High-Density; Container-Grown Raspberry Production

FNE02-418

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Project Summary: The aim of this project was to conduct a trial of container grown raspberries using long cane nursery stock of the 'Tulameen' variety. The goals of this trial were several-fold:

- **To work out a method of growing 'long-cane' plants in pots.** Long-cane plants are not the industry standard planting stock used for establishing new raspberry plantings, but they provide an advantage in that they will produce fruit the first year they are grown. There are specialized handling requirements for using this type of plant but, if overcome, they may provide significant advantages.
- **To learn more about fruit quality and marketability of unique/specialty bramble varieties.** 'Tulameen" raspberry is not a variety that is considered suitable for the Northeast because of it's lack of winter hardiness, but is otherwise a very high quality variety with strong market appeal. Grown in this system, their lack of winter hardiness is not a limitation. Other varieties that might do well in this system would include Marionberries, Boysenberries, and other tender blackberries like 'Kiowa' and 'Lock Ness'.
- **To learn more about whether this system might be transferable to non-traditional production sites.** The containerized production system could allow production on non-traditional sites because inherent soil suitability is not necessary; the growing medium is provided in the pots. Thus the main site requirement is access to good quality irrigation water and a reasonably flat land area to place the pots. Also, access to a cold storage facility for winter storage of mature plants and for the acclimation process of the dormant long-canes nursery stock is also needed.
- **To investigate the decreased need for herbicide applications in this system.** This system should need few or no applications of herbicides to control weeds, something that is important in field production. Eliminating existing weeds prior to setting out plants and mulching the soil surface between the rows of pots should be adequate for controlling weed growth.

Farm Background: Hamilton Orchards is, in many ways, a typical New England farm tucked into the hills of west-central Massachusetts near the Quabbin Reservoir. This 100 acre family farm (35 in production) produces a range of crops (apples, pears, plums, strawberries, summer and fall raspberries, blueberries) and products (fresh fruit, preserves, baked goods, etc.) for sale in a variety of ways (i.e., wholesale, farm-stand, farmers market, pick-your-own). This diversified and integrated approach is what helps make the farm viable.

Raspberries have been a part of the crop mix since about 1928 when 'Taylor' raspberries were first established there. Now, there is a mixture of summer and fall raspberries, black raspberries and blackberries on a total of approximately 9 acres plus a 2,500 sq. ft. greenhouse for winter raspberry production. The addition of the 'Tulameen' container production system has expanded the market access to high-end buyers (e.g., restaurants) who will pay a higher price for high quality fruit, even when local raspberries are readily available.

Project Methods: The best way to narrate the steps that were taken is to present them in a list form so that the reader can follow more easily the progression of this project. Things were learned and adjustments made along the way.

GETTING STARTED

- **Summer 2001**: Growing area sprayed with Roundup® and covered with 2-3" of wood chips to prevent weed growth. Drip irrigation station set up. Plants for greenhouse production grown out and surplus plants stored in cold room for the remainder of the winter.
- **Winter 2001/02**: Plants were ordered from Sakuma Bros. Farms, Inc. in Burlington, Washington. This nursery is among the few producers of long-cane raspberry plants (which are grown primarily for glass house production in Belgium and the UK).
- **March 8, 2002**: The plants arrived and were potted up into 3 gallon pots using #52 Faffard potting mix (60% bark, 24% peat, 8% perlite, 8% vermiculite).
  - The pots were placed in an empty apple storage room with the temperature at 35˚F. From this point on the temperature in the storage was raised by 5˚F per week for the next 4 weeks. Pots can be stacked in a pyramid fashion up to 3 levels to save floor space.
- **March 31, 2002:** The temperature was at 55˚F. However, it seemed clear that this was too early to put the plants outside, so …
- **April 2, 2002:** The temperature was reduced again to 35˚F.
  - Root growth was good in the pots at this time and the plants were held at 35˚F for about 2 1/2 weeks.
- **April 21, 2002**: The temperature was raised up to 55˚F again in preparation of moving some of the plants outside.
  - However, this proved to be another false start because weather forecasts were for very cold weather and it didn't seem wise to put these plants out yet.
- **April 22, 2002**: Down went the temperatures again to 35˚F in the storage.
  - The plants appeared to be handling the temperature swings fairly well; better than if they had been put outside to freeze.
- **May 8, 2002**: After the stutter-start, the first batch of 100 plants was put outside! This group was labeled Group A.

THE GROWING SEASON

- ☑ When pots were moved outside, three 5'bamboo stakes were stuck in each pot to form a tripod to which the canes were tied for support. Once the plants were outside, they were **fertilized with soluble 20-20-20** (with minors) through the drip irrigation at a rate of 100 ppm Nitrogen daily for the rest of the growing season. Rows of pots were supported with a simple trellis using 5' iron garden stakes driven into the ground every 20' on either side of the row and 2 lines of non-degradable twine (one at 3', one at 4.5') strung between them to support the row from tipping over.
- ☑ **May 19 and 20, 2002**: Morning temperatures were 30˚F and 28˚F respectively. Overhead irrigation sprinklers were run from 2 AM to 5 AM for frost protection each morning.
- ☑ **May 26, 2002**: Second group of pots were moved outside. This was the largest group at 500 pots. This group was labeled Group B.

- ☑ **May 27, 2002:** A group of 2-3 year old potted 'Tulameen' that had been grown in the field the previous year were placed outside. These were in 5 gallon pots. This group was labeled Group D.
- ☑ **June 3, 2002**: Spread more wood chips in container area.
- ☑ **June 10, 2002**: Final 100 pots of long-cane 'Tulameen' pots brought out of storage. Some etiolated growth on these from their long stay in the storage, but were ok. This group was labeled Group C.
- ☑ **June 20, 2002**: All received Rovral 50WP fungicide application at labeled rate for control of Botrytis gray mold.
- ☑ **July 2, 2002**: All received Rovral 50WP fungicide application at labeled rate for control of Botrytis gray mold.
- ☑ **July 7, 2002**: All received Rovral 50WP fungicide application at labeled rate for control of Botrytis gray mold.
- ☑ **July 11, 2002**: First picking of ripe fruit from Group A (9 weeks from setting out).
- ☑ **July 15, 2002**: Potato Leaf Hopper infestation stunting growth; sprayed all with Malathion 57 EC at labeled rate.
- ☑ **July 20, 2002**; First picking of ripe fruit from Group B (8 weeks from setting out).
- ☑ **August 1, 2002:** First picking of ripe fruit from Group C (7.5 weeks from setting out).
- ☑ **Continued harvesting through September 14, 2002.** Group D produced fruit for the longest period.

POSTHARVEST SEASON

- ☑ **Sept. and Oct.**: Spent fruiting canes removed as time allowed during Sept. and Oct. and new primocanes thinned and tied to support stakes.
- ☑ **Late Oct.**: Plants maintained outside until late October.
- ☑ **Late Oct.:** Pots moved back into cold storage for the winter at 35˚F. [**Note**: plants were not repotted into larger pots at this time to save storage space. If needed, plants will be repotted when they are ready to come out of storage.]

RESULTS

Records were kept of harvested fruit for each group as well as production costs. Results are presented as production per plant (pot) rather than by area (linear foot or acre) since pot size and spacing may vary. Production per pot and costs per pot are adaptable to different configurations. The time to fruiting and total yield was different among the 4 main groups. However, the differences did not indicates a strong advantage to taking the plants out of storage early since they took longer to fruit (Table 1) so the slight increase in yield might be offset by additional costs. It appears that the optimal time to bring the plants out from the storage would be the latter half of May. This would help avoid some frost events that might occur earlier while maintaining yields. Frost protection must always be available via overhead irrigation (unless high tunnels are being used) if plants are out before the end of May. The late group (Group C) may have performed better if they had not spent so long in the fluctuating storage temperatures. If delivery from the nursery had been delayed to early May followed by the 4 week acclimation period, yields might have been better. Further investigation is needed on this. The most significant finding in this trial was the dramatic increase in yield for 2nd year plants (Table 1).

Table 1. Total yield of fruit per pot for 3 start dates of potted 'Tulameen' raspberry plants plus a group of 2nd year 'Tulameen' raspberry plants.

Group	Number	Date Out of	Pot Size	Description	Weeks to Harvest	Yield (in 1/2

	of Pots	Storage*			from Planting	pts) per Pot
A	100	May 8	3 gallon	BR, LC	9	2.72
B	500	May 26	3 gallon	BR, LC	8	2.34
C	100	June 10	3 gallon	BR, LC	7.5	1.85
D**	164	May 27	5 gallon	BR, LC 2nd year	9	8.59

** Groups A,B,C all potted and put into storage on March 8th.*
*** Group D 2nd year plants that were fruited in 2001 using the same system.*

The costs involved in this production system were estimated from invoices (plants, potting mix, etc.) and from other expenses that were prorated from more general bills (labor, pesticides, cold storage). It is our belief that some of these costs could be reduced once the system is more fully developed. For example, potting soil could be made in bulk and the cost reduced significantly. Labor efficiencies can almost always be found once more experience with the system is had. Even so, it is important to know that the first year of production may only cover the costs of establishment (maybe not even). It is the second year and beyond, that offers the profitability.

Table 2. Cost estimates for first year and second year of production of container grown 'Tulameen' raspberries.

Costs Per Plant		
Item	**1st year of production**	**2nd year of production**
Plants	$ 1.00	--
Potting mix & pots	$ 1.50	$ 2.00
Drip irrigation	$ 0.60	$ 0.60
Fungicide	$ 0.28	$ 0.28
Production labor	$ 2.00	$ 3.00
Trellis materials	$ 0.50	$ 0.50
Harvest containers	$ 0.26	$ 0.91
Harvest labor	$ 1.50	$ 3.00
Cold storage	$ 0.15	$ 0.75
Total	**$7.79**	**$11.04**
Gross Income	**$6.25**	**$ 21.25**
Net Income	**($1.54)**	**$10.21**

The fruit from this trial was very well received in the marketplace. Buyers were paying approximately 30% higher price for the 'Tulameen' fruit as compared with field grown raspberries that were available at the same time. No fruit went unsold and demand was strong. Most of the fruit went to roadside stands in Concord, MA and the Boston area.

Finally, the anticipated decrease in need for herbicides was born out although this depended on good site preparation and elimination of existing weeds before setting pots out. Other pesticide inputs were somewhat less than field grown raspberries, most notably in fungicides. Three applications were made for controlling botrytis gray mold, which is similar to the field grown system, but no applications were needed for controlling cane or spur blight, anthracnose, or powdery mildew as is often the case in the field grown system. This is likely due to the excellent air circulation within the rows in this system. Insecticide applications were limited to controlling potato leaf hopper.

Insects are not likely to overwinter well in this system since the pots are removed each year and put into storage. This limits the refugia for overwintering.

OUTREACH

This project included two outreach events. The first was a twilight meeting which was held on July 25th and was attended by 30 growers. Growers were able to see the system in place and in production. There were several growers who seemed to find the system appealing. The second event was a talk as part of the New England Vegetable and Berry Growers meeting on January 7th, 2003. This talk was attended by 260 growers and presented final yield and production cost information. Again, several growers approached the speaker after the talk seeking further information about this system.

In addition to these meetings, a written account of the project will be posted on the UMass Fruit Program website. An article will be published in the Massachusetts Berry Notes Newsletter in Feb. 2003.

WHAT DID WE LEARN?

1) One discovery was that a March delivery date of the long-canes from the nursery is too early. It is better to have the plants held as long as possible by the nursery and time arrival for about 4 weeks from when you want to place them out in the field. Late-May is a good target window for setting the plants out in the field.
2) The first year of production, at best the returns would only cover the costs. But, subsequent years, the plants return approximately 10 each in profit. At a 10 ft. row spacing, this could translate to about $40,000 per acre (if price is $2.50 per half pint).
   - It's important to remember that in the field grown system, the first year yields no fruit and therefore not payback for the initial investment.
3) One of the limitations of the system is efficient distribution to high-end markets. A lot of profit can be eaten up if the grower has to drive small orders to many locations. An infrastructure for distribution that doesn't disproportionally eat into the profits is going to be important for growing this system.
4) 'Tulameen' raspberries are beginning to have their own identity in the marketplace (similar to 'McIntosh' apples). This name recognition will help with the marketing of this fruit.
5) Another group of plants that were originally grown from tissue culture plugs in 2001 was also included in this trial, though data were not reported. This is because the yields were poor.
6) A small number of miscellaneous bramble plants were also grown out in pots this year. These included 'Kiowa' blackberry, 'Marionberry', 'Boysenberry', and 'Loch Ness'. These varieties were not available in long canes, so the plants were grown out for fruiting in 2003. The growth habit of these plants is very different than red raspberries. The canes are very long and trailing and THORNY (except 'Loch Ness'). They will require some special handling for this system. They also sent down very substantial roots into the soil beneath the pots which made it difficult to move the pots when the time came. This will need to be addressed in future plantings with some sort of barrier.
7) An idea was formulated for the ultimate sale of the potted plants to homeowners via garden centers as 'patio raspberries', further recovering some of the investment costs. This may prove to be the most lucrative part of the system.