

Enhancing raspberry fruit quality

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Introduction

- Successful fruit packaging relies upon the use of high quality produce.
- SCRI hopes to optimise raspberry fruit quality via focused research.
- We report on the physiology and molecular biology of raspberry fruit quality.

Ethylene and fruit firmness

Ethylene plays a causal role in raspberry fruit ripening. Immature fruits exposed to 21 ppm ethylene for 24h reddened and softened.

Ethylene levels correlate with fruit firmness, receptacle weight and time to ripen.

Cultivar	Ripeness class	Ethylene exposure	% CO ₂ (after 48 hours)	Firmness (mN)	Optical density (515nm)
Glen Prosen	2	Yes	2.3	344	1.0 ± 0.3
		No	1.9	806	0.2 ± 0.0
Glen Clova	2	Yes	1.8	228	1.0 ± 0.3
		No	1.1	714	0.2 ± 0.0

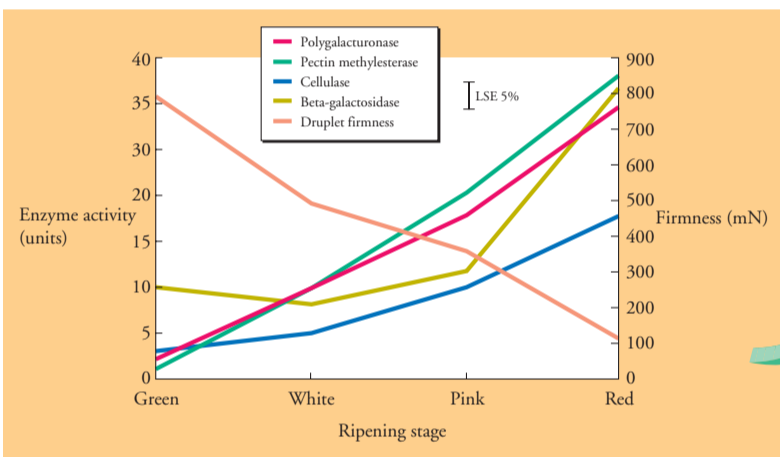
Anova	Cultivar	Ethylene exposure
	***	*
	***	***

NS Not significantly different
 * Significantly different at P < 0.05
 *** Significantly different at P < 0.01

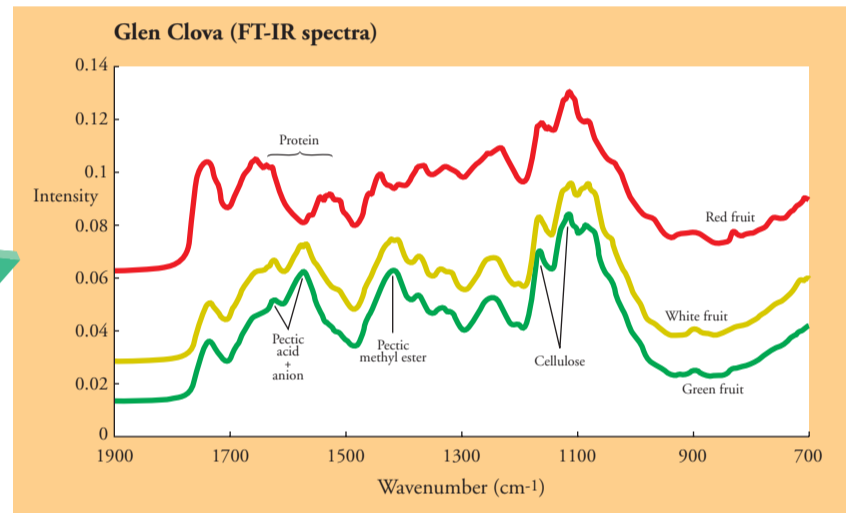
Genotype	Relative fruit-firmness	Druplet firmness (mN)	Ethylene evolution (mg hr ⁻¹ g fw ⁻¹)	Time to ripen (days)	Receptacle fresh weight (g)
EM 5007	Soft	133 ^a	55.28 ^a	54.17 ^c	0.58 ^a
Glen Clova	Soft	121 ^a	34.34 ^b	58.08 ^{b,c}	0.47 ^b
EM4997	Firm	191 ^b	20.01 ^c	61.40 ^{a,b}	0.51 ^b
Glen Prosen	Firm	210.3 ^b	23.35 ^c	65.00 ^a	0.34 ^c

a,b,c denotes anova categories for significant differences where P < 0.05

Cell-wall modifying enzyme activities increase as fruit mature. This increase correlates with a rapid decline in fruit firmness.

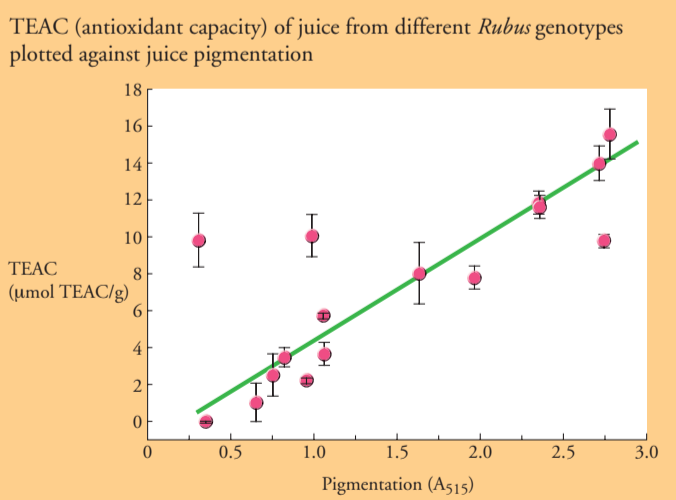


Analysis of fruit cell-wall material using GC, FT-IR and NMR showed that pectic acid/anion, methylated ester and cellulose contents declined as fruit softened.



Antioxidant capacity

Data indicates that the antioxidant capacity of ripe raspberry juice is high. The majority of the antioxidant capacity is not derived from vitamin C.



Molecular biology

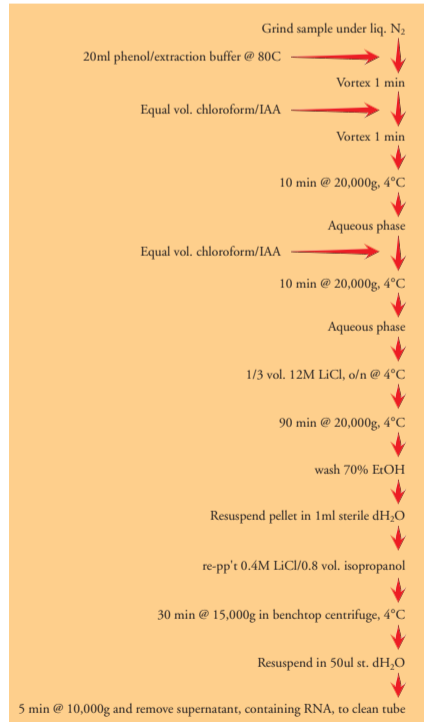
A method to extract high-quality RNA from ripe raspberry fruit was developed.

This has allowed the cloning of genes which are differentially expressed during ripening.

Differential screening				
Rasp.clone	Length (bp's)	Gene	Organism	Identity (%)
RAS1	701	Major latex protein	Opium poppy	34
RAS2	535	Metallothionein-like protein-I	Kiwi fruit	82
RAS3	1208	Endo-polygalacturonase	Peach	76

Differential display				
Length (bp's)	Gene	Organism	Identity (%)	
154	480	14-3-3 protein	Glycine	89
357	1077	ACC oxidase	White spruce	44
53c	407	Serine protease inhibitor	Bovine	35
155	445	Fumarylacetylacetylase	Human	64

cDNA-AFLP				
Gene	Length (bp's)	Gene	Organism	Identity (%)
PME	859	Pectin methylesterase	Campion	74
32con	488	Metallothionein-like protein-II	Arabidopsis	35



Raspberry packaging

Ripe raspberry fruit shelf-life can be extended to 4 days if stored at 4°C and sealed into punnets using film types 1 or 2.

Fruit contained within various films were scored for taste, firmness, colour, water loss, disease. High score = good; low score = poor; maximum points = 24. Assessments were on fruit pushed to the limits of shelf-life (hence low scores).

Cultivar	Storage temp. (°C)	Punnet treatment				Score
		Open	Air-tight (Film 1)	Film 2	Film 3	
Glen Lyon	15	2	2	2	0	8
	4	4	3	3	4	15
Glen Magna	15	1	2	2	2	7
	4	3	5	5	4	17
	Score	10	12	12	10	

Shelf-life and fruit quality are enhanced by cold storage. Films 1 and 2 were effective and extended shelf-life by up to 4 days.

The future

At SCRI we now hope to research the underlying physiology and biochemistry of successful packaging strategies.

Acknowledgements

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