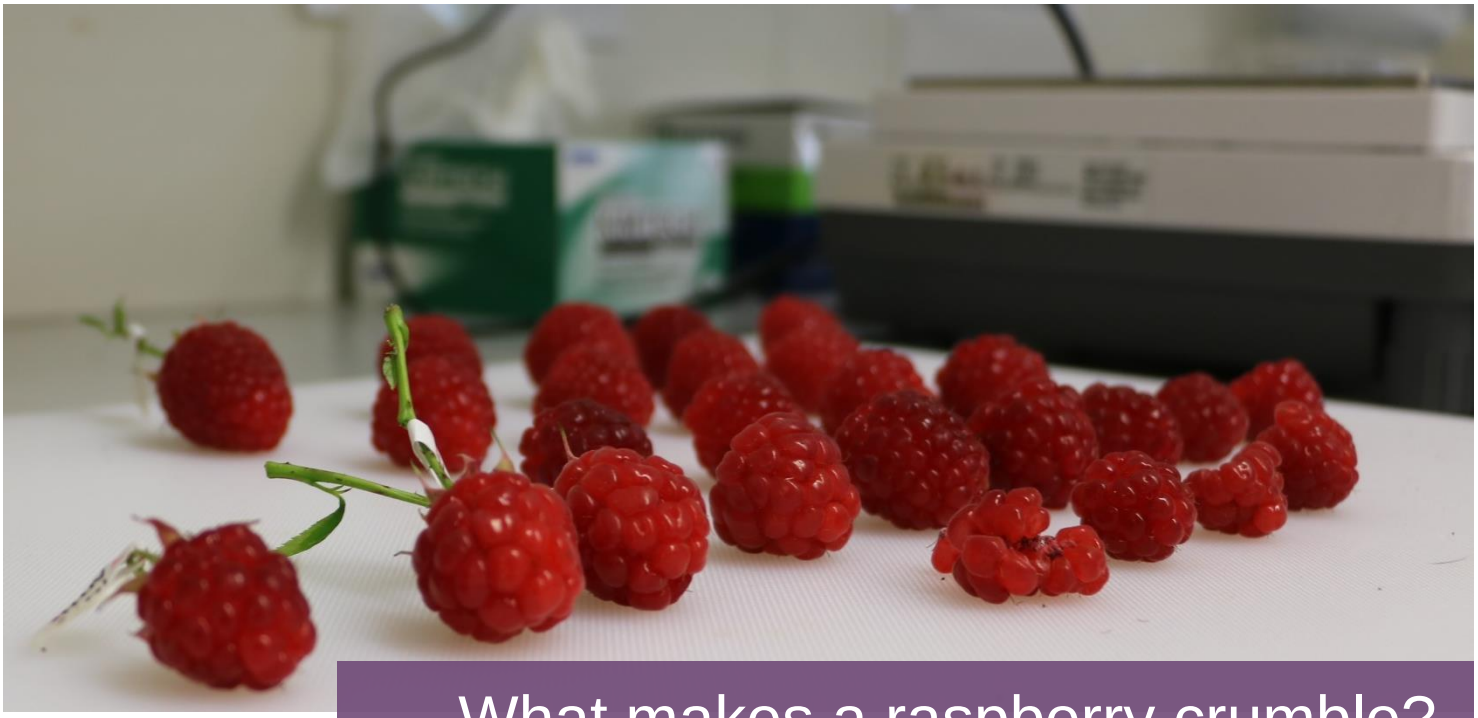
TASMANIAN INSTITUTE OF AGRICULTURE

utas.edu.au/tia



What makes a raspberry crumble?

Key Points

- **Exposure to higher temperatures** did not result in more berries with fruit crumble
- **Crumbly fruit occurred over a range of different environmental conditions** for both ‘Maravilla’ and ‘Diamond Jubilee’ raspberries which points to a genetic basis for raspberry fruit crumble.
- **Reduced bee activity in the mid tunnel** location is a potential contributor to fruit crumble.
- **Further research** on how high temperature affects the later processes of fertilisation and ovary function could provide more answers.

Do high temperatures and low humidity contribute to raspberry fruit crumble?

‘Crumbly’ fruit is a significant disorder of raspberries that occurs worldwide with crop losses ranging from 5 to 30%. Crumbly fruit occurs when too few berry segments or drupelets form, preventing these from interlocking so that fruit falls apart or ‘crumbles’ when picked. Many causes have been suggested including virus, genetics, inadequate pollination and environmental factors.

Agricultural Science Honours student, **Olivia Cripps**, investigates the effect of high temperature and low humidity (high vapour pressure deficit) on crumbly fruit. She looks at how raspberry reproductive biology and fruit formation is affected by high temperatures.

UNIVERSITY of TASMANIA | Tasmanian Government

TIA is a joint venture of the University of Tasmania and the Tasmanian Government

costa well grown

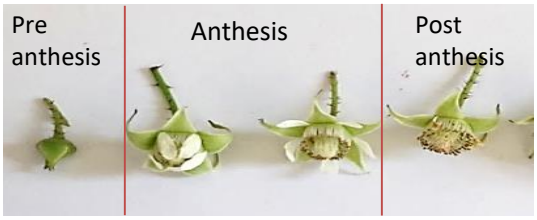
Vapour Pressure Deficit, what is it?

Vapour pressure deficit (VPD) describes the relationship between temperature and humidity. VPD is high when temperature is high and humidity is low. Plants may experience more stress at high VPD compared to a lower VPD.

Measuring the effect of temperature and VPD on different stages of flowering

To test if flowers are affected by high temperature or VPD, a trial was established at the Costa Groups Wesley Vale farm set in a 4 year old, soil grown 'Maravilla' raspberry crop under high tunnels.

On 5 dates from late February to April, flowers at 3 stages of development (pre anthesis, anthesis and post anthesis) were collected for testing pollen and flower health whilst others were tagged for future fruit quality assessment. The maximum temperature in the 24 hours prior to tagging was recorded. Flowers were collected from 2 locations, the tunnel entrance and mid tunnel (halfway from each end). Fruit was collected when nearly ripe and categorised into 5 levels of crumble from perfect fruit to extremely crumbly.



How hot did it get and for how long?

The maximum air temperature recorded in the 24 hours prior to tagging was 29 °C from late February through March. The middle of the tunnel experienced consistently higher maximum temperatures than the entrance location, with daily peaks up to 6°C warmer. The duration of these peaks was quite short, lasting for around one hour.

A second study exposed 'Diamond Jubilee' raspberries to extended periods of high temperature. Selected greenhouse plants were transferred to a phytotron with 26 hours at 32°C and low humidity, giving a VPD of 3.8.

Flowering processes and temperature

Increasing air temperature in tunnels from 15 to 29°C had either no effect or a positive effect on flower health indicators such as pollen viability, number of pollen grains adhering to the stigma, pollen germination, number of pollen tubes entering the style, pollen tube growth, pollen tube penetration of the ovary and fruit quality. This varied slightly with flower stage.

Increasing the maximum temperature from 15 to 29C corresponded with: :

- **Increasing pollen viability** for flowers tagged at anthesis
- **A greater number of pollen tubes growing down the style** for flowers tagged at post anthesis
- **Decreasing occurrence of crumbly fruit** for flowers tagged at post anthesis

Pumping up the heat – the phytotron study

When flowering 'Diamond Jubilee' plants were exposed to longer durations (26 hours) of high temperature and low humidity (high VPD) in the phytotron there was no clear difference in the levels of crumble compared to the control. Pollen germination and pollen viability were high after exposure to 32C. However the later processes of pollen tube growth and stigma receptivity were reduced by the extended exposure to 32C temperature in the phytotron.

Overall, there was no clear direct effect of exposure to high temperatures for either a short or extended period on raspberry fruit crumble.

Tunnel Location and bees

The mid location of the polytunnel had a greater proportion of severely crumbly fruit (26%) compared to fruit from close to the entrance door (10%), even though the average level of crumble was very similar. If temperature is not considered a major driver of raspberry crumble, another proposal is that lower bee activity in the middle of the tunnel could be responsible for this difference. Studies in Queensland by Hall (2019) support this.

Likely causes of crumble

It is thought that the later fertilisation processes and flower structures such as ovary function could be more sensitive to high temperatures leading to crumble. Genetic factors are a likely strong contributor to crumble based on the similar levels of crumble observed under very different environmental conditions in this study.

DISCLAIMER While the Tasmanian Institute of Agriculture (TIA) takes reasonable steps to ensure that the information on its fact sheets is correct, it provides no warranty or guarantee that information is accurate, complete or up-to-date. TIA will not be liable for any loss, damage, cost or expense incurred or arising by reason of any person using or relying on the information contained in this publication. No person should act on the basis of the contents of this publication without first obtaining specific, independent, professional advice.

TIA and contributors to this Fact Sheet may identify products by proprietary or trade names to help readers identify particular types of products. We do not endorse or recommend the products of any manufacturer referred to. Other products may perform as well or better than the products of the manufacturer referred to.

CRICOS Provider Code 00586B

More information

Associate Professor Alistair Gracie
Alistair.gracie@utas.edu.au
Senior Lecturer, Tasmanian Institute of Agriculture