

Date: December 29th, 2020

To: Edward Durner, Dept of Plant Biology, Rutgers University

From: Bill Price, Greenman Farm, [REDACTED] Easton, KS 66020

Subject: SARE Project LNE18-362 End of Year Report from Greenman Farm

Goldenberries (*Physalis peruviana*): A New Fruit for CSA Farms and Farmers Markets

Commodities

Fruits: berries (other)

Practices

Crop Production: crop improvement and selection, cropping systems, varieties and cultivars

Education and Training: demonstration, Sustainable Goldenberry Production Manual

Production Systems: Goldenberry management

Research at Greenman Farm

Solution and approach:

This portion of the project will try to demonstrate the viability of growing Goldenberry varieties in the high tunnel environment. The high tunnel provides additional growing times in the early spring and late fall shoulder seasons. With this extended growing season, can a substantial harvest be achieved?

Performance target:

Roughly 1/2 area of a 30'x72' (1,080 sqft) Gothic style high tunnel will be incorporated in this project. Using established growing spaces 54 individual Goldenberry plants will be grown in the allotted space.

The high tunnel estimated production: each plant averages 200 berries through the growing season.

The high tunnel estimated sales: 225 pints per week for 6 weeks at \$4 per pint on 0.025 acres creating a value of \$5,400 per year.

Photographs:

Photos from this project and a brief description are at the end of this report. Photo credits belong to Bill Price.

Plant layout diagram and sample of Excel spreadsheet used are at the end of this report.

Materials:

Seeds from 5 cultivars were used:

Genotype	Source	Pedigree History	Qty of seeds started
Giant Cape Gooseberry	Trade Winds Fruit	2019	12
Poha	Trade Winds Fruit	2019	6
Cape Gooseberry	Trade Winds Fruit	2019	12
Cape Gooseberry	Ed Durner	2019	18
	Rutgers University		
Schoenbrunn Gold	Ed Durner	2019	24
	Rutgers University		

Seed from Trade Winds Fruit purchased by Greenman Farm. Seed from Ed Durner was provided by SARE 18-362.

Methods:

A total of 72 seeds were started with an unknown germination rate. A total of 54 plants will be selected for transplant in the high tunnel. Seeds were all planted in a typical seed starting medium purchased from the local box store. Jiffy Seedling Trays, 6x12 cells, were used. The 5 cultivars were kept in separate groups and warm tap water soaked for 8-10 hours before being placed in the germination trays. Two seedling trays were used. One tray held the seeds from Trade Winds, another held the seeds from Ed Durner. Seed groupings in multiples of 6 were used. An Excel spreadsheet was used to record seed germination information. Each seed was given a number ID (Example: Trade Winds, Poha, 3-1 through 3-6). The seedling trays were identified to show what seed was in which cell. All seeds were placed into the soil medium on February 29th, 2020. No grow lighting was used during the germination period. First germination was expected in 8-10 days. No seed germination was noted until March 26th. After the 26th the seedlings were monitored and input recorded every 3 days for germination growth. On April 20th the seeds were transplanted into larger growing containers. A 45W LED Grow Light and a Seedling Heating Mat were used for each germination tray.

Germination success prior to transplanting:

Genotype	Source	Qty of seeds started	Seeds germinated
Giant Cape Gooseberry	Trade Winds Fruit	12	7
Poha	Trade Winds Fruit	6	0
Cape Gooseberry	Trade Winds Fruit	12	7
Cape Gooseberry	Ed Durner	18	9
Schoenbrunn Gold	Ed Durner	24	19

A few extra Ed Durner Cape Gooseberry and Schoenbrunn seeds were eventually started to help insure there would be enough plants to move to the high tunnel.

On April 20th seedlings were transplanted to an 8 ounce growing container.

Genotype	Source	Starts transplanted
Giant Cape Gooseberry	Trade Winds Fruit	7
Poha	Trade Winds Fruit	0
Cape Gooseberry	Trade Winds Fruit	7
Cape Gooseberry	Ed Durner	12
Schoenbrunn Gold	Ed Durner	27

Transplanted starts were monitored every day the first 3 days after transplanting and then every few days to ensure good growth. The 45W LED Grow Lights were still in use but not the Seedling Heating Mat.

On May 17th all plants were moved to a covered deck outside environment to begin hardening off the plants prior to being transplanted in the high tunnel. On May 20th, while away from the farm, a storm blew in and tumbled the rack holding all the plants in their identified containers. A couple transplants were lost and 12 lost their plant ID, now known as Mixed Lot. Transplants were monitored and cared for until time to be moved to the high tunnel. Survival rate was good. 51 Plants would be available for transplanting in the high tunnel.

Infrastructure:

The work done the previous year (2019) in the high tunnel demonstrated that better air circulation would be required to reduce temperatures seen in the high tunnel during the summer daylight hours. Even with the roll down side curtains, it was not uncommon to see temperatures between 95 and 110°F in various locations inside

the high tunnel. Affordable quotes for installing electrical to power the vents and fans were difficult to come by in our rural setting. In mid-April electrical work was started only to be abandoned by the electrician. A reasonable quote from another electrician was finally obtained and work on installing electrical in the high tunnel began in earnest on May 27th. The electrician was only available to work on the weekends. It would take the duration of 7 weeks to have all fans and louvers operating as required. Meanwhile all plants were being managed in a safe environment.

The Growing Season Begins:

In early July the high tunnel was moving air and keeping the temps at or below 90°F. Transplanting the Goldenberry starts in the high tunnel began.

Genotype	Source	Qty Planted	Date Planted
Schoenbrunn Gold	Ed Durner	20	July 9 th
Mixed Lot	ED + TW	12	July 10 th
Cape Gooseberry	Ed Durner	8	July 11 th
Giant Cape Gooseberry	Trade Winds Fruit	5	July 13 th
Cape Gooseberry	Trade Winds Fruit	6	July 13 th

All Ed Durner plants were set in the ground with 5' between rows and 4'3" spacing within the rows. The Mixed Lot and Trade Winds plants were set in the ground on a 4'x4' spacing scheme.

A double-row drip tape irrigation line was installed next to each row of plants. An irrigation timer was set to water the plants three times per day for 10 minutes each. With no rain in the high tunnel and the elevated temperatures, there was a concern of the ground and plants' drying out if not enough water was supplied. All plants seemed to successfully survive the transplant process, and good growth was seen on most plants after the move.

Meanwhile, research continued on the Goldenberry growth cycle while monitoring transplants' progress. Per literature review, string (for tying stalks up like tomatoes' are done) was ordered. Research on fruit set and harvest time commenced. It was discovered, through reviewing this literature that plants set in the ground in early July would not produce a harvest prior to the first date of frost damage. Therefore, stringing up the vines for plants that would not bear fruit seemed similarly "fruitless", thus that plan was dropped.

Plant growth was monitored and appeared to be doing quite well, though stem growth seemed long and lanky. Some flowers were seen in the early part of September. Berry pods were seen forming in mid-October with many plants still putting on flower. By November the cold temperatures had terminated all plant growth. Many berry pods were seen with all cultivars but none of the berries had turned yellow and all the husks around the berries were still green. The 2020 Goldenberry growing season ended without the harvest of a single mature berry.

Observation and Interpretations:

Seed germination of all varieties appeared to take longer than expected.

Seed germination rate by March 29th (30 days):

Genotype	Source	Germination Rate
Giant Cape Gooseberry	Trade Winds Fruit	67%
Poha	Trade Winds Fruit	0%
Cape Gooseberry	Trade Winds Fruit	83%
Cape Gooseberry	Ed Durner	33% (<i>additional started</i>)
Schoenbrunn Gold	Ed Durner	79% (<i>additional started</i>)

Giving each plant an ID Number was useful in maintaining historical growth rate records.

Once established, plant growth in the high tunnel was good for all varieties planted.

No significant pest problem was observed.

There was a massive amount of plant litter left over at the end of the growing season. As part of the nightshade family (Solanaceae) it is advised not to compost any of the Goldenberry plant material.

Study Limitations:

The first seedling transplant to a larger growing container could probably have happened 1 to 2 weeks earlier due to root growth seed at April 20th.

The 5'x4'3" spacing seemed too tight once the plants started putting on large volumes of plant growth.

A good trellis system may need to be in place in order to have the plants growing up vs. all over.

For Future Study:

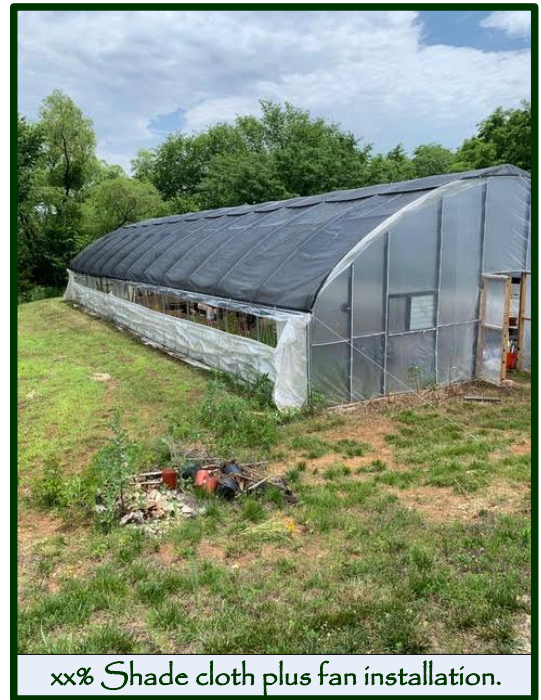
After completion of this project at Greenman Farm the following items bear additional study.

- A bi-weekly weed management regime to control weed growth.
- Trellis structures, like with tomatoes or other high tunnel crops, for better plant growth.
- Establish a time table of anticipated plant growth patterns for better plant management.
- For better plant growth pinching off some of the plant stems should support better plant growth.
- Secure a location to harden off transplants to minimize loss prior to transplanting in the high tunnel.
- Row-cover use after plants are transplanted into the high tunnel would prevent early spring frost damage.
- Investigate options for Goldenberry litter that does not include burning.

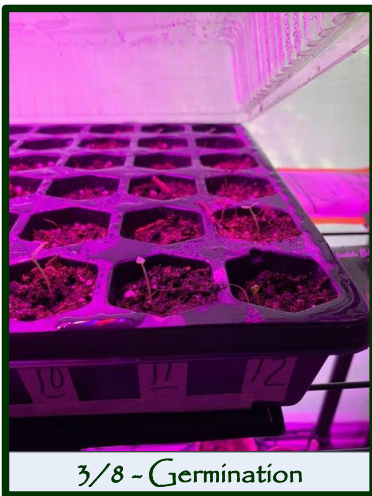


Zimmerman Gothic Style 30'x72' High Tunnel

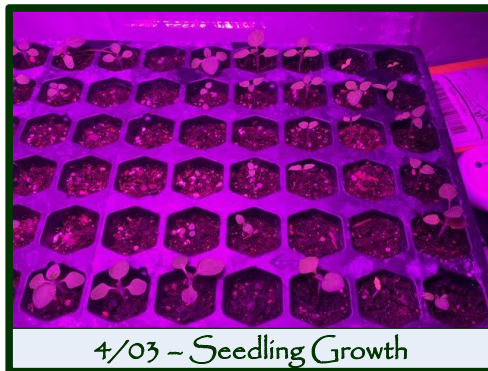
SARE Project 18-362 at Greenman Farm, Easton, KS 2020 Growing Season



xx% Shade cloth plus fan installation.



3/8 - Germination



4/03 - Seedling Growth



4/03 - Seedling Growth



4/20 - Seedling Growth



4/20 - Root Growth



4/20 - 1st Transplant



7/9 - Healthy start ready for transplanting

SARE Project 18-362 at Greenman Farm, Easton, KS 2020 Growing Season



Soil prep prior to planting



5/9 - Hardening outside



5/9 - Hardening outside



7/9 - Starts ready for high tunnel



5/20 - Wind toppled starts



7/7 - Ground cloth ready



7/9 #10-6 planted
Schoenbrunn Gold



10/31 - SARE Project Goldenberry Growth
Growth is thick. Height average 4', No trellis structure

SARE Project 18-362 at Greenman Farm, Easton, KS 2020 Growing Season



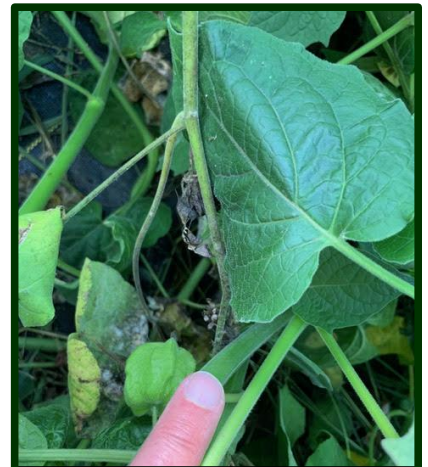
7/9 - Prior to planting
#1-4 Giant Cape Gooseberry



7/18 - 2 Weeks in the ground
#7-1 Schoenbrunn Gold



9/1 - Typical growth seen
throughout high tunnel



10/31 - Stem size
Vine growth is everywhere



10/31 - Typical husk size at this time



10/31 - Typical berry size at this time

SARE Project 18-362
at Greenman Farm, Easton, KS
2020 Growing Season



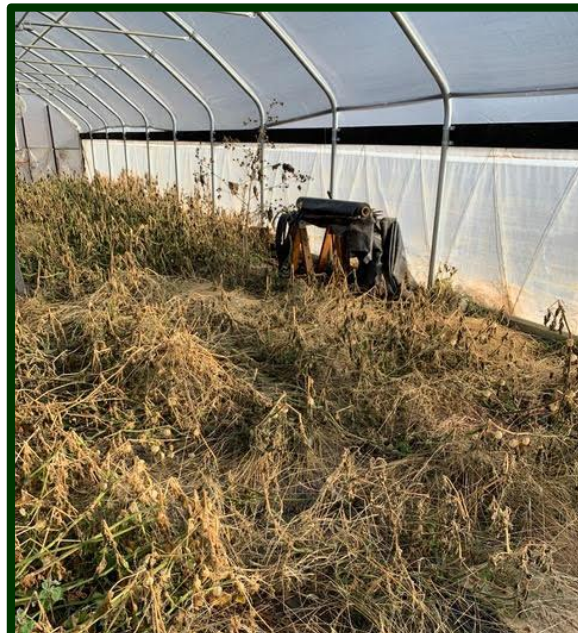
11/7 ~ After frost
Typical husk size



11/7 ~ After frost
Typical berry size



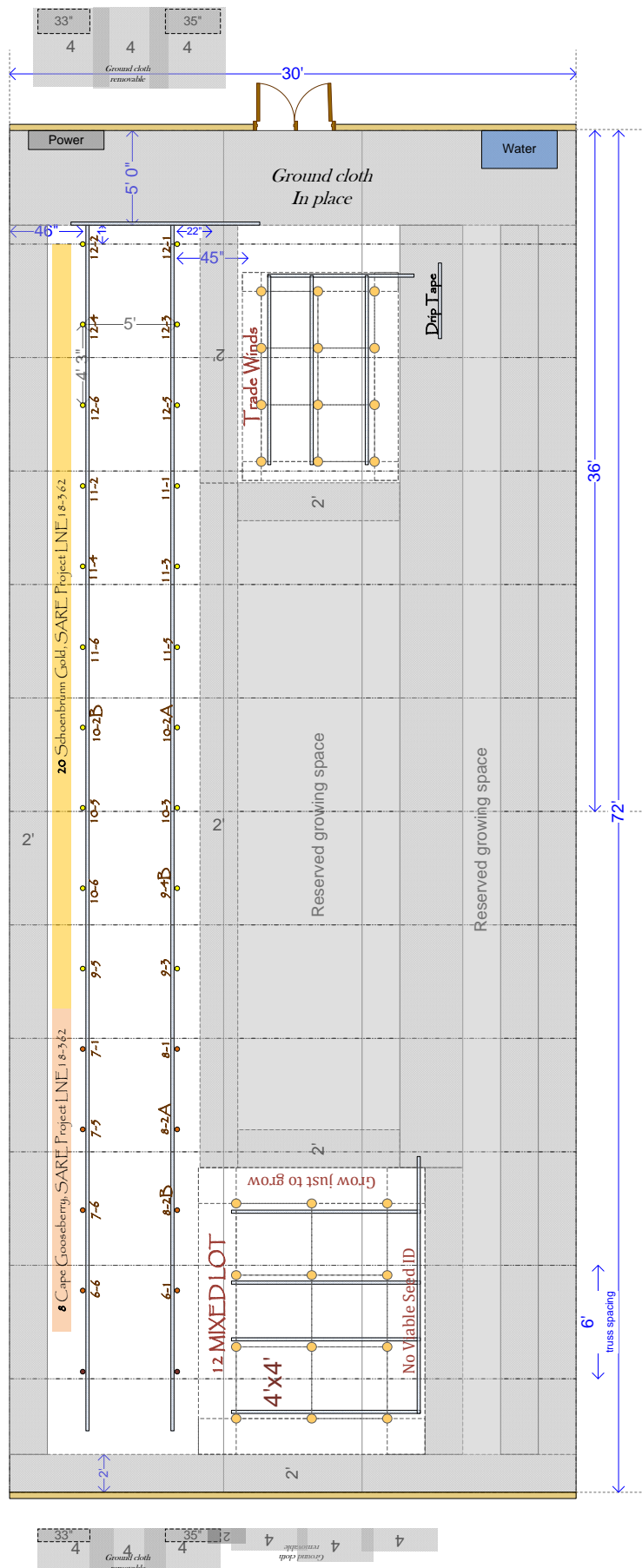
11/19 ~ After frost clean up
Trade winds Goldenberry
Lots of potential berry production



11/19 ~ After frost clean up
SARE Project Goldenberry
Lots of potential berry production

Greenman Farm
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 Owner: Bill Price
 Designer: Bill Price

SARE Project 18-362



Goldenberry Seed Germination Chart

Date viewed ►			3/26	3/29	4/1	4/5	4/8	4/11	4/13	4/15	4/20	Date viewed ►			3/26	3/29	4/1	4/5	4/8	4/11	4/13	4/15	4/20	
Giant Cape Gooseberry TW 1	1	2/29-3/7, germination period	0	0	0	0	0	0	0	0	0	Cape Gooseberry ED 6	1	2/29-3/7, germination period	1	1	1	1	1	1	1	1	1	
	2		0	0	0	0	0	0	0	0	0		2		0	0	0	0	1	1	X	X	X	
	3		0	0	0	1	0	0	0	0	0		3		0	0	0	0	0	0	X	X	X	
	4		1	1	1	1	1	1	1	1	1		4		0	0	0	0	0	0	0	0	0	
	5		1	1	1	1	1	1	1	1	1		5		0	0	0	0	1	1	1	1	1	
	6		1	1	1	1	1	1	1	1	1		6		0	1	1	1	1	1	1	1	1	1
Giant Cape Gooseberry TW 2	1	2/29-3/7, germination period	1	1	1	1	1	1	1	1	2	Cape Gooseberry ED 7	1	2/29-3/7, germination period	1	1	1	1	1	1	1	1	1	
	2		1	1	1	1	1	1	1	1	1		2		0	0	1	1	1	1	X	X	X	
	3		0	1	1	1	1	1	1	0	0		0		3	0	0	0	0	0	0	0	0	0
	4		1	1	1	1	1	1	1	1	1		4		0	0	0	0	0	0	0	0	0	0
	5		0	1	1	1	1	1	1	1	1		X		5	0	0	0	0	0	1	1	1	1
	6		0	0	0	0	0	0	0	0	0		0		6	0	0	1	1	1	1	1	1	1
plant/need 12 4			6	8	8	9	8	8	5	6	7	plant/need 18 12			4	6	10	10	12	13	7	9	9	
Germination Rate %			50	67	67	75	67	67	42	50	58	Germination Rate %			22	33	56	56	67	72	39	50	50	
yield from target %			150	200	200	225	200	200	125	150	175	yield from target %			33	50	83	83	100	108	58	75	75	
Poha TW 3	1	2/29-3/7, germination period	0	0	0	0	0	0	0	0	0	Cape Gooseberry ED 8	1	2/29-3/7, germination period	1	1	1	1	1	1	1	1	1	
	2		0	0	0	0	0	0	0	0	0		2		0	0	1	1	1	1	1	X	X	
	3		0	0	0	0	0	0	0	0	0		3		0	0	0	0	0	0	0	0	0	0
	4		0	0	0	0	0	0	0	0	0		4		0	0	0	0	0	0	0	0	0	0
	5		0	0	0	0	0	0	0	0	0		5		0	1	1	1	1	1	1	1	1	1
	6		0	0	0	0	0	0	0	0	0		0		6	1	1	1	1	1	1	1	1	1
plant/need 6 4			0	0	0	0	0	0	0	0	0	plant/need 18 12			4	6	10	10	12	13	7	9	9	
Germination Rate %			0	0	0	0	0	0	0	0	0	Germination Rate %			22	33	56	56	67	72	39	50	50	
yield from target %			0	0	0	0	0	0	0	0	0	yield from target %			33	50	83	83	100	108	58	75	75	
Cape Gooseberry TW 4	1	2/29-3/7, germination period	1	1	1	1	1	1	1	1	1	Schoenbrunn Gold ED 9	1	2/29-3/7, germination period	0	0	0	0	0	0	0	0	0	
	2			1	1	1	1	1	1	1	1		2		0	1	1	1	1	1	1	1	1	
	3			1	1	1	1	1	1	1	1		3		0	1	1	1	1	1	1	1	1	
	4			1	1	1	0	1	X	X	X		4		0	0	0	0	0	0	0	1	1	
	5		1	1	1	1	1	1	1	1	1		5		0	1	1	1	1	1	1	1	1	1
	6		1	1	1	1	1	1	1	1	1		6		1	1	1	1	1	1	1	1	1	1
Cape Gooseberry TW 5	1	2/29-3/7, germination period	1	1	1	1	1	1	1	1	1	Schoenbrunn Gold ED 10	1	2/29-3/7, germination period	1	1	1	1	1	1	1	1	1	
	2			1	1	1	X	X	X	X	X		2		0	1	1	1	1	1	1	1	1	
	3					1	1	1	X	X	X		3		0	1	1	1	1	1	1	1	1	1
	4					1	1	1	X	X	X		4		0	1	1	1	1	1	1	1	1	1
	5					1	1	1	X	X	X		5		1	1	1	1	1	1	1	1	1	1
	6		1	1	1	1	1	1	1	1	1		6		1	1	1	1	1	1	1	1	1	1
plant/need 12 4			5	10	10	12	10	11	4	7	7	plant/need 24 20			8	19	20	20	20	20	16	19	19	
Germination Rate %			42	83	83	100	83	92	33	58	58	Germination Rate %			33	79	83	83	83	83	67	79	79	
yield from target %			125	250	250	300	250	275	100	175	175	yield from target %			40	95	100	100	100	100	80	95	95	
transplant after 4/18												Schoenbrunn Gold ED 12												
bigger seedling tray												1												
then go to Seedling Transplant chart												2												
4/11, water, check left lid off												3												
4/12, no ater lid was left off												4												
4/13, found lid off, water, count												5												
some donot look so good, lid on												6												
4/15, 6 Cape Goldenberry ED and 10 Schoenbrunn seeds set in water to soak												plant/need 24 20												
will soak for 8 hours then will be planted in appropriate cells as replacements.												Germination Rate %												
												yield from target %												

transplant after 4/18

bigger seedling tray

then go to Seedling Transplant chart

4/11, water, check left lid off

4/12, no ater lid was left off

4/13, found lid off, water, count

some donot look so good, lid on

4/15, 6 Cape Goldenberry ED and 10 Schoenbrunn seeds set in water to soak

will soak for 8 hours then will be planted in appropriate cells as replacements.

soaking in wamed tap water for 10 hours. Plant at 10:00 PM the evening of 4/15

4/19, remove plastic dome, water, no count, all look OK

4/20, no water, count, all look OK, transplant all "1s", go to Seedling transplant chart now

1 soaked seed per cell

2 soaked seed per cell