

Research Report: Effects of early season heating, low tunnels, and harvest time on ginger yields in NH, 2017

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Introduction. Ginger (*Zingiber officinale*) is a tropical herbaceous perennial. U.S. consumers are likely most familiar with the golden cured rhizomes of mature ginger plants, but recently, growers in the northeastern U.S. have been successfully producing “baby ginger”, or rhizomes from young ginger plants grown for just a single growing season. Unlike mature ginger, the baby ginger is pink, tender, non-fibrous, and perishable. It can be used for cooking and can be candied or pickled, and keeps well in the freezer for culinary use.

In New England, ginger seed rhizomes are typically purchased from Hawaii, and they arrive in late February or early March. Rhizomes are sprouted in trays held in temperatures ranging from 75-85F (using a heat mat, germination chamber, or other approach), and are then transplanted into high tunnel soils once the soil temperatures are consistently above 65F. Rhizomes are dug for market in fall, typically starting in late September, but prior to frost.

Our objectives were to answer the following questions:

- 1) Does early-season heating dramatically increase end-of-season yields?
- 2) Could ginger be grown in a low tunnel rather than a high tunnel to decrease costs?
- 3) Are yields and/or quality of ginger reduced by harvesting early, rather than late in the fall?

What we did.

Twenty pounds of seed ginger cv. Bubba Blue was purchased from Hawaii Clean Seed LLC (Pahoa HI). Rhizomes arrived in late February, and on 28 Feb, pre-cut rhizomes were laid out in flats filled half-way with Pro-Mix BX, lightly covered with Pro-Mix, and moistened. Eight of the flats were placed on heating mats set to maintain soil temperatures of 80F. The other eight flats were placed on benches without heating mats, and the greenhouse was set to maintain 60F minimum temperature. On 22 May, the flats on heat mats had sprouted, but those off the heat mats had not. For the last three weeks prior to transplanting out, the sprouted flats were removed from the heat mats, and previously-unheated flats were placed on the heat mats to encourage sprouting.

On 14 June, ginger was transplanted into two growing sites: 1) an unheated high tunnel, and 2) low tunnels (Tunnel Flex system from Dubois Agrinovation, Quebec, CA), covered with 2 mil plastic that was perforated on the sides. Throughout the summer, the sides of the low tunnels were raised all the time except during (infrequent) storms. Roll-up sides were also raised all the time for the high tunnel, which was also equipped with automatic fans set to ventilate when the air temperature inside the tunnel exceeded 80F. The ginger in both sites was hilled on 27 July 2018.

Crop fertility in the low tunnel and high tunnels differed, to accommodate other experiments. **In the high tunnel:** 50 lbs/A of N and 145 lbs/A of K₂O were provided pre-plant, using soybean meal (7-1-2)

and sulphomag (0-0-22). **In the low tunnel:** 60 lbs/A of N and 60 lbs/A of K₂O were provided pre-plant, using 27-0-0 and 0-0-50. Beginning June 1, plots were fertigated with 5 lbs/A of N and K₂O using 21-5-20. Thus, the total amount of nutrients applied was 125 lbs/A of both N and K₂O for the ginger harvested on 1 Sept.

Experimental Layout:

2 low tunnels; each with eight plots (4 with early heat (gray hatched), 4 without (clear)). Each plot (6 plants) was harvested at a single date: A (1 Sept), B (15 Sept), C (4 Oct) and D (1 Nov).

	A	D	B	C	C	A	B	D	
	C	B	A	D	B	D	A	C	

2 rows within a single high tunnel; each with eight plots (4 with early heat, 4 without). Each plot (6 plants) was harvested at one of four dates: A, B, C, and D.

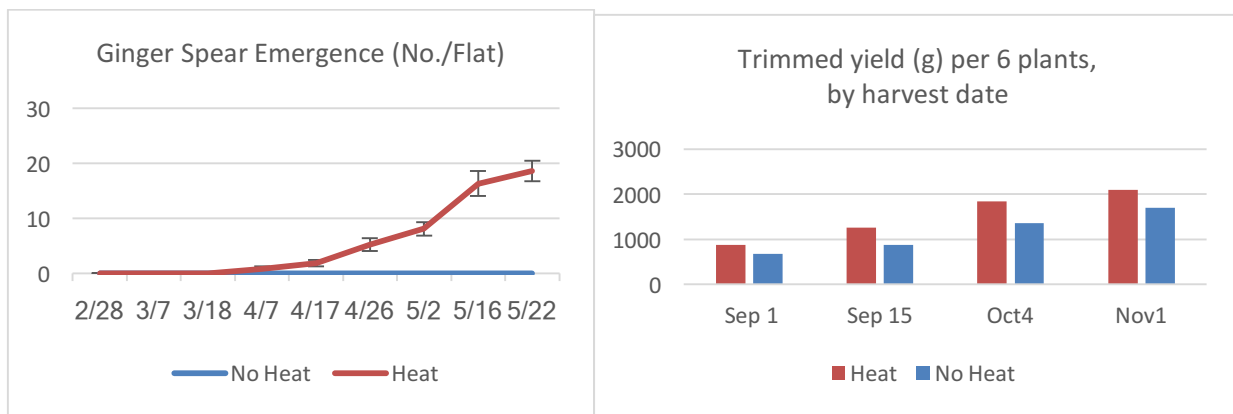
	D	C	B	A	A	C	D	B	
	B	A	C	D	C	B	D	A	

Data collected.

Throughout the spring, we monitored sprout emergence in all trays. We also measured soil and air temperature (at crop height) outdoors as well as in low and high tunnels. Subplots of ginger were harvested at four different dates: 1 Sept, 15 Sept, 4 Oct, and 1 Nov.

What we learned.

Heat mats promoted early season growth. We observed much faster sprouting in flats that were on heat mats than in flats that were not kept on heat mats. Flats had 14-18 rhizomes per flat, and all rhizomes had produced at least one sprout in the heated flats. In fact, by 21 May, no sprouts were visible in flats that had not been on heat mats. During transplanting, however, we observed that all rhizomes, even those without shoot sprouts, had extensive root growth.



Early heat mat use = earlier sprouting

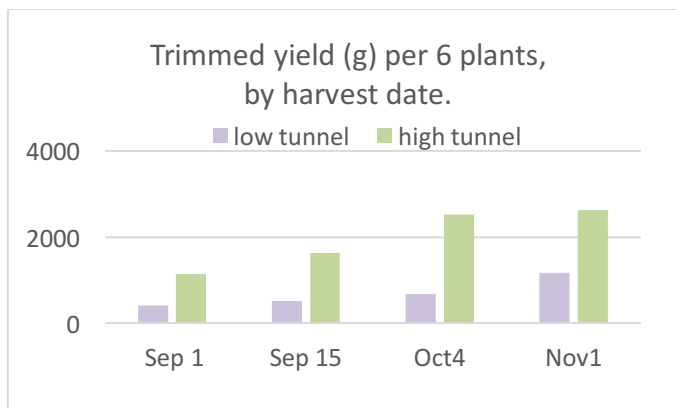
Early heat mat use = slightly higher yields.

Early season heating also resulted in higher yields. At each harvest date, the plots with plants exposed to early season heating produced higher (but not statistically significant) yields. With all dates combined, yields **were** significantly higher for the heated treatments (p<0.01).

Harvesting early reduced yields. Overall, lower yields were obtained in earlier harvests; yields doubled between 1 Sept and 1 Nov. For ginger grown in high tunnels, with early-season heat, 1 Sept harvests produced 221 g (7.8 oz) per plant, vs. 466 g (16.4 oz) per plant. Rhizomes harvested later were also larger and more attractive than those harvested earlier.

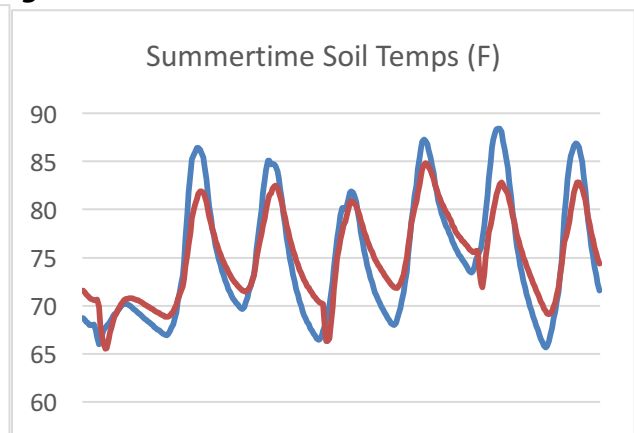
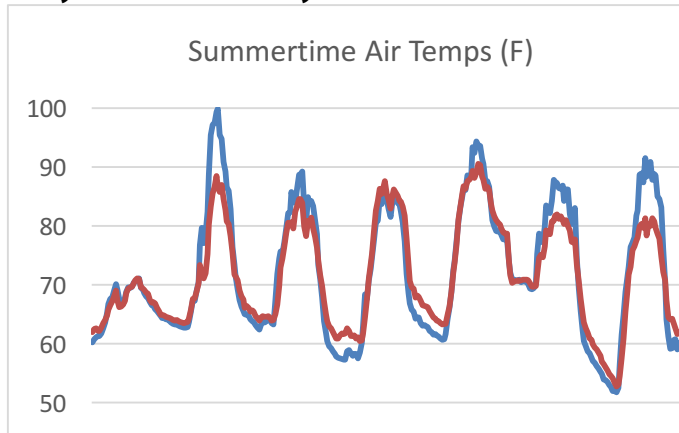
Low tunnel vs. high tunnel. During the growing season, ginger plants appeared much more vigorous and healthy in the high tunnel than in the low tunnels. This translated into significant yield differences, with ginger grown in the high tunnel yielding **over twice as much** as ginger grown in the low tunnel. The low tunnels also consistently experienced more temperature extremes than the high tunnel, with higher air and soil temperatures in the daytime, and cooler temperatures some nights.

Important disclaimer: Our experimental design doesn't allow us to directly compare high tunnel vs. low tunnel conditions, because we only used one high tunnel. Also, the high tunnel and low tunnel treatments were different in several ways. In particular, the low tunnels received much more fertility (a total of 125 lbs/A of N and K₂O) compared to those in the high tunnels (50 lbs/A of N; 145 lbs/A of K₂O). The poor growth of ginger we observed in low tunnels may have been due to differences in temperature/environment, excess nitrogen fertility, or other reasons. Additional experiments would be necessary to definitively compare high vs. low tunnels.



Early harvest = lower yields.

Ginger in low tunnel, with sides raised.



Temperatures over a period of 7 days in late August, 2017. Blue = low tunnel, Red = high tunnel.



Seed ginger laid out for sprouting, 28 Feb (L), sprouting with and without heat mats, 21 May (R).



Unsprouted, but well-rooted rhizomes (L), and transplanting into the tunnel (R), 14 June.



Digging ginger in the high tunnel (L), freshly harvested and cleaned ginger (R).

Take-home messages & future directions.

In this one-year study, we found that early-season heating did speed up ginger growth early in the season, and this did translate into higher yields at the end of the season. However, it is important to weigh this against the cost of heating; in our system, we ran a heat mat for nearly 12 weeks. We found that the first sprouts did not emerge until nearly 6 weeks after planting, even on the heat mat. Thus, the same results could likely be obtained by sprouting the ginger in a warm, insulated location without need for light for several weeks.

We did not observe good growth of ginger in low tunnels, in our one-year experiment. It is entirely possible that low tunnels might be suitable for ginger production if other variables were modified (e.g. different coverings used, different fertility regimes, etc.). Based on our preliminary results, however, the high tunnel environment produced the best yields of high-quality ginger.

Lastly, we clearly showed that early harvest results in yield penalties. While it was possible to harvest nice ginger around Sept. 1, yields were doubled by waiting an additional 2 months. The take-home message here is to harvest late in order to maximize yields, and only harvest what is needed for earlier markets. It may also be worth considering charging a premium price for “early” baby ginger, as it will result in less yield overall.

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Sources. Other information about growing this crop can be found in these publications:

Shyka, P. [Growing Ginger in Maine](#). Maine Organic Farmer & Gardener, Winter 2011-12.

Decker, S. [Growing Ginger in the Northeast](#). New England Vegetable & Fruit Conference, December 2015.