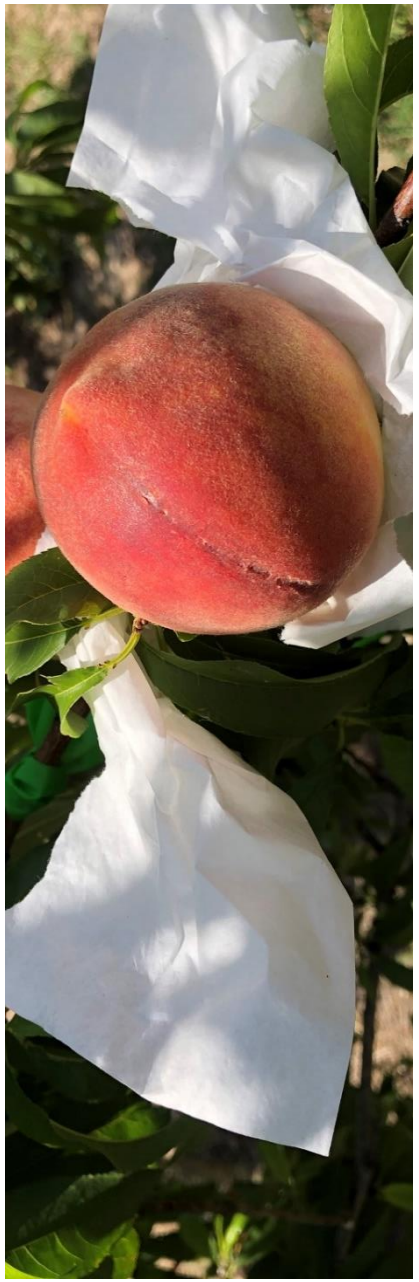

Bagging as an Alternative Insect and Disease Management Tool

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Committee Chair: Dr. Danielle D. Treadwell

Committee Members: Drs. Brecht, Gillett-Kaufman, and Sarkhosh

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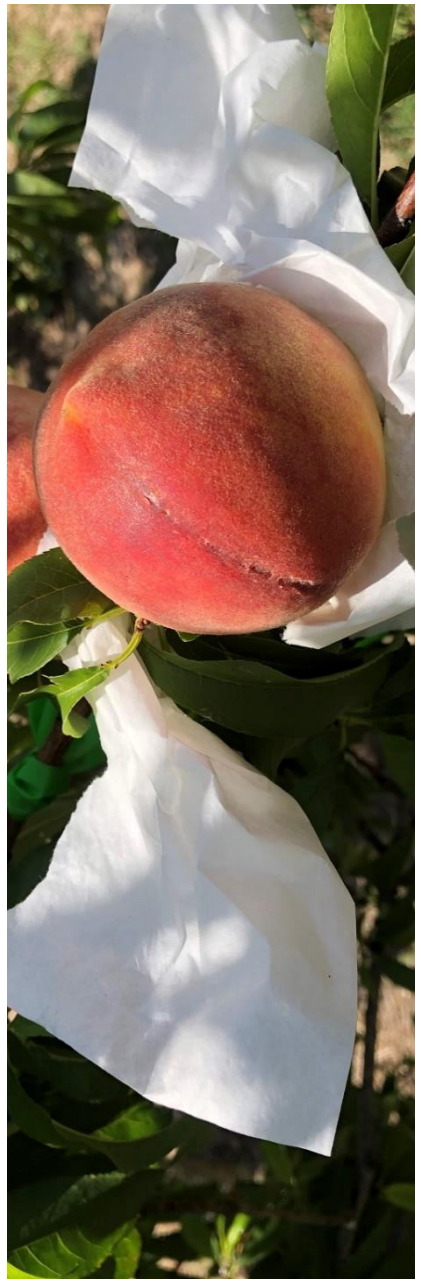

FARMER AND AGRICULTURAL SERVICE PROVIDER STAKEHOLDER SURVEY

- **Materials provided:**
  - Informed consent form
  - Survey
- **Participation is voluntary**
- **You can ask questions or stop taking the survey at any time**
- **No compensation for participation**
- **Identification is confidential**
- **No risk for researcher or provider for taking the survey**
- **If you want to talk about the study see the informed consent or contact Dr. Danielle Treadwell, ddtreadw@ufl.edu or David Campbell, campbell@ufl.edu**

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WHAT IS BAGGING

- Bagging is an cultural technique to reduce insect and pathogen injury
- Bagging provides a physical barrier for pests and pathogens
- Bags are constructed of a variety of materials and are manually applied

BAGGING RESEARCH

Fruit	Insect/Disease Managed	Reference
Guava	Fruit fly (*Anastrepha* spp.) and guava weevil (*Conotrachelus psidii*)	Blick et al., 2011
Pomegranate	Anar butterfly larvae (*Deudorix Virachola*)	Bagle, 2011
Litchi	Stalk-end borer (*Conopomorpha cramerella*) and stone borer (*Platypepla* spp.)	Debnath and Mitra, 2008
Mango	Anthracnose (*Colletotrichum* spp.)	Hofman et al., 1997
Peach	**Brown rot (*Monilinia fructicola*)**	**Melgar and Schnabel, forthcoming**

CLEMSON PRELIMINARY FINDINGS 2015

	Bagged	Not Baggged
Disease free fruit	75%	46%
Brown rot after storage	40%	80%
Insect damage	Absent	Present
Fruit quality	Same	Same
Blush	More	No change
Customers would pay $0.25-$1/lb more	Yes	n/a

(Melgar and Schnabel, submitted for publication)

Pest and Disease Complex

Peach scab
(*Cladosporium carpophilum*)

Brown rot
(*Monilinia fructicola*)

Pest and Disease Complex

Heimptera damage
(Pentatomidae or Coreidae)

Orthoptera damage
(Acrididae)

Pest and Disease Complex

Heimptera damage
(Pentatomidae or Coreidae)

Orthoptera damage
(Acrididae)

Pest and Disease Complex

Heimptera damage
(Pentatomidae or Coreidae)

Thrips damage
(Thysanoptera)

Orthoptera damage
(Acrididae)

NIFA OREI PEACH BAGGING PROJECT OBJECTIVES

Objective 1: Develop an organic production strategy for peaches in the southeastern United States

Objective 2: Economic assessment of organic/bag vs. organic standard

Objective 3: Dissemination of results

Dr. Juan Carlos Melgar

Dr. Danielle Treadwell

Dr. Guido Schnabel

Dr. Dario Chavez

Dr. Brett Blaauw

Dr. Nathan Smith

DESIGN AND LOCATION

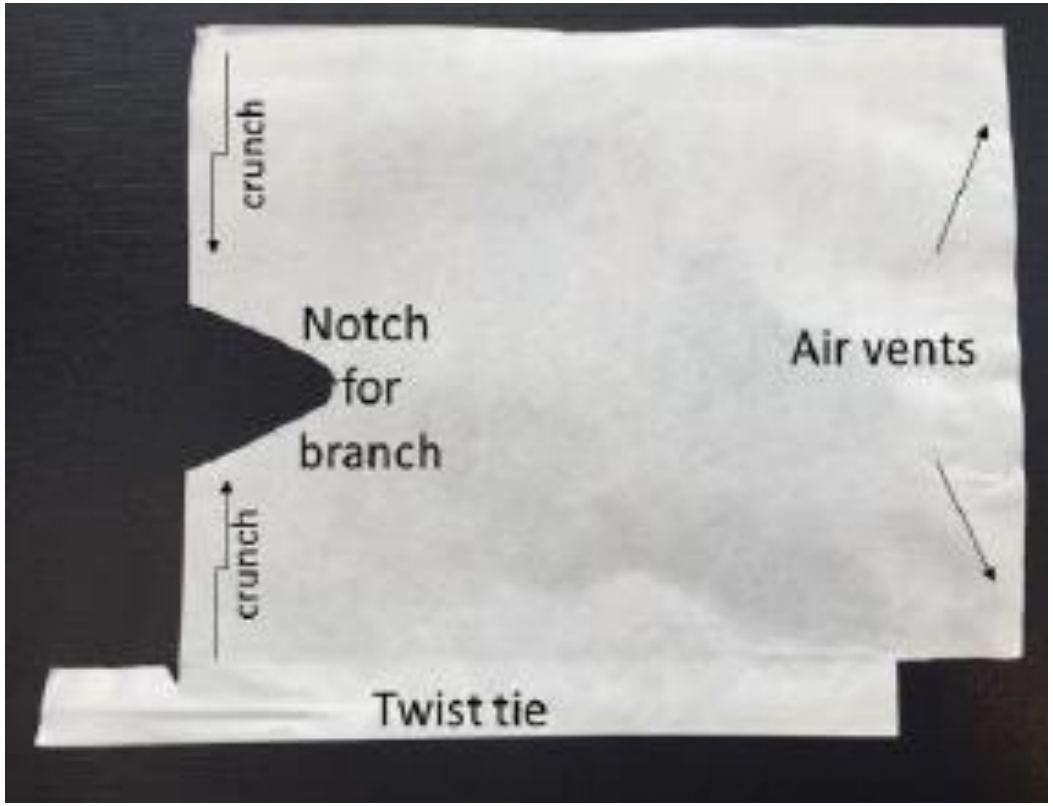
Certified organic McLean Family Farms U-Pick peach orchard

Randomized block (24 single tree plots) with two factors and four replications

- Bagging (at two levels: bagged and not bagged)
- Ordinance (at four levels: north, east, south, and west)

Data were analyzed using the Glimmix procedure in SAS (V 9.4, Cary, NC) for main effects and interactions at $\alpha = 0.05$.

BAG INSTALLATION



PRODUCTION SEASON 2018

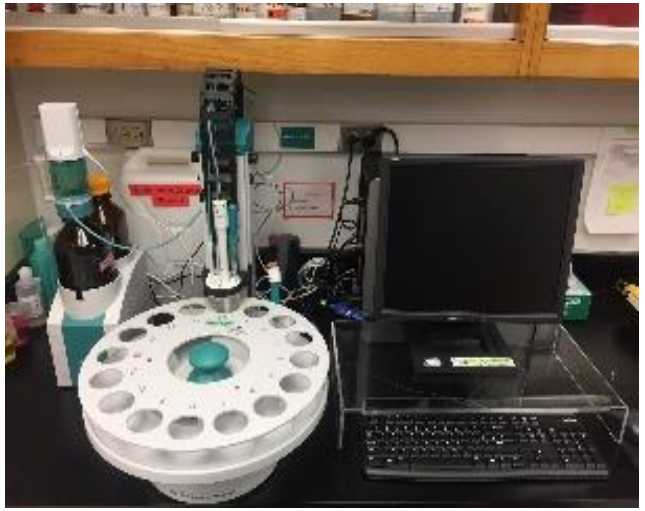
POST HARVEST METHODS

- **Measurements**
  - Weight
  - Diameter
  - Skin color
  - NIR total soluble solids
  - DA (chlorophyll proxy)
  - Fruit injury due to insects
  - Disease progression

Colorimeter

DA meter

NIR brix meter



TA/pH meter

Refractometer

Firmness meter

QUALITY RESULTS

	Bagged	Not Bagged	P value
Fresh weight (g)	108.84	117.38	0.1390
Diameter (mm)	58.20	59.84	0.1760
DA-chlorophyll proxy*	0.49	0.39	0.0037
Puncture force (N)	23.87	19.29	0.1187
Total soluble solids	12.13	12.19	0.8673
Malic acid	1.04	0.93	0.7735
Skin lightness**	55.01	48.71	0.0252
Skin red color***	28.17	31.03	0.1274
Flesh red color***	9.09	10.58	0.0283
Skin hue****	40.35	38.38	0.7336
Flesh hue****	80.25	78.67	0.0483

*** Larger number is more green (contains more chlorophyll)**

**** Larger number is lighter, more white**

***** Larger number is more red**

****** Larger number is more yellow**

PEST INJURY AND DISEASE RESULTS

	Bagged	Not Bagged	P value
Biting injury*	0.08	0.00	0.978
Cat-facing lesions***	0.00	0.00	1.000
Thrips lesions****	0.15	0.13	0.773
Scab-like lesions**	0.59	0.05	0.025

Scab-like lesion

Cat-facing injury

Thrips injury

Scab-like lesion

*** Likely causal pest: Orthoptera**

**** Likely causal pest: Hemiptera**

***** Likely causal pest: Thysanoptera**

****** Likely causal organism: *Cladosporium carpophilum***

DISEASE PROGRESSION

Harvest

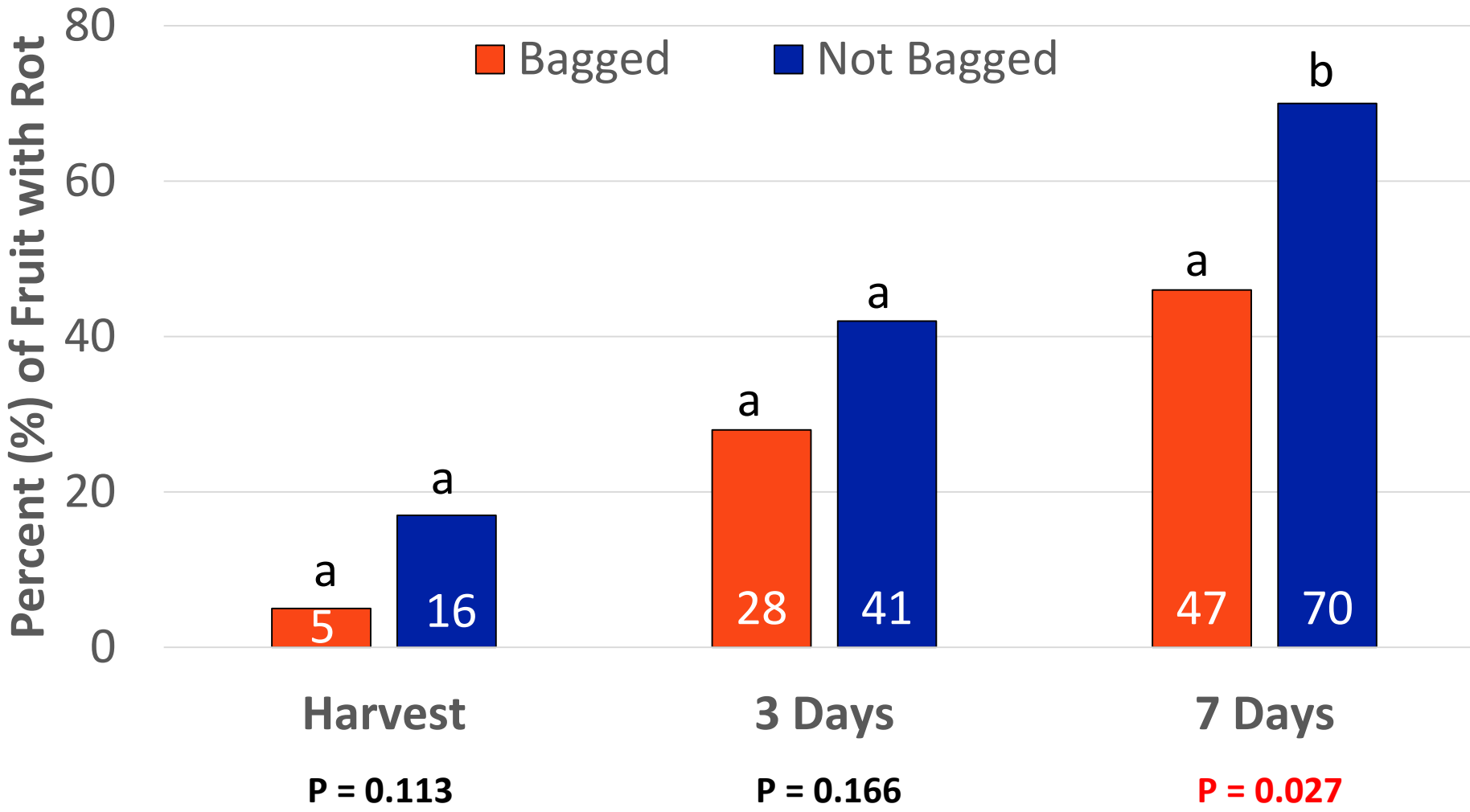
Seven Days After Harvest

Not Bagged

Bagged

DISEASE PROGRESSION RESULTS

- Overall, the odds of not having your fruit rot was 2.67x more if fruit were bagged



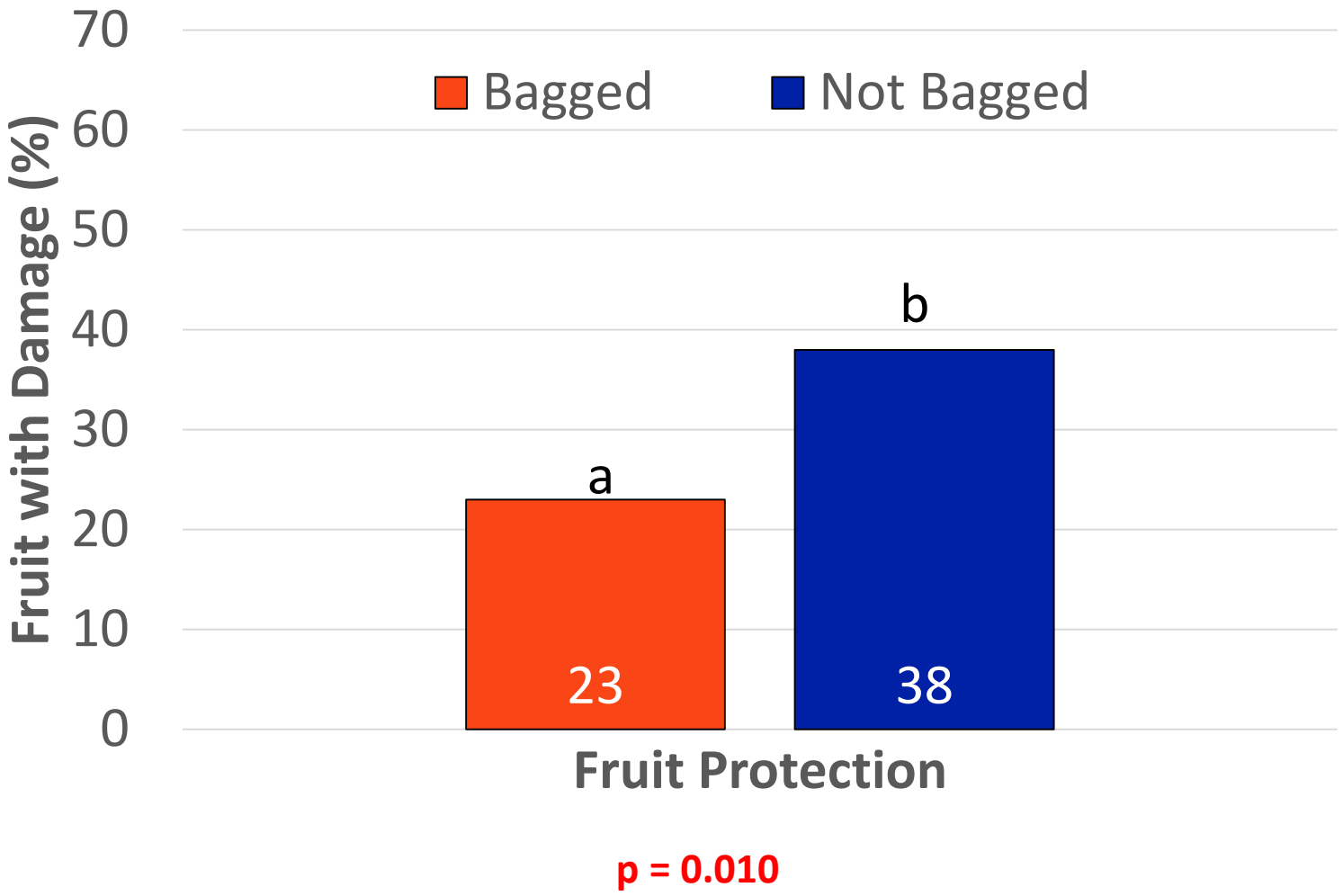
(n=384)

FRUIT WITH INJURY EXCEEDING U-PICK STANDARDS

Injury Exceeding "U-Pick Standards" at Harvest

- No Rot
- No Insect Injury
- **Color change is acceptable**
- **Scab is acceptable**

Note: Metrics based on informal discussion with farmer and consumers.



BAGGING COST

	Bagged	Not Bagged	Notes
Bag	$70/ha	$0	~1 penny/bag
Installation*	$589/ha	$0	2.5 bags/min
Removal*	$29/ha	$0	48 bags/min
Production Cost (grower provided)	$7,414/ha	$7,414/ha	$3,000/ac
Total	$8,102/ha	$7,414/ha	$688/ha more

*Assumptions: 148 fruit/tree, $12/hr labor

ESTIMATED THEORETICAL U-PICK COST AND RETURN

U-Pick Standards at Harvest

- No Rot
- No Insect Injury
- **Color change is acceptable**
- **Scab is acceptable**

Note: Metrics based on informal discussion with farmer and consumers.

	Bagged	Not Bagged
Yield*	4,668 kg/ha	4,668 kg/ha
Percent Marketable	77.1%	62.0%
Total Marketable Yield	3,599kg/ha	2,3894kg/ha
Product Value**	$6.61/kg	$6.61/kg
Gross	$23,789/ha	$19,130/ha
Production Cost (grower provided)	$7,414/ha	$7,414/ha
Bagging Cost	$688/ha	0
Net	$15,688	$11,716

*Yield was similar for bagged and not bagged fruit

**Based on U-Pick Price

WHAT IF THE BAGS WERE DIFFERENT COLORS?

- **Limited published research**
  - All color treatments (bagging, netting, or growth chamber) showed mixed results
- **Blue bags** improved firmness, weight, and size for date palm, *Phoenix dactylifera*. (Harhash and Al-Obeed 2010)
- **Green netting** increased vegetative growth, but no effect on weight or color for apple, *Malus domestica*. (Solomakhin and Blanke, 2008)
- **Red bags** decreased anthocyanin and chlorophyll for red Chinese sand pear, *Pyrus pyrifolia*. *(*Huang et al., 2009)
- **White bags** showed mixed mixed results for chlorophyll, anthocyanin, acids, and sugars for multiple varieties of peach, *Prunus persica*. (Zhang et al., 2015; Liu et al., 2015)
- **Black bags** decreased anthocyanin for peach, *Prunus persica*. (Liu et al., 2015)

WHAT IF THE BAGS WERE DIFFERENT COLORS?

- **Follow up experiment in 2019**
- **Location: Citra, FL and Clermont, FL**
- **Cultivars: UFSun and Tropic Beauty**
- **Treatments:**
  - No Bag
  - White Bag
  - White Bag + Black Insert
  - White Bag + Blue Insert
  - White Bag + Green Insert
  - White Bag + Red Insert
- **Measurements:**
  - Quality plus anthocyanin

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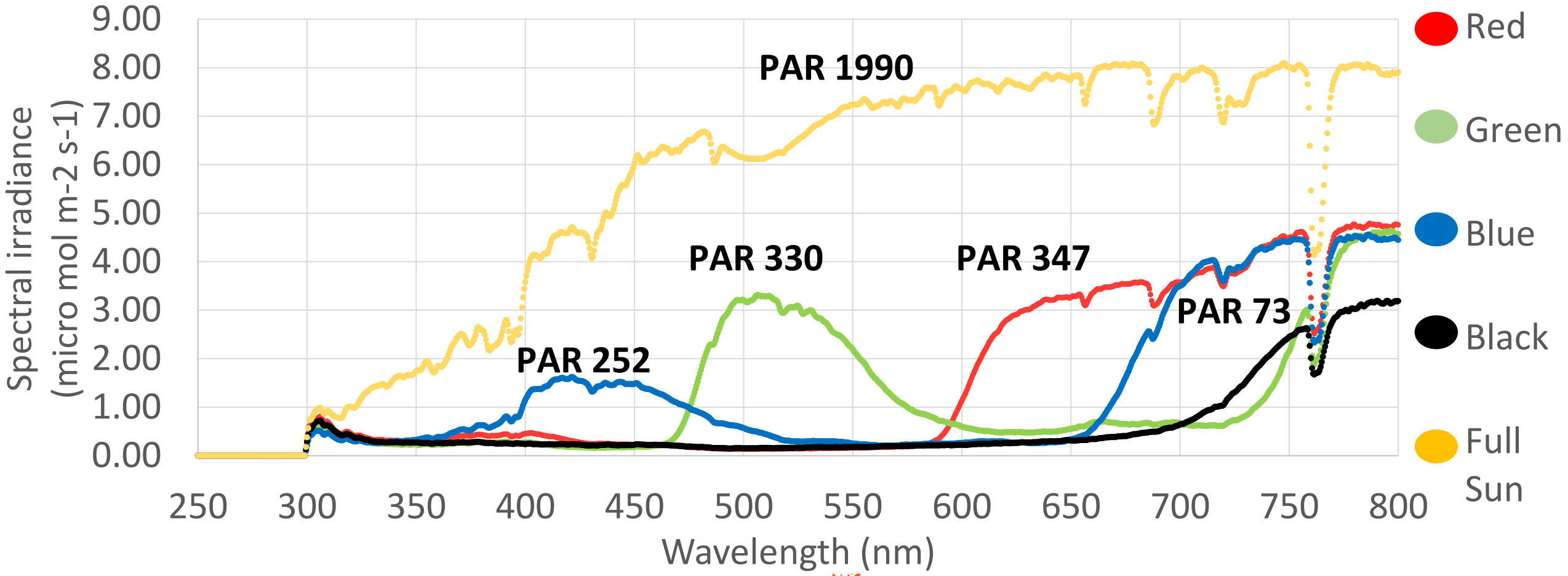
Bag Plus filter transmittance



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Color Treatments

No Bag

White

Black

Blue

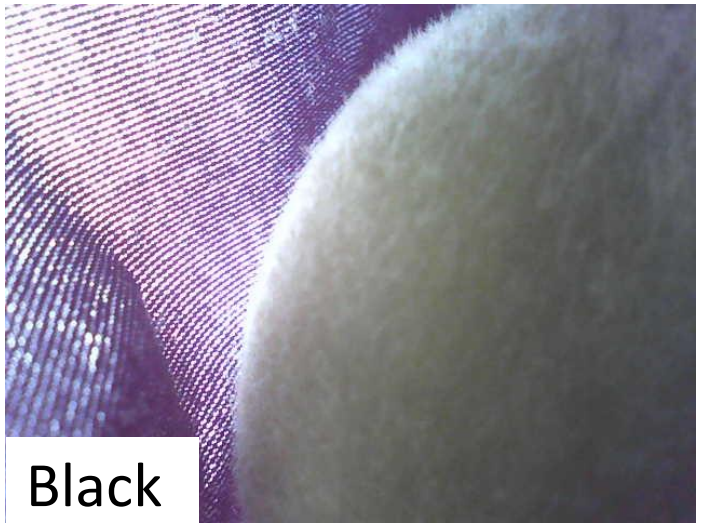
Green

Red

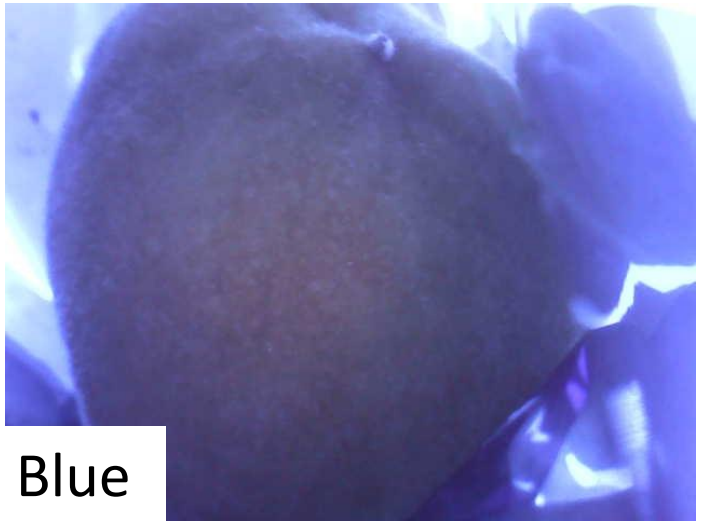
Color Treatments

No Bag

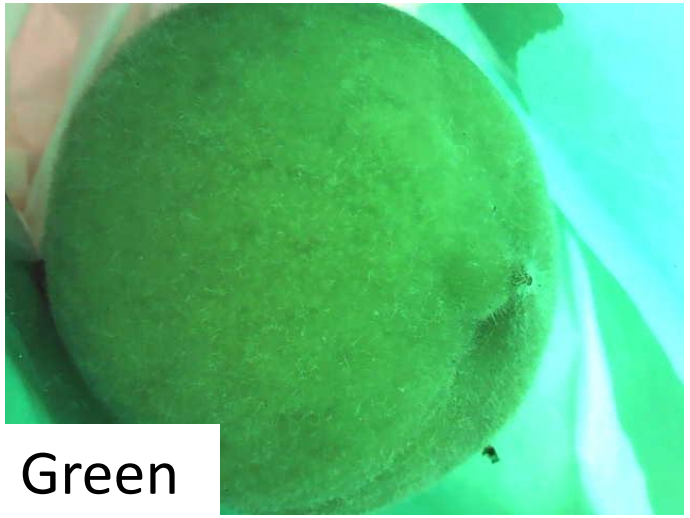
White



Black



Blue



Green

Red

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Color Treatments

No Bag

White

Black

Blue

Green

Red

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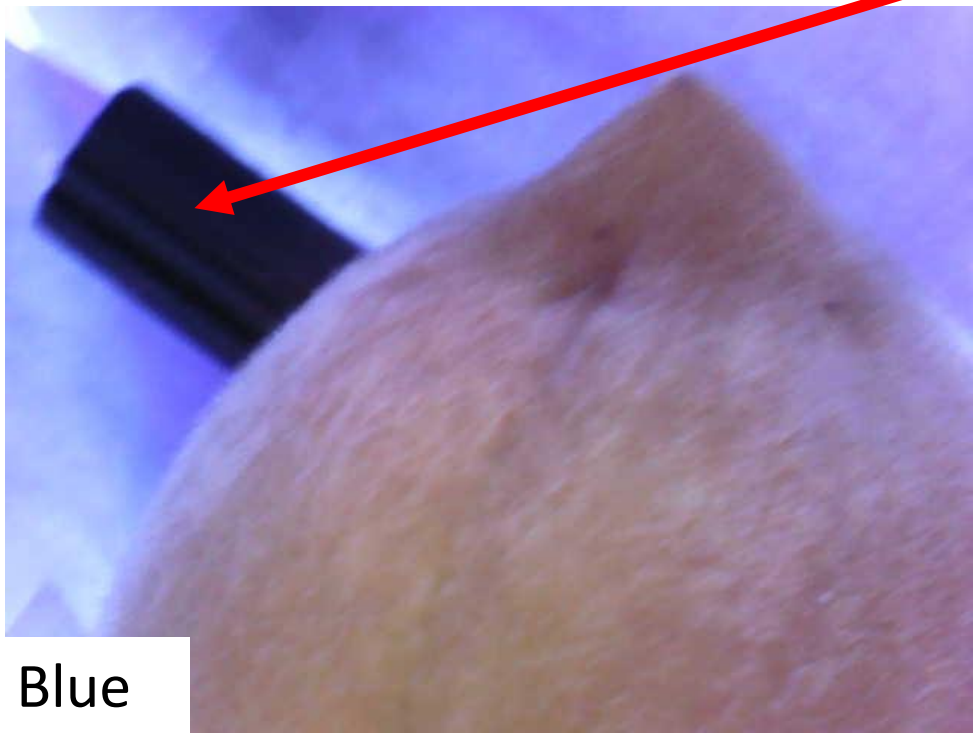
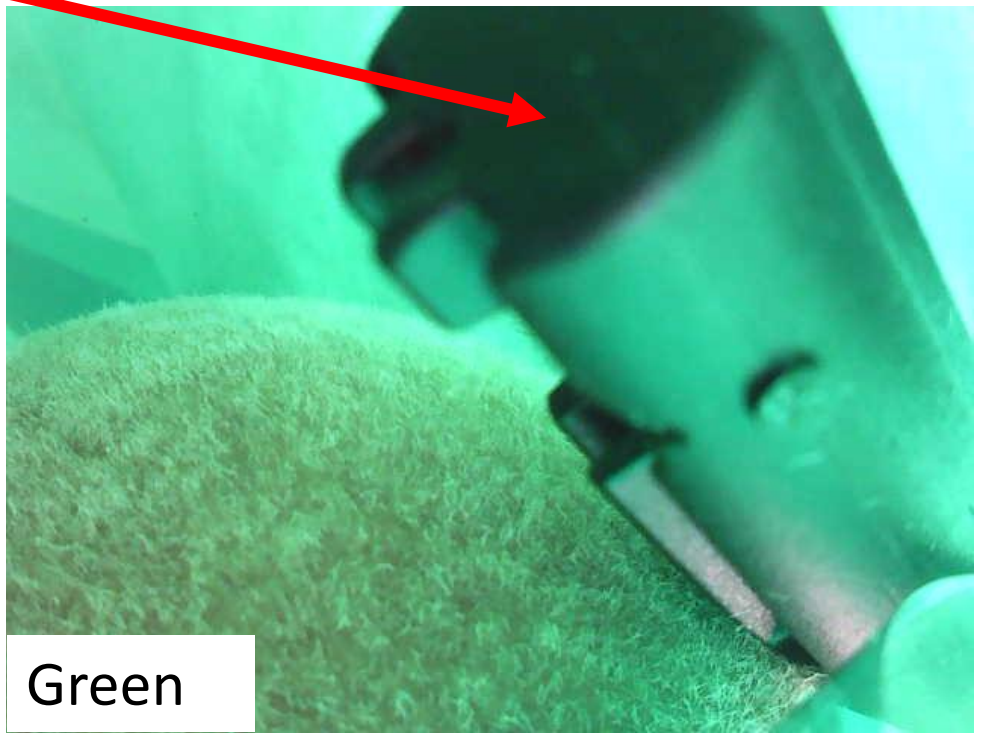
Color Treatments

Temperature and Relative Humidity Sensors inside the Bag



Blue



Green

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  - Drs. Chaparro, Folta, Gezan, Olmstead, Sargent, and van Santen
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BAG TRIAL AND RESULTS RECAP

- **If you would like to try some bags on your farm, text: 352-262-5545**

- **Bagging peaches did not affect:**
  - Yield, fruit size, sugars, acids, piercing-sucking pest injury, and biting pest injury
- **Bagging peaches did affect:**
  - Fruit pathogens: Less brown rot and less scab-like injury
  - Fruit Skin: Lighter and less red color
  - Fruit flesh: More yellow (less red) color
  - Fruit maturity: More chlorophyll at harvest
- **Additional questions contact:**
  - David Campbell, campbell@ufl.edu, 352-294-3182

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