

Counting Bad Apples

Exclusion Netting in the Control of Codling Moth

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on Rogers Mesa



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Outline

- Background -
- Economics -
- Data & Discussion -
- Further Research -
- Synthesis -

Background & Focus

As part of a CDA specialty crop block grant, I've spent the last 2 years studying codling moth dynamics in Organic Orchards on Rogers Mesa & the broader North Fork valley.

•
Only 1 orchard employed netting in 2020.

3 orchards netted in 2021.

Next year, ~100 acres will be netted across 6 orchards.

•
The research began broadly, but has focused on netting as the most hopeful IPM technique.





A History of Pesticide Resistance

Codling Moth's first insecticidal resistance was recorded in the Grand Valley (to Lead Arsenate!)

CM acquired resistance to the Organic pesticide Granulovirus after just 2 decades in Europe

We haven't verified a local resistance but should prepare for it

How to Fight the Codling Moth.

By Prof. C. P. Gillette.

Many orchardists spray for the codling moth and still grow very wormy fruit.

The writer knows of an orchard at the Experiment Station that was treated with an arsenical mixture the last summer and in which the loss of the fruit was very small.

It was taken in September.

is controlled

The first year

10,000 worms from 50

500 and this year 10

cluded an additional 10

trees. One pound of

to 50 gallons of wa



Nets aren't new

They are commonly used to protect
Grape & Honeyberry from bird damage



Drape Netting

Uses a finer mesh net than grape netting
(originally made for hail protection)

•

Covers individual rows

•

Decades of use in Europe, South Africa
& Australia

•

Increasing use in Washington state
for sunburn protection



Net Wiz

Made in Australia

•

4 hydraulic hookups: 2 for boom, 2 for the retrieval wand

•

50 Horsepower

•

Preferably a crew of 5





Economics

Quick Numbers

\$4000

1 acre of netting material
(10 year lifespan)

•

\$18,000

Net Wiz netting machine

(One machine can net
~50 acres per season)

•

Possible to reduce CM damage
to <2% & total culls to <10%
in the first year



Reduce pesticide expenses

The labor cost associated with netting is < than the cost of pesticides + spray labor

-
- 1st year - Cut out CYDX usage
- 2nd year - Stop using Entrust
-

(Can continue foliar nutrient programs)



Return on Investment

A simplification of the Harvest needed to break even on an acre:

- $T*(P_F - P_C) \times (\%C - \%N) - \4000

Where:

- T = Total Harvest (in pounds)
- P_F = Fancy Price
- P_C = Cull Price

- $\%_C$ = No nets Cull %
- $\%_N$ = Nets Cull %

Better to see visually ->

ROI Projections

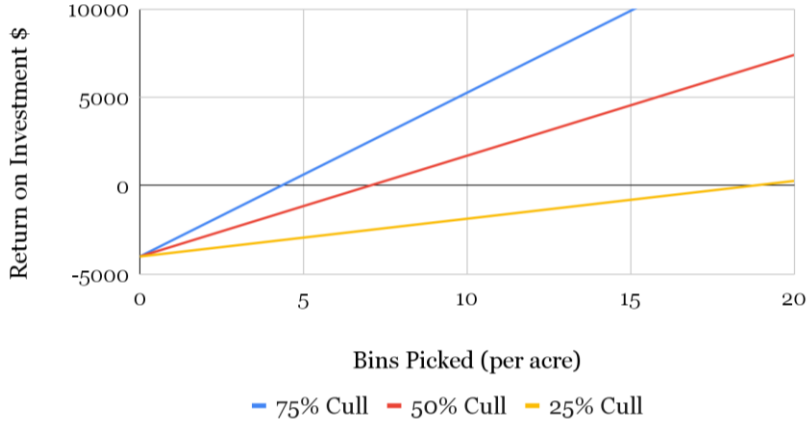
Each series represent a different cull % prior to netting & a 10% total cull rate afterwards

Honeycrisps:

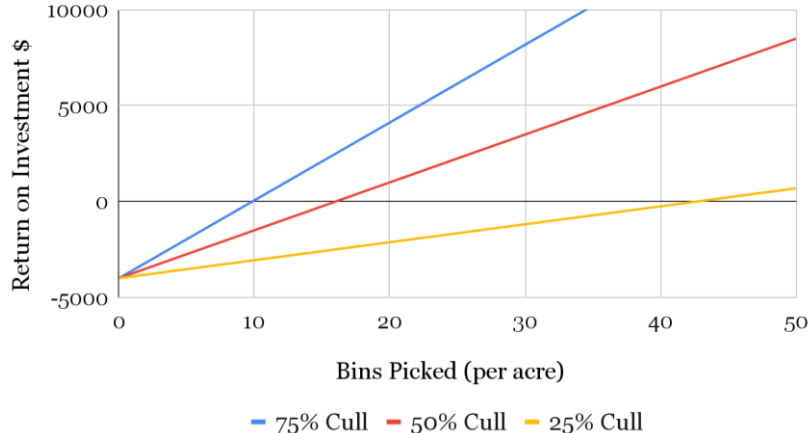
10x profit margin for Fancy price versus Cull price

Galas: 5x profit margin

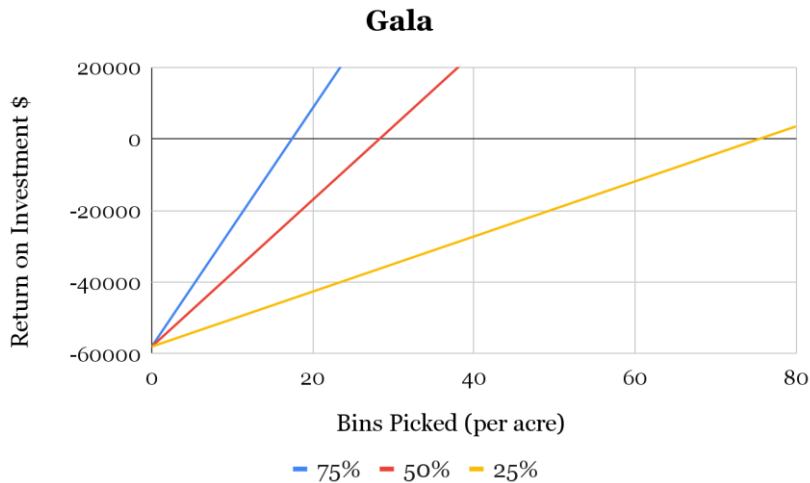
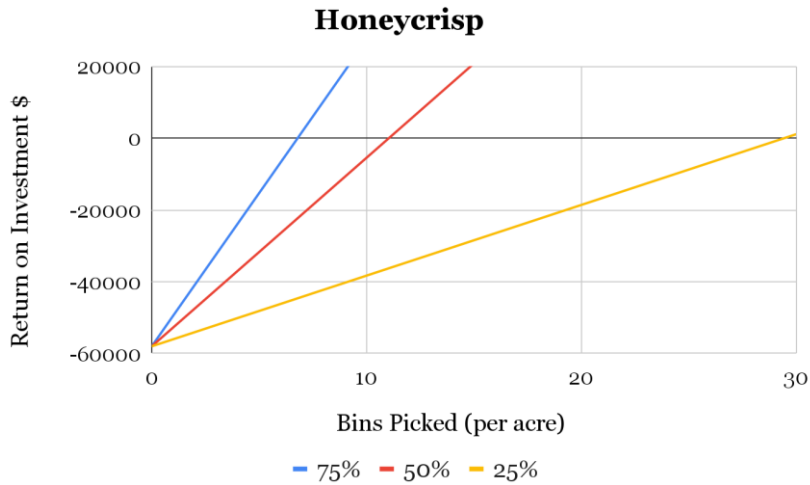
Honeycrisp



Gala



Projections including a NetWiz



What harvest will pay off
10 acres of netting (\$40,000)
+ a NetWiz (\$18,000)?

Cherries?

Cherries have an even higher price point

An orchard in Paonia tried netting
their sweet cherries this past year

Estimate they recouped $\frac{1}{3}$ loss from bird damage
~10% culls



Nets are a variety dependent solution

- Nets have proven cost effective for HoneyCrisp & Gala
 - Return on Investment possible in the first year
- Long ROI for low value varieties
- More research needed for vigorous / late season varieties like Fuji
 - Prone to Woolly Aphid Infestations
- Bonus: Prof Einhorn's research indicates that
 - Honeycrisp can be thinned with early netting
 - Will verify results at OARS in 2022



Data & Discussion

First Year netting experience:

Galas

- 2020 Unnetted -

- Full rate of entrust

- CydX every week

- >70% culls at packout

- It's uneconomical to pay for sorting labor
over 70% culls

- So they sent it in bulk to the juicer



First Year netting experience:

Galas

- 2021 Fully Netted -

- No thinning
- No Mating Disruption
No CYDX
- Half Rate Entrust

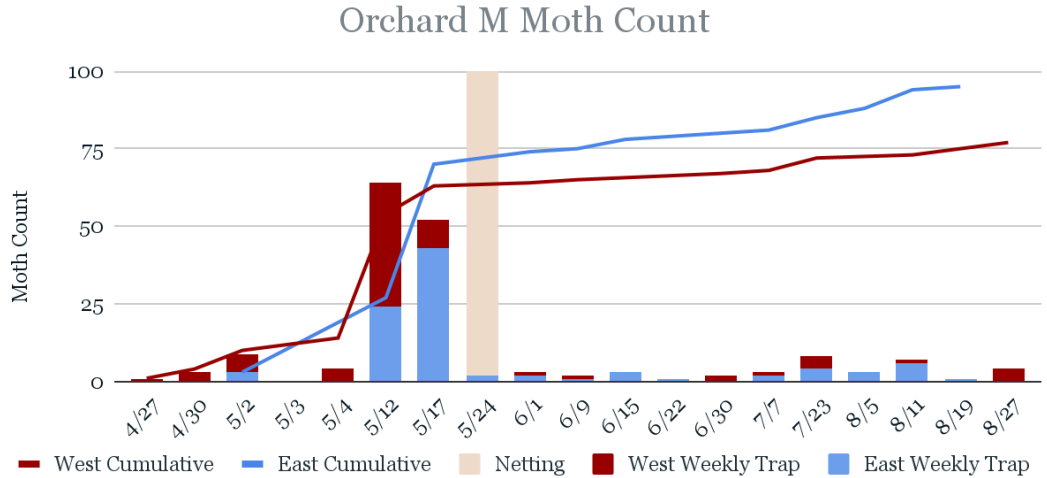
- <2% CM damage at packout
- (10% total culls)

- 17x marketable apples
- Only 1.6x larger harvest in 2021



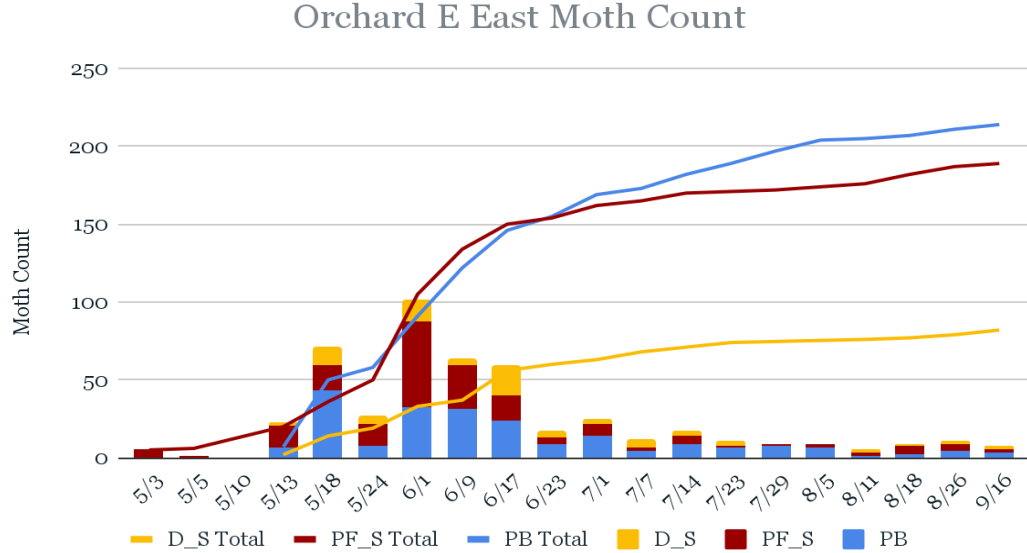


CM Population Dynamics



- Nets were installed the week between 5/17 & 5/24
 - Sharp decrease in trap counts after netting
- Attempted to trap inside the net - but never caught CM

An Unnetted Comparison



- This is a nearby unnetted orchard
- Smoother Gaussian tail to the distribution

Flight Pattern Disrupted



Insects are still found underneath the net

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But if they can't find the trap outside - they can't find each other to mate.

•

Think about moth flight patterns – not exactly the most agile creatures

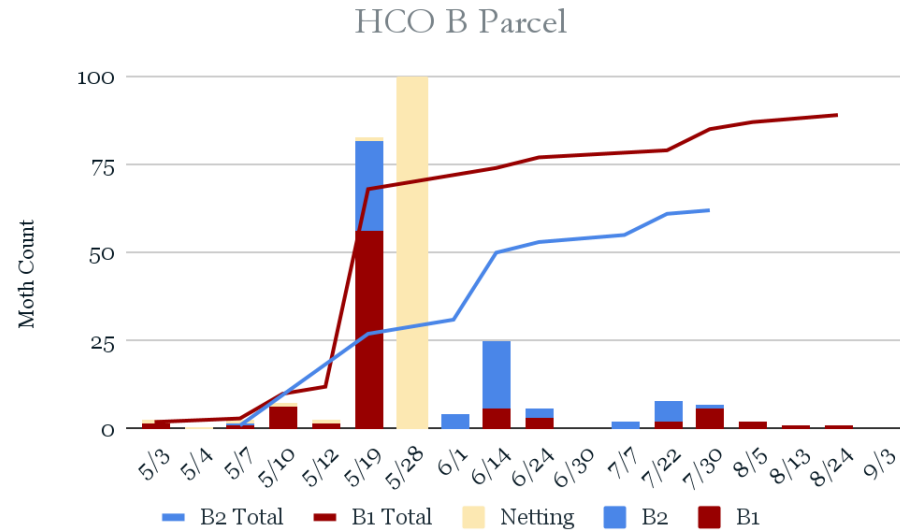
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Nets also make it more difficult to lay eggs

Moth Populations under the nets?



- Possible for large trees
 - However, damage is contained to that row
- Example: a Parcel with partial netting ->
 - Mature Open vase trees
 - High CM pressure from neighboring orchards
- High trap count just before netting
 - (Netted by June 1)
- Had 1 row with >33% damage prior to August thinning
 - Highlights the continued importance of monitoring



What if apples touch the net?

Higher probability of CM damage
(from moths landing on the net outside)

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Defects from rubbing on the net

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Risk of hail damage / sunburn

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Better to prune fruit away from the net



Research Station Trap Count

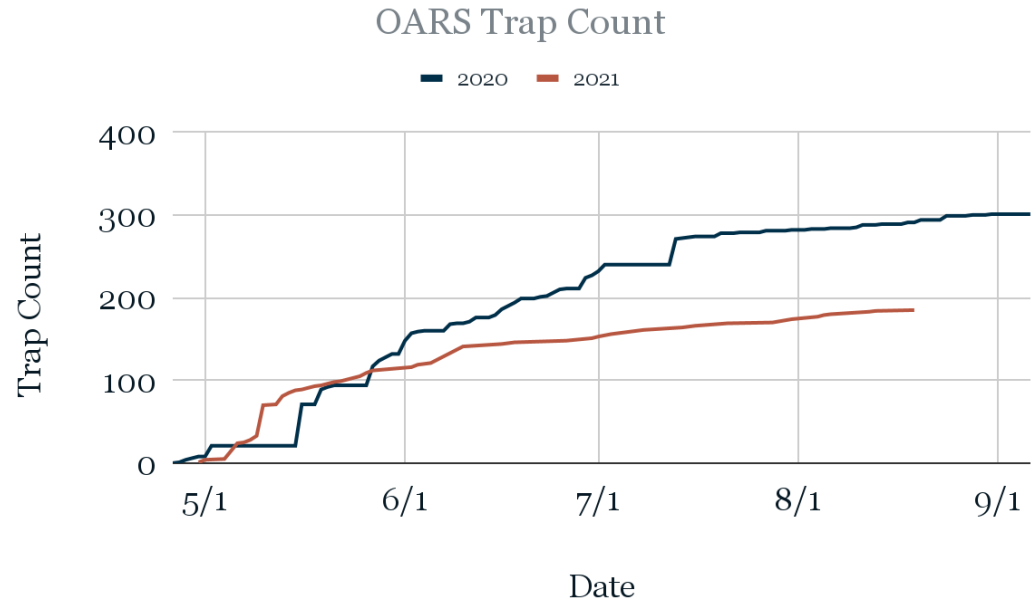


We left one row of Honeycrisp unnetted

•
100% loss by mid July - from CM & hail

•
Data from the trap in this row
is shown at right for 2020 & 2021 ->

•
Less of a population, but not the drastic
reduction seen in the above slides



Research Station Honeycrisp Harvest

I sorted about half of the honeycrisp harvest at OARS (1/2 acre - 5 out of 10 rows)

•

- Three rows averaged -

1.2% CM damage out of a total 5136 apples
(9.91% total culls)

•

- Two rows near the unnetted row averaged –
9.4% CM damage out of 3269 apples

•

Even with a short crop this year – nets paid themselves off in the first year

Fuji & Cameo netted harvest

Too small of a crop this year to be worth netting

•

But we did anyway – & saw <1% CM damage at
harvest

•

Both varieties had wooly aphid infestations



Further Research



Woolly Aphids

While Rosy Apple Aphids cleared up by the heat of August,
Woolly Aphids were a problem for Fujis.

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Research from WSU observed 100x the incidence of woolly
aphids under netting than outside

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No woolly aphids observed on Honeycrisp



Reflective Blushing

Net Coloration





Bullhorns

While open-vase architecture needs no extra infrastructure,
High Density Plantings need ‘bullhorns’

•

Netting will stunt upward growth for young trees if
laid on-top of them





Unintended Consequences

Insects, birds & deer can get
caught in the nets

Importance in a warming world?

Mixed research on the effect of nets on temperature & humidity

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But consensus on less wind & increased soil moisture

•

Lower fruit skin temperature (thus less sunburn)



Synthesis

Netting is a variety & climate dependent solution

•
Quick return on investment for high value crops

•
So effective it could be useful for conventional orchards

•
The research continues!



Thanks!

Special Thanks

& gracias a Arturo Jimenez



Questions?