Trough Irrigation versus Traditional Overhead Watering in a commercial greenhouse operation

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by: Stacey Chapley
in cooperation with: Paul M. Chapley &
University of Massachusetts Extension

TROUGH IRRIGATION versus TRADITIONAL OVERHEAD WATERING
in a commercial greenhouse operation

The goal of this project was to do a cost comparison of traditional hand watering versus a trough sub-irrigation system on potted flowering annuals. In this trial we used vegetative cut- geraniums. In factoring the cost, 1.) we tried to keep track of water usage through metering of cubic feet of water used in the trial, 2.) man hours needed for watering a 30 foot by 96 foot greenhouse, 3.) amount of fertilizer used, 4.) loss of plants due to root rot, and 5.) fungicide usage. We hoped to provide more information on real life practical use of sub-irrigation.

In updating information on our operation after we received the grant, we worked on a layout design and hoped to retrofit the troughs to the existing bench support, but later decided it would not allow the system to be uniformly angled and drain consistently. As a result we purchased a rolling bench system. This increased our growing area from 2,182 square feet in a 2,880 square foot greenhouse, (a 75% usage,) to a growing area of 2,430 square feet, (a usage of 84% of the total area,) by streamlining with the trough irrigation on a rolling bench system.

Cooperators involved are;

Paul M. Chapley - Paul is owner of Chapley Gardens and is in charge of all growing productions. He oversaw the constructon of the rolling bench system and designed the system feeding the troughs along with the recirculating system. Once the trough system was up and running Paul did all the watering in the greenhouse.

University of Massachusetts Extension - helped with the preliminary research for the grant proposal and as support for any testing that may have been needed. They will also be assisting in the outreach part of the grant through their publication of "Floral Notes" and assistance in writing papers for submission to trade magazines.

Massachusetts Growers Association - help with outreach

The actual research went as follows:

In the 1994 growing season, prior to installation of the trough system, the bench system consisted of pallets elevated on a stand constructed of lumber and cement blocks (see enclosed photos). 2,946 geraniums grown in 4.5" pots were placed on these pallets to grow. 53 geraniums were lost to root rot over the duration of the growing season.

The biggest cost involved in a greenhouse production facility is the cost of labor to hand water. In order to throughly water the greenhouse it took approximately 3-4 hours per watering, to pay a person at $6.50 an hour would cost the grower $26.00 per watering. At the end of the growing season it took approximately 253 man hours to water the crop from mid-February to mid-June, costing a total of $1,644.50. The next cost analysis is water, fertilizer and chemicals. Since the water and fertilizer mixtures go through one supply line to the whole growing range, knowing exactly how much was used in each particular house could not be figured, so the total for the growing range wasfigured at 23,370 cubic feet (175,275 gallons)

Water	usage was approximately 788.46 gallons used per watering
Fertilizer{15-16-17}	400 pounds dry (at a rate of 200 ppm)

The following chemicals were used at recommended rates in the trial greenhouse

Banrot	1 application for root rot
Ornalin	1 application for Botrytis
Gnatrol	1 application for fungus gnats
Talstar	1 application for fungus gnats
Malathion	1 application for fungus gnats

In the 1995 growing season with the trough sub-irrigation system installed (see enclosed photos & schematics). A total of 5,025 vegetative geraniums were grown in 4.5" pots on 2,430 square feet of growing surface. This was an increase of 41% more product produced than 1994.

The costs for watering the geraniums were as follows;

Labor - aside from the construction of the rolling benches and troughs, once the system was up and running, minimum time was 20 minutes up to one hour maximum compared to 3-4 hours previously needed. This means a grower would only spend $6.50 per watering as compared to $26.00 per watering

Water - the amount needed to thoroughly water the plants was 300 gallons per watering.

Fertilizer - 200 pounds of dry concentrate (mixed at a rate of 200 ppm)

Other Chemicals - none
there was no need to treat for fungus gnats, root rot, or botrytis

The recirculating trough system had a holding capacity of 300 gallons located under one bench, that storage of water is pumped to 30 benches using a 70 gallons per minute (gpm), 1/2 horsepower pump, through an 1 1/4" main line to 3/4" line at each of the 30 benches. Dispersing the water to each individual trough was a 1/2" spray bar. The water then trickled down the trough, hitting each of the pots for a duration of 20-40 minutes. During this time the plants would absorb the water up 3/4 of the pot, fully saturating the soil less mix after the water was turned off.

The water would continue to be dispersed among the remaining dry growing media. The extra water left on the trough is caught in a 4" wide vinyl gutter that ran the length of the greenhous (refer to schematics), the gutters drain into a sewer return pump that dumps the water, through a nylon stocking filter, back into the 300 gallon holding tank area located under a bench.

Our Findings and Accomplishments are as follows

*amount of time needed to water the crop dropped 75%
*the amount of water needed decreased 61%
*by increasing the growing area, we increased our production numbers, this was unexpected
*there was a decrease in fungus gnats and shoreflys, this was unexpected
*selection of cultivars need to be checked or trialed, this was unexpected
*for 1996 growing season, a change in growing media will be used to try for better and quicker absorbtion rate
*fertilizer usage decreased by half

One specific site information relevant to know exactly how much water to compare is unclear. As stated earlier the water used in the test greenhouse is supplied by one line, metered at only one location and is fed to the whole growing range. I figured the amount of water used by figuring out the amount of water used per square foot of greenhouses. Then figured how much each greenhouse used by multiplying the total square footage of each house. The numbers used to figure is probably on the low side, geraniums take more water than a flat of 1020 trays.

The economic findings is substantial. The total cost of the trough sub-irrigation system was $4,855.85 (see financial summary of expenses below). The savings from labor and fertilizer was $1457.00. In 3.3 years this savings would make up for the cost of the irrigation system. In our growing facility we only grow one crop a year. If a grower did a second crop rotation, the savings would be realized even sooner.

As a note of information the cost for adding the rolling bench system was $4,617.00. To make up for this cost, an additional 3.2 years will be needed to pay off the investment.

Financial Summary of Expenses

Trough sub-irrigation	$2632.50
Vinyl gutter & Hardware	$139.52
Ball valves	$105.00
Plumbing (water return & recirculation)	$439.47
Holding tanks	$241.40
Hardware	$251.56
Recirculating Pump	$596.40
Sewage Tank	$450.00
Total	$4,855.85

Results from this trial has solved a major drain on capital such as labor costs. It also stopped the runoff of contaminated water into our valuable fresh water supply. This trial opened up the possibility of watering other greenhouse crops in a similar way, such as bedding plants in 1020 trays and other larger potted crop productions. We are currently experimenting with New Guinea Impatiens grown in 4.5" pots.

We will continue to use the trough irrigation system. This watering system saved on the amount of labor needed, provided uniform watering and produced a better quality product. For the next growing season, fine tuning on spacing will be worked on, so all plants will have plenty of room to grow into a quality product.

Information to tell other greenhouse growers is as follows;

*This system is easy to learn and can be fine tuned to a variety of crops
*The decrease in labor needed will help free up workers to do other tasks
*By using a closed system, water usage was cut over 50%. It is safer for the enviroment and water containing fertilizers and chemicals will not leach into our valuable drinking water supplies, helping our children and future generations
*Less chemicals were needed, cutting down on workers exposure to pesticides and fungicides.
*Less fertilizer was needed, resulting in less cost to produce the same quality product and helping with the bottom line
*The finished product is just as good, if not better, due to a stronger root system and less water on the leaves.

Our outreach program includes at this time, an article being written for submission to the UMass Extension publication "Floral Notes" to be distributed to 400 flower growers in Massachusetts. Also this article will be submitted to trade publications. Copies of any article will be forwarded to the SARE program.

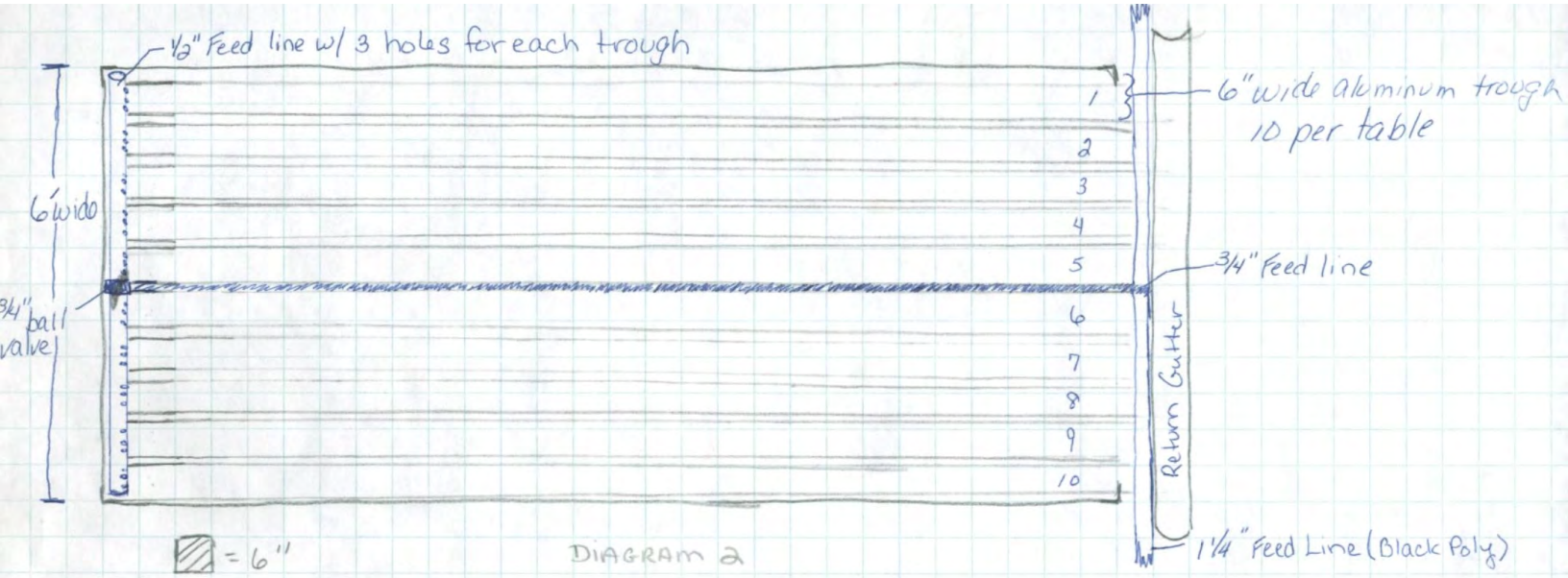

DIAGRAM 2

Close up of 6" wide trough table

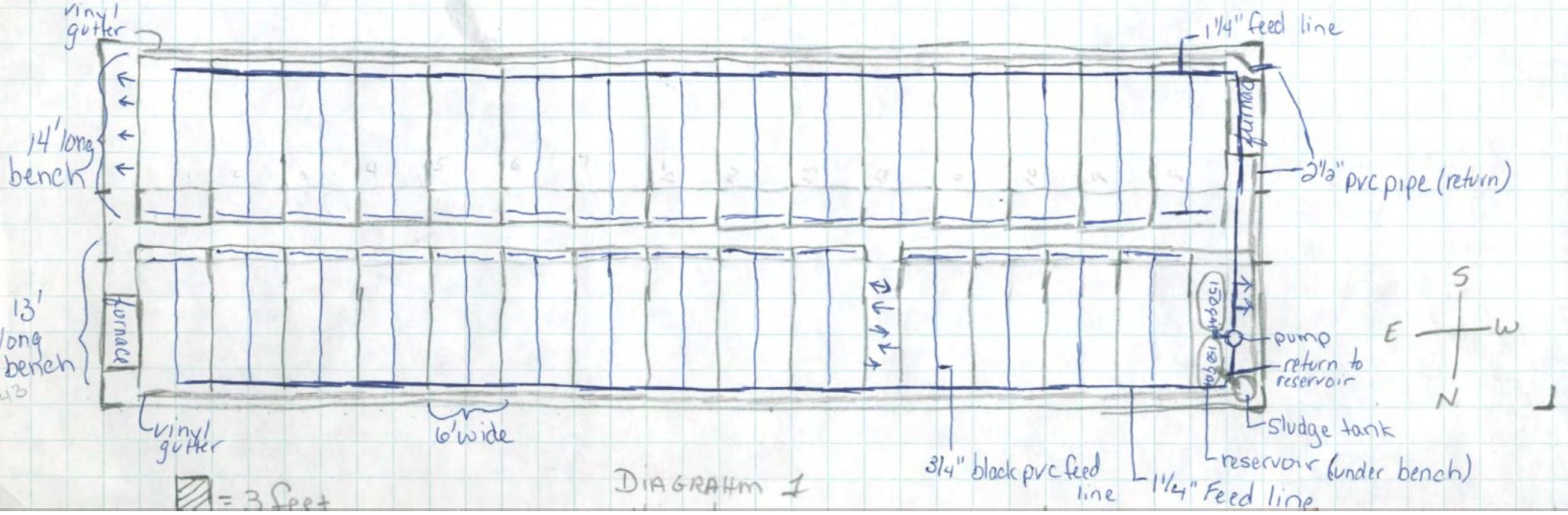

DIAGRAM 1