



# Plasticulture Strawberry Production and Winter Protection

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# **BIG THANKS!!**



Ohio Produce Growers  
& Marketers Association



Vegetable and  
Small Fruit  
Research and  
Development  
Program

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# Outline

- Overview of what we know is critically important to successful strawberry production
- Review our winter protection data
  - Cold and mild fall and winters
  - Recommendations



# Strawberry Plasticulture

- Intensive agriculture
- High cost of production
  - High returns per acre
- Our approach is to develop research proven methods that mitigate risk





# Plasticulture Strawberry

What's the big deal?

- Why do customers like it?
- Even the most die hard NC matted row growers converted
- Marketing benefits – 3 main ones
- Earlier and longer season
- Quality, size and ease of picking
- Ready pick option
- Cleaner fruit
- Less fruit disease
- No berry-soil contact

Profit potential in Ohio??



# Details about the system

- Total specified variable and fixed costs
  - Cold winter regions -~ \$15,000/A
  - Varies by farm
  - PRICES KEEP GOING UP!!
- Marketable yields
  - mild winter regions – ~24,000 lbs +
  - cold winter regions – ~18,000 lbs/A
  - NOT CONSISTENT ENOUGH YET
- Production season
  - ~ 3-5 weeks in Ohio





# Biological, Environmental and Market constraints; Management tools to Help Mitigate Risk



- Weather extremes
  - Summer drought
  - Cool falls and cold winters
  - Frosts
  - Spring heat
- Disease pressure
  - Botrytis
  - Anthracnose fruit and crown rot
  - Bacterial angular leaf spot
- Insect pressure
  - Spotted winged Drosophila
  - Spider mites
- Choice of cultivar
  - Limited options
  - Planting dates
- Concentrated harvest
  - Chandler avalanche
  - Cultivar



# Strawberry Production Essentials

- Long period for flower bud initiation in fall, winter and early spring
  - Otherwise, it won't pay...
- Produce top-quality berries
- Opportunity to get a good price
- Willingness and time to put in extra effort
- \$\$ up front
- Willing to gamble (much risk involved)



# Site preparation and selection

- Begins at least a year before planting
- Correct drainage issues
- Soil test & add P, K fertilizer *if needed*
- Adjust pH (*if needed & possible*)
- Control perennial weeds
  - Repeated cultivation/tillage
  - Non-residual herbicides
- Add organic matter
  - Manure, green manures, compost, biofumigant crops (mustard blends)

# **Well formed beds ~ 4 weeks before planting**





# Profits were lost here...



# Planting date decision

- Too early
  - Risk of Excess Plant Growth
  - Runnering
  - Multiple Crown Formation too early
  - 8 + crown plants = excess fruit #'s
  - Hard to pick
- Too late
  - Low yield
- Just right – August 28 to September 20
  - site dependent
  - Minimal runnering
  - ~3-5 crowns in May
  - ~35 fruits per plant





# Planting conclusions

Too late

Too early





# Just Right





# Key Requirements of Plasticulture Strawberry

**Row covers**



**Plugs**









# Row Covers

- How can we use row covers to enhance yield and overall productivity?
- Mulches slow heat loss and desiccation, thus reducing injury to plants by maintaining a more uniform temperature in the crown area



- **Fall:** Correct for off-target planting dates
  - Enhance growth and development
    - branch crown #
    - flower #
  - Timing
- **Winter:** protection from sub-lethal temps
  - Varies based on physiological state
  - Nov>Dec>Jan>Feb>March
  - April, dormancy breaks and cold sensitivity increases
- **Spring:** Frost protection
  - Marginal events (defined by the stage)
  - Most effective early in the spring
  - Flower and foliage damage in windy conditions
  - Poor pollination during extended periods of use

A photograph of strawberry plants growing in a field. The plants have green, serrated leaves and several white flowers with yellow centers. The plants are growing in rows, and the ground is covered with black plastic mulch. The text 'Goal' is overlaid in the top left corner in a large, 3D, orange-yellow font.

# Goal

35 Successful Blossoms/Plant  
= 1.5 lbs/plant  
= 26,250 lbs/acre



# Influenced by # viable blossoms.

## Profits



Dormancy Period	Transition Period	New Leaf Growth Stage	New Leaf Growth Stage	New Leaf Growth Stage
Buds inside crown	Tight buds inside crown	Buds inside crown	Emerged buds	Popcorns/early season open blossoms
Hardy to 10 F	Hardy to mid-teens?	Hardy to upper teens	20 – 25 F critical temp	Could be hardy to 27-28 in dry air (low <u>dewpoint</u> condition – like tonight)



# Digital Thermometer- Good investment preharvest strategy









# Freeze and frost protection





# Winners and Losers



# What's Needed for Success in Ohio

- Current row cover recommendations for winter protection are effective but do not maximize winter plant protection, late season sunlight transmission or yield.
- Apply 1.25 to 1.5 ounce/ per sq. yard row covers when weekly temperatures average 50 degrees Fahrenheit (10 degrees Celsius).
- A one-time early fall application may limit crown development and yield by limiting sunlight transmission to plant.



**1.25 to 1.5 ounce Row Covers  
(~Nov 1) Weather dependent  
~50 degrees F. avg. / 1 week**



# Scope of Research

- Investigate multiple row cover treatments using sequential applications of lighter weight row covers in fall and early winter.
- Compare to the standard single row cover application in early fall (the control treatment).
- Hope to determine a system that maximizes winter protection while enhancing yield and overall plant growth.



# Scope of Research

- Trials were established using 4 week old Chandler variety plug plants transplanted early September using a Randomized Complete Block Design at the OSU South Centers research farm in Piketon, Ohio (southern Ohio).
- At each harvest yield data and fruit quality attributes were observed and recorded.



- ZONE 6a
- -10 to -5 F.
- Avg. Min. Temp
- Extreme -20 degrees Freeze Events





# Scope of Research

- All plug plants were transplanted by hand and watered in with 20-20-20 water soluble starter fertilizer.
- Strawberry plants were spaced in double rows with 12 inches between rows and plants.
- Pre-plant broadcast application of 60 pounds of nitrogen, phosphorus, and potassium
- Chateau herbicide was applied prior to the bed being covered with black plastic.



2012 2 3



# Row cover management research results 2013

2013 Winter Protection Yield Data, Piketon Ohio.

Treatment	Marketable Fruit/Plant	Marketable lbs./Plant	Marketable lbs./Acre	Average Fruit Weight (oz.)
3	41.367 A	1.62 A	23522 A	0.62807 A
4	39.644 A	1.5017 AB	21805 AB	0.61724 A
5	38.248 A	1.4711 AB	21360 AB	0.60874 A
1	35.158 A	1.3266 AB	19262 AB	0.60806 A
6	34.111 A	1.2929 B	18773 B	0.60552 A
2	33.8 A	1.2787 B	18567 B	0.60545 A
LSD	9.67	0.3181	4619	0.0665

2013 Row Cover Treatments.

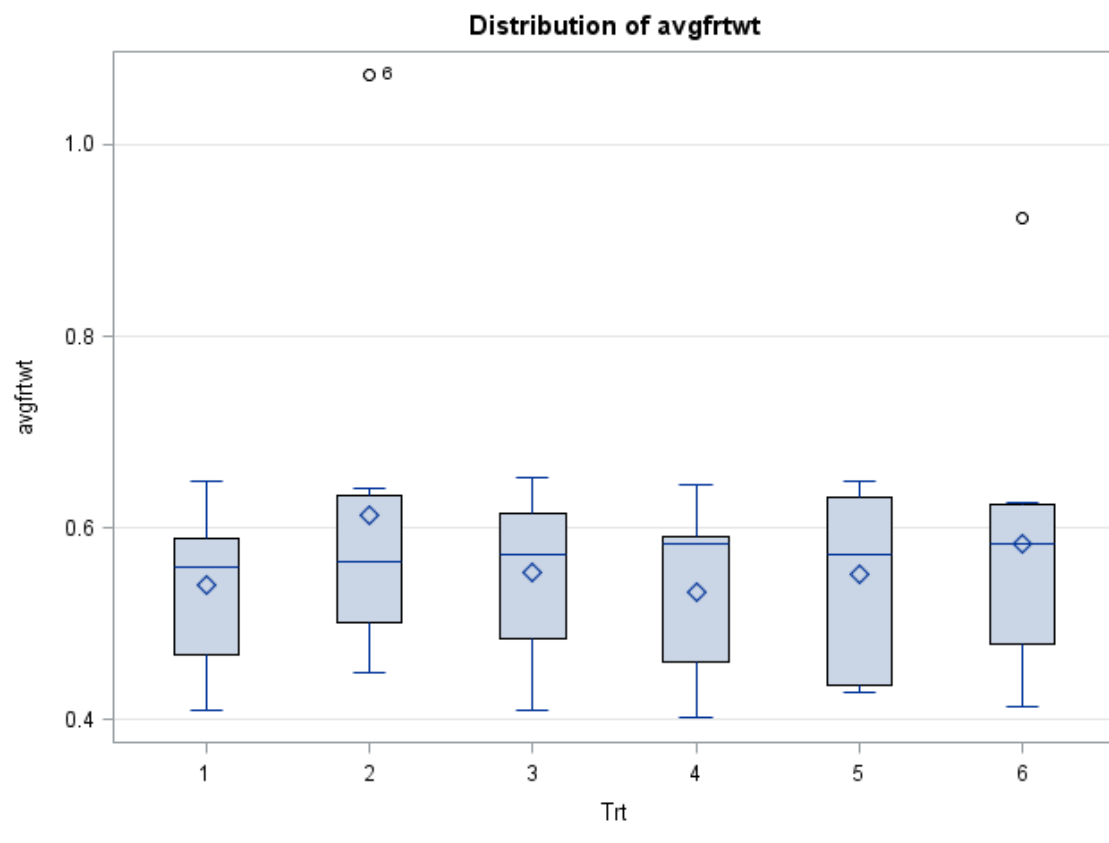
Treatment	Row Cover Weight
1	.9 oz. alone applied October
2	1.25 oz. alone applied October
3	1.25 oz. applied October plus .9 oz. applied January
4	.55 oz. applied October plus .55 oz. applied January
5	.9 oz. applied October plus .55 oz. applied January
6	1.25 oz. applied October plus .55 oz. applied January

# Results

- Below average winter temperatures the week of January 20th to 26th with limited snowfall
- Exceptional harvest year for plasticulture strawberry growers throughout most of Ohio
- Some of the highest yields reported in Ohio research and by growers.
- Fruit quality and brix levels were also some of the best and highest in many years.



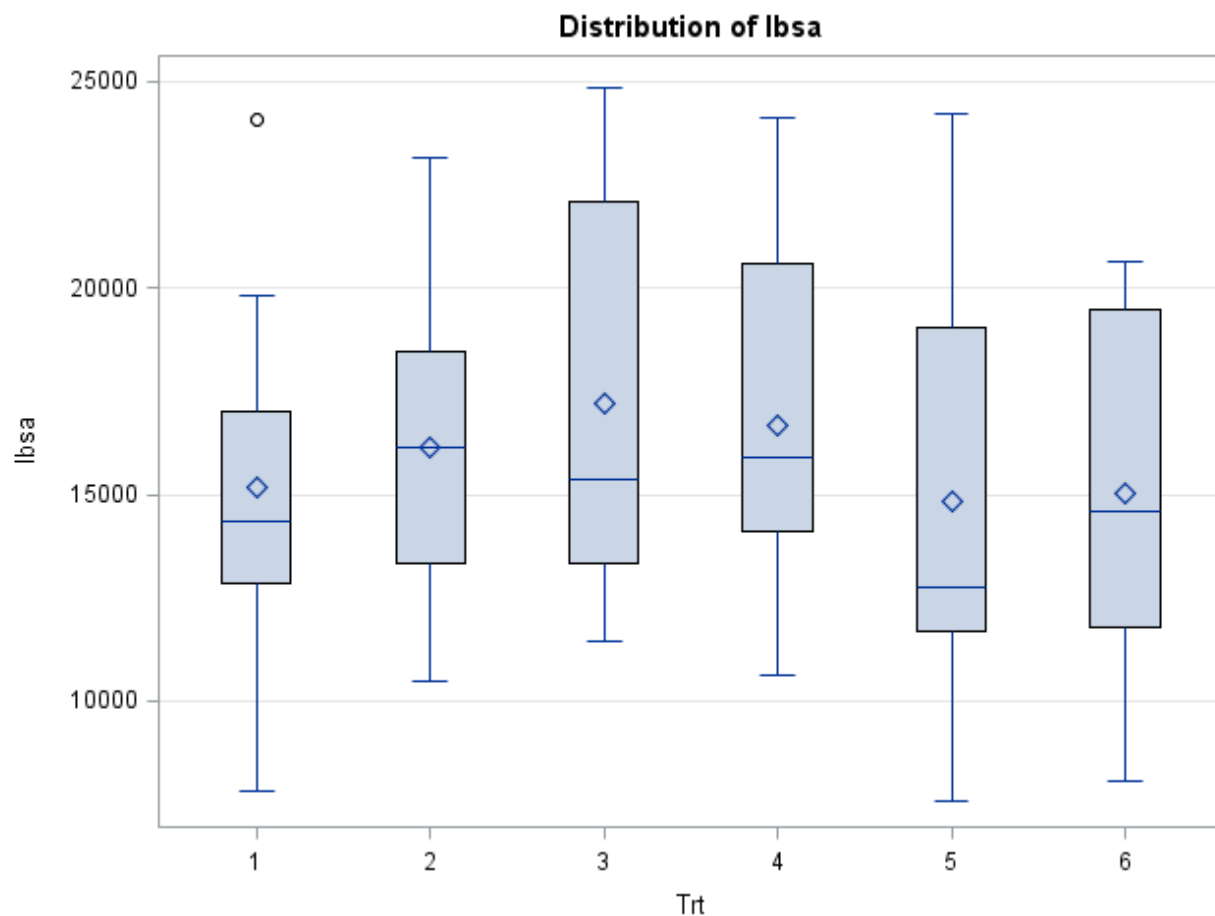
# Average Fruit Weight 2011-2016



Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	Trt
A	0.61269	9	2
A			
A	0.58390	9	6
A			
A	0.55403	9	3
A			
A	0.55078	9	5
A			
A	0.54009	9	1
A			
A	0.53342	9	4

# Pounds per acre 2011-2016



Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	Trt
A	17186	9	3
A			
A	16693	9	4
A			
A	16121	9	2
A			
A	15179	9	1
A			
A	15009	9	6
A			
A	14811	9	5



# Summarizing the benefit of cover in 2011-2016

- Row covers had their most benefit by being “on” the crop at 50 degree F average temps for a week
- Higher yields (by about 2,000 lbs)
- Did not impact fruit weight
- How are the covers enhancing yield?
- Increasing flower number per branch crown
- Is there room for improvement???
- YES!!!!!!!!!!!!!!!!!!!!!!

# Summarizing the benefit of cover in 2011-2016

Yield is influenced most by year to year variations in weather.

Can't do anything about the year and weather factor....or can we?

Are we applying our covers to early? Too late? Growing degree day model?

Row covers have their most benefit by being “on” the crop 7 to 10 days of average 50 degrees F.



# Where Are We Going From Here?

- It appears that the majority of the crop is “made” before Christmas
- Sept ,Oct, Nov and part of Dec
- Optimum temps for flower bud initiation (70 degrees F.)
- Refining our Growing Degree Day model for row cover applications for Ohio to optimize yield and fruit quality is our goal.
- Snow pack helps with extreme temperature lows or double up row covers.

# Recommendations

- Preliminary results show that for southern Ohio a lighter weight row cover applied in fall when temperatures average ~50 degrees Fahrenheit (10 degrees Celsius) for 1 week followed by a second application in early January looks to be the best winter protection treatment to maximize yield of plasticulture strawberry.
- Most past winters have been somewhat mild
- NOT FOR 2014 or Dec.2017!!!



# Freeze injury test

(photo by Mike Roegge, Ill. Ext.)





# **“Best” System?? Farm Dependent**

- It all comes down to the price you can get for your berries.
- Works for some and not for MANY others
- Need to continue to refine and conduct more research
- Have potential? Yes (for some)





# **What's Needed for Continued Plasticulture Strawberry Success in Ohio?**

- Willing to gamble (much risk involved)
- Fine tuning the Ohio system to maximize profits
- Continued research
- Protection from harsh Ohio winters
- \*\*\*Long period for flower bud initiation in late fall, winter and early spring
  - Otherwise, it won't pay...



# ANY QUESTIONS?







# **Full research reports, assistance and production information**

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