AMCOR FIBRE PACKAGING

AUSTRALASIA

SESSION SIX

Session Six
Postharvest quality, outturn

New Zealand and Australia Avocado Grower's Conference'05
20-22 September 2005
Tauranga, New Zealand

Mode of action of water loss on fruit quality of ‘Hass’ Avocados

N Lallu, J Burdon, G Haynes, K Francis,
P Pidakala, D Billing

HortResearch

Role of water loss

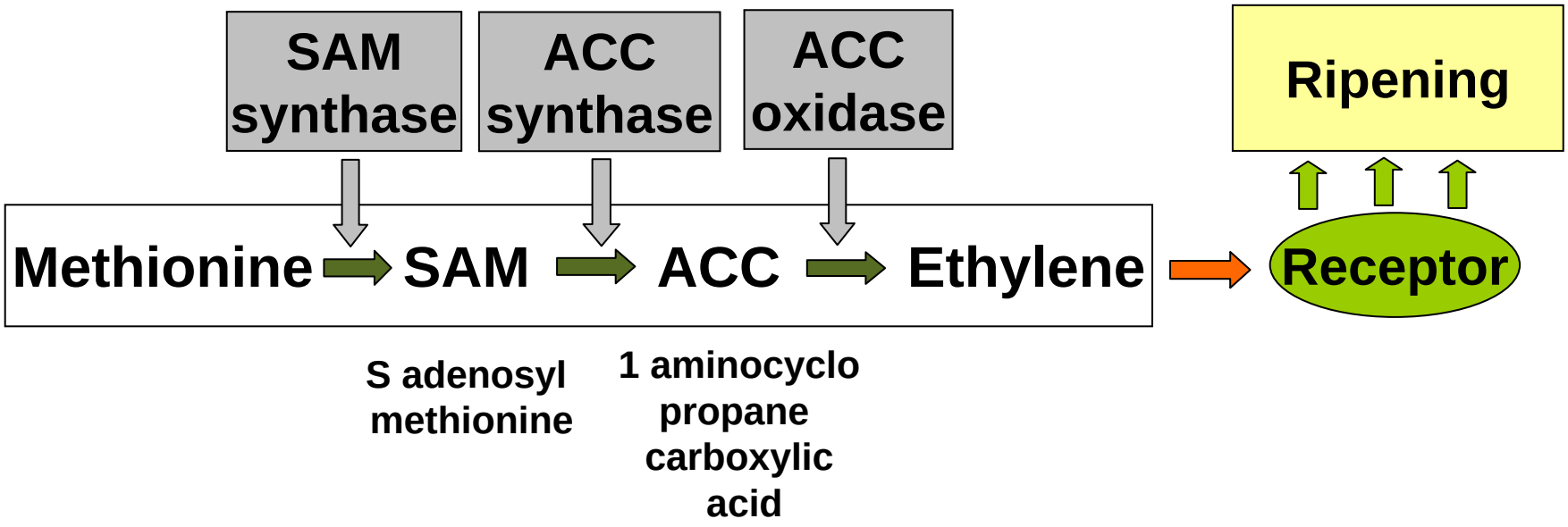
Affect on:

- Ripening rates
- Rot development

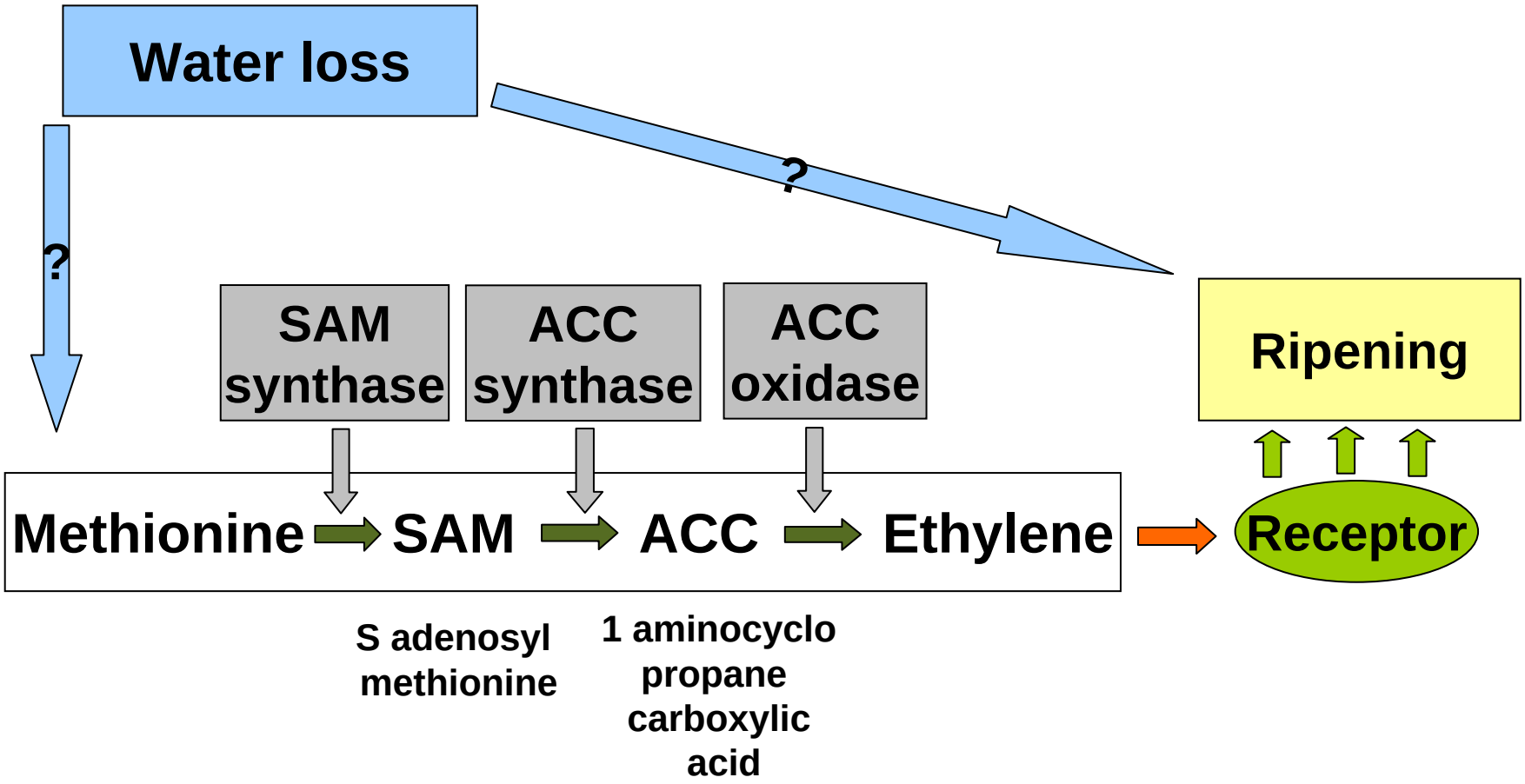
Questions:

- Are rates and timing of water loss important?
- Is water loss acting: through ethylene, or
  independent of ethylene?

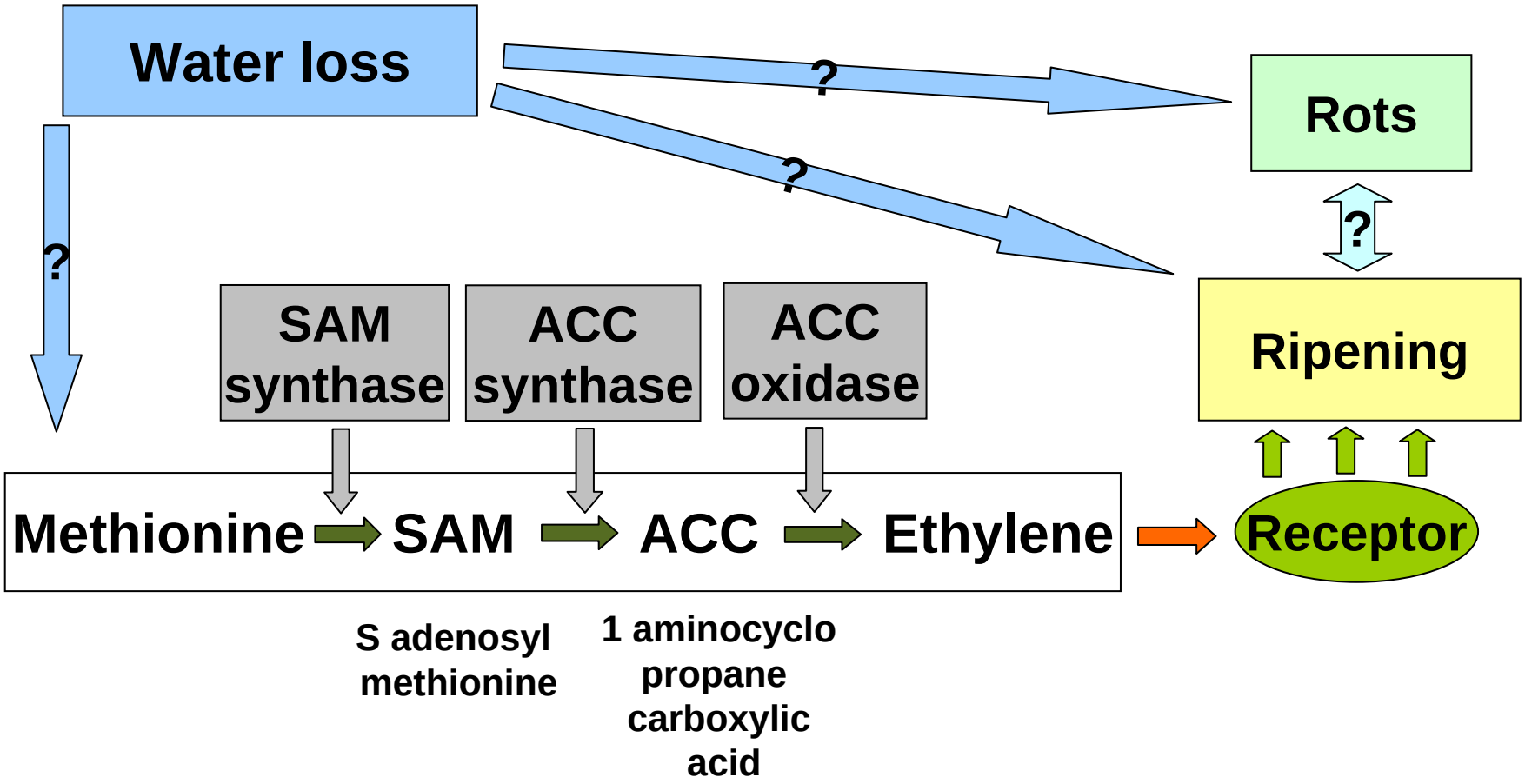
Ethylene biosynthesis



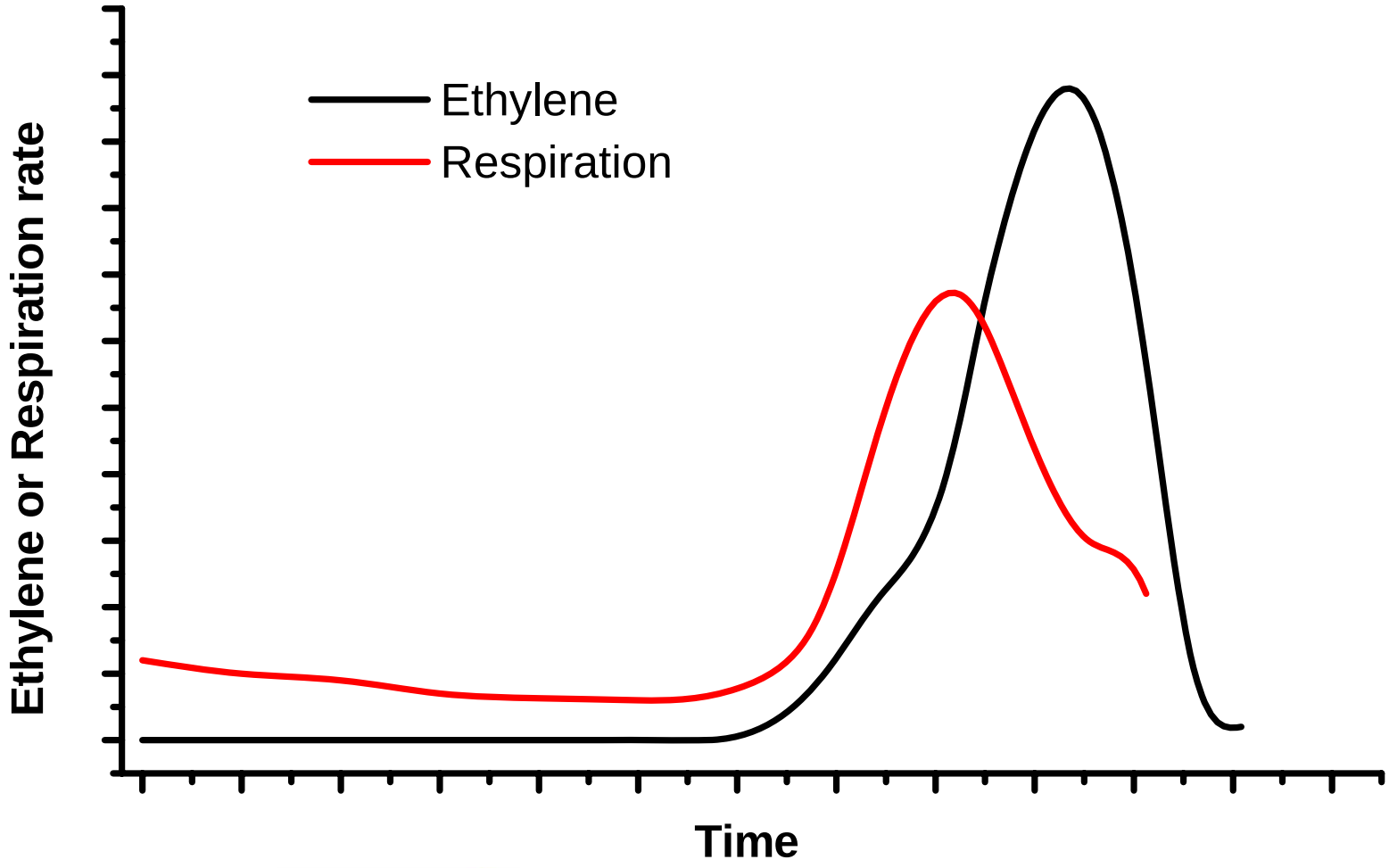
Water loss and ethylene biosynthesis



Water loss and ethylene biosynthesis

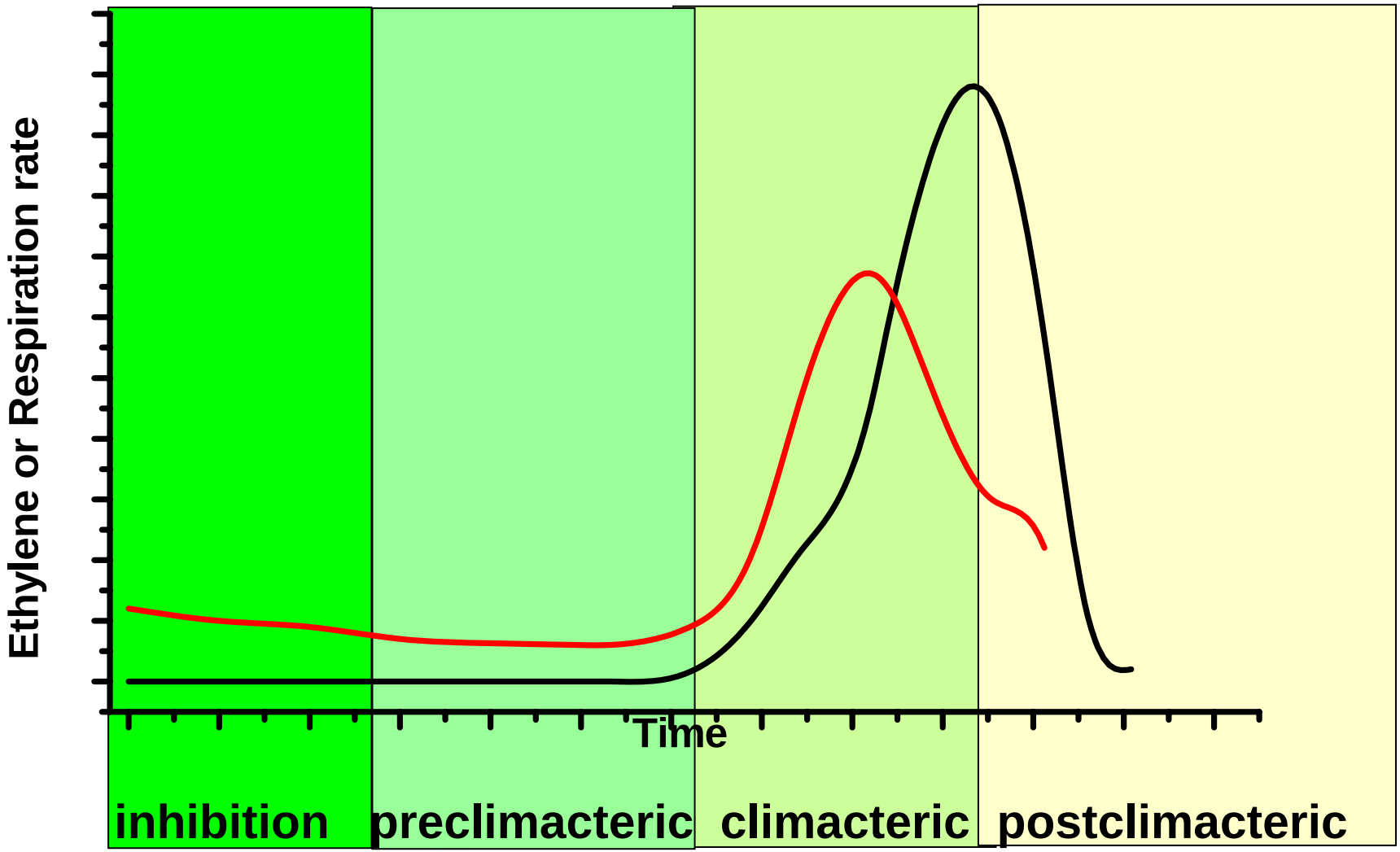


Ripening physiology avocado



HortResearch

Ripening physiology avocado



Experimental

- Fruit from 3 orchards harvested early, mid and late season:

  Water loss induced during: inhibition, preclimacteric, climacteric, postclimacteric.

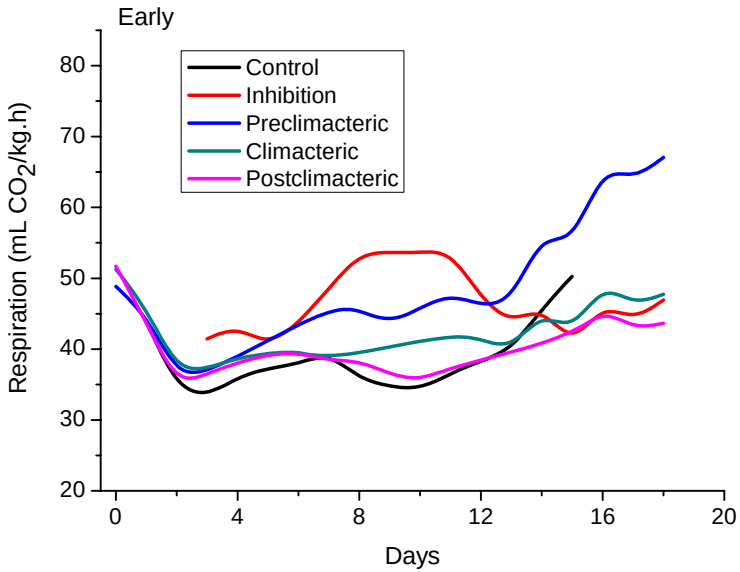
  Transferred from a high RH (>95%) to low RH (<20%).

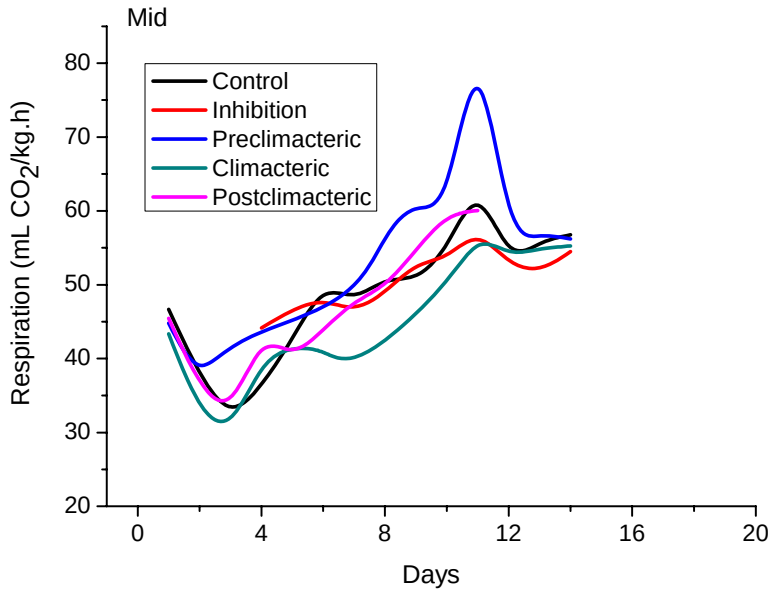
  Treated with or without SmartFresh™ (1-MCP)

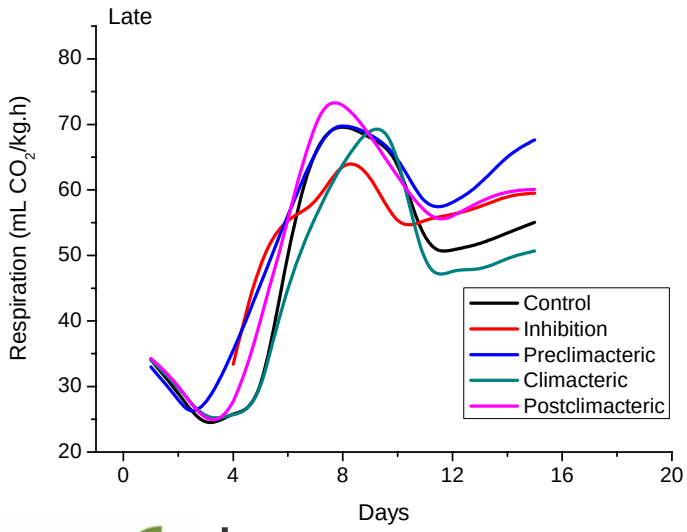
  Fruit held at 20°C.

- Determined days to ripen, respiration and ethylene production, ACC content and ethylene forming enzyme (ACC oxidase) activity and rot incidence

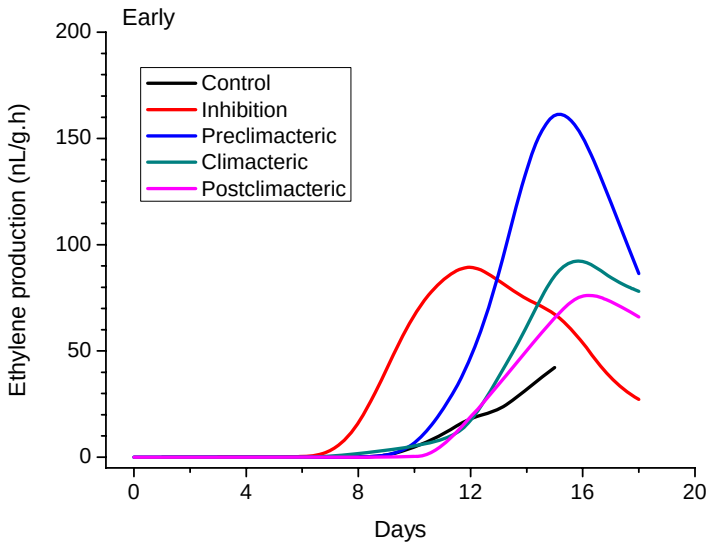
Respiration

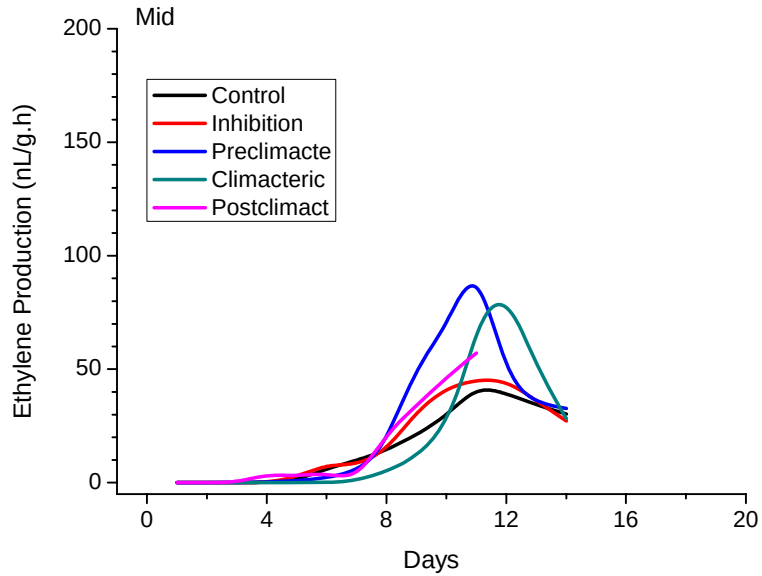


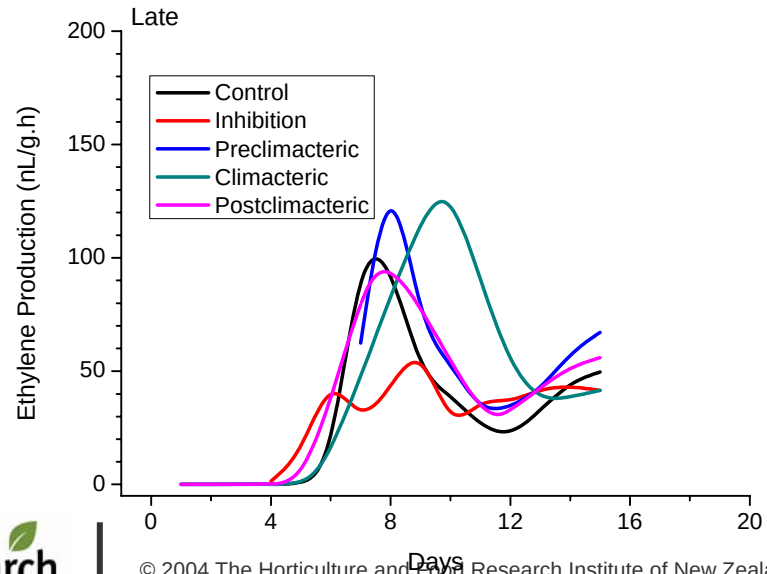




Ethylene production: Early







Duration of ripening phases: control fruit

Treatment	Days		
	Early	Mid	Late
Inhibition	3	3	3
Preclimacteric	4	4	3
Climacteric	4	4	2
Postclimacteric	3	3	2

Water loss incurred during treatments (increase above control fruit)

Treatment	Water loss (%)		
	Early	Mid	Late
Inhibition	3.1 (3.3)	2.4 (2.5)	2.6 (2.4)
Preclimacteric	4.4 (4.1)	2.5 (2.5)	2.4 (2.4)
Climacteric	4.0 (4.3)	2.2 (1.7)	1.5 (1.8)
Postclimacteric	3.9 (3.8)	1.9 (1.7)	1.9 (1.6)

(1-MCP treated fruit)

HortResearch

Water loss and time to ripen

Treatment	Days to ripen		
	Early	Mid	Late
Control	16.4	13.2	10.3
Inhibition	14.1*(18.7)	12.4*(18.1)	10.3 (15.4)
Preclimacteric	14.1*(22.1)	12.8 (20.4)	10.8*(18.8)
Climacteric	15.7*(23.3)	13.7*(17.4)	10.0*(10.0)
Postclimacteric	17.0*(16.2)	13.8*(13.9)	10.1 (10.1)

(1-MCP treated fruit)

Water loss and stem end rot incidence

Treatment	Incidence (%)		
	Early	Mid	Late
Control	53.5	69.8	33.3
Inhibition	57.0	44.2*	29.3
Preclimacteric	35.1*	45.6*	16.3*
Climacteric	35.5*	53.3*	23.1
Postclimacteric	38.7	71.3	16.7*

(1-MCP treated fruit)

Water loss and body rot incidence

Treatment	Incidence (%)		
	Early	Mid	Late
Control	45.9	67.5	12.3
Inhibition	34.2	60.5	28.3*
Preclimacteric	26.0*	61.1	17.4
Climacteric	22.4*	60.0	5.5
Postclimacteric	42.7	68.8	5.1

(1-MCP treated fruit)

Water loss and rot incidence

- 1-MCP treatment increased rots
- Interpretation of water loss effect is confounded by longer ripening times for MCP treated fruit
- Increase is due to longer ripening time rather than the increased water loss

ACC content and EFE activity

- ACC and EFE activity increases during ripening with a peak around the climacteric.
- Increase occurs mostly after water loss has ended.
- MCP delays increase or results in accumulation (ACC).
- Similar patterns for all harvests.

ACC content: Early

	ACC content (nmol/g) after			
Treatment	Inhibition	Pre climacteric	Climacteric	Post climacteric
Control	1.1	0.3	42.6	nd (14.1)
Inhibition	0.6 (0.5)			(0.5)
Preclimacteric		0.3 (21.4)		(0.3) (99.3)
Climacteric			20.3 (34.4)	(36.4)
Postclimacteric				65.4 (29.5)

(+ 3 or 4 days)

1-MCP fruit

EFE activity after treatment: Early

	EFE activity (ul / kg.h) after			
Treatment	Inhibition	Pre climacteric	Climacteric	Post climacteric
Control	2.6	2.5	6.0	7.8 (8.9)
Inhibition	0.7 (5.3)			(0.6)
Preclimacteric		4.2 (5.4)		(2.0)
Climacteric			6.6 (14.6)	(12.8)
Postclimacteric				(14.1)
				16.6 (14.0)

(+3 or 2 days)

1-MCP fruit

Summary

- Water loss during initial stages affects rate of ripening and incidence of rots.
- Water loss during late stages of ripening has little or no effect.
- Fruit early in the season have a greater capacity to be affected by water loss.
- Impact of water loss is greater on rate of ripening than incidence of rots.
- Water loss affects are most likely acting through the ethylene biosynthesis and action pathway.

Closing comments

- Water loss in the first 72 hours after harvest is critical to fruit quality.

- For stored fruit an increase of 5-15% in incidence of rots can be expected when rate of water loss is doubled.

Acknowledgements

- Funding from the New Zealand Foundation for Research, Science and Technology Public Good Science Fund: Contract nos. AVIX0201 and CO6X0203.
- Jerome Hardy (Apata) assisted in sourcing the fruit.
- Jonathon Dixon and Henry Pak provided useful discussions on experimental approaches.
- AgroFresh provided the 1-MCP

www.hortresearch.co.nz

HortResearch


2005
PROFIT TOGETHER