

UMass Extension

## Greenhouse Crops and Floriculture Program

### Fact Sheets

### Greenhouse Management / Engineering

#### Rainwater Harvesting

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Water is a precious resource necessary for growing plants. We often take our water supply for granted until its quantity or quality declines. Then we are forced to adopt drip irrigation methods or expensive filtration systems.

About 97% of the earth's water is seawater and another 2% is in the form of ice. Of the remaining 1%, as much as 75% is used by agriculture in some states. Depending on the crop, time of year and location, greenhouse and nursery crops may need as much as 0.4 gallons per square foot of growing space per day. This can exceed the supply that is available.

With the development of gutter-connected greenhouses, growers have the opportunity to collect large quantities of high quality rainwater that can be used for plant irrigation. Rainwater harvesting, as it is referred to, is promoted in arid western states such as New Mexico and Arizona. It can also be adopted almost anywhere in the U.S.

#### Quantity

Significant quantities of water can be collected. A 1" rainfall on an acre of greenhouse amounts to 27,100 gallons. A common yield is about 65% with losses due to evaporation, wind, leakage of the piping system and diversion of the first few minutes of the rainfall to remove debris. To calculate the amount that can be collected, multiply the footprint of the greenhouse by 0.4 and this will give you a quantity in gallons.

#### Quality

Rain water is generally soft with very few chemicals. It is clean except for any debris that gets into the system. In some parts of the country, it is slightly acid and may have to be treated.

It is fairly easy to set up a collection system. In addition to the roof and gutters, a filtration and storage system are needed. Where water is in very short supply, some growers have captured rainfall from driveways and parking lots. It is also possible to add a gutter to the base of a hoop house and collect water that would normally run off to a drain or swale

#### Collection

In most gutter-connected greenhouses, the gutters are drained through a downspout and piping system. Usually the downspouts are connected to a 4 inch or 6 inch PVC pipe. The downspouts are connected to larger pipes as more gutters are fed into the system. In large greenhouses, the end pipes may be 18 inches or larger. A minimum slope of 1/16<sup>th</sup> inch per foot with cleanouts every 100' is the recommended pipe installation.

#### Filtration

Before entering the tank or pond, the debris should be removed from the water. A device called a roof washer is normally used to divert the first flush of water that is collected. This is a small tank, sized for the quantity of water collected. The sloped top is covered with ¼ inch hardware cloth to trap and divert any leaves. Dust, bugs, bird droppings and other small debris that gets through the screen settles in the small tank and are drained away with a small pipe. Some systems have a diverter valve that switches once rainfall picks up. This tank has a full size pipe at the top to carry the rainwater to a cistern, tank or water silo. Roof washers are commercially available or can be homemade.

### **Storage**

A concrete cistern is a low-cost storage device available locally. It can be a concrete septic tank that is set in place or a one that is cast in place. The largest septic tanks are usually 5000 gallons as this is about the largest size that can be handled on a truck. A typical cost is about \$4,000 to \$5,000. Larger tanks are made by using forms that are filled with concrete. A good seal is needed between the base and sidewalls to prevent leakage.

Fiberglass or Polyethylene tanks are available from many greenhouse suppliers. They are available as above ground or buried tanks the largest being about 12,000 gallons. A 12,000 gallon tank would be about 12 feet in diameter and 16 feet long. Depending on the transportation cost, they run from \$0.80 to 1.25/ gallon. They come with threaded fittings for pipe connections and large manholes for cleanout.

Water silos, manufactured by Zwart Systems ([www.zwartsystems.ca](http://www.zwartsystems.ca)), are corrugated steel tanks that can be assembled to provide a large water holding capacity. A chemical resistant liner is installed to contain the water. As they are formed in sections from sheet steel they are easy to ship and assemble on site. Tanks and silos that are inside a greenhouse or headhouse allow the water to be warmed some before it is used for irrigation.

Growers with several acres of greenhouses usually build a pond to retain rainwater. These can be made to any size but usually require a design by a licensed engineer and a permit from the local wetlands agency. If the soil is porous, a vinyl liner is placed on the bottom of the pond to prevent seepage. The disadvantage to a pond is that the water may become contaminated from algae or other plant growth.

In all of the above storage devices, an overflow is needed to handle excess water. The water needs to be directed to a wetland or drainage area where it does not flood neighboring property.

Once you have collected the water, it can be distributed to the greenhouses with the normal irrigation system.

As good water supplies become more difficult to get, water harvesting may be an necessary option for many growers. The gutter-connected greenhouse allows large quantities of water to be collected at low cost.