

Evaluation of a portable impact probe for rapid assessments of flesh firmness in peaches and nectarines

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Introduction and methods

Background and aim of the study

- Flesh firmness (FF) is a measure of fruit maturity and quality in stone fruit
- Portable non-destructive devices for rapid maturity assessment are sought after by the horticultural industries for in situ and post-harvest use
- New handheld instruments provide the opportunity to collect large volumes of data via smartphones and wireless communication (Bluetooth/WiFi)

Aim of the study

Evaluate the suitability of a portable Bluetooth impact probe prototype for rapid flesh firmness assessments in peaches and nectarines.



Methods

- Experiment conducted in 2019/20 on 200 fruit per cultivar
- **Peach** cultivars: 'August Flame', 'O'Henry', 'Redhaven' and 'September Sun'
- **Nectarine** cultivars: 'August Bright', 'Autumn Bright' and 'September Bright'

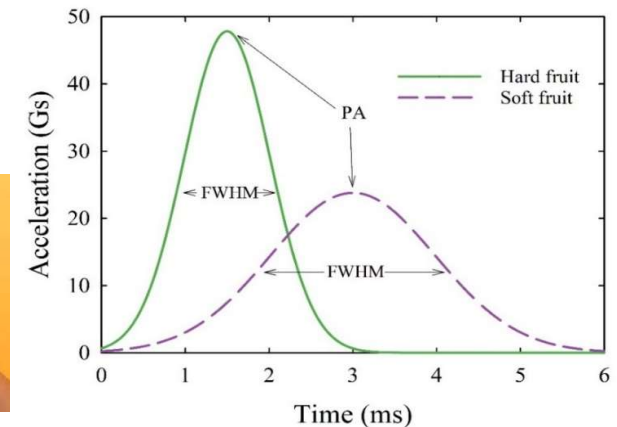
Reference determination of FF

A penetrometer (FT327, FACCHINI srl, Alfonsine, Italy) equipped with an 8-mm tip.



Portable impact probe

- Exerts a known force through a non-penetrating tip.
- Bluetooth wireless data communication.
- Device outputs:
 - Peak acceleration (PA)
 - Full width at half maximum (FWHM)

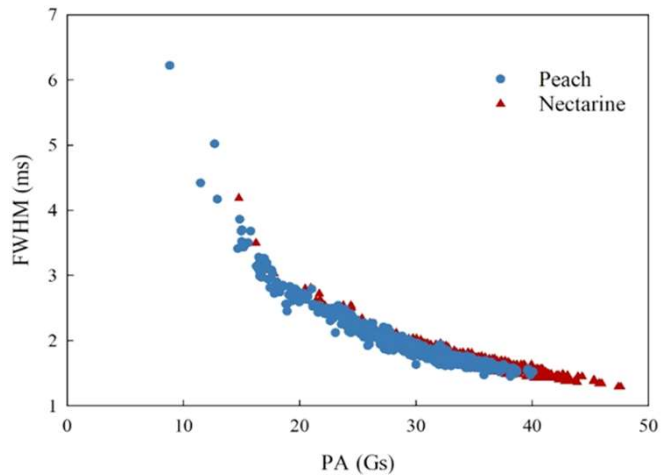


Results

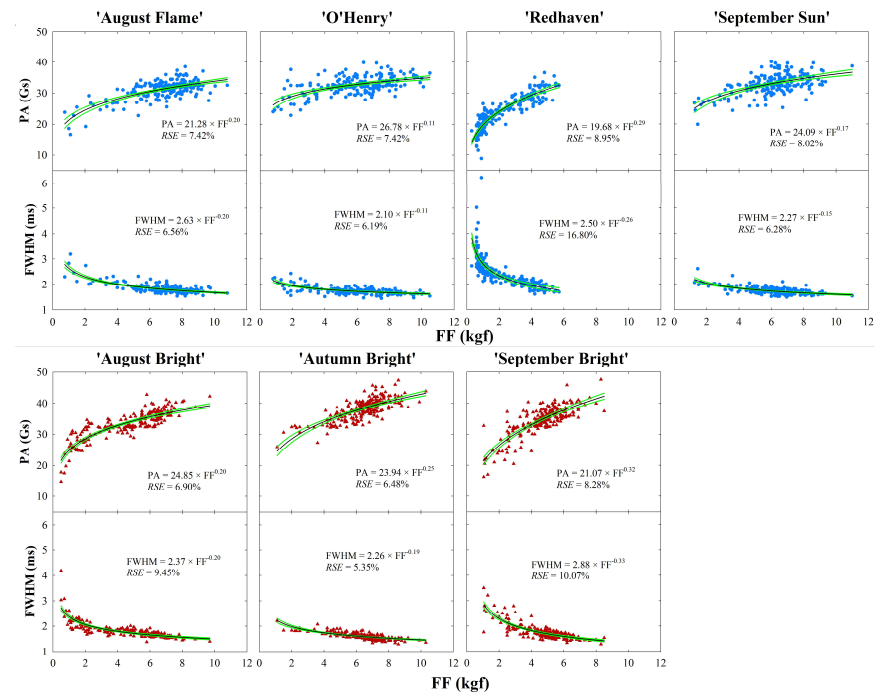
Maturity indicators in peach and nectarine cultivars

Crop	Cultivar	FF (kgf)	DMC (%)	I _{AD}	PA (Gs)	FWHM (ms)
Peach	'August Flame'	6.88 (1.79)	13.04 (1.95)	1.07 (0.43)	31.1 (3.12)	1.83 (0.20)
	'O'Henry'	5.93 (2.09)	15.02 (2.06)	0.88 (0.53)	32.49 (2.90)	1.75 (0.15)
	'Redhaven'	2.34 (1.52)	11.59 (1.32)	0.23 (0.27)	23.91 (5.46)	2.43 (0.60)
	'September Sun'	6.05 (1.71)	13.79 (2.21)	0.91 (0.45)	32.76 (3.26)	1.75 (0.15)
	'August Bright'	4.63 (2.10)	14.89 (2.36)	0.23 (0.15)	33.02 (4.56)	1.82 (0.30)
Nectarine	'Autumn Bright'	6.39 (1.48)	11.73 (1.73)	0.57 (0.37)	38.06 (3.53)	1.61 (0.13)
	'September Bright'	4.67 (1.43)	14.86 (2.29)	0.59 (0.36)	34.35 (4.88)	1.78 (0.32)

FF: flesh firmness; DMC: dry matter concentration; I_{AD}: index of absorbance difference; PA: peak acceleration; FWHM: full width at half maximum.

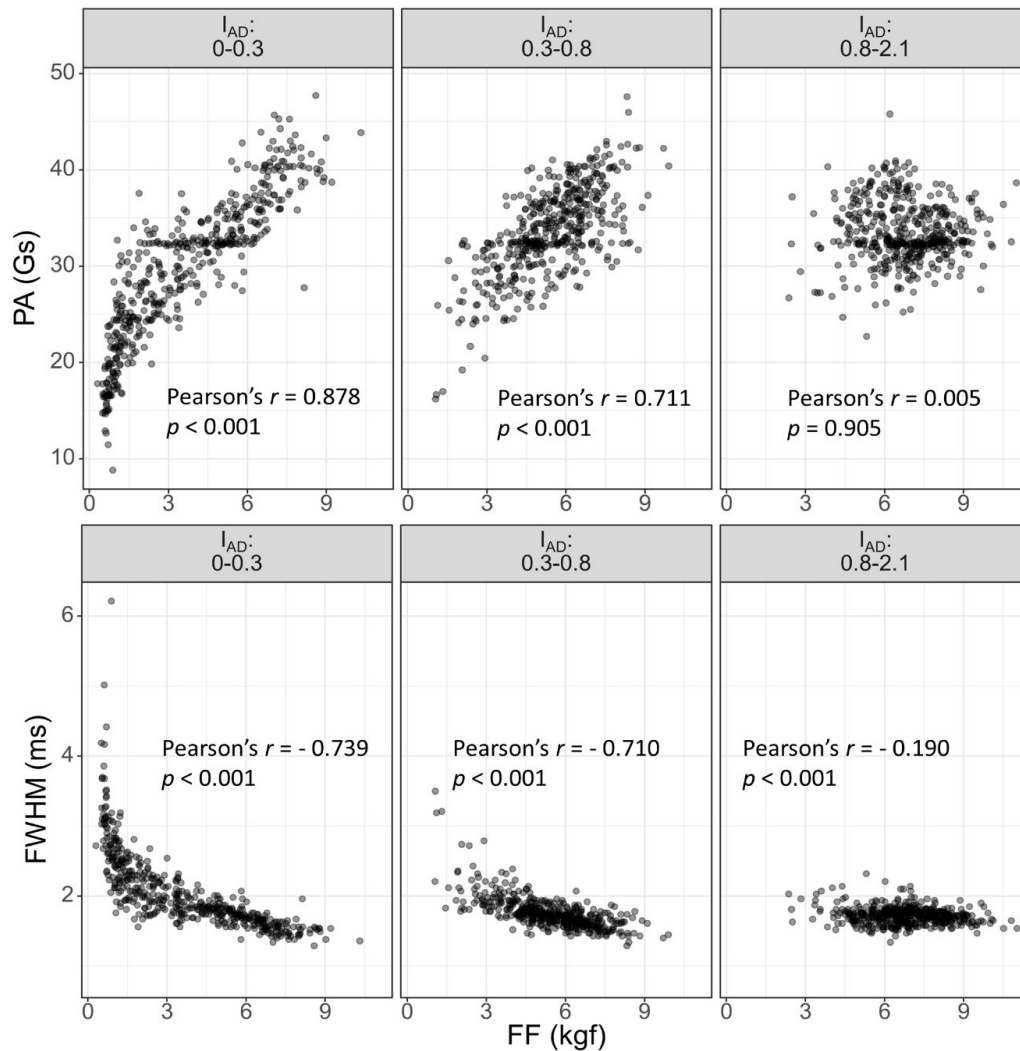


PA and FWHM



- PA and FWHM were related to FF by power functions.
- The predictions of FF using PA had similar errors in all the cultivars, suggesting higher precision of PA than FWHM.

Results



PA and FWHM vs FF

- The relationships of PA and FWHM with FF lost accuracy when fruit were more immature ($I_{AD} > 0.8$).
- PA was more suitable for measurements in soft fruit and FWHM improved prediction in hard fruit, although prediction was not accurate.

Conclusions

- The portable probe was user-friendly, reduced data collection time and avoided fruit sample destruction
- Predictions for peach and nectarine's FF were not affected by skin characteristics
- The prediction of FF was best in softer fruit, suggesting suitability in the post-harvest chain
- Future studies could focus on the application to softer fruit crops, such as berries

ACKNOWLEDGEMENTS

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