



Improving Mountain West Anemone and Ranunculus Production

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Anemone coronaria and *Ranunculus asiaticus*

- Cool-season annuals
- Minimum air temperature for survival 27°F¹
- Optimum air temperature for flowering^{2,3}:
 - Day: 57-64°F
 - Night: 41-50°F
- Air temperature of 77°C triggers dormancy⁴



Anemone tubers



Ranunculus tuberous roots



¹Armitage & Laushman, 1990 ¹Sakai & Yoshie, 1984

²Ohkawa, 1986 ³Ohkawa, 1987 ⁴Meynet, 1993

In Utah, anemone and ranunculus production are challenged by:

- Management recommendations originating from milder climates^{1,2}
- A narrow production window^{1,3}
 - Risk of cold injury through last frost
 - Dormancy induced by >77°F air temperatures as early as June
- Decreased stem lengths due to intense sun and wind^{1,4}



¹Loyola et al., 2019 ²Armitage & Laushman, 2003 ³Utah Climate Center, 2023 ⁴Armitage, 1991

Trial Goals and Field Site

- Determine optimal practices to advance harvest and maximize yield:
 - High tunnel and field
 - Planting dates
 - Winter protection
 - Tuber preparation
 - Cultivar selection
- Work with grower collaborators to investigate different microclimates
- Field Site: Greenville Research Farm
 - North Logan, UT Elevation: 4635'
 - USDA Hardiness Zone 5, Last frost date: May 15



Treatments

High tunnel:

- Nov, Jan, Feb, Mar planting dates
- Winter protection:
 - HT only
 - Low tunnel inside a high tunnel
(AG-50 fabric)

Field:

- Nov, Mar, Apr planting dates
- Winter protection:
 - None
 - Mulch only (straw)
 - Low tunnel only (AG-50 fabric)
 - Low tunnel with mulch



Both sites:

Presprouting

Cultivars:

Year 1 (2019-2020):

Ranunculus 'LaBelle', 'Amandine', 'Gigi', 'Tecolote'

Years 2 - 3 (2020-2022):

'LaBelle' and 'Amandine' Ranunculus

'Galilee' and 'Carmel' Anemone

Presprouting vs. Direct Planting

- Tubers soaked for 3-4 hours in room temperature water
 - Drained and soaked in 0.3% Captan fungicide for last 20 min (ranunculus) or 60 min (anemone)
- Presprouting: tubers placed in flats of moist potting soil, left in GH (~70°F) for 7 days and then garage (~40°F) for 7 days



High Tunnel/Field Prep

- Formed 4' wide beds in field and high tunnel
- Planting: 6" x 6" spacing, 2" depth, staggered rows, pointy ends down
- Installed low tunnels, mulch, and drip tape after planting
- Split application of N, P, and K fertilizer between fall and spring (when buds are visible)



Data Collection

- Air and soil temperature
- Plant emergence
- Harvest timing
- Yield, by grade
- Market demand and pricing
- Estimated supply and labor costs



Quality

- > 10 in.
- Straight
- \$1.50 per stem
- Likely to sell

Speculation

- 8 -10 in.
- Straight
- \$1.25 per stem
- Less likely to sell

Cull

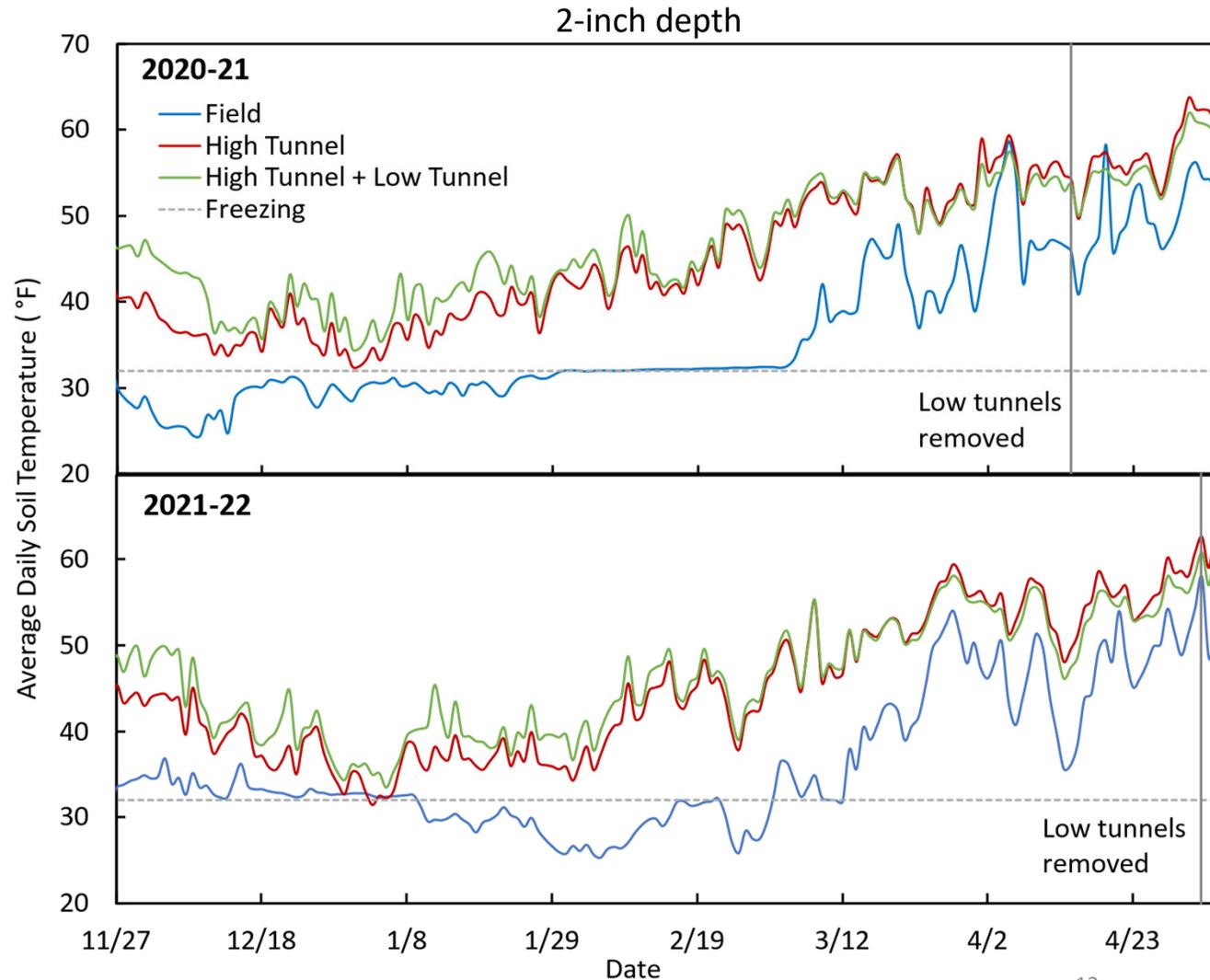
- < 8 in.
- Curved or deformed
- \$0 per stem
- Unable to sell



Results

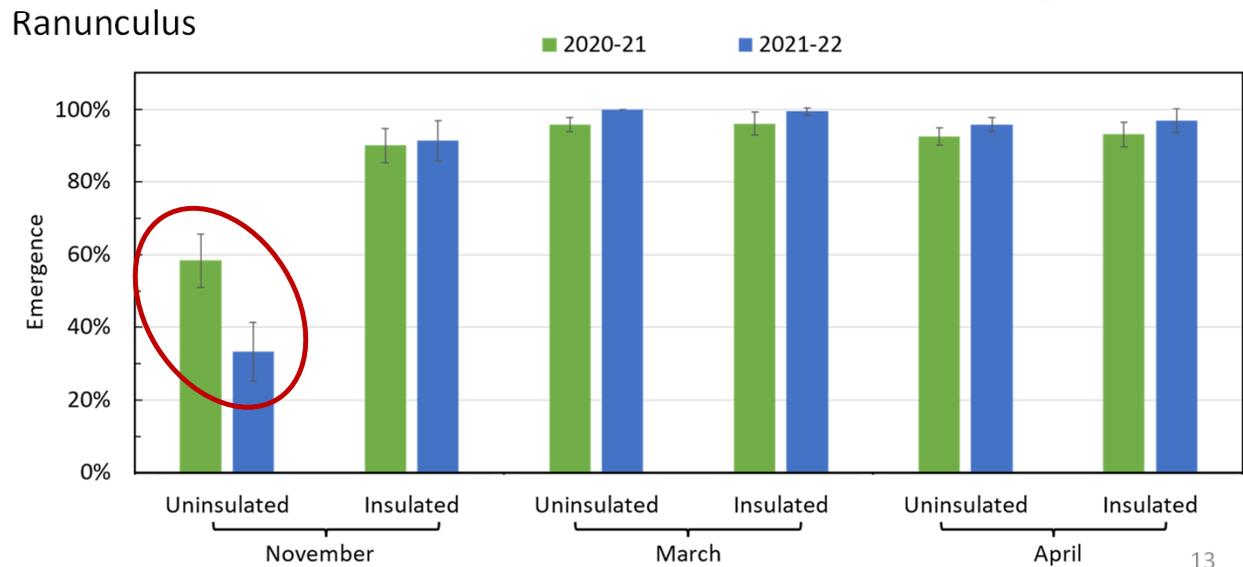
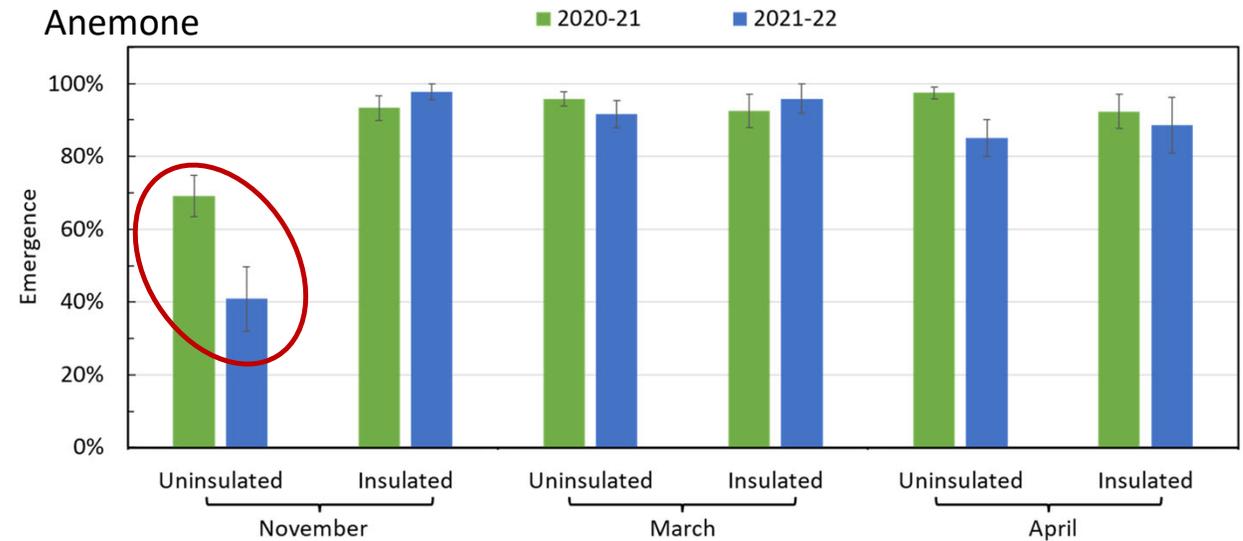
Soil Temperature

- Soil temperature was 9°F greater in the **high tunnel** than the **field**
- **Low tunnels** within the **high tunnel** increased soil temperature by an additional 2°F
- Soil temperatures coldest in Nov. to Dec. 2020 and Feb. – Mar. 2022



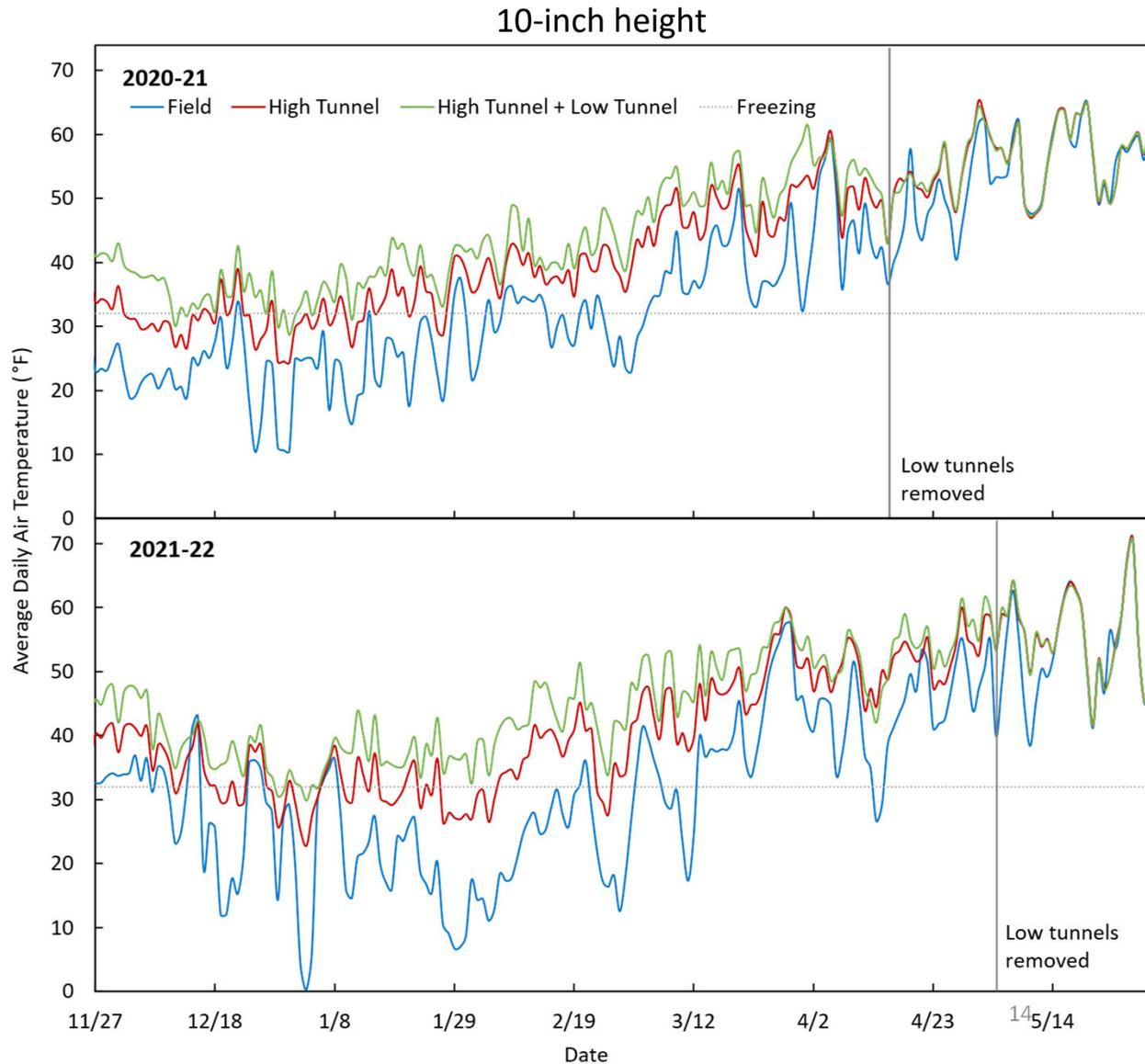
Winter Survival

- Survival of unprotected fall field plantings reduced by cold injury
- All HT and other field plantings had > 80% emergence
- Pre-sprouting increased anemone survival and decreased ranunculus survival for fall field plantings



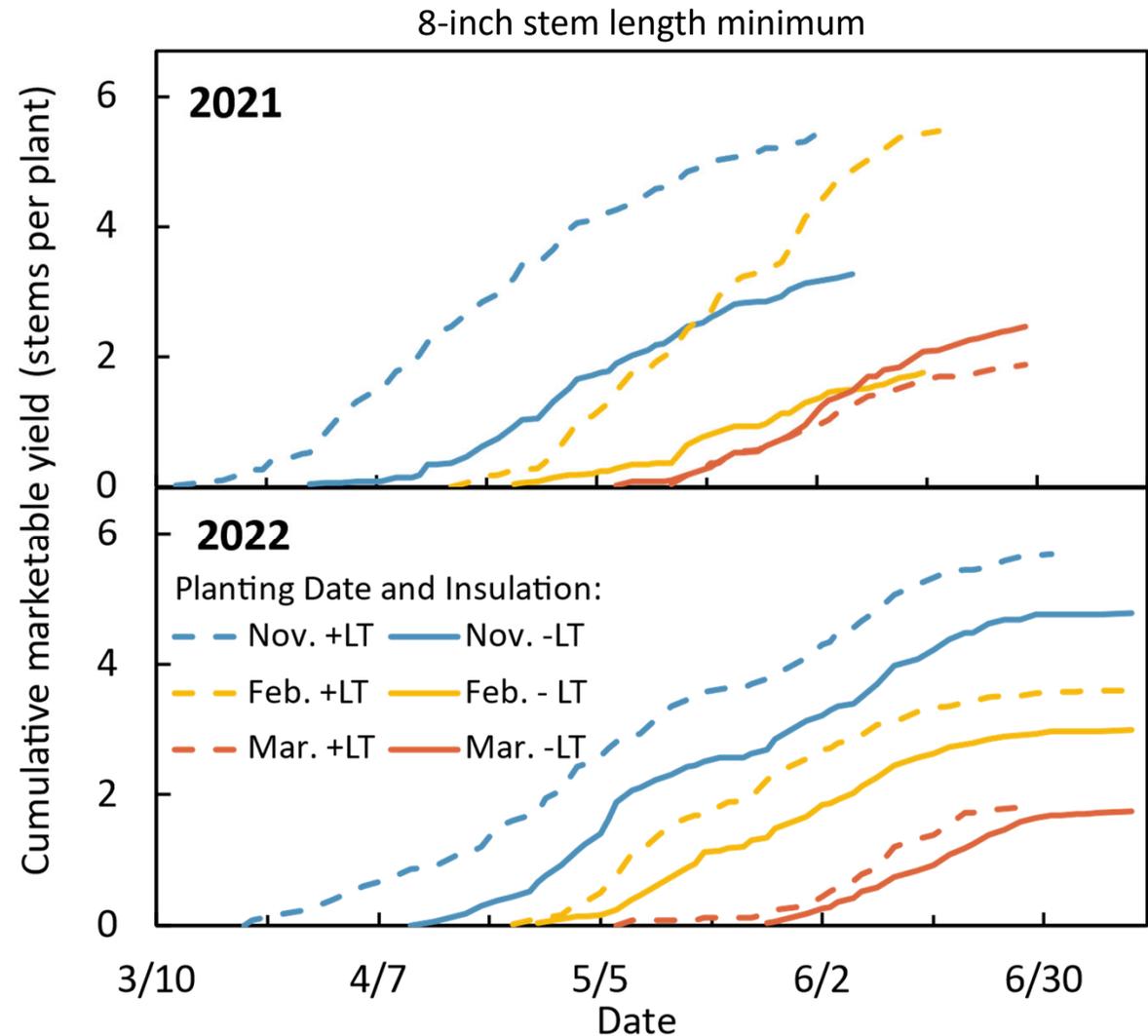
Air Temperature

- Air temperature was 8°F greater in the **high tunnel** than the **field**
- **Low tunnels** within the **high tunnel** increased air temperature by an additional 4°F
- Colder air temperatures and more time below freezing in 2021-22



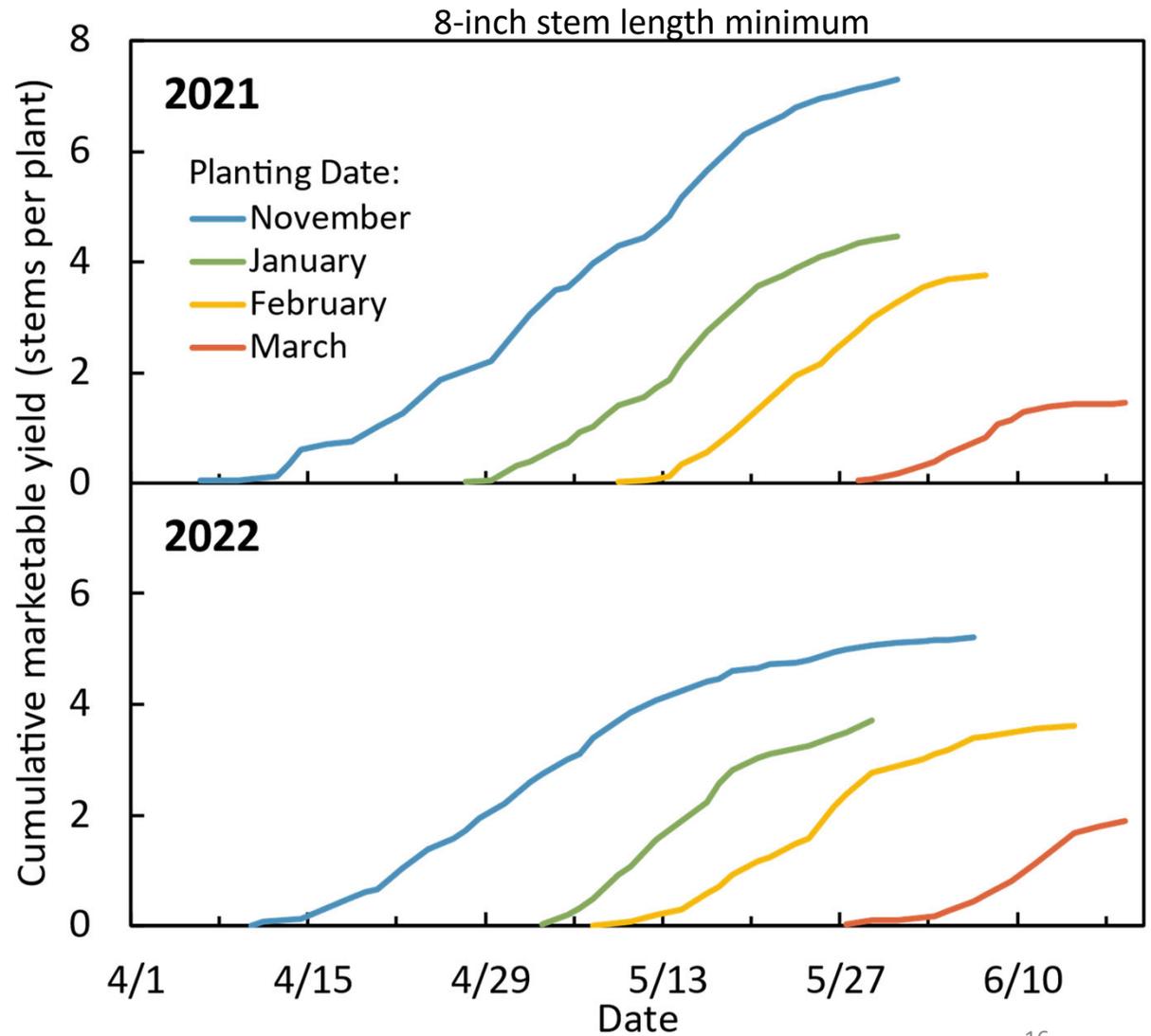
Anemone high tunnel marketable yield was...

- 1.3 stems per plant greater in 2021 than 2022
- Lowest for Mar. plantings (1.9 stems per plant)
- 1.2 stems per plant greater with low tunnels (+LT) than without low tunnels
- 0.6 stems per plant greater with pre-sprouting than direct planting
- 1.0 stems per plant greater for 'Galilee' than 'Carmel'



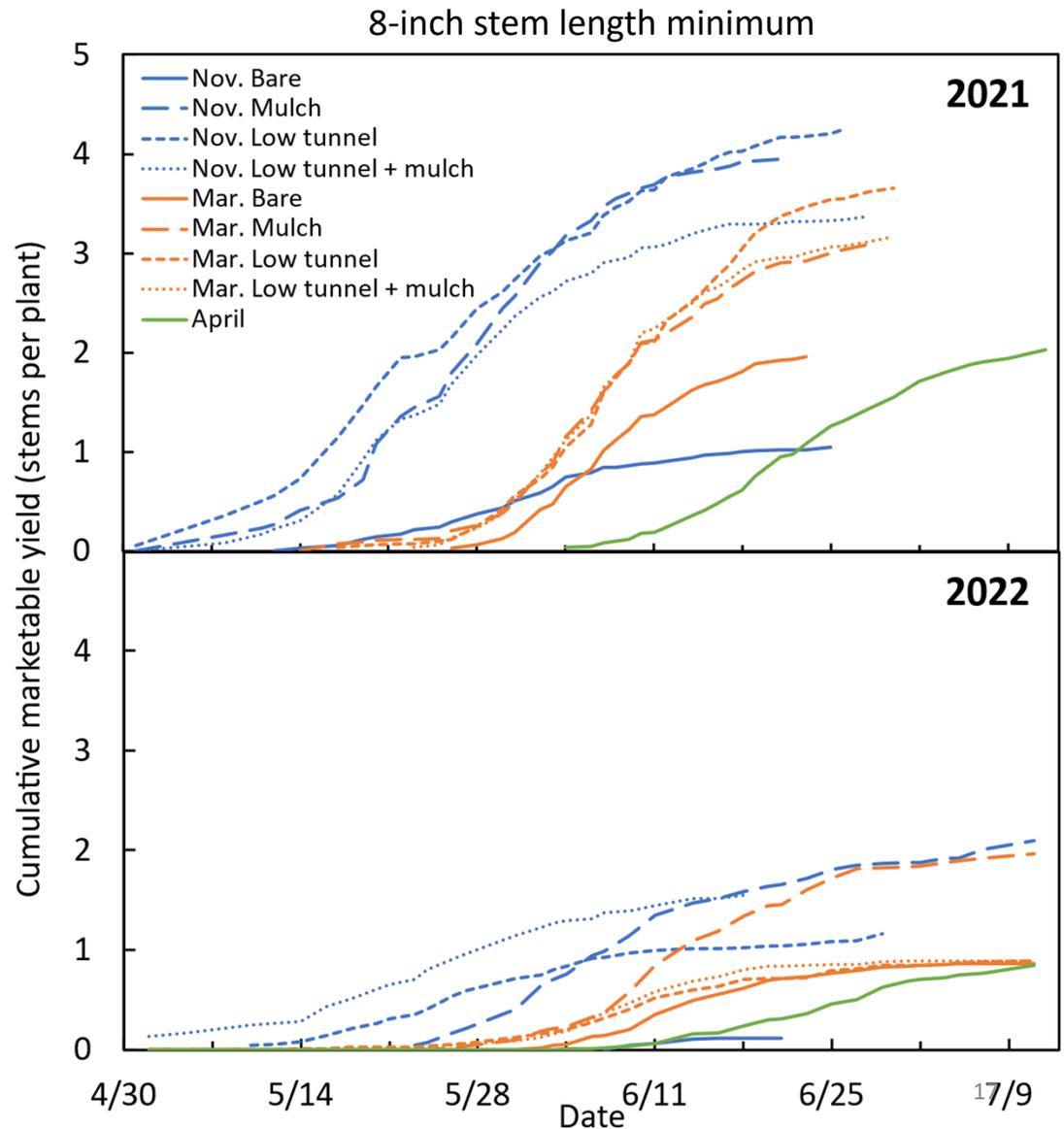
Ranunculus High Tunnel Marketable Yield

- Average of 4.1 stems per plant in 2021 and 3.3 stems per plant in 2022
- 372% greater for Nov. than Mar. plantings
- 1 stem per plant greater with pre-sprouting
- 0.8 stems per plant greater with 'LaBelle' than 'Amandine'



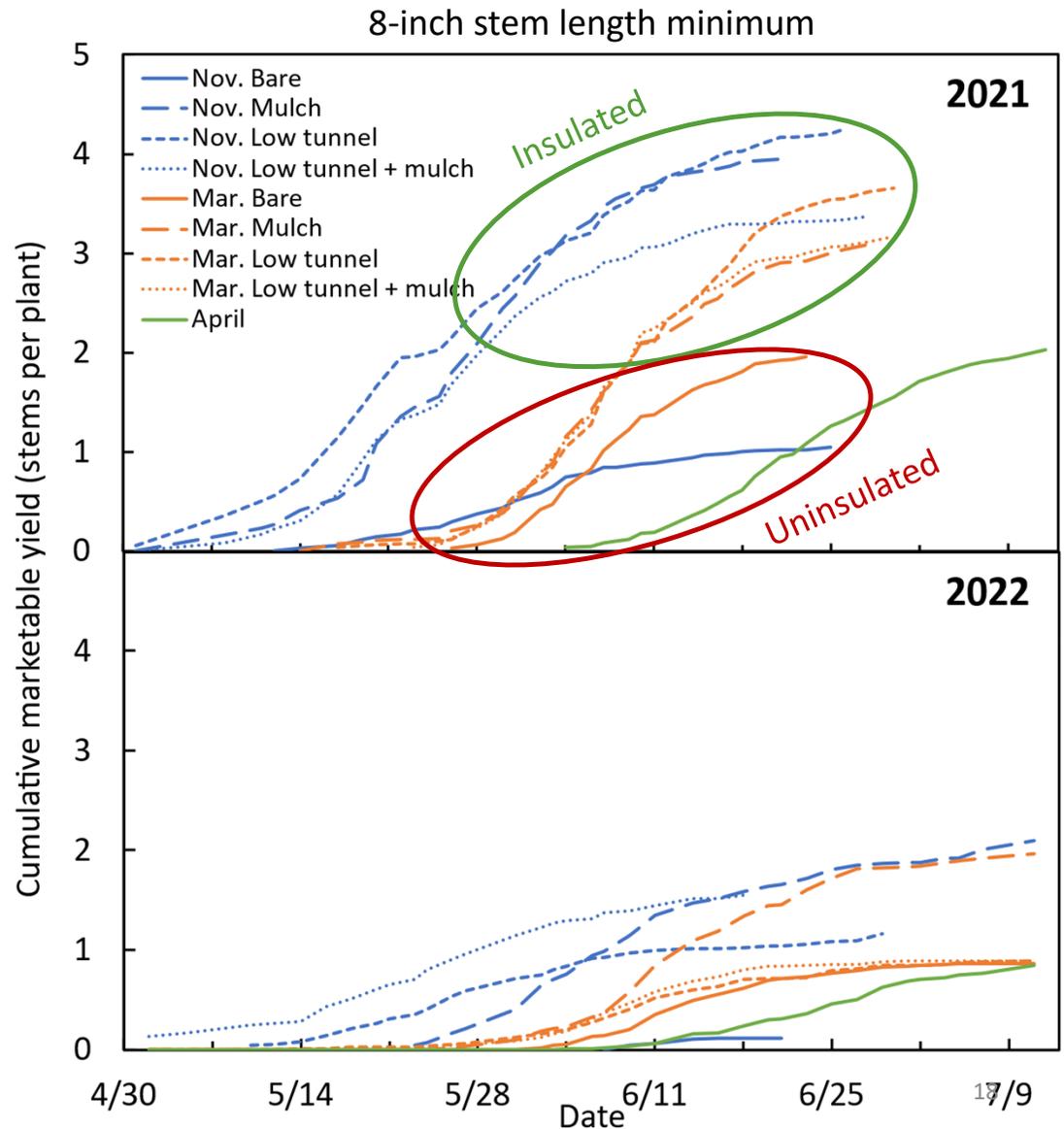
Anemone field marketable yield was...

- 1.6 stems per plant greater in 2021 than 2022
- 0.5 stems per plant greater for Nov. or Mar. plantings than Apr. plantings
- 1.3 stems per plant greater with any protection for Nov. and Mar. plantings
- 0.6 stems per plant greater with pre-sprouting than direct planting
- 0.4 stems per plant greater for 'Galilee' than 'Carmel'



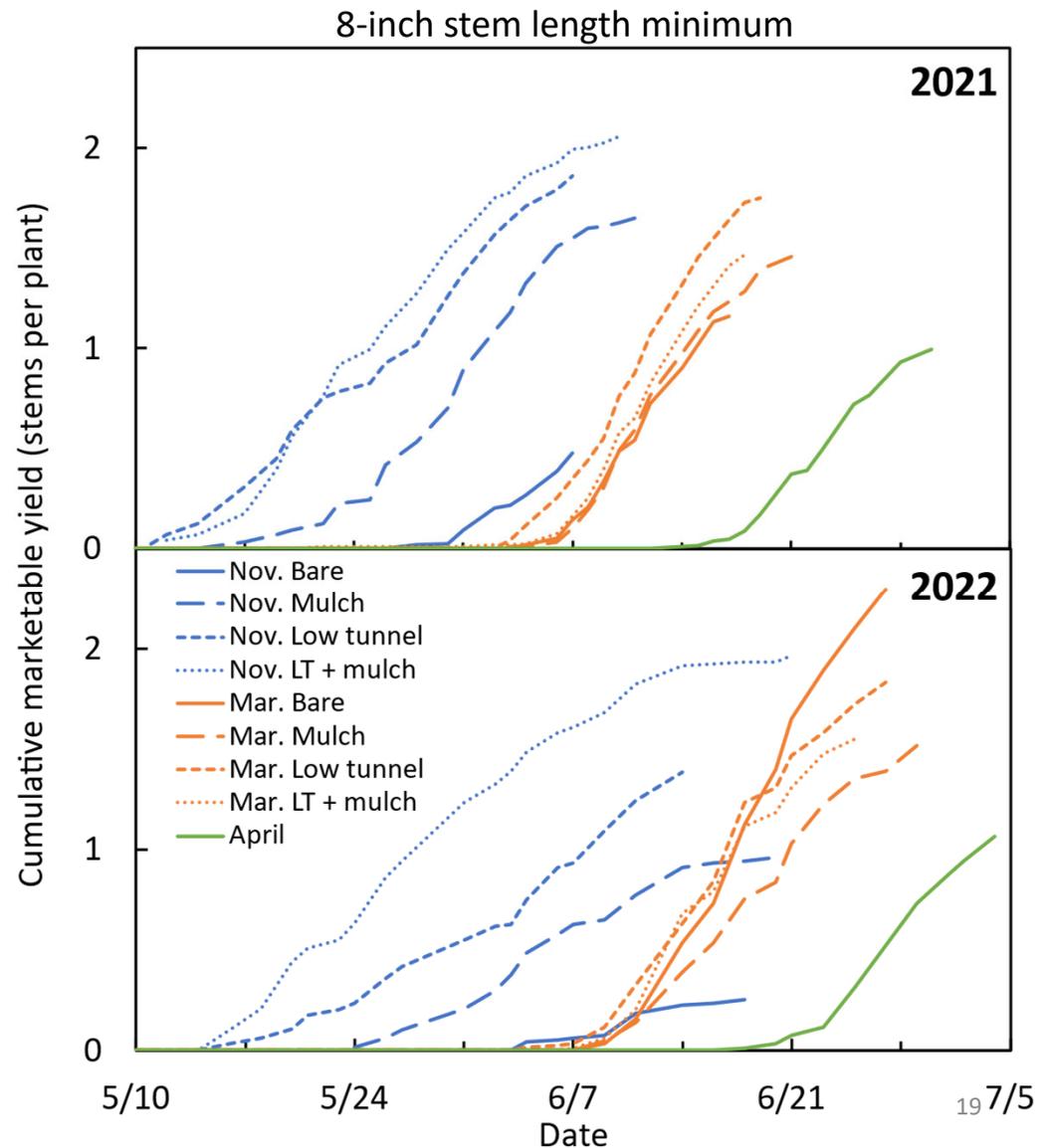
Anemone field marketable yield was...

- 1.6 stems per plant greater in 2021 than 2022
- 0.5 stems per plant greater for Nov. or Mar. plantings than Apr. plantings
- 1.3 stems per plant greater with any protection for Nov. and Mar. plantings
- 0.6 stems per plant greater with pre-sprouting than direct planting
- 0.4 stems per plant greater for 'Galilee' than 'Carmel'



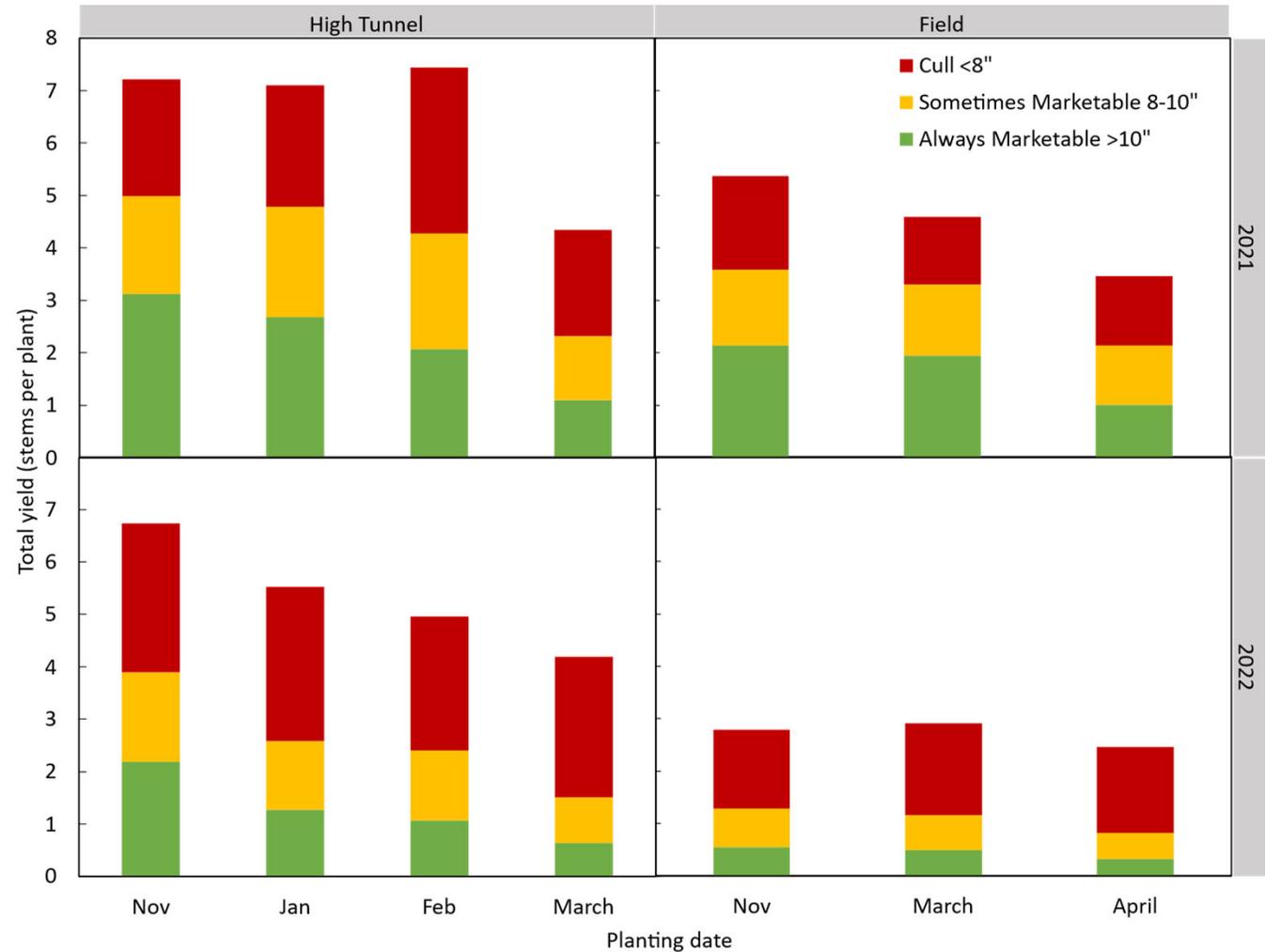
Ranunculus field marketable yield was...

- 1.4 stems per plant on average
- Lowest for April plantings (1 stem per plant)
- 1.1 stems per plant greater with insulation for Nov. plantings
- 0.5 stems per plant greater with pre-sprouting for Mar. and Apr. plantings
- 0.1 stems per plant greater for 'LaBelle' than 'Amandine'



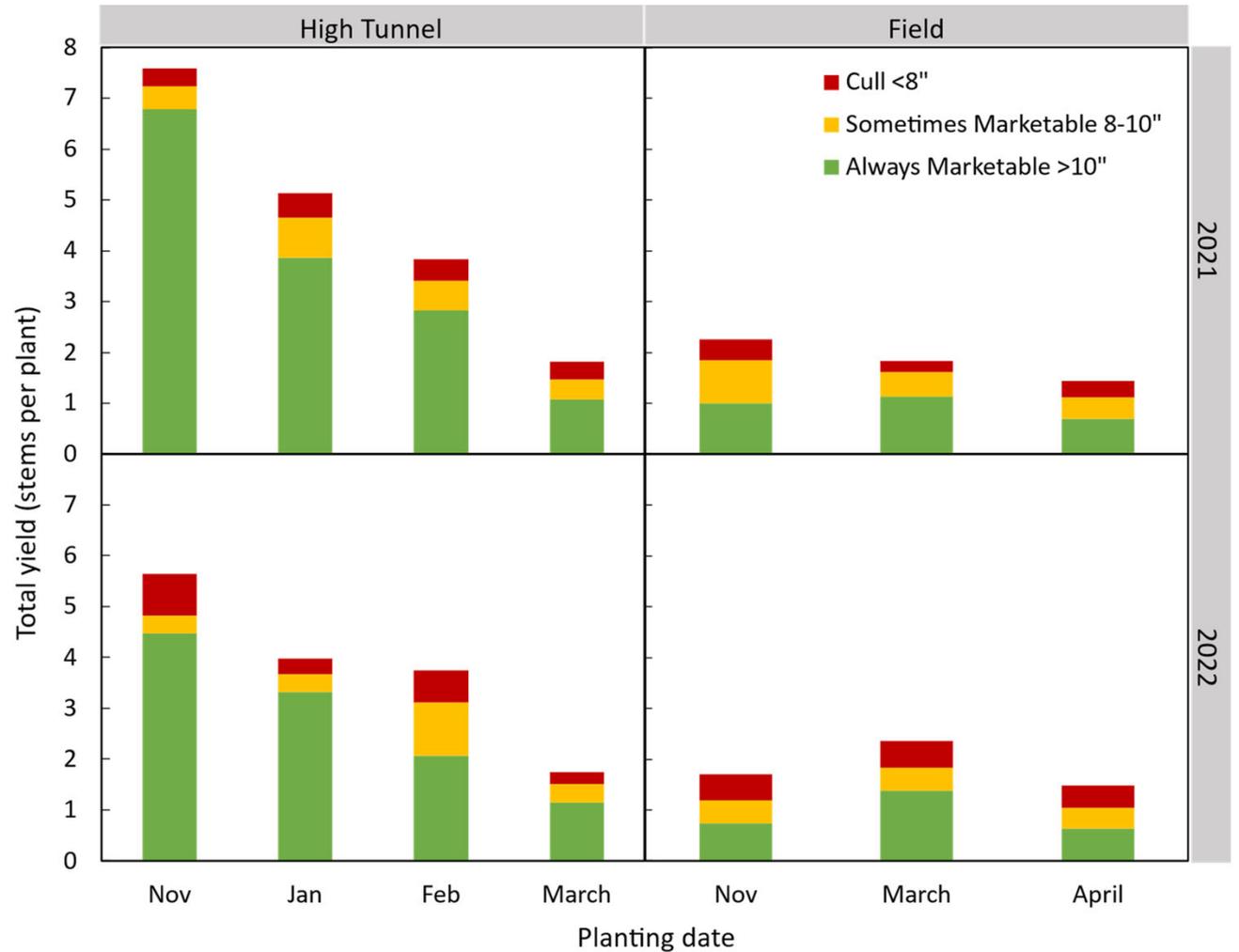
Anemone Stem Quality

- 51% average marketability across high tunnel and field
- Number of marketable stems decreased with later planting dates
- Low tunnels (+LT) improved high tunnel stem quality by 89%



Ranunculus Stem Quality

- 83% marketability across high tunnel and field
- Greater proportion of >10" stems in the high tunnel (72%) than field (48%)
- Greatest proportion of >10" stems for Nov. +LT high tunnel planting



Wholesale Profitability

Assumptions:

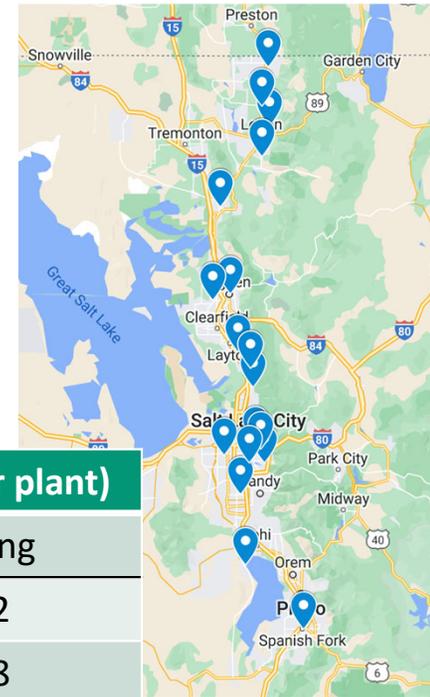
- Selling wholesale with a 30% co-op delivery fee
- 100% of stems > 10" sell at \$1.50 per stem
- 50% of anemone stems 8-10" sell at \$1.25 per stem

Net Projected Returns (USD per square foot)		
High Tunnel	Field	
\$3.49	\$0.50	Anemone
\$5.03	-\$0.95	Ranunculus



Grower Collaborators

- Poor emergence (<40%) of bare fall plantings
- Winter protection improved yield of fall plantings
- 26% of growers pre-sprouted



		Total yield (stems per plant)		Marketable yield (stems per plant)	
Planting date		Fall	Spring	Fall	Spring
Anemone	Growers (avg.)	6.7	4.3	4.7	3.2
	Greenville Farm (avg.)	5.3	3.7	3.3	1.8
	Growers (range)	1.2 – 25.4	1.3 – 10.7	1 – 20.3	0.9 – 8.6
	Greenville Farm (range)	0.7 – 12.1	0.2 – 8.5	0.0 – 9.7	0.0 – 5.6
Ranunculus	Growers (avg.)	4.4	3.3	3.4	2.5
	Greenville Farm (avg.)	4.2	1.7	3.7	1.4
	Growers (range)	0.2 – 13.7	1.4 – 11.7	0.2 – 10.9	0.4 – 7.8
	Greenville Farm (range)	0.3 – 10.2	0.1 – 4.2	0.0 – 10.0	0.0 – 4.0

Summary

- Industry recommendations from milder climates can be difficult for Utah's narrow spring production window
- Management practices that advance bloom are key to improving yield, quality, and profitability

High Tunnel Recommendations

- Pre-sprout
- Preferred cultivars: 'Galilee' anemone and 'LaBelle' ranunculus
- Plant as early as possible, preferably by mid-Feb. at the latest
- Cover with low tunnels to improve stem length and reduce risk of cold injury



Field Recommendations

Anemone:

- Plant as early as possible, preferably between November and March
- Cover with any type of insulation (e.g., low tunnels, straw mulch)
- Pre-sprout

Ranunculus:

Option 1:

- Don't pre-sprout
- Plant in November
- Cover with any type of insulation (e.g., low tunnels, straw mulch)

Option 2:

- Pre-sprout
- Plant in March
- Cover with low tunnels/frost fabric for extra protection as needed



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S+K Blossoms

Sego Lily Flower Farm

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Wasatch Blooms

Wheeler Historical Farm

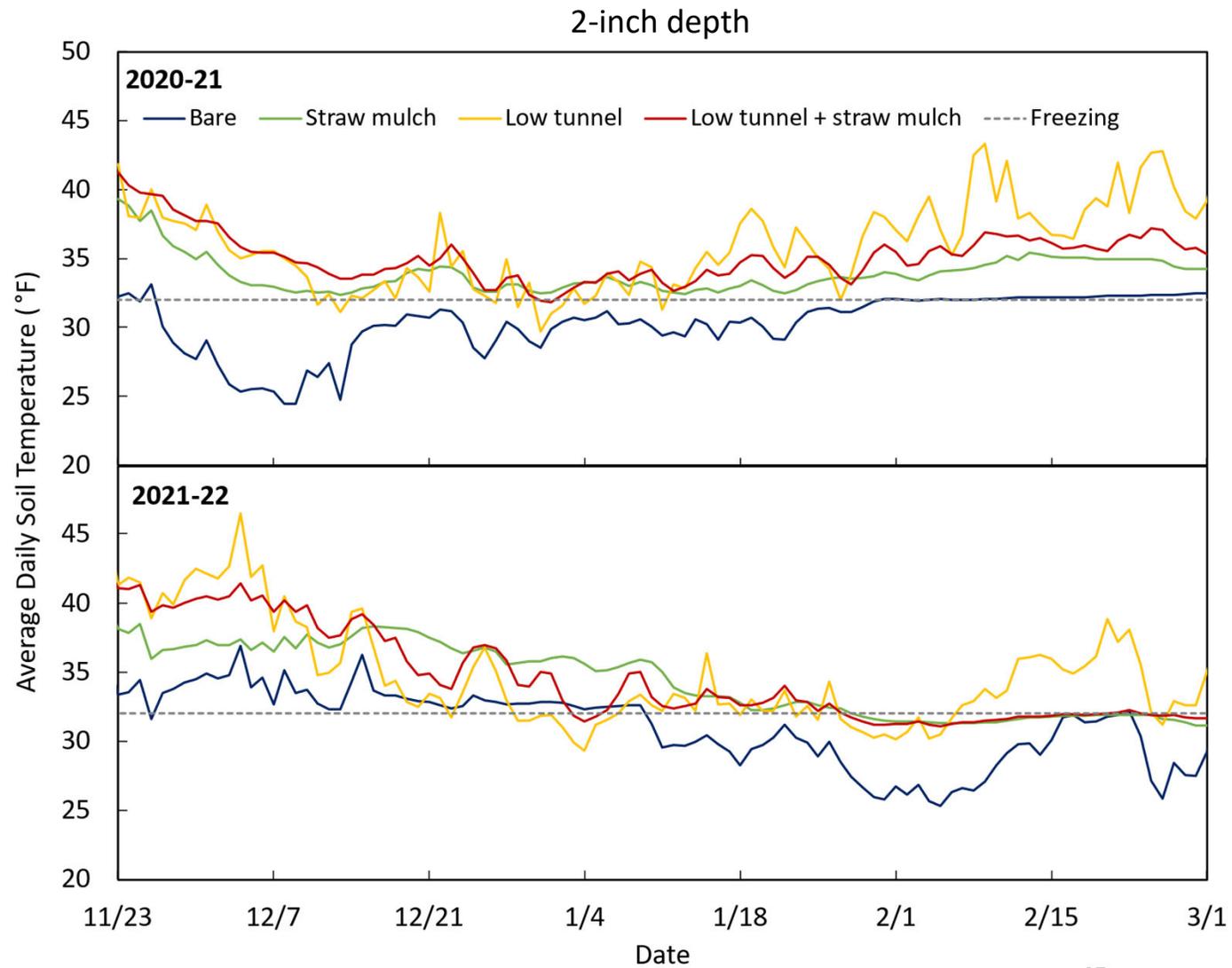
Questions?

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Soil Temperature in the Field

Average Daily Soil Temperature Lift Compared to Bare (°F)	
Straw mulch	3.5
Low tunnel	4.7
Low tunnel + straw mulch	4.0



Air Temperature in the Field

Average Daily Air Temperature Lift Compared to Bare (°F)	
Straw mulch	1.3
Low tunnel	4.4
Low tunnel + straw mulch	6.7

