



UNIVERSITY OF  
MARYLAND

OFFICE OF RESEARCH ADMINISTRATION

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December 22, 2020

Patti Keller  
State Horticultural Association of Pennsylvania  
480 Mountain Road  
Orrtanna, PA 17353  
patti@acnursery.com

Reference: Proposal Title: "Use of Extenday reflective groundcover on mid-Atlantic apple cultivars: impact on red blush and canopy light distribution"  
UMD Proposal Number: 57955  
UMD P.I.: Dr. Macarena Patricia Farcuh  
DUNS #: 79-093-4285  
EIN: 52-6002033

Dear Ms. Keller,

Please find enclosed the above referenced proposal submitted on behalf of the University of Maryland and signed by an Authorized Representative. We have assigned a University Proposal Number which you may use to reference this proposal in any future communication with our office. The budget request is in the amount of \$5,731.20.

We acknowledge that Dr. Farcuh is identified by name as the PI at the University of Maryland and that she intends to carry out all responsibilities identified in the attached proposal. Should this submission result in an award, the University of Maryland is prepared to enter into an agreement under mutually acceptable terms and conditions for a State Institution of Higher Education.

Please direct any technical questions regarding this proposal to Dr. Farcuh at 301-405-1323 or mfarculh@umd.edu. Administrative questions should be directed to Maura Collinge at 301-405-9743 or mcolling@umd.edu.

We look forward to collaborating with you on this project.

Sincerely,

Takeia M. Bradley  
Assistant Director

## **Use of Extenday reflective groundcover on mid-Atlantic apple cultivars: impact on red blush and canopy light distribution**

### **Personnel:**

**Lead PI:** Macarena Farcuh, Assistant Professor  
2116 Plant Sciences Building/ 4291 Field House Drive  
University of Maryland, College Park/ College Park, MD 20742-4452  
Phone: 301.405.1323; email: [mfarcuh@umd.edu](mailto:mfarcuh@umd.edu)

**Co-PI:** James R. Schupp, Professor of Pomology  
Penn State Fruit Research and Extension Center

**Duration of Project:** One year

### **Justification:**

The retail sector is requiring a minimum 50-60% red skin blush in high apple value cultivars, such as Honeycrisp. However, Honeycrisp marketability and the continued growth of the industry across the eastern US, and particularly in the mid-Atlantic, is threatened by the lack of effective strategies for reaching the required red fruit coloration, with dramatic losses as a result of poor or marginal development of skin red blush.

Although many factors, directly or indirectly, influence apple skin color development (genetic background, developmental stage of the fruit, nutritional status, canopy architecture, crop load), it is also affected by environmental factors such as temperature and light. Red coloration development is suppressed at warmer temperatures (hot days (>90°F) and warm nights (>68°F)), thus it is difficult to produce apples with sufficient red coloration in some locations, e.g., the mid-Atlantic Region. Besides temperature, light intensity affects apple red blush. Increasing light intensity and exposure on the fruit surface has potential to increase red blush. Hence, it is necessary that light is uniformly distributed throughout the canopy.

The common practice to increase color by delaying harvest is generally harmful to overall fruit quality and storability, as over-mature apple fruits soften faster, abscise from the tree before harvest, and have a shorter shelf-life. Therefore, there is a need for developing new preharvest orchard management strategies that can optimize apple fruit red blush so as to improve overall profitability.

One innovative strategy developed to amplify the cumulative light intensity reaching the apple fruit surface and apple fruit exposure in the orchard is through the installation of reflective groundcovers, such as Extenday. The use of reflective groundcovers has been widely and successfully adopted in important apple producing areas around the US, such as Washington State. However, research is lacking in terms of evaluating the effect of this technology in apple orchards established under the mid-Atlantic region environmental conditions. Thus, understanding the effect of using these important tools of modern fruit production is of great importance for potentially improving the marketability of commercially important apple cultivars and for promoting the long-term profitability of mid-Atlantic apple growers.

Considering this background, the goal of the proposed research is to characterize the effect of Extenday reflective groundcover on enhancing fruit skin red blush and canopy light distribution of commercially important apple cultivars grown in the mid-Atlantic.

The results of this study will be reported to the mid-Atlantic apple industry and will form the basis for development of a future Specialty Crop Research Initiative proposal. This study will also complement a Maryland Specialty Crop Grant awarded to Dr. Farcuh that will evaluate the effect of reflective groundcovers in overall fruit quality (including fruit ripening patterns and physicochemical properties) throughout different ripening stages on the tree, and at different canopy levels of Honeycrisp grown in the mid-Atlantic.

Dr. Daniel Weber has agreed to collaborate in this project by coordinating research project implementation with Pennsylvania growers, assisting in the collecting of data, and in other supportive roles such as assisting with the publication process. (Please see support letter included as part of this submission.) His knowledge and experience will be of great value for conducting this study.

### **2020 SHAP Topical Priority List Categories:**

#### ***Horticulture***

- Maintaining Fruit Quality
- Changing Fruit Finish Issues: Color Enhancement

### **Objectives:**

1. Evaluate the effect of Extenday reflective groundcover on red skin blush, commercial packouts and fruit drop of Honeycrisp and Fuji cultivars grown in the mid-Atlantic.
2. Measure the effect of Extenday reflective groundcover on light distribution within the canopy of Honeycrisp and Fuji cultivars grown in the mid-Atlantic.

### **Procedures:**

#### **1. Grower-cooperator recruitment.**

Our research team will partner with two or three grower-cooperators to evaluate red skin blush, commercial packout, fruit drop and orchard light relations in commercial orchards. At the time of this writing, Joy Cline from Bear Mountain Orchards, Aspers, Pennsylvania, and Mark Boyer from Ridgetop Orchards, Fishertown, Pennsylvania have acquired Extenday fabric groundcovers, and have agreed to participate in this study. One additional grower-cooperator in Pennsylvania or Maryland will be sought.

#### **2. Cultivar Selection and Fabric Deployment**

Commercial blocks of Honeycrisp and Fuji will be selected for study. Treatments will compare multi-tree plots of Extenday reflective groundcover with untreated control sections in the same orchards. The growers will deploy the fabric groundcover approximately three weeks before anticipated commercial harvest and will allow us access to the block for measurement of solar radiation and for fruit sampling. Growers will communicate and coordinate harvests with the investigators.

#### **3. Evaluate the effect of Extenday reflective groundcover on red skin blush, commercial packouts and fruit drop of Honeycrisp and Fuji cultivars grown in the mid-Atlantic.**

Fruit samples will be collected at harvest times scheduled by the grower-cooperators. Fruit drop will be counted at each sample date on several pre-counted limbs per plot. All remaining fruit will be harvested by the grower and segregated by treatment (with or without Extenday deployment).

Harvested fruit of each treatment will be inspected by electronic graders and red skin blush and commercial packout will be recorded and reported.

**4. Measure the effect of Extenday reflective groundcover on light distribution within the canopy of Honeycrisp and Fuji cultivars grown in the mid-Atlantic.**

We propose to measure light interception in photosynthetically active radiation (PAR), and ultraviolet (UV) A+B radiation bandwidths, since both ranges are vital to red fruit blush development and quality. The investigators will measure canopy light distribution with a LI-COR PAR meter and a Spectrum Technologies UV meter, with primary focus on the lower third of the canopy. This will be done proximal to solar noon on cloud-free days on the north and south sides of the trees. Additionally, groundcover reflectance will also be measured in both PAR and UV bandwidths.

**Budget:**

<b>Budget Items</b>	<b>Justification</b>	<b>Total May 2020-April 2021</b>
Student Labor	\$15/hour × 8 hours/day × 15 days	\$ 1,800.00
Fringe Benefits	Hourly labor at University of Maryland at 5.4%	\$ 97.20
Travel	5 round trips to PA × 200 miles/trip × 0.575/mile	\$ 575.00
Supplies	Farcuh lab and field supplies	\$ 500.00
<u>Subcontract-PSU</u>	<u>Dr. Jim Schupp (wage payroll, fringe benefits, supplies)</u>	<u>\$ 2,759.00</u>
<b>Total Direct Cost</b>		<b>\$ 5,731.20</b>
<b>Total Cost</b>		<b>\$ 5,731.20</b>

**Other Support:**

This proposal has not been submitted to any other agency. As mentioned above, this study will complement a Maryland Specialty Crop Grant awarded to Dr. Farcuh that will evaluate the effect of reflective groundcovers on overall fruit quality (including fruit ripening patterns and physicochemical properties) throughout different ripening stages on the tree, and different levels of the canopy, of Honeycrisp grown in the mid-Atlantic.

**Results:**

Research results will be published in the *Pennsylvania Fruit News* and a poster will be presented at the Mid-Atlantic Fruit and Vegetable Convention as well as in Pennsylvania and Maryland growers' meetings.



**PennState Extension**

**Daniel E. Weber, Ph.D.**

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Gettysburg, PA 17325-3404  
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daniel.weber@psu.edu

The State Horticultural Association of Pennsylvania  
480 Mountain Road  
Orrtanna, PA 17353-8701

To the SHAP Research Committee:

I am writing this letter in support of the research proposed by **Dr. Macarena Farcuh**, Assistant Professor at the University of Maryland, titled **“Use of Extenday reflective groundcover on mid-Atlantic apple cultivars: impact on red blush and canopy light distribution”**.

Dr. Farcuh has asked that I participate as a collaborator on this research by providing her with the following support:

- Contact potential grower collaborators and obtain commitments and authorization to conduct research trials in their commercial orchards.
- Locate and mark experimental replicates within blocks of the desired cultivars at each of these orchards.
- Collect, label, and deliver fruit samples harvested from these replicates at the intervals identified by the research protocols and based on grower collaborator feedback regarding harvest windows.
- Communicate with the grower collaborators once the research has concluded and ensure that all research materials are removed from the orchards prior to the end of the season.
- Review written evaluations of the research results prior to publication and assist with publication of the results in *Pennsylvania Fruit News* and via the Penn State Extension web site and *Fruit Times* newsletters.
- Assist with any other essential task within my power to ensure the success of this research.

I agree to these requests and am willing to support her in this research effort that undoubtedly will provide useful information to growers and managers of climate-controlled storage facilities throughout the Mid-Atlantic region.

Sincerely,

Daniel E. Weber, Ph.D.

Penn State Extension Educator, Adams County