached desired saturation or you are close.

To verify that you have reached desired saturation, run a test with DRI in that soil type independent of the tree or vine. Once the 4- to 6-inch wet spot begins expanding to 8 or 10 inches, dig down into the soil with a backhoe to observe the subsurface saturation profile. We call this the "backyard test."

35. Can DRI be used for deficit irrigation?

Yes. Deficit irrigation (watering a lot less) is conducted at the end of the season, just prior to harvest, to bring the sugar content up in the fruit. DRI is perfect for deficit irrigation because you can deliver as much or as little water as you want. Because of the longevity of the subsurface bulb of saturation created by DRI, you may want to start your deficit irrigation earlier.

36. If I am using DRI, how will I continue frost protection?

Most growers are opting to keep their existing line of fan jets, micro sprinklers, and impact sprinklers for frost protection.