

The retractable roof production system



for raspberry production



Financial target

1. Achieve a 2 to 5 year return on the capital investment and the highest profit per kg



Retractable roof production system strategy

1. Integrate the plant layout with spray systems and retractable roof design to create the optimal overall production system
2. Utilize the retractable roof to prevent major losses due to extreme weather events (rain, wind, cold, heat, hail) and to optimize the growing environment to allow the plant genetics to produce the maximum yield and quality while targeting the high price harvest window
3. Reduce the impact of the spotted wing drosophila by having closed walls to prevent entry
4. Increase overall plant health and resistance to reduce losses from botrytis, powdery mildew and fungal diseases of the cane



Key cultural problems in tunnels (which can be solved using the retractable roof)

1. Static growing environment limits production potential
2. Extensive spray requirements necessitates frequent roadways for tractors causing a reduction in plants /m²
3. Open walls facilitate entry of spotted wing drosophila into the tunnels necessitating excessive spraying which increases risk of insects developing resistance to the insecticides
4. Excessive heat causes an increase in mites
5. Fruit ripen too fast when temperatures are excessive
6. Climate and water is different at the post row causing lower harvest volumes
7. Salts build up in the soil
8. Night temperatures may be greater than 16C causing a reduction in sugar accumulation in the fruit



Drosophila photo by: Kurt Stepnitz, MSU





Retractable roof control strategy

The retractable roof will be automatically controlled to manage the growing environment to:

1. Accelerate flowering by 2 to 4 weeks (roof is closed during the cold)
2. Prevent losses due to frost (roof is closed during the cold)
3. Prevent losses due to poor pollination (roof could be closed or retracted depending on temperature, rain or wind)
4. Accelerate growth during the fruit growing period (increase heat units by closing the roof 100% during the cold, retract the roof during optimal temperatures,
5. preventing excessive heat by closing the roof 85% during sunny and hot conditions)
6. Accelerate first harvest by a total of 4 to 6 weeks to achieve higher prices and level out harvest labor requirements
7. Leave the walls closed to prevent entry of spotted wing drosophila
8. Prevent sunburn or soft fruit (closing the roof 85% during sunny hot conditions)
9. Extend the harvest from the floricanes in the summer by protecting fruit from excessive heat and from the primocanes in the fall from excessive cold

Raspberry Trials at Michigan State University

Trials at Michigan State University

June 12, 2013

OPEN FIELD



RETRACTABLE ROOF



July 8, 2013



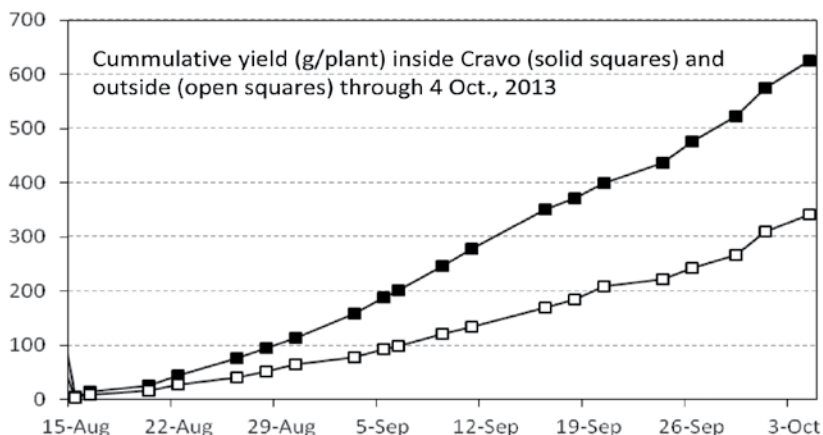
October 9, 2013



A small trial led by Dr Eric Hanson was started in 2013 consisting of nine primocane-fruiting (fall fruiting) cultivars grown in three gallon plastic Gro-bags filled with a mix of 70% composted pine bark and 30% peat. Plants were either potted in 2011 or 2012. Plants were held in a cooler until late May 2013 when they were arranged in three replicate plots inside and outside of a Cravo retractable roof greenhouse. Each replicate contained one plant of each cultivar.



Preliminary results



Harvest began on 15 Aug.

Yields and average berry weights were recorded. On 22-Aug, 26-Aug, 29-Aug, 5-Sep, 10-Sep, 19-Sep, 25-Sep, 1-Oct and 6-Oct, a 6-oz clamshell container of fruit was collected from each plot and held in a cooler for 6-24 hours, then at room temperature for 12-24 hours.

Samples were then rated for overall appearance on a scale of 1 (non-salable) to 5 (excellent with no defects). Berries were also sorted to determine the percentage with visible mold.

Yield through 4-Oct totaled 626 g per plant (inside) and 342 g per plant outside.

Location	g/berry	Appearance (1-5)	Rot incidence (%)
Inside	3.79	3.6	0.6
Outside	3.21	3.1	2.4

Berry weight, appearance and percent rot of berries inside and outside of a Cravo retractable roof greenhouse, CHES, 2013. Half pint berry samples were held for 24-36 hours at 18C then rated for overall appearance on a scale of 1 (not marketable for any use) to 5 (excellent, no flaws), and percentage of fruit with visible mold. Means are from nine dates, 3 replicate samples per date.

2014 Strategy



- Double crop using later primocane fruiting varieties: Plant in the spring, harvest in the fall from primocanes and in the following spring from floricanes
- Keep the perimeter walls closed to understand the impact of the walls on the populations of the spotted wing drosophila
- Determine reduction in spraying of insecticides which will help growers comply with the limits of the frequency of application and reduce the chance that the insects develop a resistance

X Frame



Flat Roof



The Retractable Roof Production System Design for Raspberries

Optimize plant layout

- Increase plants / hectare compared to that in tunnels by:
 - determining the appropriate spray system inside the retractable roof (micro mist, support lines off retractable roof) to reduce number of roadways required for spraying
 - narrow row spacing if possible
 - shorten distance between plants along the row since plants grown in a retractable roof will naturally be more compact than those grown in tunnels

Retractable roof house design

- Determine whether the X Frame or Flat roof is more suitable for the location. If rainfall is extensive, then the X Frame is more suitable.

Contact your Cravo representative if you would like to see a profitability comparison and return on investment for the "retractable roof production system" in comparison to your current production system.



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