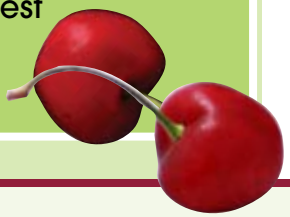
The retractable roof production system

RRPS™

for cherry 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 orchard layout with spray technologies 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
3. Utilize the retractable roof to accelerate or delay the harvest in order to realize highest prices
4. Increase overall plant health and resistance to reduce losses from bacterial and fungal diseases
5. Reduce damage due to the spotted wing drosophila and Japanese beetle by having closed walls to reduce insect entry

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, preventing excessive heat by closing the roof partially during sunny and hot conditions)
5. Accelerate overall harvest by a total of 4 to 6 weeks to achieve higher prices and spread out harvest labor requirements
6. Prevent or reduce loss due to cracked fruit (roof is closed during rain)
7. Reduce double fruiting by protecting trees from excessive summer temperatures
8. Prevent sunburn or soft fruit (closing the roof partially during sunny hot conditions)
9. Manage the weather extremes to prevent losses due to bacterial canker and cherry leaf spot
10. Leave the walls closed to reduce the entry of spotted wing drosophila and Japanese beetles

Cravo®

Cherry Production Trials at Michigan State University

OPEN FIELD

RETRACTABLE FLAT ROOF

RAIN SHELTER

RETRACTABLE X FRAME

Trials are being done at the Clarksville Research Station by Dr Greg Lang from Michigan State University.

Trees were planted in the spring of 2010. All trees were severely damaged by freezes (and subsequently bacterial canker-mediated death of current and future fruit spurs) in the spring of 2012, implying that maximum yields per tree will not be realized until 2015. The retractable X Frame was installed late spring of 2012, the rain shelter was installed in the summer of 2012 and the retractable flat roof was installed in the late spring of 2013. The retractable flat roof house was installed in another field to understand the impact of the water flow during rain on cherry splitting since the flat roof has drainage holes cut into the roof. There was a frost during flowering in 2013 resulting in loss of flowers in both the open field and the rain shelter.

Since 2013 was the first year that the trees were covered during the growing season, the primary focus was to develop an understanding of how to optimize control of the retractable roof during the stages of flowering, pollination, fruit growth, harvest and post harvest.

Key Results and lessons learned

- Harvest in the retractable roof was accelerated by 10- 14 days compared to both the rain shelter and the open field. It is believed that harvest can be accelerated by 4-5 weeks in Michigan in the retractable roof by optimizing the operation of the retractable roof
- Average yields in the rain shelter was 14% higher than the open field and 153% higher in the retractable X Frame. Yields were very low in the open field and rain shelter primarily due to the impact of the frost in 2013
- Japanese beetle populations were reduced in the retractable roof
- Incidence of cherry leaf spot were eliminated inside the retractable roof
- Integrating tree spacing and training system with the orientation of the drainage slits in the retractable flat roof could result in 80-90% of the fruit remaining dry during rain events

Michigan State University

RETRACTABLE ROOF

RETRACTABLE ROOF

2014 Goals at MSU

- Accelerate flowering by 3 weeks and fruit harvest by a total of 4 weeks
- Optimize set points for roof control to maximize photosynthesis during the fruit growing stage
- Determine extreme weather overrides to prevent trees from experiencing excessive stress.
- Develop optimal orchard design and tree training system in combination with retractable flat roof.

Yield (metric ton/ ha) and % increase versus unprotected trees
(Benton Variety - Preliminary data)

	Tree Training System	Outside	Rain Shelter	% increase	Cravo	% increase
	KGB					
Average		0.2	0.3	50%	0.8	300%
	TSA					
Average		1.4	1.5	7%	3.6	157%
	UFO					
Average		0.7	0.4	-43%	1.5	114%
	SSA					
Average		2.0	2.7	35%	5.0	150%

Mean yields per production system (preliminary data)

Unprotected	mean 1.95 metric tons/ ha
Rain Shelter	mean 2.23 metric tons/ ha = 14% increase in yield versus unprotected
Retractable Roof X Frame	mean 4.93 metric tons/ ha = 153% increase in yield versus unprotected

X Frame

Flat Roof

Retractable Roof
Production system design for cherries

	X Frame	Flat Roof
Roof profile	Peaked	Flat
Roof Covering	RC02 with coating	RC02 with coating and drainage slits on a 80/100cm x 45cm grid
Gutter to collect water	Optional	No
Percent of fruit protected from rainfall	99%	80%-90% feasible
Control of soil moisture	Yes	No
Hectares of roof powered per motor	.45	1
Life of roof covering	8-15 years	8-15 years

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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