

2012

# Rainwater Catchment from a High Tunnel for Irrigation Use

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## Recommended Citation

Naeve, Linda L. and Shouse, Shawn C., "Rainwater Catchment from a High Tunnel for Irrigation Use" (2012). *Iowa State Research Farm Progress Reports*. 10.

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# Rainwater Catchment from a High Tunnel for Irrigation Use

## **Abstract**

High tunnels are simple, plastic-covered, passive solar-heated structures in which crops are grown in the ground. They are used by fruit and vegetable growers to extend the growing season and intensify production in cold climates. The covered growing area creates a desert-like environment requiring carefully monitored irrigation practices. In contrast, the exterior expanse of a high tunnel generates a large volume of water with every measurable rainfall. Each 1,000 ft of high tunnel roof will generate approximately 300 gallons from a half inch of rain. Unless the high tunnel site is elevated from the surrounding area or drainage tiles installed, or other drainage accommodations are made around the perimeter, the soil along the inside edge of the high tunnel is nearly continuously saturated. High volumes of water can also create an erosion problem.

The objective of this project was to design and construct a system that enables growers using high tunnels in their production operation to reduce drainage problems, erosion, and crop loss due to excess moisture in and around their high tunnel(s) without permanent environmental and soil mediations.

## **Keywords**

RFR A1198

## **Disciplines**

Agriculture | Bioresource and Agricultural Engineering

# Rainwater Catchment from a High Tunnel for Irrigation Use

## RFR-A1198

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### Introduction

High tunnels are simple, plastic-covered, passive solar-heated structures in which crops are grown in the ground. They are used by fruit and vegetable growers to extend the growing season and intensify production in cold climates. The covered growing area creates a desert-like environment requiring carefully monitored irrigation practices. In contrast, the exterior expanse of a high tunnel generates a large volume of water with every measurable rainfall. Each 1,000 ft of high tunnel roof will generate approximately 300 gallons from a half inch of rain. Unless the high tunnel site is elevated from the surrounding area or drainage tiles installed, or other drainage accommodations are made around the perimeter, the soil along the inside edge of the high tunnel is nearly continuously saturated. High volumes of water can also create an erosion problem.

The objective of this project was to design and construct a system that enables growers using high tunnels in their production operation to reduce drainage problems, erosion, and crop loss due to excess moisture in and around their high tunnel(s) without permanent environmental and soil mediations.

### Materials and Methods

Vinyl gutters were installed on the 30 × 96 ft high Quonset-style high tunnel at the ISU Armstrong Farm, Lewis, Iowa to capture rain in two 500 gallon tanks located on each side

of the tunnel. Gutter brackets were attached to the high tunnel on a support board constructed of a 2 × 4 in. lumber split diagonally for more vertical surface area (Diagram 1). The boards were attached to the high tunnel below the hip board allowing a 6-in. drop per 100 linear ft to allow for adequate flow into the tanks.

Methods to channel the water from the cover to the gutter were demonstrated, including attaching an additional strip of plastic to the cover with repair tape and attaching it in the channel with wiggle wire. The strip of plastic was long enough to reach the inside bottom of the gutter. The gutter extended beyond the high tunnel to drop the water into the tank and to accommodate excess water (Diagram 2).

Overflow valves were installed in the tanks to divert excess water away from the tanks and into a waterway. A basket of coated wire held the ball below the drop outlet. As the water level approached the top of the tank, the floating ball in the basket rose and eventually sealed against the downspout adaptor, preventing more water from entering the tank (Diagram 3).

For demonstration purposes, both electric and solar power-sources were used to operate the pumps. The collected water was pumped alternately from the tanks and used to irrigate the crops grown in the high tunnel.

### Results and Discussion

Between June 25 and October 29, 2011, the system with two, 500 gallon tanks captured approximately 44 percent of the irrigation needs in the high tunnel. The tanks were drained with each irrigation use to minimize the build-up of algae in the tanks. Increasing the storage tank size to collect the first inch of rainfall should capture 60 to 70 percent of the

growing season rainfall, or about 14 to 17 in. on the roof area of the high tunnel in Iowa (two 1,000-gallon tanks would collect approximately 28,000 gallons per season from a 30 ft × 96 ft high tunnel). A water sample was taken from the storage tank in early August and analyzed by the State Hygienic Laboratory at the University of Iowa. Test results showed the presence of Coliform and E.coli bacteria. This was anticipated due to the likelihood of bird manure on the high tunnel cover and insects in the gutters and tanks. Because of this risk, rainwater collected from the high tunnel should only be used for drip irrigation and other non-potable needs.

The rainwater catchment system cost approximately \$1,200 (an additional \$700 for solar-powered) and required approximately 70 hours of labor to install. The water catchment system developed in this study is described in ISU Extension publication, PM-3017, *Rainwater Catchment from a High Tunnel for Irrigation Use*, available as a downloadable pdf document at <https://store.extension.iastate.edu>.

### **Acknowledgements**

We would like to thank Randy Breach, ISU Armstrong Research and Demonstration Farm, for his assistance on this project and Jane Lenahan, Extension graphic designer, for the illustrations. Funds for this project were provided by the Leopold Center for Sustainable Agriculture.

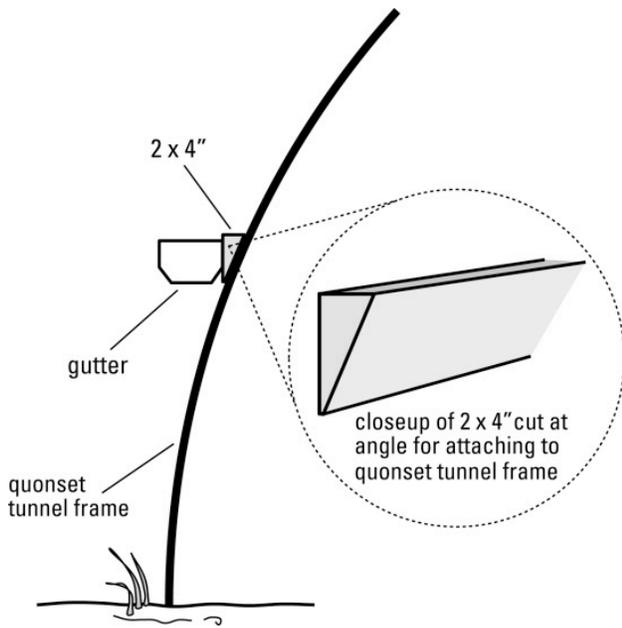


Diagram 1. Gutter attachment on the high tunnel.

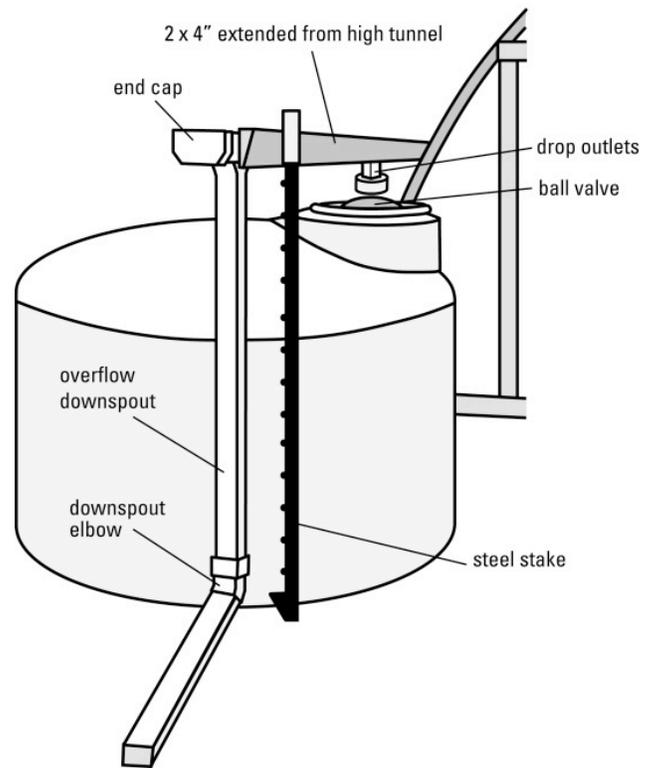


Diagram 2. Water catchment and over flow.

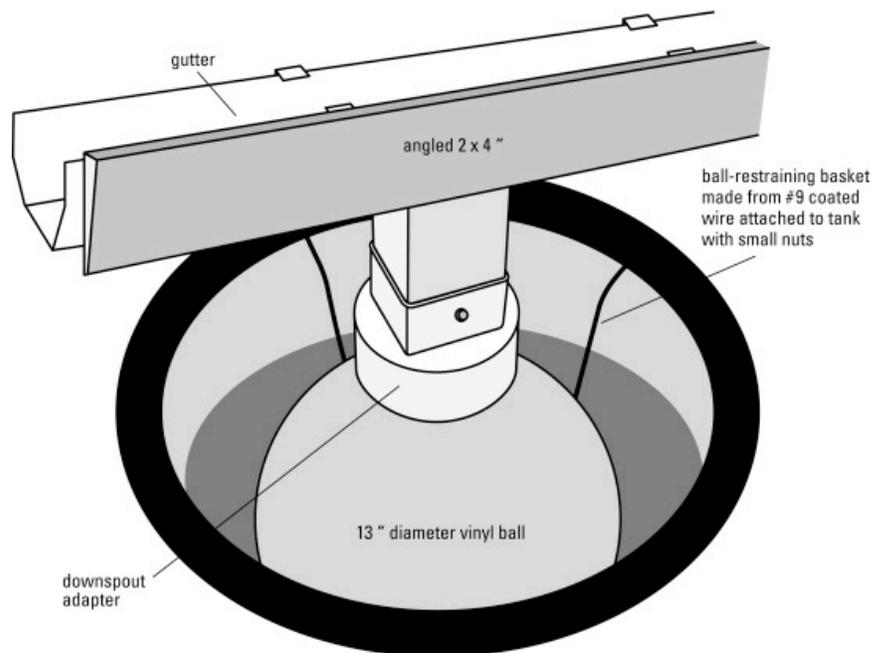


Diagram 3. Ball valve in the water collection tank.