

FARMER-LED TRIALS REPORT

TROUVAILLE FARM

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Farmer-Led Trials: Shade Cloth for Seed Production



IN A NUTSHELL

Applying shade cloth is a common season extension technique. In Southeastern Ohio, seed grower Lindsay Klaunig wanted to determine if shade cloth improved fruit set, yield, and seed quality of peppers. The trial used a randomized block design with shaded and unshaded plots. Data collected included fruit and seed weight, and seed germination. Results showed higher fruit and seed yields in unshaded plots, which may have been a result of higher temperatures under the shade cloth. In the future, Lindsay plans to test white shade cloth and larger hoops for her netting, which may help provide shade from the sun and reduce under cloth temperatures.

ABOUT THE FARM

Lindsay Klaunig is the owner/operator of Trouvaille farm, located in the hills of Southeastern Ohio. With 20 years of growing experience, she produces a range of openpollinated vegetable varieties that are being grown as seed crops, to be sold through small regional seed companies, along with a diversity of heirloom crops grown for local and regional markets.

Lindsay manages the land using regenerative, organic practices and focuses on building healthy soil, and increasing biodiversity so that she can provide nutritious food for her family and neighbors. She uses many different tactics to keep her organic farm thriving: like planting insectaries, rows of flowering plants that Farmer-Researcher: Lindsay Klaunig Trouvaille Farm Athens, OH



Lindsay with her goats.

attract beneficial insects, throughout the farm that naturally keep pests under control; and planting cover crops in any beds not occupied by a market crop to help protect the highly erosive ridgetop soils, reduce weed pressure and provide habitat for pollinators.

WHAT WAS THE ON FARM TRIAL ABOUT?

As a seed grower, it is important to Lindsay to have access to varieties that are regionallyadapted and able to thrive in low-input



Too hot for peppers?

High temperatures can result in reduced fruit yields in bell peppers.

Lindsay's research question was: Will using shade cloth improve fruit set in pepper plants grown for seed? And how will that impact fruit yield and seed yield?

systems. She sees the opportunity of openpollinated seed varieties as a vital tool as the climate changes and modern hybrids may not have the same capacity to thrive in severe weather events. Seeds from open-pollinated varieties can be saved by the grower and selected for those that best meet the demands of their own particular climate, growing systems and market. This is ever more important for growers using organic systems, where farmers look to cover crops and compost for soil fertility rather than synthetic fertilizers.

In recent years, the extremes of heat and drought have been a major challenge for many of her long season summer crops, like tomatillos and peppers. Lindsay has been interested in trying shade cloth on her peppers, but wasn't sure if it would have a negative

Related research:

- <u>Photoselective Shade Netting in a Sweet</u>
 <u>Pepper Crop Accelerates Ripening Period and</u>
 <u>Enhances the Overall Fruits Quality and Yield</u>
- Bell Pepper Crop as Affected by Shade Level

effect on fruit set or seed production. Lindsay thought that shade cloth may help certain crops produce more flowers, fruit, and seed in the heat of the summer.

Since Lindsay grows many pepper varieties and their seed value is relatively high, she wanted to find out will using shade cloth improve fruit set in pepper plants grown for seed? And how will that impact fruit yield, seed yield and seed quality (germination).

HOW WAS THE TRIAL DONE?

The trial was designed as a randomized complete block design, with one factor: shade cloth. Treatments were: 1) peppers grown under 35% black netting shade cloth and 2) peppers grown under no shade cloth. Fresh fruit weight, and fresh and dried seed weight were measured, and fruit quality data observations were made. Since she often sells her peppers for seeds, rather than as fresh fruit, this was the most helpful measurement for her production practices.

The farm is hilly, so Lindsay randomized to mitigate the air flow and grade issues. Both areas were treated with the same cultivation and mulched with hay.

market crop	BLOCK 1&2	BLOCK 3&4	market crop
tomato	buffer	buffer	beans
	51	N3	
	buffer	buffer	
	N1	53	
	buffer	buffer	
	N2	54	
	buffer	buffer	
	52	N4	
	buffer	buffer	

Figure 1. Plot layout of the trial at Trouvaille Farm.

During the summer of this trial, the weather was extreme and Lindsay experienced a very hot, dry summer. Extreme drought conditions in her region and a very late heat wave in September all had a great impact on her peppers and the outcomes of this trial.

Table 1. Thirty year and 2024 monthly mean air temperatures in Athens, OH.

Month	Mean air temperature 1991-2020 (°F)	Mean air temperature 2024 (°F)
March	41.1	47.7
April	52.4	58.0
May	61.1	65.2
June	69.4	72.6
July	72.7	75.0
August	71.4	73.9
September	65.0	67.9
October	53.8	54.6



Drought map of the region on the first harvest date.



Drought map of the region on the second harvest date.

Fruit yield and other data were collected twice over the growing season, once in September and again in October. Data were combined across harvests to reflect total fruit and seed yield, and analyzed separately.





Pepper harvest at Trouvaille Farm, with different blocks labeled in separate bags.

We intend to replicate this experiment again with other seed crops, like cucurbits and certain flowers that seem to suffer in high heat. It will help that we now have a framework to start with, for trial plot design and data collection records.

- Lindsay Klaunig, farmer-researcher

FINDINGS

Total fruit yield (Harvest 1+Harvest 2) was significantly higher in non-shaded plots, with a total yield of 10.9 lb compared to just 4.7 lb in shaded plots (Table 2). Seed yield (per plant and per bed ft) was also higher in non-shaded plots. Seed yield per lb of fresh fruit was higher in shaded plots, but this is likely due to the low fruit yield in these plots.

There were, however, some differences between results from the two separate harvests in September and October. For example, in Harvest 1, seed yield per bed ft was not significantly different in shaded vs unshaded plots, but in Harvest 2, seed yield per bed ft was significantly higher in unshaded plots

Figure 2. Seed yield in shaded and unshaded pepper plots. Error bars denote standard deviation; within

per bed foot (g)

Figure 2. Seed yield in shaded and unshaded pepper plots. Error bars denote standard deviation; within each harvest date, overlapping error bars indicate no significant difference between treatments at α =0.05.

(Figure 1). It should be noted that the actual values of seed produced per bed ft was similar

at the two harvest dates, but because of increased variability, statistical significance was not detected. Due to this high variability, we would recommend larger plots and/or more replications in future studies.

Та	hi	10	2

Treatment	Combined Harvests					
	Fruit yield (lb)	Seed yield/lb fresh fruit	Seed yield/plant (g)	Seed yield/bed ft (g)		
Shade	4.7	6.9	2.2	3.5		
No Shade	10.9	5.2	4.1	6.3		
F test	**	**	*	*		

* significant at P<0.1, ** P<0.05, ns denotes no significant difference at P<0.1



TAKE HOME MESSAGES

The season that this trial took place was one of the warmest and driest on record. The use of black shade cloth may have increased the temperature rather than provide any shade relief, as intended. In the future, Lindsay would like to try white shade cloth, and be sure to use larger hoops to allow space for more airflow over bushier crops like peppers.

During this trial Lindsay grew the pepper Yaglik 28, which is a Turkish sweet pepper landrace, introduced to the US by Mehmet Oztan of <u>Two Seeds in a Pod</u>. It is a feature of landraces to have variability, and so this may have been a factor for the range of fruit size as well as for the size and weight of the seed. This variability is an asset that allows for adaptation to a variety of growing conditions, but also poses a challenge for collecting data in a small scale grow-out. Lindsay observed one block in the no shade treatment that thrived, and produced larger than average fruits, and may have become an outlier in the data. While Lindsay values the traits of landrace varieties, the inherently greater genetic variability in trait expression may result in greater variability in the data, necessitating a larger sample size.



Pepper seeds fermenting prior to cleaning.



Pepper seeds drying.

ACKNOWLEDGEMENTS

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Farmer-Led Trials Program Spotlight: Trouvaille Farm

Written by Mary Hathaway, OFRF's Research & Education Program Manager

In the hills of Southeastern Ohio you will find Lindsay Klaunig on her farm: Trouvaille Farm. While she has been a grower for more than 20 years, this her seventh season as owner and operator of Trouvaille Farm, something that the name itself acknowledges (Trouvaille means lucky find).

The farm landscape is a patchwork of diversity. There are grass-fed beef and goats on pasture, heirloom crops on the ridge tops and fruit trees throughout the farm. Many of the open-pollinated varieties are being grown to maturity and processed as seed crops, to be sold through small regional seed companies.

Lindsay manages the land using regenerative, organic practices and focuses on building healthy soil, and increasing biodiversity so that she can provide nutritious food for her family and neighbors. To avoid using pesticides, there are insectaries, rows of flowering plants that attract beneficial insects, throughout the farm that naturally keep pests under control.

Open Pollinated Seeds for Climate-Resilience

As a seed grower, it is important for Lindsay to have access to varieties that are regionally adapted and able to thrive in low-input systems. She sees the opportunity of open-pollinated seed varieties as a tool that is vital as the climate changes and modern hybrids may not have the same capacity to thrive in severe weather events. Seeds from open-pollinated varieties can be saved by the grower and selected for those that best meet the demands of their own particular climate, growing systems and market. This is ever more important for growers using organic systems, where farmers look to cover crops and compost for soil fertility rather than synthetic fertilizers.



An apprentice in the pepper field at Trouvaille Farm.

In recent years, the extremes of heat and drought have been a major challenge for many of her long-

season summer crops, like tomatillos and peppers. Lindsay has been interested in trying shade cloth on her peppers to help nurture them through extreme weather conditions, but she wasn't sure if it would have a negative effect on fruit set or seed production. After learning about OFRF's Farmer-Led Trial program, she decided this would be a relatively risk-averse way to see the impact of this growing practice on her harvest.

Farm trial plan

After considering some of the logistics of on-farm research trials with OFRF staff, Lindsay was able to develop a question that would help her decide if shade cloth would help, or hurt her seed harvest. The trial was further narrowed down to peppers. Research Questions: Will using shade cloth improve fruit set in pepper plants grown for seed? And if so, will that lead to early mature harvest and overall higher yields?

The trial was designed as a paired comparison with the treatments being peppers that were given 35% black netting shade cloth vs. peppers that received no shade cloth. The measurements Lindsay decided upon were to weigh the fresh fruit harvested and the fresh and dried seed weight in addition to taking basic fruit quality observations. Since she often sells her peppers for seeds, rather than as fresh fruit, this was the most helpful measurement for her production practices.

market crop aisle BLOCK 18.2 aisle BLOCK 38.4 aisle market crop buffer <

Plot map - legend S= shade; N= no shade

Trial updates

Harvest data is almost complete, with the first harvests beginning in late September, much later than expected due to the extreme drought conditions. Once the harvests are complete, Lindsay and the OFRF staff are excited to see the results and impact of shade cloth on pepper production.



"Every season we adjust our growing methods and try out new techniques. But inevitably the season gets busy, we lose track of outcomes and end up with incomplete impressions of what worked or didn't. With the FLT program, I had support in designing a solid project, and funds to allow me allocate time and focus to data collection and analysis."

– Lindsay Klaunig, Trouvaille Farm

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Learn more about OFRF's Farmer-Led Trials Program



