Unpowered Pitcher Drip Irrigation Controller

A major advance in drip irrigation using a clay pot

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Pitcher ready to be buried

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1. How to make DIY low cost pitchers for irrigation

Small pitcher made from two 9cm terracotta pots (AU$1.27 each at Bunnings)
Medium pitcher made from two 12cm terracotta pots (AU$1.76 each at Bunnings)

Step 1. Select two identical unglazed terracotta pots and seal one of the drain holes (for example, use silicone adhesive or masonry adhesive)

Step 2. Apply a bead of silicon sealant or masonry adhesive to the rim of the pot with the sealed drain hole

Step 3. Carefully position the upper pot directly above the lower pot

Step 4. Gently press the pots together and allow 24 hours for the sealant to cure

Step 5. Connect a 13mm barbed poly tee to the pitcher using a 13mm rubber grommet. A 13mm rubber grommet requires a 16mm hole. Attach an 8cm length of 13mm polypipe to provide an air inlet/outlet for the pitcher.

2. Installation of the Pitcher Drip Irrigation Controller

Select a drip irrigation zone where all the plants in the zone have the same irrigation requirement and each plant is irrigated by a single dripper.

1. Select a control plant and replace its dripper by one or more subsurface pitchers. A suitable wicking soil fills the space between the seedling and the pitchers. Note that the corn seedling will draw more water from the pitchers as the corn grows.

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2. Connect the pitchers to the controller so that water can flow from the controller to the pitcher.

3. Connect the water supply for the zone to the inlet of the controller (at least 5 kPa pressure).

4. Connect an irrigation dripper inside the controller.
5. Connect the drip irrigation application to the outlet from the controller
6. Turn on the water supply and all the plants will be watered automatically with the water they need and without power.

3. How to use the Pitcher Drip Irrigation Controller

The discharge from each dripper during an irrigation event is the same as the on-demand discharge from the subsurface pitcher (or pitchers) since the previous irrigation event.

If any plant irrigated by a subsurface pitcher (or pitchers) starts to look unhealthy, move the subsurface pitcher (or pitchers) to a healthy plant.

Use mulch to reduce evaporative losses.

If you decide that your plants are not receiving enough water by drip irrigation, you can increase the water usage by opening the lid of the controller. In this case discharge from each dripper during an irrigation event is the same as the on-demand discharge from the subsurface pitcher (or pitchers) since the previous irrigation event plus the net evaporation (evaporation minus rainfall) from the controller since the previous irrigation event.

The water usage can be adjusted by replacing the dripper inside the controller with an adjustable dripper. Increase the water usage by decreasing the flow rate of the adjustable dripper, and decrease the water usage by increasing the flow rate of the adjustable dripper.

4. Key features

1. All plants in the zone should have the same irrigation requirements
2. Unpowered (no batteries, no solar panels, no electronics, no computers, and no WiFi)
3. Use for subsurface or surface drip irrigation
4. Use pressure compensating (PC) drippers or non pressure compensating (NPC) drippers
5. The water supply pressure should be at least 5 kPa
6. The water usage is controlled by the demand from the control plant
7. The discharge from each dripper during an irrigation event is the same as the on-demand discharge from the subsurface pitcher (or pitchers) since the previous irrigation event
8. As the water needed by your plants changes as the plants grow, the discharge from each dripper during the irrigation event adjusts automatically
9. The water usage increases significantly during a heat wave
10. Water in the controller is protected from debris, algae, mosquitoes and thirsty animals
11. Provided the water supply is continuous, you can leave your irrigation application unattended for months on end
12. A tap timer may be used so that irrigation is only available between sunset and sunrise

5. Conclusion

The technique of using pitchers to water plants has been known for at least 2000 years. It is well known in India where it is called pitcher irrigation. Round porous clay pots are buried into the soil near the crop and filled with water. The water seeps out slowly through the porous walls of the pot and reaches the roots of the plants. As the plants consume the water, more water will seep out from the pot.

A major advance in drip irrigation can be achieved by integrating drip irrigation and pitcher irrigation. This remarkable irrigation technology is called **pitcher drip irrigation.** Compared with the most sophisticated drip irrigation technologies, pitcher drip irrigation is far more water efficient and at a fraction of the cost.

Conventional drip irrigation controllers are either sensor-based or weather-based. The most water-efficient sensor-based controllers use expensive soil moisture probes to determine the start time and the run time of next irrigation event. With pitcher drip irrigation the soil moisture probes are replaced by pitchers. Instead of using soil moisture to control irrigation scheduling, plant demand for water is used.

As the crop grows, the demand for water will also grow, and so the crop can be left unattended throughout the growing season.

Conventional weather-based irrigation controllers use reference evapotranspiration data from the Bureau of Meteorology to determine irrigation scheduling. This means that the water usage needs to be adjusted whenever the crop coefficient changes. There are 2 major disadvantages of weather-based irrigation controllers.

- The weather conditions at a weather station of the BOM may differ significantly from the on-site weather conditions.
- To determine the water usage required by your crop at its current stage of growth, the reference evapotranspiration *from* the BOM is multiplied by your best estimate of the crop coefficient. The irrigation scheduling needs to be adjusted manually as the crop grows and the crop coefficient changes. Furthermore, the theoretical evapotranspiration is a crude estimate of the actual evapotranspiration.

For pitcher drip irrigation, the irrigation scheduling is controlled by the water demand of the plants, and so the two major disadvantages of weather-based irrigation controllers become irrelevant.

For drip irrigation or crops, pitcher drip irrigation may be the most water-efficient and cost-effective technology ever.