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Manipulating harvest maturity and ethylene to extend storage life of feijoa

A thesis presented in partial fulfilment of the requirements for the
degree of Doctor of Philosophy in Food Technology at Massey
University, Palmerston North, New Zealand

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2015



Abstract

In New Zealand feijoa (*Acca sellowiana*) are harvested by touch-picking and can be stored at 4 °C and 90% RH for up to 4 weeks with a subsequent shelf life of 5-7 d at 20 °C. Extending the storage potential of feijoa can enable export to new marketplaces through sea freight. The objective of this work was to extend the storage life of feijoa. Harvest maturity, variability within batch and ethylene all have the potential to influence postharvest storage performance.

Harvesting feijoa earlier not only makes touch-picking irrelevant but will necessitate changes to the present grading standards of feijoa. Harvesting feijoa 2 weeks prior to touch-picked maturity consistently enabled storage life extension for up to 6 weeks at 4 °C with a subsequent shelf life of 5 d at 20 °C. However, these fruit were low in SSC with high TA suggesting that their taste profiles may be altered and hence a consumer taste acceptance investigation is recommended. There is also a need to identify a ripening index for feijoa while redefining grading criteria suitable for both local and export markets.

This work demonstrates that feijoa having higher °hue (> 122) at the time of harvest possessed longer storage potential than those with lower °hue (< 122) that are ready-to-eat. Blocking ethylene responses of touch-picked or early harvested feijoa by postharvest 1-methylcyclopropene treatment had minimal effect on physiology (ethylene production and respiration rates) or quality after storage. Feijoa were also insensitive to exogenous ethylene application while CA technology stimulated surface injury. However preharvest Aminoethoxyvinyl glycine (AVG) application reduced fruit drop and delayed maturity (retaining firmness) of feijoa at the time of commercial harvest. AVG suppressed ethylene production during storage without altering quality attributes (firmness, SSC, TA

or flesh colour). A conceptual model was developed to summarise feijoa responses to ethylene manipulations. Postharvest ripening in feijoa appears to be substantially ethylene-independent.

Storage life of feijoa was extended by harvesting fruit earlier than current touch-picking maturity. Segregating feijoa by skin colour change would allow sea freight of less mature fruit. However, taste acceptance of these fruit and commercial trials of preharvest AVG are required before practical recommendations can be made to the industry.

Acknowledgements

I am grateful to the Lord God Almighty for giving me an opportunity to work in this project. I am very thankful to my chief supervisor Dr. Andrew East for his excellent advice, cherished feedback and continued support during the study. I thank my co-supervisor Professor Julian Heyes for his suggestions, guidance and encouragement during this work.

I am thankful to Peter Jeffrey, Sue Nicholson for their brilliant technical support and Jamal for analysing fruit X-rays. I thank all my colleagues at Centre for Postharvest and Refrigeration Research for their constructive appraisal on my research findings during discussion meetings.

I would like to acknowledge that the work reported was possible with financial support from Sustainable Farming Fund, New Zealand Feijoa Growers Association, Turner & Growers research grant and Helen E Akers PhD scholarship. I am thankful to AgroFresh Inc. (USA) and Nufarm Ltd., New Zealand for their generous gift of chemicals. Sincere thanks to Southern Belle Orchard, Matamata for allowing me to conduct experimental trials and for the supply of fresh feijoa. I would like to thank my friends Majid, Jacob, Benhur for accompanying me during orchard visits. Part time work at Idea services as a community support work was a good learning experience.

I would like to take this opportunity to appreciate the church, my mum, daughter, sisters and friends for their unwavering support in prayer and encouragement. This work is dedicated to my father whose word is to get wisdom though it cost all you have. It is the glory of God to conceal a matter, to search out a matter is the glory of kings (Proverbs, Holy Bible).

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List of Abbreviations and Symbols

ACC	aminocyclopropane-1 carboxylic acid
ACO	ACC oxidase
ACS	ACC synthase
Ag	silver
AgNO ₃	silver nitrate
AIN	ACC insensitive
ANOVA	analysis of variance
AOA	aminoxyacetic acid
Au	gold
AVG	aminoethoxyvinylglycine
°C	degree Celsius
C	carbon
C ₂ H ₄	ethylene
CA	controlled atmosphere
<i>cnr</i>	colourless non-ripening
CNT	controls
CO ₂	carbon dioxide
CoCl ₂	cobalt chloride
CT	computed tomography
Cu	copper
d	day (s)
DACP	diazocyclopentadiene
DMCP	3,3-dimethylcyclopropene
DNP	2,4-dinitrophenol

EIN	ethylene insensitive
ERS	ethylene response sensor
ETO	ethylene overproducing
ETR	ethylene receptor
FDP	fruit development period
g	grams
GDD	growing degree days
GLM	general linear model
H	hydrogen
h	hour
H ₀	harvest at touch-picking maturity
H ₋₁	harvest at one week before touch-picked maturity
H ₋₂	harvest at two weeks before touch-picked maturity
H ₋₄	harvest at four weeks before touch-picked maturity
HCN	hydrogen cyanide
HP	hewlett packard
HU	hounsfield unit
I_{AD}	interactance spectrum
kg	kilogram
kPa	kilo Pascal
L	litre
μL	micro-litre
L*	lightness
lb	pound force
LEACS	<i>Lycopersicon esculentum</i> ACS

MCP	1-methylcyclopropene
min	minute
mL	millilitre
MRI	magnetic resonance imaging
MTA	5'-methylthioadenosine
N	newton
N ₂	nitrogen
NAI	normalised anthocyanin index
NBD	2,5-norbornadiene
NDVI	normalised difference vegetation index
NE	no effect
Ni	nickel
NIR	near infrared
nL	nano-litre
nmol	nano-mole
<i>nor</i>	non ripening
NS	not significant
NZFGA	New Zealand Feijoa Growers Association
O ₂	oxygen
PAL	Phenylalanine ammonia-lyase
PLP	pyridoxal-5'-phosphate
pmol	pico-mole
POD	peroxidase
PPO	polyphenol oxidase
PVC	polyvinylchloride

R2E	ready to eat
(r_{CO_2})	carbon dioxide production rate
RH	relative humidity
<i>rin</i>	ripening inhibitor
s	second
SAM	S-adenosylmethionine
SRS	space resolved spectroscopy
SSC	soluble solids content
STR	storage
STS	silverthiosulphate
TA	titratable acidity
TRS	time resolved spectroscopy
UK	United Kingdom
USA	United States of America
v/v	volume / volume
w/w	weight / weight
%	percent