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The last decade has seen many beginning farmers operating diversified vegetable operations. A common reference point for many of these growers is Eliot Coleman's "The New Organic Grower." The book details many aspects of producing vegetables on a small-scale, diversified farm. Many practices are recommended, some of which have scientific research behind them, while others rely on anecdotal evidence.

One practice the book discusses is soil blocking, which is a method of starting transplants in molded blocks of soil as opposed to plastic pots. Coleman suggests the practice reduces root circling, leading to increased yield, earlier harvest, and more resilient plants. The practice also cuts back on the amount of plastic being used on the farm. One concern we had about this practice was the amount of time involved in creating soil blocks, as labor is harder for all types of vegetable farms to find, and increases in minimum wage make farm budgets even tougher to balance.

Our goal in this trial was to see if starting plants in soil blocks increased yield or decreased the time to harvest, and if so, if it was by enough to offset extra money spent producing the blocks. To test this, six commercially available indeterminate tomato varieties were started either in a traditional pot or in a soil block. These transplants were then either planted in a hoophouse or in the field, and yield was tracked through the growing season. In our trial, the methodology used to start the transplant had little effect, with variety being the most important factor in yield.

Materials and Methods

General Information

The trial was conducted at Tollgate Farm and Education Center in Novi, Michigan (suburban Detroit). Soil on the site is a Marlette series sandy loam with approximately 3% soil organic matter.

Varieties

Caimen, Damsel, Frederik, Green Zebra, Moskvich, and Valencia certified organic seeds were purchased from Johnny's Seeds and High Mowing Seeds (Table 2). These varieties represent a mix of heirloom and hybrid indeterminate types that are commonly direct marketed at small farm

venues such as restaurants, CSAs and farmers markets and can be grown successfully in both hoophouses and field conditions in a SE Michigan climate.

Germinating

Seeds were germinated in 20 row flats on a heat mat at 85 degrees. Seeds were germinated in and potted into Seed Starter 101 mix made by Morgan Composting.

Blocking and Potting

At the first true leaf stage, seedlings were moved into either a pot or a soil block. Pots were 2 ¾" L x 2 ¾" W x 2" H (11.88 inches^3). Soil blocks were created using the stand up 6 cell blocker from Johnny's Seeds, which created blocks 2 3/8" L x 3" W x 2" H in dimension (14.26 inches^3). The blocks have a larger volume but because wet soil is pressed into the blocks, the weight of dry soil in each treatment was comparable (41g in block, 35g pot).

Plant height was measured four weeks after moving tomato plants into their treatments. At the time of transplanting, plants were observed for signs of excessive root circling.

Hoophouse Tomatoes

Seedlings for hoophouse production were started on March 12th, moved into blocks or pots on March 26th, and planted into the hoophouse on May 2nd. An overwintered cover crop of hairy vetch and winter rye was incorporated a week prior to planting. On planting, steamed bonemeal (2-13-0) was added at a rate of 345 lbs/acre, shredded alfalfa (2.8-0.3-2.4) at 2,300 lbs/acre and compost at 50 yards/acre following soil test data. Two beds of tomatoes were planted into black landscape fabric at 18 inch in-row spacing with one row per bed and beds on 42 inch centers. One line of drip tape per bed was used with water coming from a well-fed reservoir.

The hoophouse is an original, caterpillar tunnel-style design, 14 feet wide and 8.5 ft tall at the peak. Plants were trellised from the hoop bows with the lower and lean system and one leader per plant. Some leaf curl occurred due to hot conditions but did not appear to impact production significantly.

Field Tomatoes

Plants for field production were germinated on April 18th, moved into their treatment on April 27th, and planted into the field on May 31st. An overwintered cover crop of hairy vetch and winter rye was incorporated a week prior to planting. On planting, steamed bonemeal (2-13-0) was added at a rate of 350 lbs/acre, shredded alfalfa at 2,300 lbs/acre (2.8-0.3-2.4) and compost at 50 yards/acre following soil test data. Two beds of tomatoes were planted into black plastic at 18 inch in row spacing with one row per bed, with beds on 42 inch centers. One line of drip tape per bed was used with water coming from a well fed reservoir.

Field tomatoes were trellised using the stake and wire method, with one leader per plant. Field plants were sprayed bi-weekly with *Bacillus subtilis* (brand Serenade) following the onset of cool, wet conditions in August to control for septoria leaf spot and early blight.

Harvest and Data Collection

Study units were groups of three plants that were kept together throughout the study. Harvest was prompted by blushing across the entire fruit. Marketable yield is reported in this study. The yield of tomatoes with deep cracks was also measured because these fruit can be sold in some small farm venues as seconds. Harvested fruit was weighed with a CAS SW-1 digital scale.

Statistics

The data set was analyzed using linear models (R Version 3.0.3, R Development Core Team, 2013), and LSD tests were used to determine differences between treatments. Models included variety, treatment, and block as fixed factors.

Results and Discussion

While differences were present among varieties, there were no differences between the hoophouse or field setting for per-plant yield of tomatoes started in traditional pots and tomatoes started in soil blocks (α=0.05). In field tomatoes, the total average yield of all tomatoes started in blocks was less than the total yield of all tomatoes started in pots (19.41 lbs vs 22.07 lbs), though this didn't hold when broken down to a per-plant yield. This is likely due to four plants from soil blocks not surviving, reducing the overall yield, but the loss of these plants is reflected in the per plant analyses, which is the focus of the remainder of the section.

The amount of time it took to prepare pots and blocks was similar, though preparing soil blocks has more nuance and is more physically demanding. It can take trial and error to find a soil mixture that will hold its shape when blocked, and adding the right amount of water to get the soil mixture malleable but not overly wet can add time to the blocking process.

There was a difference in plant height at the time of transplanting. Tomatoes grown in soil blocks were taller than those grown in pots (39.7 inches vs 27.8 inches, LSD.05=1.97). No significant root circling was noted in either treatment.

Soil Blocks and Hoophouse Tomatoes

In the hoophouse, the per plant yield of tomatoes started in soil blocks versus pots was similar. There was also no significant difference in the yield of cracked tomatoes produced. The main differences present were between varieties. The number of days it took to reach the first harvest was comparable between the two treatments (Table 1).

Soil Blocks and Field Tomatoes

In the field, the per plant yield of tomatoes started in soil blocks versus pots was not significantly different. There was no difference in the yield of cracked tomatoes between treatments. The number of days to the first harvest was also similar between the treatments (Table 1).

Overall Varietal Differences

The main differences present in our trial were between our six varieties. In the hoophouse, Frederick and Caiman yielded significantly higher than the other four varieties on a per plant basis. Damsel produced significantly more cracked fruit than the other cultivars. Green Zebra took significantly longer to be harvested than the other varieties (Table 2).

In the field, Frederik and Caiman again yielded significantly higher on a per plant basis than the other varieties in the trial. Damsel produced more cracked fruit than the other varieties. Time to harvest was comparable among all varieties in the field (Table 2).

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Table 1. Average marketable and cracked fruit yield (in lbs per plant across season) and average days to first harvest across six tomato varieties started in either soil blocks or plastic pots in Novi, MI. Bolded values indicate that the variety was statistically similar to the variety with the highest value for the measure (LSD, alpha=0.05).

	Hoop			**Field**		
Treatment	**Marketable Yield** *lbs/plant*	**Cracked Fruit Yield** *lbs/plant*	**Days to Harvest**	**Marketable Yield** *lbs/plant*	**Cracked Fruit Yield** *lbs/plant*	**Days to Harvest**
Block	8.09	0.30	111.1	6.84	0.17	98.9
Pot	7.82	0.30	112.8	7.36	0.11	99.9
Grand Total	7.96	0.30	111.9	7.10	0.14	99.4
LSD 0.05	NS	NS	NS	NS	NS	NS

Table 2. Average marketable and cracked fruit yield (in lbs. per plant across the season) and average days to first harvest of 6 tomato varieties started from both soil blocks and pots in either hoophouse or field conditions in Novi, MI. Bolded values indicate that the variety was statistically similar to the variety with the highest value for the measure (LSD, alpha=0.05).

Variety	Seed Source [1]	Type [2]	Hoop			Field		
			Marketable Yield *lbs/plant*	**Cracked Fruit Yield** *lbs/plant*	**Days to Harvest**	**Marketable Yield** *lbs/plant*	**Cracked Fruit Yield** *lbs/plant*	**Days to Harvest**
Caiman	HMS	F1	**10.46**	0.06	112.5	**8.99**	0.16	98.6
Damsel	HMS	F1	7.47	**0.80**	106.8	7.17	**0.49**	98.3
Fredrik	JS	F1	**11.27**	0.16	113.6	**9.69**	0.00	102.0
Green Zebra	HMS	H	7.10	0.12	**122.9**	6.48	0.07	101.3
Moskvich	JS	H	5.63	0.40	106.0	4.66	0.03	96.6
Valencia	JS	H	5.81	0.27	109.9	5.60	0.10	99.6
Grand Total	--	--	7.96	0.30	111.9	7.10	0.14	99.4
LSD 0.05	--	--	2.39	2.02	7.9	1.30	0.19	NS

[1] HMS=High Mowing Organic Seeds ; JS=Johnny's Selected Seeds
[2] F1=Hybrid; H=Heirloom