



Mulching the garden with wool

Melanie Stock, Alex Rodriguez, and Chad Page

Associate Professor / Extension Urban & Small Farms Specialist



Navajo Sustainable Agriculture Project
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Our research:

Improve crop and sustainability

- Some research is very basic – what to plant and when, how to harvest, expected yield, markets.
- We also work on **season extension** (using tunnels) to address supply shortages, improve quality, and help farmers sell earlier and longer in the season.
- More focus now on sustainability – taking care of **soil, nutrients, water**, and preparing for drought.
 - Irrigation rates for flowers
 - Restricted irrigation of low-water annuals, in tunnel and field systems + wool mulch.
 - Water-wise perennials with mulches



Many mulches reduce weeds, save water



Plastic (black plastic or woven fabric)

- *Advantage:* Woven fabric lasts multiple years. Black warms the soil and traps heat to keep soil warm at night.
- *Drawback:* Expensive, too hot for some crops in summer, replacement each year. Many farmers wish to use less plastic.



More mulch options

- Wood chips/bark
 - *Advantage*: Breaks down and adds organic matter to the soil.
 - *Drawback*: Perennials ok, but keep adding more to maintain. Disrupts tillage, can steal nutrient (problems for annuals). Can be \$\$\$\$.
- Hay/straw/bedding/leaves
 - *Advantage*: adds organic matter to soils.
 - *Drawback*: cost adds up, add more to maintain, weed seeds.



What about wool? Interested because...



- **Natural** product. **Less plastic, supports local.**
- Breaks down...someday
 - Has **nitrogen** (about 10%). #1 plant nutrient.
 - Holds up well – might not need to replace each year. No idea how long, depends on how thick.
- **Insulates** and **protects** the soil
 - Keeps water in, lets rain pass through.
 - Keeps soil cooler (summer) and reflects sunlight, warmer (fall).
 - Protects soil surface from wind.



What about wool? Uncertainty because...

- **Pricing** – how may it compare to other mulches?
- Does it **break down** in our sun OR **persist/disrupt** tillage?
- Can **weeds** grow through? Could it add weeds?
- Is crop **harvest** more difficult?
- How to **transport** bulk wool efficiently?
- How much **water** could it save?
- Can **yield** increase?
- Do some plants do worse?
- Would gardeners/farmers accept it?



(I still can't answer all of these! Love to hear ideas...)

Goals of the wool mulch studies



- **Part I: 6 warm-season annual flowers**
 - Develop guides for 6 new flowers that are important to florists (sales) *and* might use less water.
 - Limit irrigation: water 2x/week, no more than 1.5 in/wk. (1/2 the water needed by the #1 flower crop.)
- **Part II: 3 water-wise perennial flowers**
 - Develop guides for 3 new flowers that are important *and* might use less water.
 - Test different mulches
 - Use soil moisture to irrigate
- I also tried the **wool at home with vegetables**: tomatoes and peppers (2023), squash and potatoes (2024), squash and peppers (2025)

Trialing 6 crops in 2023 and 2024

- Short to tall annual flowers: gomphrena, dianthus, statice, strawflower, centaurea, cosmos
- Different growth rates, bloom timing, yield potential, water tolerance.



The six flowers tested



Dianthus



Strawflower



Statice



Centaurea



Gomphrena



Cosmos



Here is what we did in 2023

- Bed prepped – tilled, installed sensors, laid drip tape.
- 10 lbs of wool per 16 ft² (0.6 lbs/sq. ft.). 4" thick. Any thicker = small plants struggle. Netting to secure in 2023, but this was **not** needed.



What we did in 2024

- The old wool decomposed a lot, but some remained on the soil until spring. We cleared this away, tilled, and prepped the field like usual.
- We also soil tested.
- Then laid new wool and planted. NO netting – stayed in place fine.



I grow food, so I put extra wool at home

- 2023 – applied wool after planting tomatoes and peppers.
- 2024 – planted squash in 2nd year wool, potatoes in fresh wool
- 2025 – planted peppers, eggplant, okra in 3rd year wool, squash in 2nd yr.



Then we cared for the crops

- Irrigate twice per week, less than 1.5 in/wk.
- Fertigated, injected fertilizer into drip tape. (At home, I added nutrients before wool.)
- Harvested 1-3 times per week.
- Weed as needed.

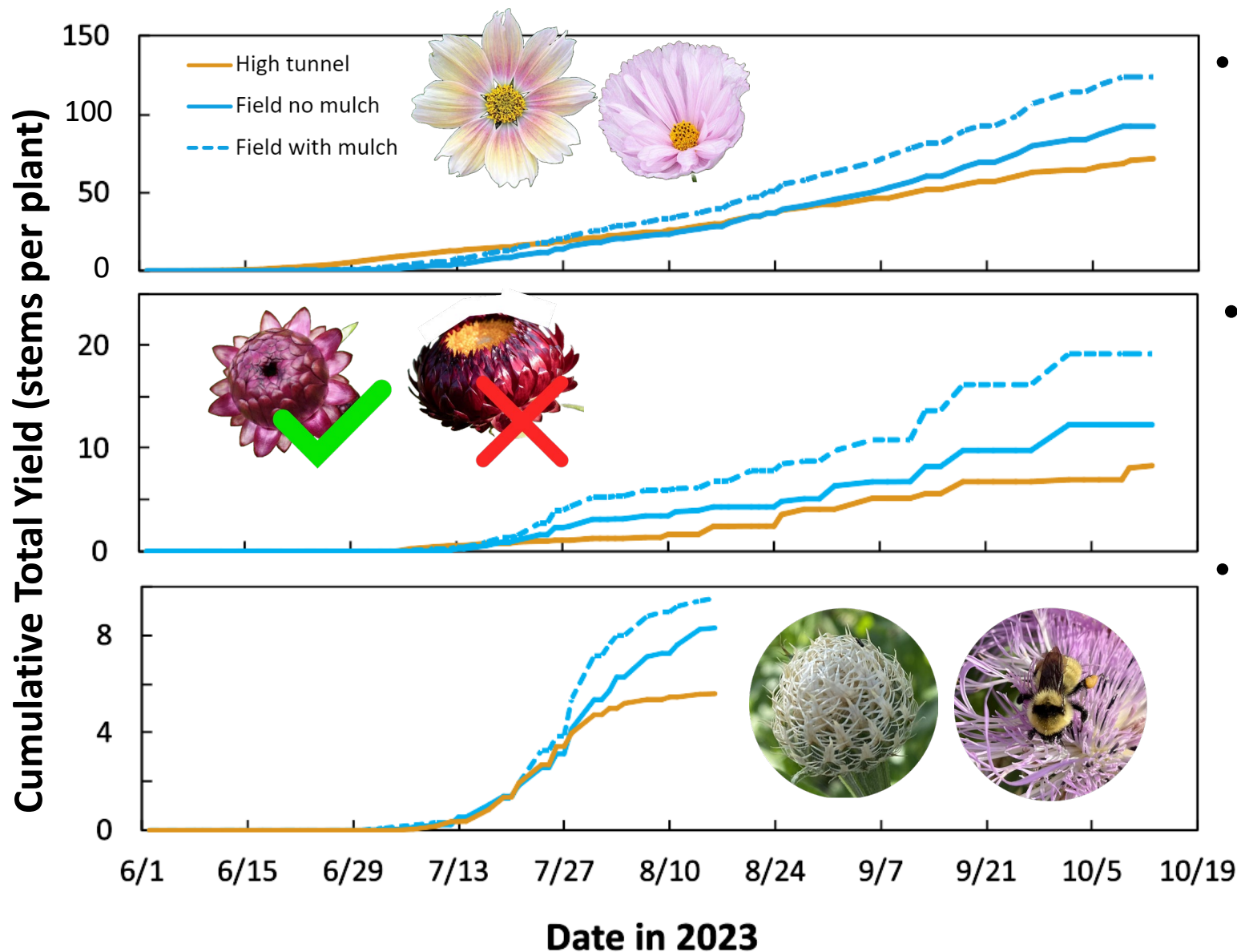


Overall observations

- Early season
 - Wool smelled at first – kinda like it, but some may not.
 - Challenging for short or slow-growing plants.
 - Best used with transplants or add well after emergence of tubers or direct-sow crops.
 - Netting was **not** needed – won't use again.
- Later season
 - May use less. Held up; reduce cost for competitiveness.
 - Wool helps with weeds, but not bindweed.
 - Not very effective for repelling slugs and earwigs.
 - Provided habitat to beneficials.
 - Home: stayed in place with flood irrigation too.
 - May consider wool after soil warms up for some crops.

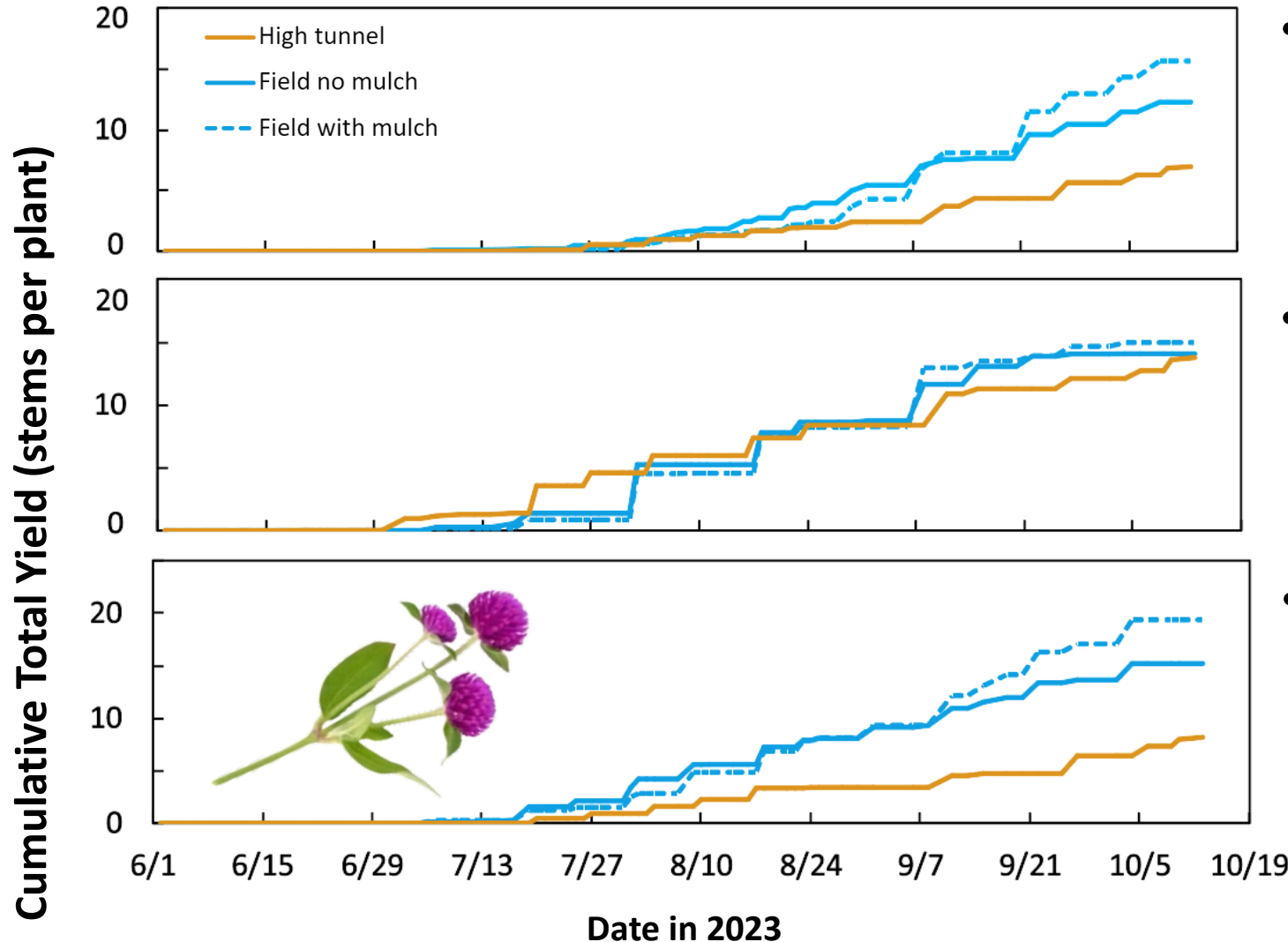


First three cut flowers...wool yields best



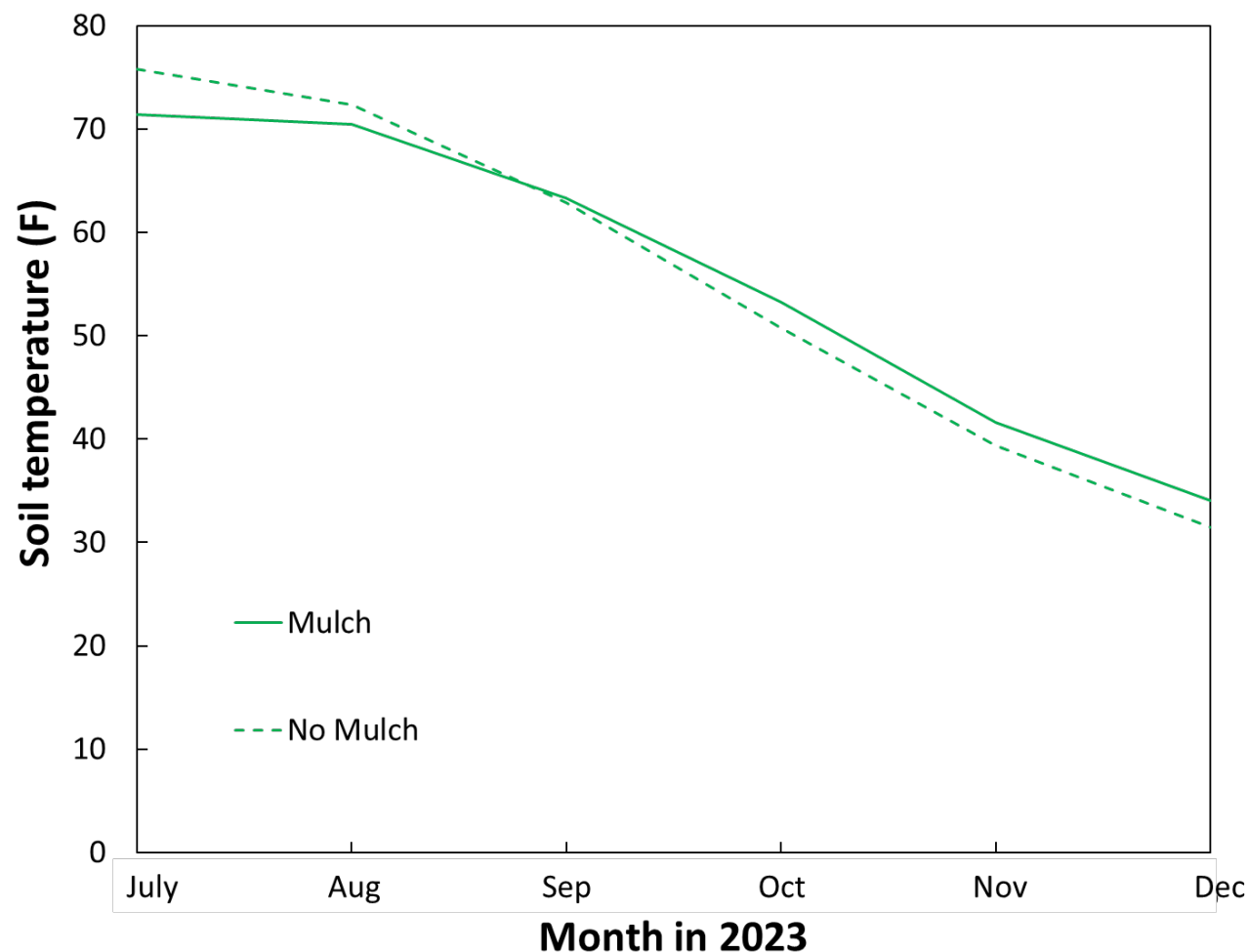
- **Cosmos:** 50-60 days to maturity
 - 40% increase in late season production compared to early summer
 - Differences in production by cultivar
- **Strawflower:** 75-85 days to maturity
 - 82% of all stems were marketable
 - Specific harvest time at the "bundt cake" stage
- **Centaurea:** 65 days to maturity
 - Many ideal harvest stages
 - 2x increase of yield in late July
 - Popular with pollinators

...and the other 3 flowers – wool won again



- **Dianthus:** *90-120 days to maturity*
 - Blooms increased later in the season (late Aug. to early Oct.)
 - Early Sept. rainstorms - inflection point between mulch vs bare
- **Statice:** *90 days to maturity*
 - HT production started 1 month earlier
 - Long recovery period between harvests and late ideal bloom stage
- **Gomphrena:** *90+ days to maturity*
 - Adjust initial cut for longer stems by leaving extra buds
 - HT was less productive

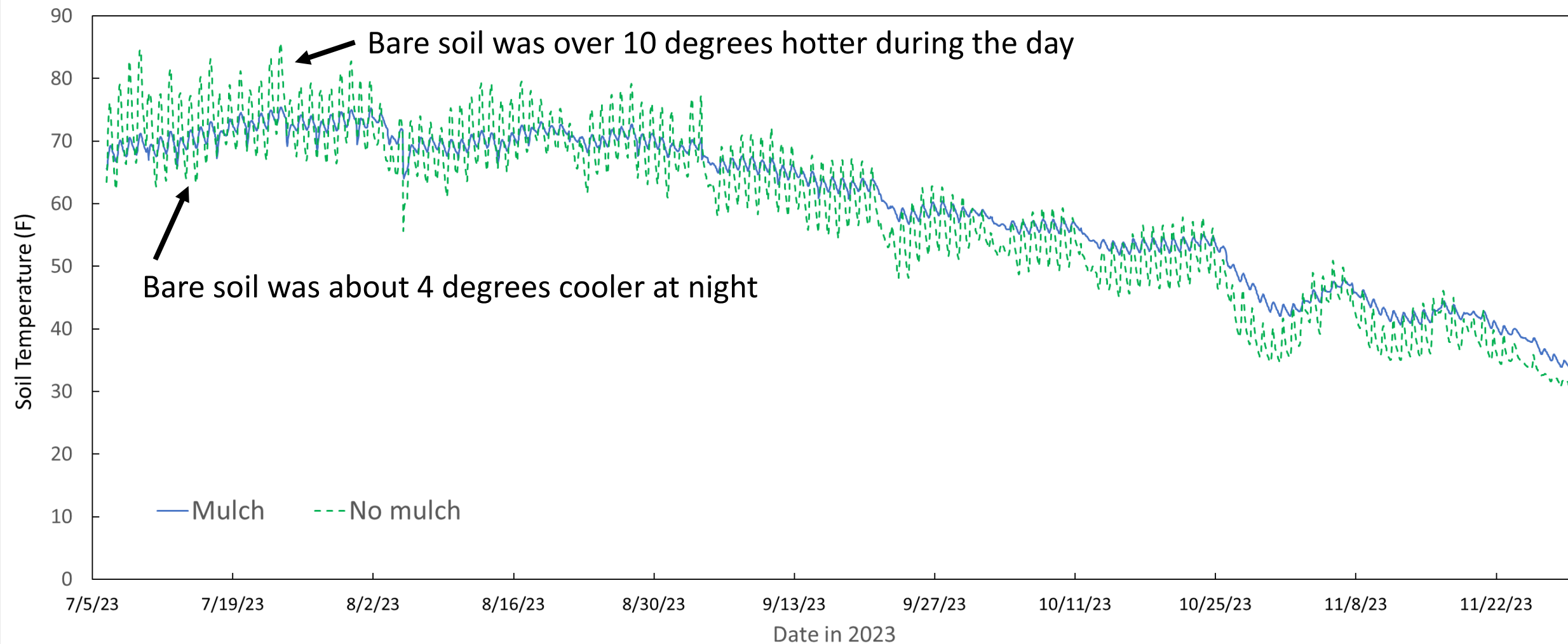
Soil temperature – cooler in summer, warmer in fall.



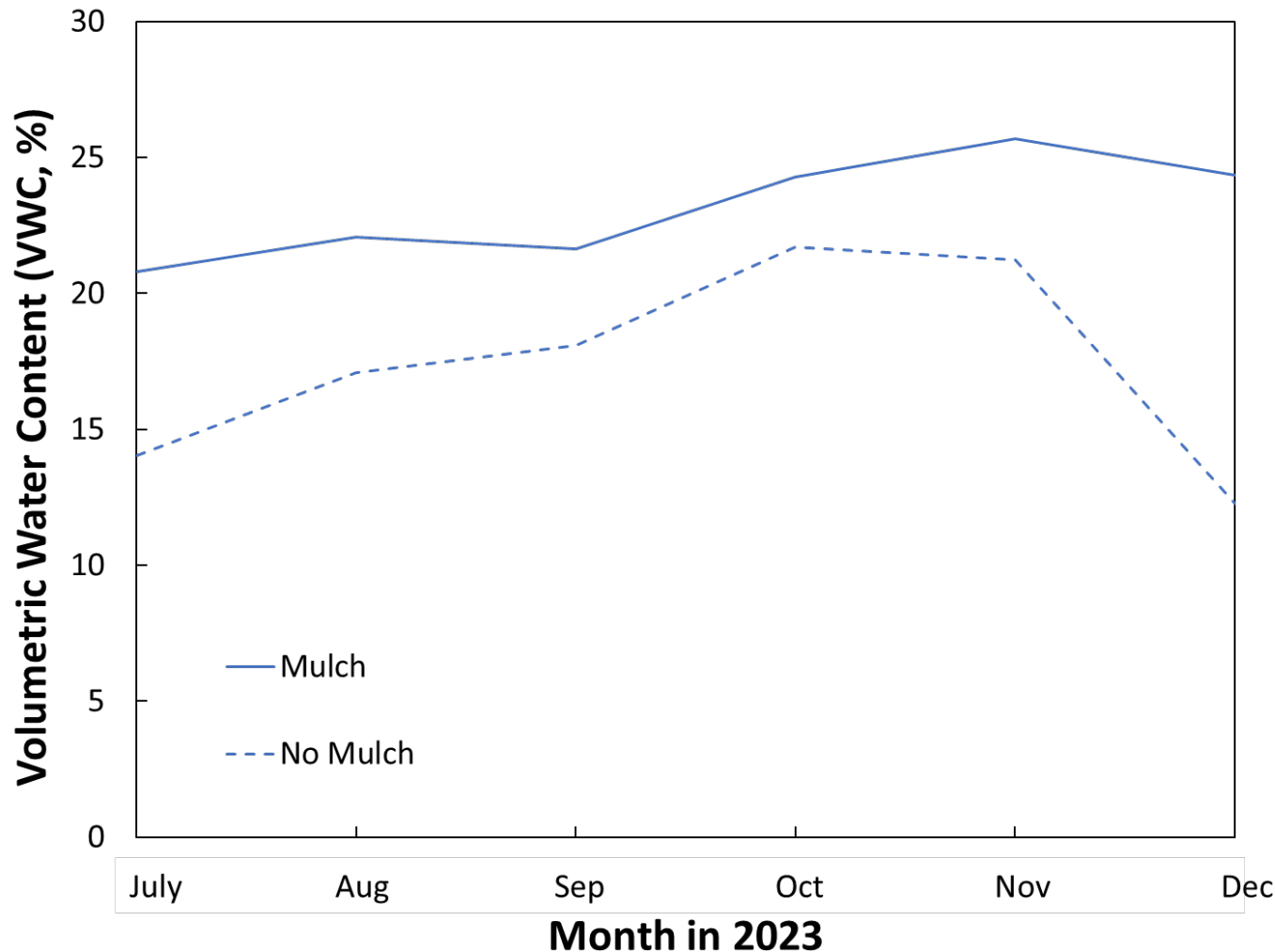
- 3 inches deep
- Differences look small when we zoom out to month



Here is hourly soil temperature



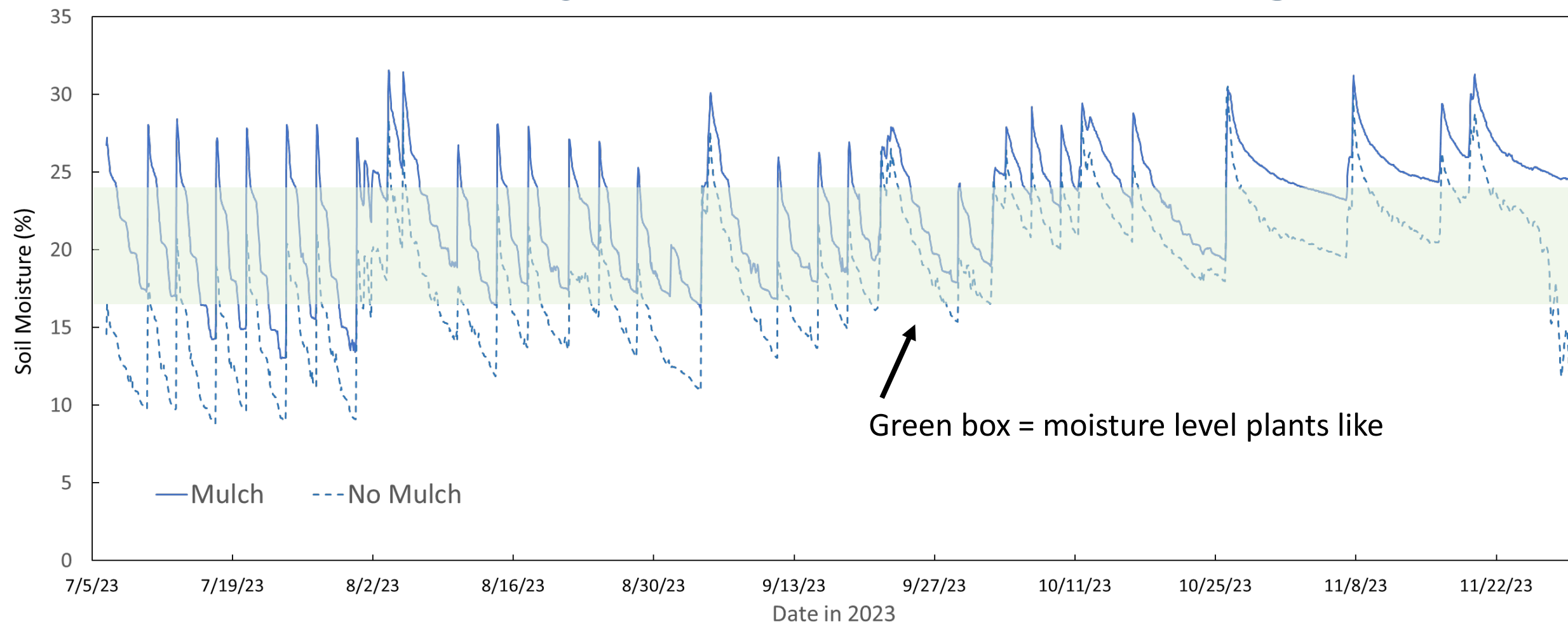
Soil moisture – more water in soil with wool than bare soil.



- 3" depth: wool kept about 5% more moisture in the soil than bare soil.
- This is about 100 gallons more water over 1000 sq ft with wool than without!
- Amazing because we had a much more productive crop too.



Here is hourly soil moisture storage



Soil conditions after a year of wool

Soil condition	After wool	Bare soil	Optimal	Interpretation
pH	7.8	7.8	6.5 – 8.0	No change
Salinity (dS/m)	0.73	0.48	<2.0	Wool increased salinity – drawback
Phosphorus (P, ppm)	18.6	24.1	21-30	Greater crop P use?
Potassium (K, ppm)	200	129	126-300	Wool added K
Nitrate-Nitrogen (N, ppm)	12.6	2.86	>25	Wool added N – best benefit



2024 weather and field conditions

- We had a cold spring with frost in late May and mid-June.
- More frost damage with wool. Roots and parts of plants in wool survived – replanted about 10% of one crop.



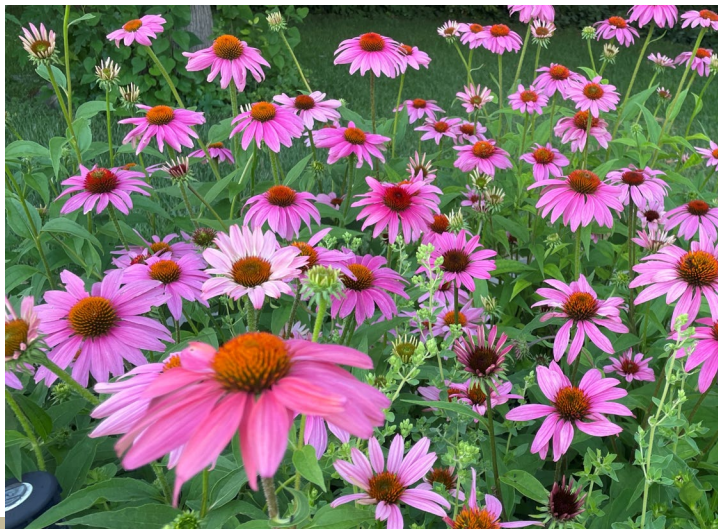
2025-2026 Mulches

- This summer, we expanded the project to study:
 - New wool each spring
 - Same wool (2-years old)
 - Plastic fabric
 - Bare soil.
- Much larger and detailed trial:
 - 144 Plots!
 - 1,152 plants!
- Wool applied:
 - 3" deep instead of 4" (7.5 lbs/16 ft²)
 - White Romney and Black Face.



2025-2026 Flowers

- 3 perennials that are likely drought tolerant and identified as priorities for Utah's floral markets. Also commonly grown in landscapes.
 - Echinacea (cone flower): 'Primadonna Deep Rose', 'Primadonna White', 'Magnus Superior'
 - Echinops (globe thistle): 'Blue Glow', 'Star Frost', and 'Ritro'
 - Eryngium (sea holly): 'Blue Glitter', 'White Glitter', and 'Sea Holly'

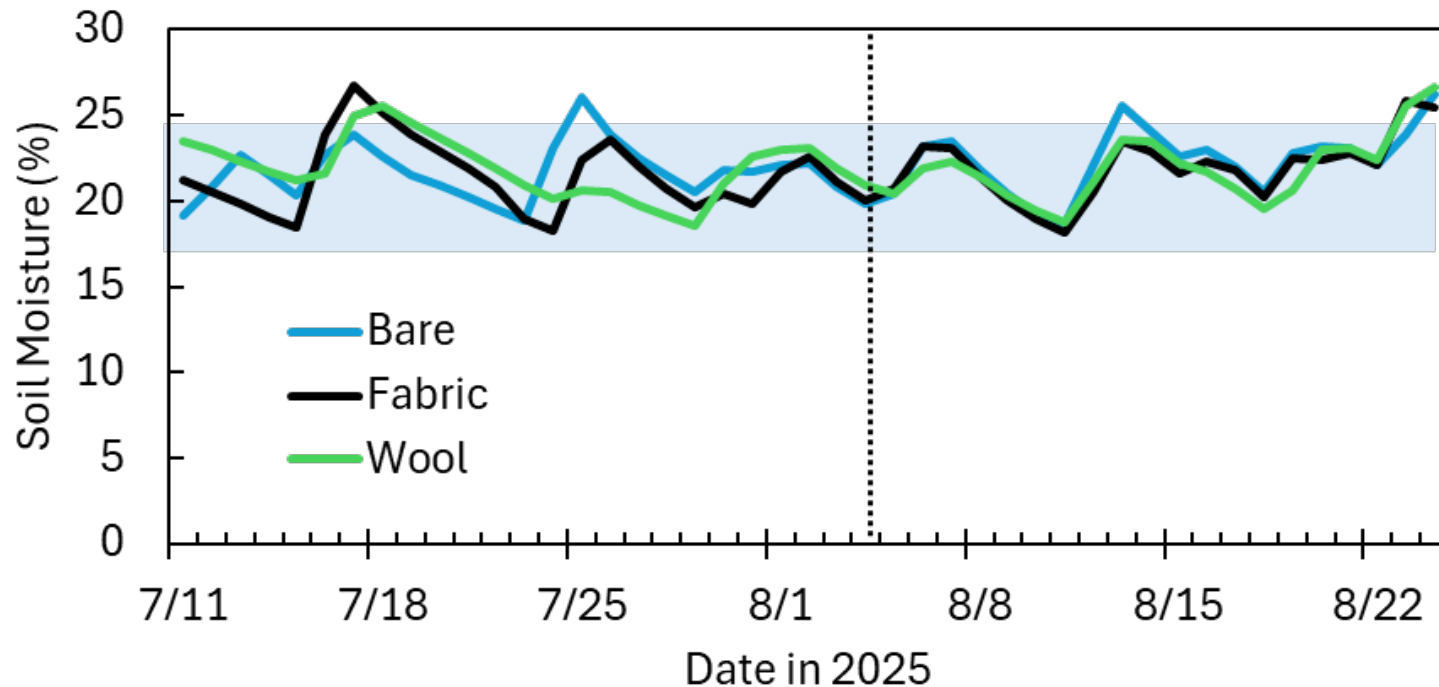


Here is our study in 2025



How we watered

- We measured soil moisture to know when to add more water.
- Goal: keep moisture in the light blue zone so plants are not stressed
- Do you see any patterns?



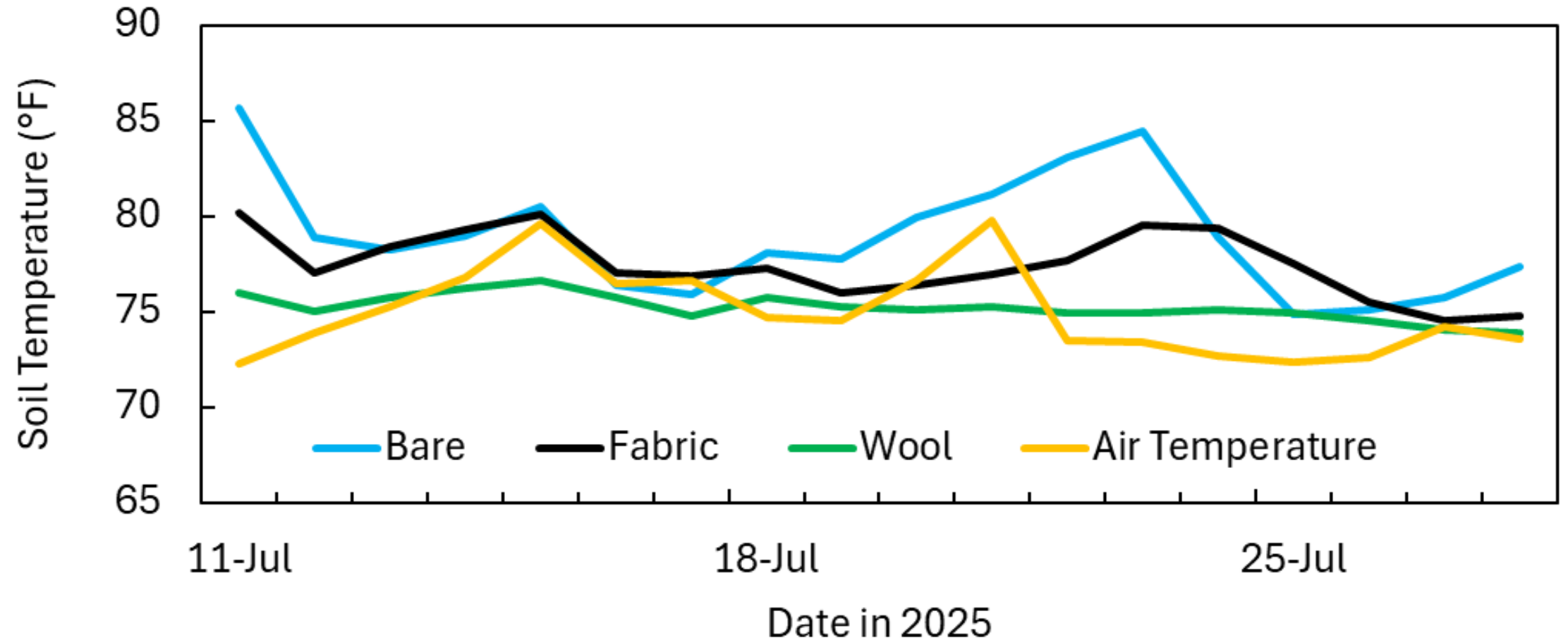
Amount of water used so far

Month	Bare Soil	Fabric	Wool
	Gallons of water used*		
July Total	575	516	357
August Total	664	758	671
<i>July-Aug Total</i>	<i>1240</i>	<i>1275</i>	<i>1029</i>
	Inches of water used*		
July Total	3.0	2.7	1.9
August Total	3.5	4.0	3.5
<i>July-Aug Total</i>	<i>6.5</i>	<i>6.7</i>	<i>5.4</i>
	Hours of Irrigation*		
July Total	7.5	6.8	4.7
August Total	9.3	9.8	8.6
<i>July-Aug Total</i>	<i>16.8</i>	<i>16.7</i>	<i>13.2</i>

*average per 4 ft x 74 ft (296 sq. ft) bed



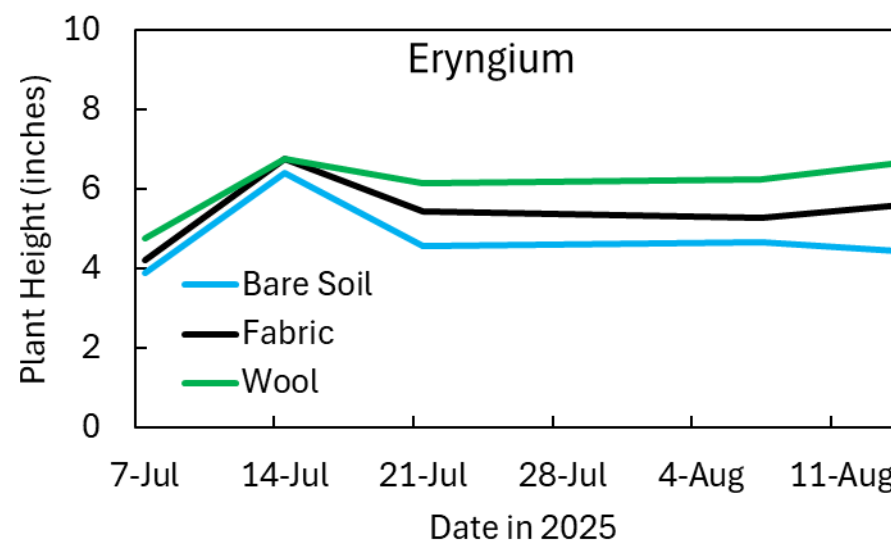
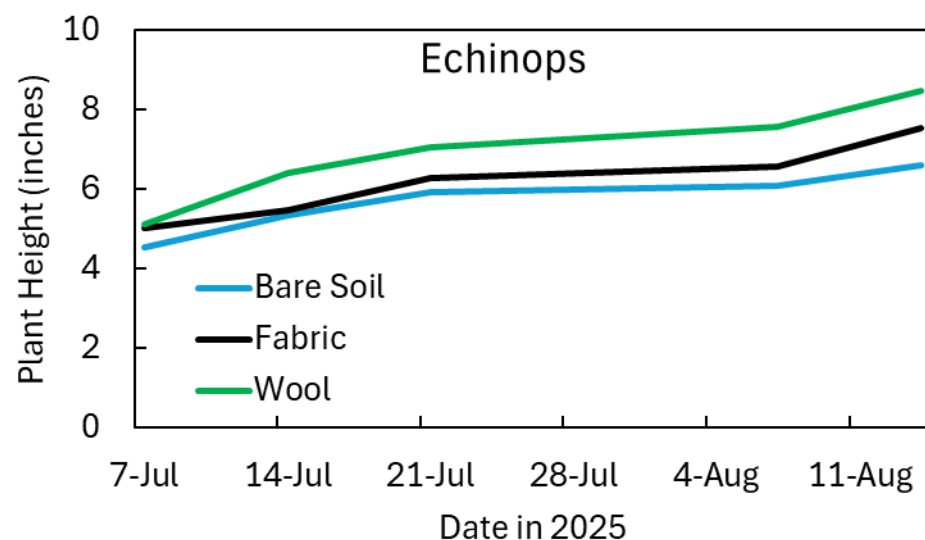
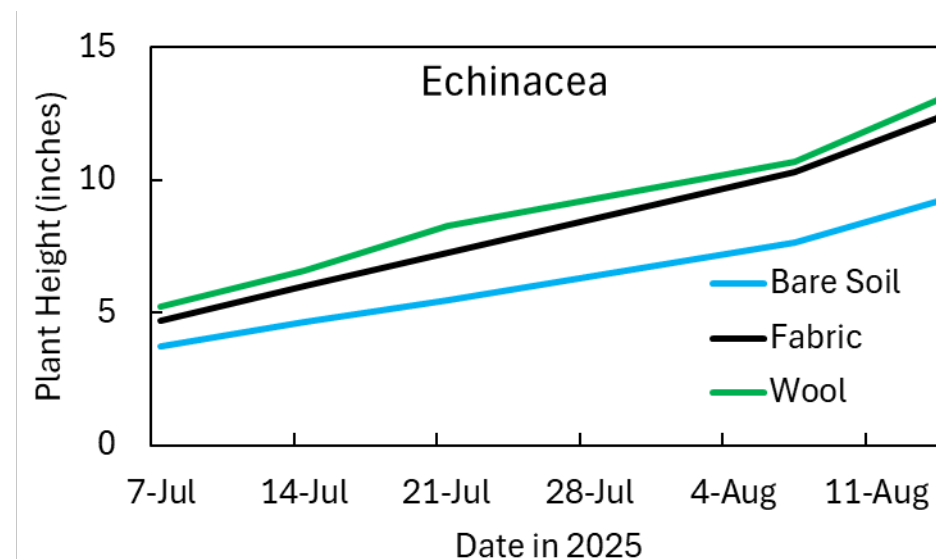
Soil temperature is cooler under wool



Growth: Plant Height

All crops were taller with wool, followed by fabric, and shortest with bare soil.

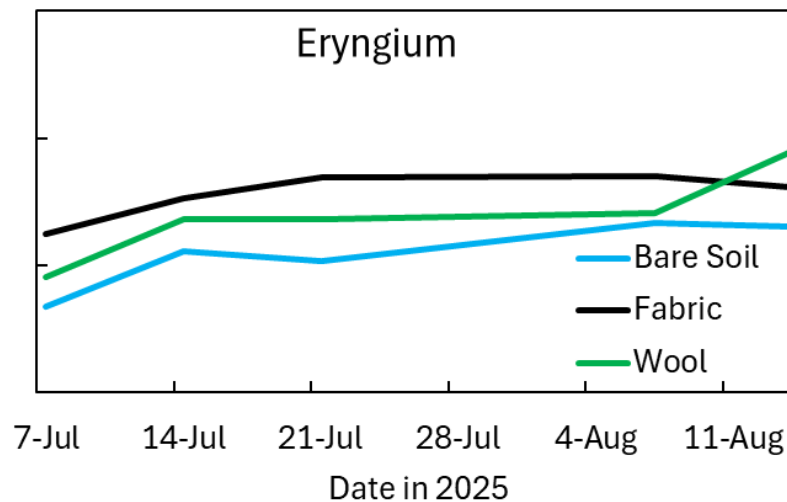
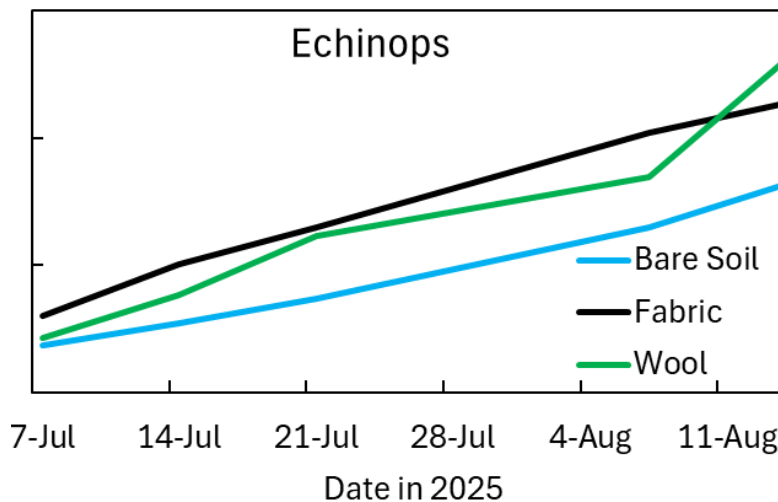
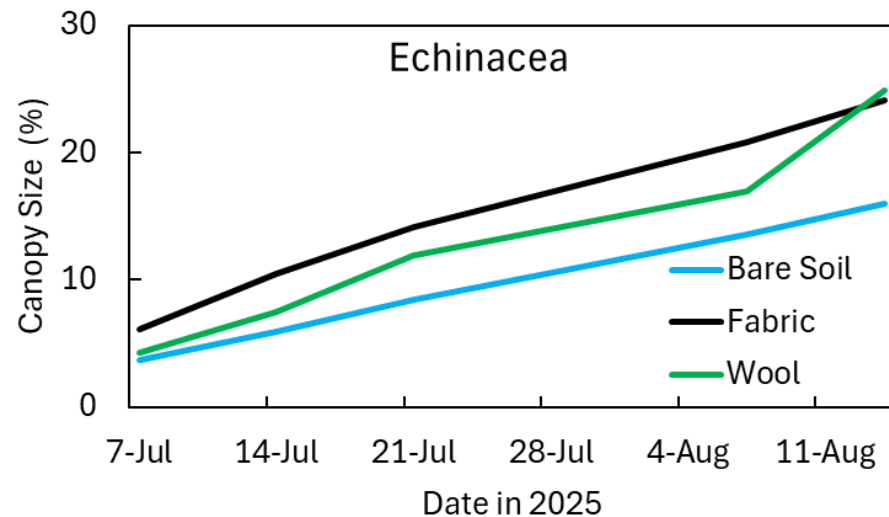
- Taller in wool than bare by 2.6 inches
- Taller in wool than fabric by 0.9 inches
- Taller in fabric than bare by 1.8 inches



Growth: Plant Canopy

Most of the season, crops were wider with fabric, then wool, and bare soil. Now:

- Bigger in wool than bare by 8%
- Bigger in wool than fabric by 2%
- Bigger in fabric than bare by 6%



Farm logistics and considerations



- Weeding is the most time-consuming aspect of the study
- Wool is no match for bindweed!
- Planting into wool can be tricky – careful not to bury the plants or let them get burned.
- We are testing wool at our farm in Cache Valley. How would the wool behave and plants respond by you? We would love to work together to understand more soils and weather conditions.



Summary of findings... so far

- Annuals with restricted irrigation & wool
 - Greater yield in the field than tunnel, and with wool mulch vs. bare soil.
 - More soil moisture with wool mulch – could cut water use.
 - Cooler summer temperature with wool mulch, keeps warmer in fall.
- Perennials with wool, fabric, and bare soils
 - More growth with wool and fabric, less water use. We'll find out about yield next year.
 - How can we more efficiently weed?



Please evaluate this talk

- Anonymous
- 5 questions
- Thank you!!



Contact info:



melanie.stock@usu.edu



smallfarmslab.com



[usu_smallfarms](https://www.instagram.com/usu_smallfarms)

Extension
UtahStateUniversity.

