

ASCFG Grower Grant Report

Research Supported by an ASCFG Grower Grant

Focused Radiant Heat to Control and Enhance Off-season Cut Flower Production

Tanis Clifton

Happy Trails Flower Farm, Dennis, Mississippi

In our years of growing Mother's Day oriental lilies in a high tunnel, we have had the unpleasant surprise of harvesting blooms one to five weeks after Mother's Day on a consistent basis. To add to this obvious problem, when we actually had the lily harvest come in, often the florists still had leftover lilies or did not need 500 of them all at once! If we were going to try to target this holiday, we had to come up with a solution.

This problem prompted us to apply for an ASCFG Grower Grant. We were thrilled to have our application approved. We could now begin to test our theory that focused radiant heat may control and enhance off-season flower production.

We believed that to deliver out-of-season flowers, in a time-sensitive manner, focused radiant heat must be applied to target areas within the hoophouse. The reason for this is twofold. First, it is more economical to heat small target areas of a hoophouse than to heat the entire structure. Second, multiple crops with various temperature requirements can be grown in the same hoophouse.

To address the issue of how to grow cool- and warm-season specialty cut flower crops simultaneously, we built a secondary hoop within the hoophouse, then installed a hydronic radiant heat system. This technology is currently being used to heat commercial buildings and homes as well as to prevent ice buildup on driveways.

Our objectives were as follows:

1. To control and maintain optimal growing conditions, regardless of weather, to a target area within a hoophouse.
2. For our small cut flower operation to have more than one climate within a single hoophouse.
3. To provide an economical and portable heat source for a target area inside an existing hoophouse.
4. To increase the likelihood of expected target harvest date for out-of-season flowers for holidays such as Valentine's Day, Mother's Day and Christmas.

As usual, we planted three varieties of oriental lilies in bulb crates on December 21, 2013. Oriental lilies were the flower choice for this particular experiment as they require more consistent temperatures to guarantee specific harvest dates. Our normal procedure is to water them in, and cool them in the walk-

in cooler for 3 weeks. This would have meant that we placed the lilies in the high tunnel on January 11, 2014. Although the temperature was a comfortable 48 degrees F that day, within the week the forecast was for low temperatures in the teens. These low temperatures held true for the entire month of January. So we spread all the crates out in the cooler and added supplemental lighting because the bulbs had started to sprout. This protected them from potential damage from the cold temperatures outside. These extreme cold temperatures in January also prevented us from building the project on schedule.

The construction of the mini greenhouse finally commenced. The first step was laying double bubble insulation on the hoophouse floor. Then we built a structure that would be large enough to allow space for two rows of bulb crates.

The actual dimensions of the structure were 40' x 45" x 6' high. We started the project with the intentions of using PEX tubing as our radiant heat pipe. We found that due to the small area that we planned to run the radiant heat, the PEX tubing was too rigid to bend at a tight enough angle to make the curves. We decided to try our theory with PVC pipe so we could get the right angles. The 1" PVC pipe was laid on top of the insulation, then connected to an inline water heater.

(fig.1) The heater was an Electric Circulation Baptistry Water Heater. We used this because it was small, portable and efficient. We then covered the PVC with sand (fig.2), believing that this would transfer heat better than the air under the bulb crates. We then covered the entire structure with 3 mil overwinter poly. The





fig.3



fig.4



fig.5

theory was that the water would be heated, circulated and returned to be reheated again, in a closed loop, through the PVC. The water temperature was controlled thermostatically with the hope that we could maintain an air temperature of 60 degrees F. We also added four heat lamps inside the mini greenhouse to supplement the radiant heat. Air was circulated using fans on either end of the structure. Roll-up sides were utilized to ventilate the structure on warm days. (fig.3) In addition we added supplemental light starting February 25, from 4:30-7:30 to extend the day. (fig.4)

The extreme cold temperatures seemed to break on February 1. At this point, all lilies had sprouted and had some length on them. (fig.5) We placed all lilies into the

hoophouse on February 1. Six crates were designated as the control and placed in the hoophouse. The control was exposed to inconsistent temperature fluctuations influenced by daily weather. This is the existing standard. The remaining crates were placed into the mini greenhouse structure. Although temperatures were not as cold, growth was somewhat slow as outside temperatures in February were averaging between 23 degrees F to 48 degrees F. We started charting temperatures inside the hoophouse beginning March 1 through May 1 (chart). The temperature was monitored and noted daily using inline thermometers at the outlet and return of the heating unit. The mini greenhouse air temperature was also monitored and noted daily.

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fig.6



fig.7

(fig.6) Ambient air temperature for the control group was monitored and noted daily as well. As you can see from the chart there was a significant difference in growth rate when comparing the mini greenhouse versus the standard hoophouse (control) setting.

It was obvious to us that the addition of bottom heat as well as the use of heat lamps resulted in an earlier harvest. However we had insufficient heat transfer from the tubing, due to the linear flow. Heat transfer may have been improved had we used more flexible tubing with a non-linear fluid flow. The reality was that although we realized an earlier harvest on one lily variety, it was not consistent with all varieties of oriental lilies that we planted. (fig.7) We still had quite a few lilies harvested after Mother’s Day (chart).

All in all, with a little tweaking of lily variety and possibly a different heat source, we feel like we can still heat a small area within the hoophouse, thus saving energy costs and allowing plants with different temperature requirements to thrive in the same main structure. Next season we will be testing with LA hybrid lilies, which are much less sensitive to cool temperatures compared to oriental lilies. Maybe—just maybe—we can get a dependable harvest for Mom.

DATE	MINI GREENHOUSE HIGH/LOW TEMP	PLANT HEIGHT	CONTROL HIGH/LOW TEMP	PLANT HEIGHT	MORNING
2/1*	60/44	8"	60/44	8"	44
3/1*	90/48	20"	75/40	14"	50
3/2	60/60	20.75"	60/60	14.5"	60
3/3	60/50	21.25"	48/44	14.5"	22
3/4	60/40	22"	54/40	15"	23
3/5	50/40	23"	42/38	15.25"	34
3/6	74/58	23.5"	60/48	15.75"	45
3/7	60/40	23.75"	60/40	16"	38
3/8	68/48	25"	68/48	16.75"	48
3/9	62/52	25.5"	60/48	17.25"	50
3/10	68/54	26.5"	68/48	17.25"	48
3/11	75/46	27.5"	75/44	17.25"	40
3/13*	60/40	29"	50/34	17.5"	28
3/14	60/54	30"	48/44	17.5"	40
3/16*	60/58	31"	60/58	18"	58
3/18*	58/52	34"	52/48	18.75"	40
3/19	58/50	35"	52/50	19"	48
3/20	62/44	36"	60/40	19.75"	40
3/21	58/46	37"	52/48	19.75"	40
3/22	90/56	37.25"	90/50	20"	50
3/23	80/55	38.75"	80/55	20.25"	46
3/24	53/48	39"	48/38	20.5"	32
3/25	58/42	39"	50/46	20.5"	40
3/26	60/38	39.5"	45/38	21"	24
3/27	64/54	40"	60/54	21"	50
4/2*	62/58	42.5"	62/58	21"	60
4/5*	60/48	43.5"	60/48	21.5"	60
4/9*	60/48	44"	60/48	21.5"	55
4/16*	60/48	45"	60/38	22"	32
4/23*	80/60	46"	78/54	22.5"	46
4/30*	70/60	47.25"	68/50	22.75"	50
5/7	90/65	48"	90/60	23"	60

*-indicates day(s) skipped

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In Search of the Ultimate Mini-Sunflower

Paula Rice

BeeHaven Farm, Bonners Ferry, Idaho

The perfect mistake. That probably sums up a great many discoveries. And while I wouldn't want to portray the image of my flower farming practices as fly-by-the-seat-of-your-pants farming, I do keep a watchful eye out for perfect conditions that lead to great cut flowers solely by chance. Basically, it boils down to observation. When something shows up on the scene that either I did (by chance or by purpose), or Mother Nature did, I think to myself "Okay, you're really great." Why?

That is how the search for the perfect mini-sunflower came about. I was planting up the hoophouse several years ago and, in an effort to cram as much in there as I could (high-dollar real estate, right?), I planted 'Sonja' sunflower plugs about 6" apart every direction, and pinched them (soft pinch, they were pretty small) so they would branch. Later that summer I was picking tons of the cutest little sunflowers ever. In fact they were so abundant, cute, and small, I bunched 10 stems to group and sold them as straight bunches. I've grown them successfully for several years now in both the hoophouse and in the field. But it got me to thinking...I wonder if there are other branching varieties that would do the same thing and be an even more perfect mini-sunflower?

I wanted to stick with branching varieties because I was looking for:

- 1.) Uniformity among the sunflower heads (I don't want the nuisance of grading and sorting).
- 2.) Abundance per square foot.
- 3.) Strong, stiff stems.



Surprising Discovery #1. There was not much difference between head size from the 6" spacing to the 24" spacing. That is not what I read would happen. In my area, for the last two summers, we consistently had nighttime temperatures that dropped into the 50s. Perhaps this had some effect on head size. Personally, I thought this was great. Since I want as many heads per square foot and it didn't affect head size, I will go with the tighter spacing.

Varieties trialed:

- 'Giant Sungold' (110 days)
- 'Frilly' (65 days)
- 'Soraya' (85 days)
- 'Valentine' (70 days)
- 'Peach Passion' (55 days)
- 'Greenburst' (50 days)
- 'Lemon Aura' (60 days)
- 'Shock O' Lot'
- 'Sonja' (55 days)

All these were started as plugs so I could be more "scientific" about the spacing. I planned for two separate plantings in 4-foot beds. The first would be three rows per bed (18" between rows) and the second would be 4 rows per bed (12" between rows). All plantings were pinched to encourage branching and decent stem length.

Both plantings had four different spacings within these beds and included all the above varieties. Example: In Bed #1 (which had 3 rows) we would plant all of the 'Giant Sungold' but start with 6" spacing, then move to 12" spacing, then 18" spacing and finally with 24" spacing down the row. This was done so that, should the ultimate sunflower appear, we could know the "perfect" spacing.

We did the same with the second planting of plugs into the 4-foot bed with four rows spaced 12" apart. Because I am also going for productivity, I was curious to see how much difference that 4th row would make in quantity and head size.

The results were surprising. Not at all what I expected, because what I expected was exactly what I wanted, which is not what I got. But with the spacings I used, some interesting discoveries were made and we did still end up with a winner, so hang with me here a little while longer.



Surprising Discovery #2. Most varieties at this spacing produced small to medium heads, not minis. The entire crop looked exactly the same down the row. Head size and productivity did not change much from the 6” spacings to the 24” spacings for the 3-row beds as well as the 4-row bed. They could still be sold as 5-stem bunches or per stem.



Surprising Discovery #3. All branched nicely, with 5-6 stems per plant, again regardless of spacing. All except ‘Peach Passion’ had very acceptable and amazing stem length.

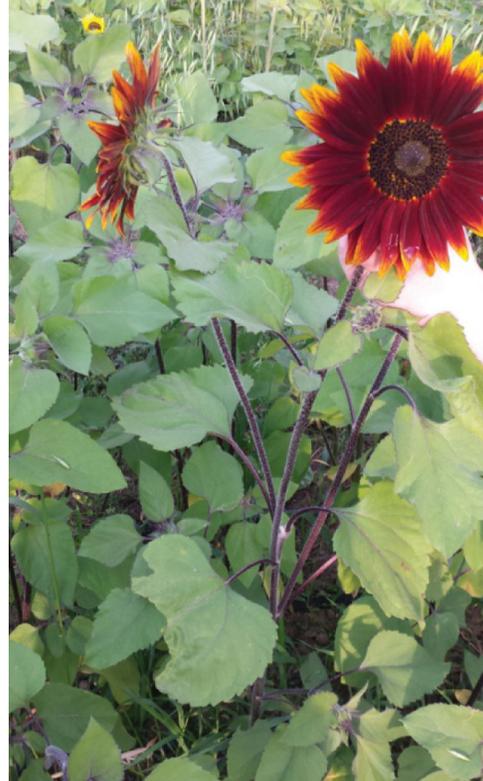
Variety Information

‘Valentine’ did not have a strong enough neck and of all the sunflowers, the flies were attracted to this light yellow and would mark up the petals so much that many were simply left in the field and not sold. Because of its weak head, I do not consider it a choice for the future.

‘Giant Sungold’. I was really looking forward to a stellar harvest of ‘Giant Sungold’ (110 days). There were tons of perfectly sized (not-mini) heads swaying in the breeze. It was going to be my main crop for September. But we had an incredibly hard frost (24°) the second week of September which brought my business to a crashing halt. There were a ton of these uniform sunflower heads just waiting to mature enough to take to market. I could tell the necks were going to be a touch on the weak side, but still within acceptable standards for me. Next year, I will grow a pinched crop and a non-pinched crop, as pinching definitely put this behind schedule. If I don’t get that hard frost, I’m in the game. If I do, that’s just how it goes sometimes.

‘Shock O’ Lot’ branched nicely, but the stems were not stiff and strong. But I will say this: I always sold out of it on the van for the florist route. Even though it would need to be wired for design work, they still wanted it. And compared to other red sunflowers, it wasn’t as bad for dropping its petals. I will grow this as my red until I get something better, and continue to pinch it to get nice uniform-sized heads and uniform stem length.

Lemon Aura’ was nice. It is a very different lemony/lime-green, teddy-bearish, type of sunflower that had nice stiff stems. It did have a higher percentage of deformity, but nothing too drastic. It didn’t get as tall as the others, nor as long as stems but still very acceptable for creating straight bunches. This one, I think, may have the potential to make it into a mini category with more intense spacing.



‘Shock O’ Lot’



‘Greenburst’



‘Peach Passion’

‘Peach Passion’ was not acceptable at any level in my opinion. It simply did not perform at all once it had been pinched. It did its thing way too soon before any stem length could develop, the flower matured quickly, and the centers turned a dingy, mustardy yellow which I did not like. Though it did bloom sooner than everything else, a lot went to waste in the field because of no stem length.

‘Greenburst’ from Harris Seed was awesome. It had long, strong stems and averaged 5-6 stems per plant. Though I liked everything about it culturally, my florists and I had a hard time with postharvest. I stopped picking and selling it, which broke my heart to see all that color in the field. It may just need special postharvest treatment.

Won’t Grow Again with This Technique

‘Peach Passion’, ‘Valentine’, and ‘Filly’. I really like ‘Filly’ and successfully grow it un-pinched. It does have somewhat of a weak neck which becomes more pronounced with this type of cultural manipulation. I suspect that is the same with ‘Valentine’. And though ‘Greenburst’ was really a great-looking sunflower and tolerated this type of pinching and intense spacing, I will look into my vase life problems before trying to grow him again.

Will Grow Again with This Technique

‘Giant Sungold’, ‘Shock O’Lot’, and ‘Lemon Aura’.

And the Winner Is...

That leaves us with two candidates for the Ultimate Mini-Sunflower, the only ones which actually produced a mini size: ‘Sonja’ and ‘Soraya’. Both are very sweet and could be manipulated with tight spacing to produce the most precious mini-sunflowers you have ever seen. While both have seriously outstanding upward facing blooms on strong, stiff stems (drum roll please), ‘Sonja’ is going to the top of the list because she is abundant, prolific, and easy to grow. ‘Soraya’ tends to come into harvest slowly and over a stretch of time, so there really isn’t a “critical mass”, at least nothing like ‘Sonja’. ‘Sonja’ also has a shorter crop time so you can get in several harvests. ‘Soraya’ takes 85 days and with my cool nighttime temps, I can only get in one, maybe two crops, though I will admit that the blossom of ‘Soraya’ is more double than ‘Sonja’ and therefore a better flower in my opinion. If you live more southern (I’m in North Idaho so you probably do) it may be you would choose ‘Soraya’ over ‘Sonja’, she may perform better for you. I say try both.

Summary

So why the trial? Why didn’t I just go/stay with ‘Sonja’ in the first place? Sonja isn’t perfect; there are a few things about her I was hoping to improve upon by using a pollenless variety. She has pollen, not much and certainly within acceptable ranges, but it would be nice if she didn’t. She matures very quickly, you must pick every day. I would sift through my buckets and cull any whose centers were fully developed. I liked a tight center and Sonja can go “furry” quickly. There is a fraction of blooms that are deformed or have oddly placed petals. I suspect this is due to the intense spacing and pinching. It isn’t bad, but I was hoping not to have to throw any down.

