Paul C. and Edna H. Warner Endowment Fund for Sustainable Agriculture
Interdisciplinary Grant Program for On-Farm Research

Report Form

Project Title: Evaluating low-cost approaches to optimize yields of spinach and lettuce during hotter summers

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Summary *(Describe your project, its objectives and results in one or two sentences)*

The long-term goal for our research is to help develop and test low-cost methods for small-scale farmers in Ohio to increase yields of leafy greens under conditions of increased heat stress. Our central hypothesis is that simple changes in watering schedules and shade treatments can lead to significant benefits in crop yield, and our goal is to measure the effect sizes of these treatments to help farmers perform a cost-benefit analysis of whether these treatments make sense on their farms. Cool season leafy greens also bring a higher price during warmer season market sales.

What was done? *(One paragraph describing the goals, experiments and how they were performed)*

Past findings: In 2020, to test methods for mitigating heat stress on lettuce, we compared the simultaneous effects of an adjusted watering schedule and the addition of white shade cloth on crop yield. We found evidence that the combination of the shade and water treatment increased the mass yield of harvested salad greens compared to the control treatment; however, we did not detect a clear effect of the water or shade treatment alone on the mass of salad mix or on the final mass of harvest lettuce heads. The estimated effect size of the combined water and shade treatment was 2.1 standard deviation increase in yield of Salanova lettuce and 1.6 standard deviations yield increase in our direct seeded lettuce mix.

Current methods: In 2021, we built on these findings by comparing the effects of white and black shade cloth on leafy greens. Specifically, we compared the yields of direct seeded lettuce mix ('Wildfire' lettuce mix from Johnny's Seeds) and spinach ('Space' from Johnny's Seeds) under 50% black shade cloth, 50% white shade cloth, or no shade cloth. Although black shade cloth is cheaper and more widely available, we suspected that white shade cloth could lead to higher yields because it may cool the crop and soil more than black shade. Our overall goal is to measure and compare the effect sizes for black and white shade cloth. We also compared the effects of two planting methods for spinach: direct seeding primed seed vs transplanting paperpot spinach (paperpot.co).

For statistical guidance, we are consulting with Dr. Gerald Carter, Assistant Professor of Evolution, Ecology, and Organismal Biology, at The Ohio State University.

What were the results? *(One paragraph on the outcome of the experiments, what was learned from them)*

Data analysis is in progress, but preliminary analyses of data from 2021 tentatively suggest white shade cloth may have led to higher yields for leafy greens (Figure 1). Preliminary analyses suggest no clear evidence for an effect of planting methods. Currently, we are working to combine our analyses from 2020 and 2021.

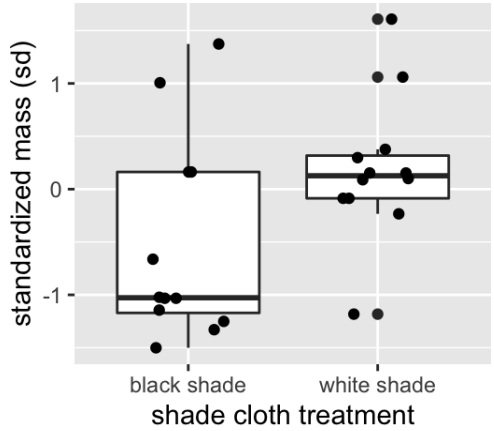

Figure 1. Preliminary comparison of leafy green yield by shade cloth color. Plot shows evidence for an effect of shade cloth color on crop yield. Y-axis is units of standard deviations in mass, i.e. mass of bed scaled within each crop type (lettuce mix or spinach).

How have the results contributed or will they contribute to sustainable agriculture? *(One paragraph on how will farmers use this research information and what difference will it make on their farm?*

Climate change is making it harder to grow healthy crops through the hottest parts of summer, and many farmers are desperate to find ways to adapt to the heat. Our goal is to test low-cost approaches that small-scale organic farmers can use to increase yields of spinach and lettuce during increasingly hot summers. By sharing our results, we hope to help farmers make informed decisions that can increase their resilience and potential profit in the face of climate change.

In February 2021, we presented the results from our 2020 experiment at the Ohio Ecological Food and Farming Conference. In addition to presenting our findings, we translated our effect sizes into a financial cost-benefit analysis to estimate how much money a farmer could save under a realistic scenario. Our talk was well attended, and five attendees told us that they thought it was the best or most helpful of the conference.

To share our methods and findings with other growers, we plan to present our most recent findings at a public outreach field day at Franklinton Farms in Spring or Summer of 2022 with on-site technique demonstration. We also hope to publish our findings in a peer-reviewed scientific journal, such as the Journal of Extension.