


Ripening Tomato Fruits



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Quality of Tomatoes

Types and varieties
 Conventional & ESL
 MG & VR stages
 Growing areas
 Growing seasons

} All Impact Final Quality


Tomato Quality Attributes

Color
Firmness
Composition (sugars, acids, volatiles)
Ripening physiology


Tomato Type & Composition, U.S. Retail

Tomato Type	% Soluble Solids	% Titratable Acidity
Grape	7.55	0.62
Cherry	6.25	0.67
Orange Cluster	4.70	0.44
Round	4.65	0.33
Roma	4.25	0.31
Round Cluster	4.20	0.35

Group 1



Group 2



Tomato Type	% Soluble Solids	% Titratable Acidity
Cherry	7.15	0.77
Campari	6.30	0.58
Romanita	6.30	0.44
Grape	5.60	0.51
Round greenhouse	4.50	0.36
Roma	4.30	0.27
Roma	3.75	0.44

Maturity & Ripening Stages


- 1 **GREEN** The tomato surface is completely green. The shade of green may vary from light to dark.
- 2 **BREAKERS** There is a definite break of color from green to bruised fruit Tannish-yellow, pink or red or 10% or less of the tomato surface.
- 3 **TURNING** Tannish-yellow, pink or red color shows on over 10% but not more than 30% of the tomato surface.
- 4 **PINK** Pink or red color shows on over 30% but not more than 90% of the tomato surface.
- 5 **LIGHT RED** Pinkish-red or red color shows on over 60% but red color covers not more than 90% of the tomato surface.
- 6 **RED** Red means that more than 90% of the tomato surface, in aggregate, is red

*VR = vine-ripe


<http://www.californiatomatofarmers.com>
<http://www.floridatatoes.org/>

Tomato mature-green and breaker stages; fruit with internal color will ripen well without ethylene treatment.


MG1 MG2 **MG3** MG4 Br



Ethylene Treatment for Ripening MG fruit



- Ethylene concentration: 10-100 ppm
- Temperature: 15-25°C (60 to 77°F)
- Relative humidity: 90-95%
- Duration: 24 to 72 hours
- Air circulation: sufficient for distribution of ethylene in ripening room
- Ventilation: sufficient to prevent accumulation of CO2 over 3%



Shelf-life/Storage/Ripening Conditions

Effect of temperature on ripening rates of **conventional tomato cultivars**.

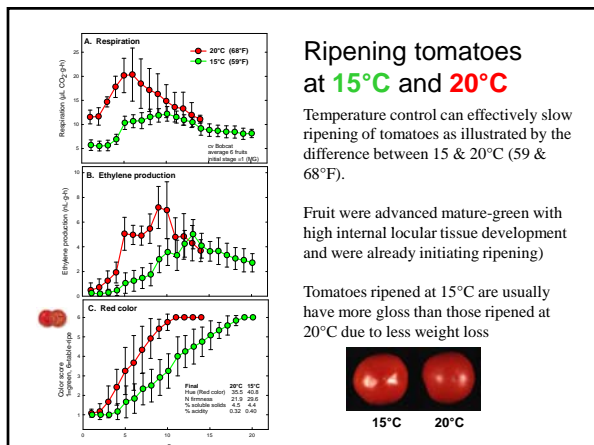
Ripeness stage	Days to full red color at indicated temperature					
	12.5C 55F	15C 59F	17.5C 64F	20C 68F	22.5C 72F	25C 77F
Mature-green	18	15	12	10	8	7
Breaker	16	13	10	8	6	5
Turning	13	10	8	6	4	3
Pink	10	8	6	4	3	2

Ripening Temperatures for Tomatoes



	20°C 68°F	25°C 77°F	29°C 84°F
Hue (color)	39.0	45.6	50.2
a* (red)	24.5	21.0	19.2

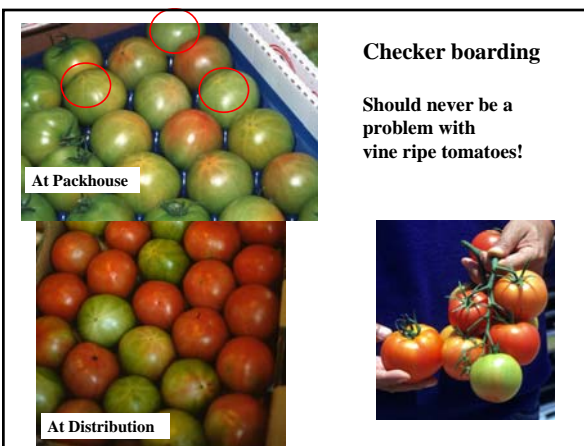
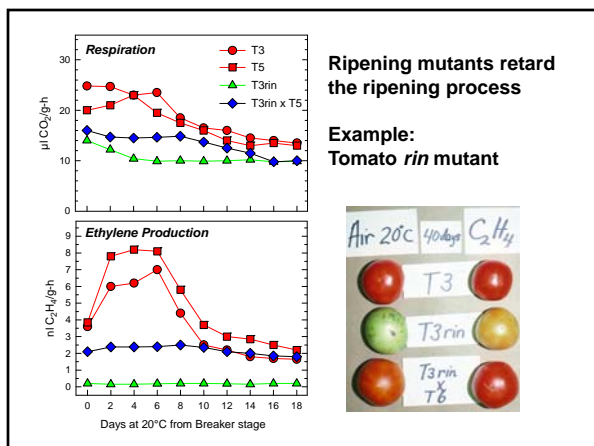
Appearance of tomatoes (cv Bobcat) after 7 days at 20, 25 or 29°C plus 2 days at 20°C (68°F). Initial color stage = 3-4.

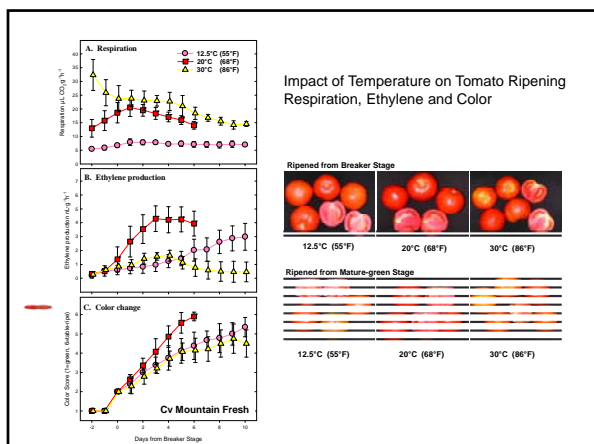


Tomatoes ripen into similar quality in temperature range from 12.5-20°C

Temp. °C	Initial color	Days to TR	Weight loss %	Firmness N	Red color Hue	SS %	Sugar mg/ml	TA %	Vit. C mg/100ml
20	2	13	4.3	27.0	35.0	4.0	18.3	0.26	21.8
12.5	2	32	4.2	28.2	38.3	4.0	17.8	0.26	24.3
20	3	11	3.4	23.0	35.9	4.0	20.8	0.26	27.4
12.5	3	22	3.0	28.5	39.4	4.2	19.5	0.28	29.9
20	4	7	2.2	25.5	37.2	4.0	20.2	0.29	26.6
12.5	4	18	2.2	26.3	37.6	4.1	19.9	0.27	30.3
20	5	5	2.0	23.0	39.7	3.9	19.4	0.28	27.4
12.5	5	18	2.3	20.5	37.5	4.2	22.7	0.26	29.3
Average 20C		9	3.0	24.6	37.0	4.0	19.7	0.27	25.8
Average 12.5C		22	2.9	23.4	38.2	4.1	20.0	0.27	28.4
LSD.05			0.5	3.7	1.8	0.2	2.9	ns	3.5

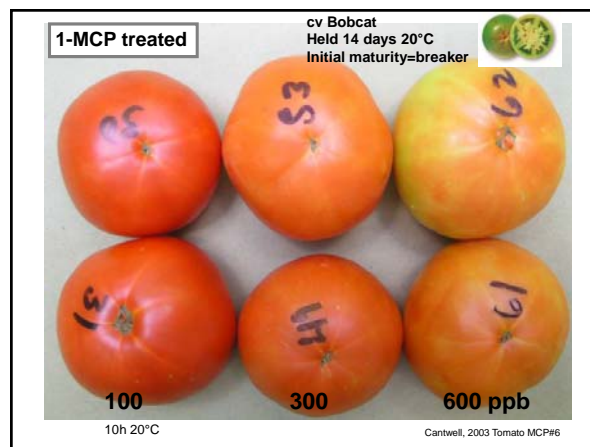
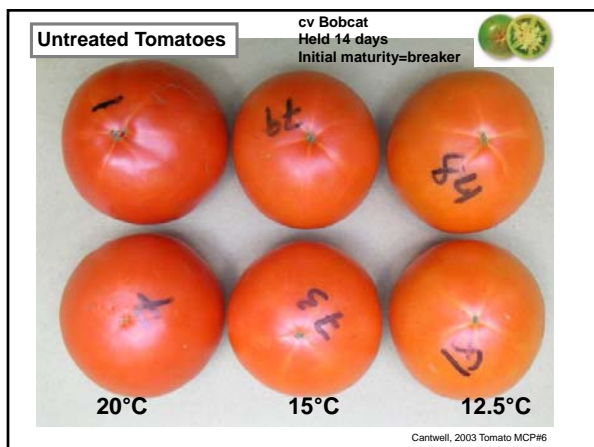
Cantwell, 2003 MCP#7, unpublished; cv Bobcat





Storage of Tomatoes

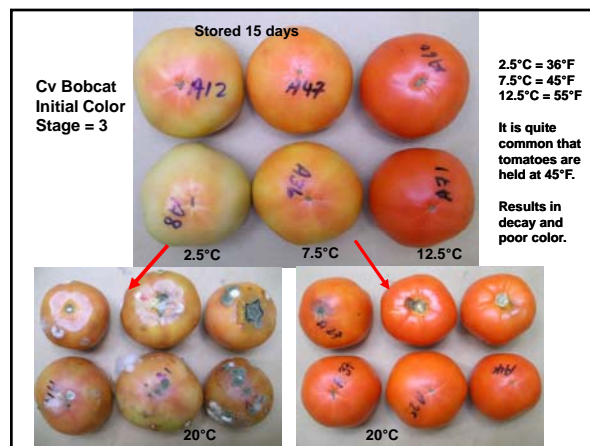
- 12.5°C (55°F)
- No lower than 10°C (50°F)
- 2-3 weeks
- Controlled atmospheres
 - 3% O₂, <3% CO₂
 - Relative humidity ~85%

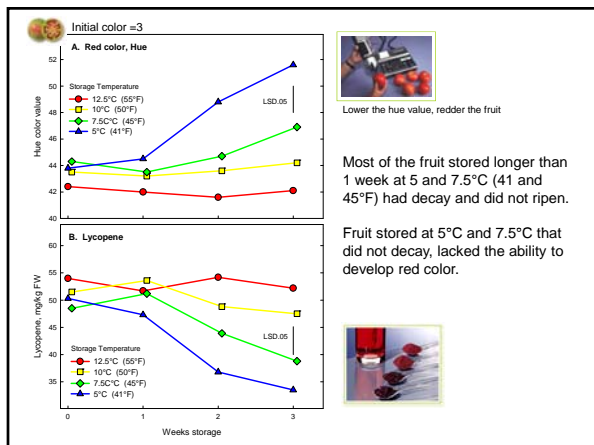
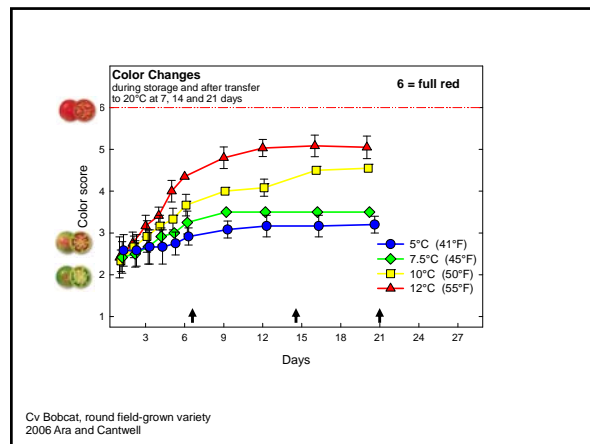
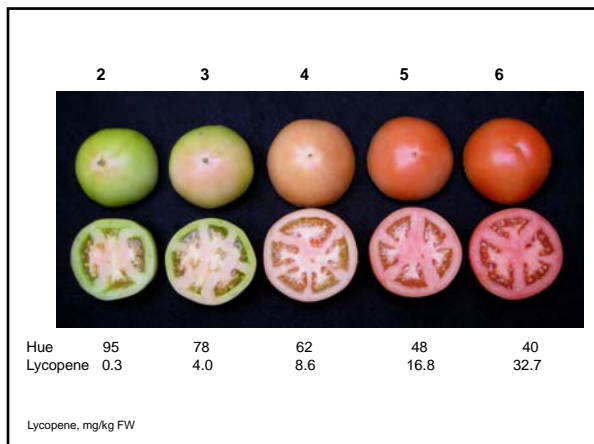


Tomatoes and 1-MCP (SmartFresh™)

- 300ppb 1-MCP at 20°C ≈ 12.5°C Storage
- 1-MCP is a powerful regulator of tomato fruit ripening
- Easy to overdose and have poor final quality (red fruit)
- Important to determine where 1-MCP can add value to the tomato category

Review Paper: The use of 1-MCP on fruits and vegetables.
 C.B. Watkins. 2006. Postharvest Biology Technology 24: 389-409.





Tomato quality

- Variety and maturity at harvest
- Minimize physical injury
- Storage: temperature & duration
 - 12.5°C (55°F), No lower than 10°C (50°F)
 - 2-3 weeks
- Ripening conditions
 - Temperature 15-20°C
 - High humidity
 - If MG fruit, 100 ppm ethylene 3 days

