

Some of the differing responses of peach rootstocks to root temperatures

by

^{1,2} P.Malcolm, ² P.Holford, ²W.B.McGlasson.

¹NSW DPI, Richmond, Australia

²CHAPS, University of Western Sydney, Australia.

- Background to RZT work
- General responses of peaches to RZTs
- Some of the differing responses of peach rootstocks to RZTs

Background to RZT work

**Near Sydney, low chill stone
fruit, particularly peaches
and nectarines are grown**



- Sometimes have a *problem* in low chill stone fruit with a condition called *Spring Shock Syndrome*



Spring shock syndrome often associated with:

- Leaf discolouration in the spring
- Poor / slow rates of leaf development in the spring and therefore,
- Poor leaf cover on the trees
- Symptom severity is influenced by choice of rootstock

Q. What causes spring shock syndrome ???

- Number of possible explanations for spring shock syndrome including partial graft incompatibility, poor root development, insufficient chilling, disease, poor mineral nutrition etc
- Another possible explanation is that root temperatures during flowering and fruit development are low.

What are typical soil temperatures near Sydney throughout the year ?

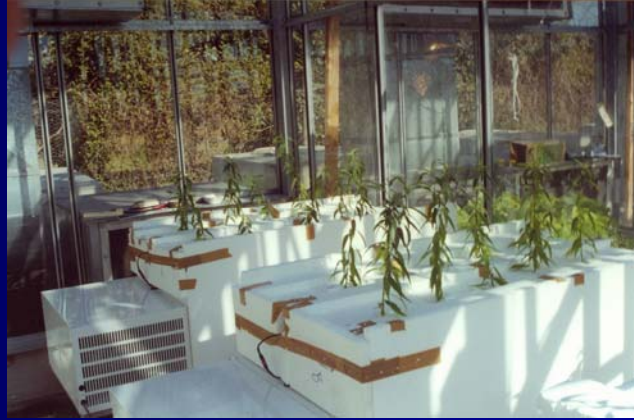
Mean monthly soil temperatures at Somersby HRAS (near Gosford, 60km north of Sydney)

Phenological Stage	Mid Summer Vegetative Growth	Mid Summer Vegetative Growth	Vegetative Active Growth	Vegetative Active Growth	Actively growing Early Leaf Fall	Dormancy
Soil Depth	Jan	Feb	March	April	May	June
30 cms	22°C	22°C	20°C	18°C	15°C	11°C
60 cms	22°C	22°C	20°C	19°C	16°C	13°C
90 cms	21°C	21°C	21°C	20°C	17°C	14°C
Phenological Stage	Pink Bud-Burst, Flowering	Flowering Vegetative Bud burst	Fruit & Leaf Development	Fruit & Leaf Development Fruit Harvest	Fruit Maturity (Harvest)	Fruit Maturity (Harvest)
Soil Depth	July	Aug	Sept	Oct	Nov	Dec
30 cms	10°C	11°C	13°C	15°C	16°C	19°C
60 cms	11°C	12°C	13°C	16°C	17°C	20°C
90 cms	13°C	14°C	14°C	16°C	17°C	19°C

This raises some interesting questions:

- What are the general responses of peach rootstocks to such root zone temperatures (RZT) ?
- Does seasonal growth cycle affect RZT responses?
- What is the effect of higher RZTs on growth of peach rootstocks?

Q. What are the responses of stone fruit rootstocks to root temperatures?



Low root temperature effects on shoot growth (DP)

Left to Right- RZTs of 5, 15, 20 and 26/15°C

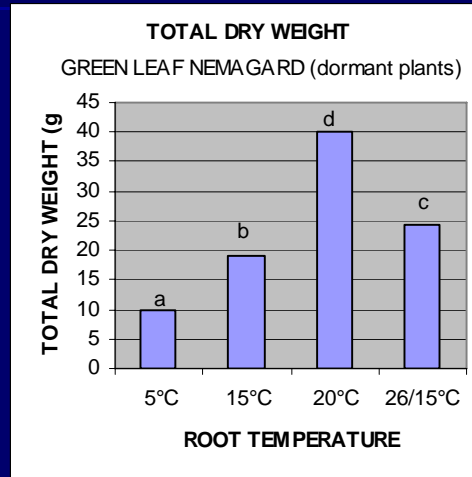


Low root temperature effects on root growth (DP)

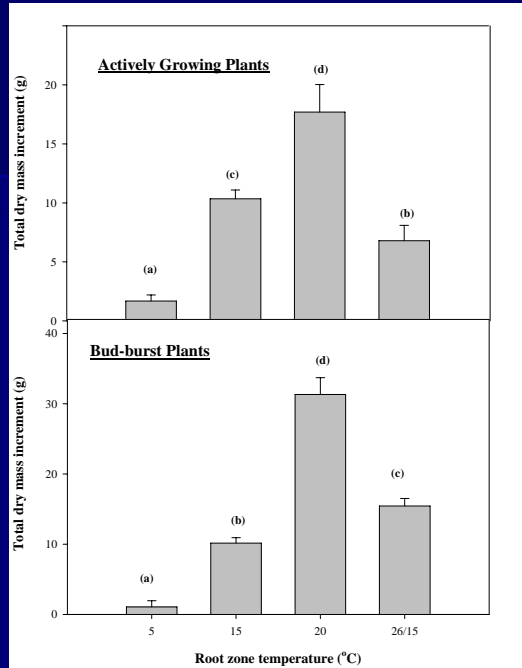
- Left to Right- RZTs of 26/15, 5, 15 and 20°C



Effect of low root temperature on the growth of GLN peach (DP)



Effect of RZT on dry matter increment



Relationship between RZT and dry matter increment (DMI)

Actively growing plants
$$\text{DMI} = 0.663 + 0.043 (\text{RZT})^2$$

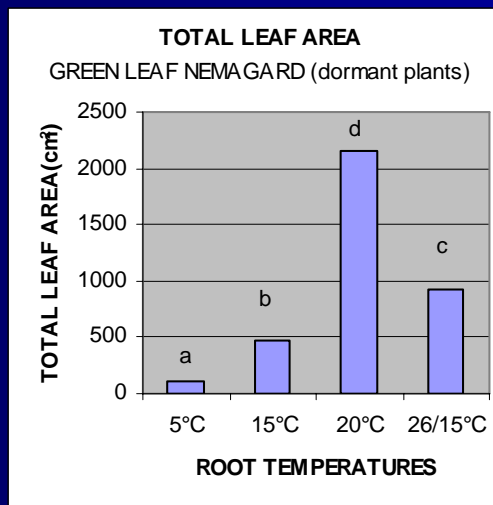
while for

Bud-break plants
$$\text{DMI} = -1.26 + 0.004 (\text{RZT})^3$$

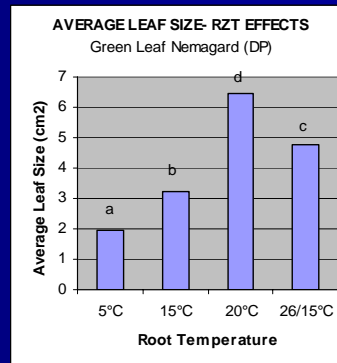
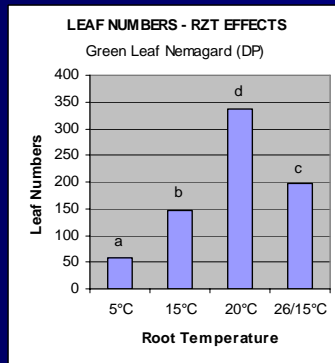
Summary Point N°1

- Low root temperatures, independently of air temperatures, significantly affect growth in stone fruit

Effect of low RZT on leaf development in GLN peach



Effect of low RZT on leaf numbers and leaf size (DP)



Effect of RZT on leaf size and colour



Summary Point N°2

- In stone fruit, root temperatures, independently of air temperatures, significantly affect leaf area and its components, leaf numbers and average leaf size

- Are peach rootstocks also affected by higher root temperatures?



The comparative effect of sub-optimal and supra-optimal RZTs on shoot growth (bud-burst plants)

- Left to Right- 5, 13, 21, 29 and 29/20°C RZTs

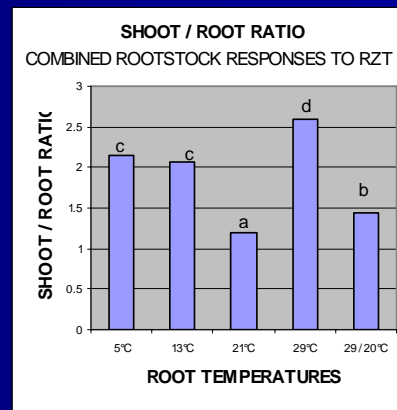
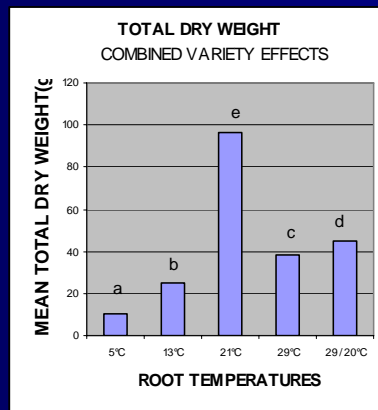


The comparative effects of sub-optimal and supra-optimal RZTs on root growth (bud-burst plants)

- Left to Right- RZTs of 29, 21, 13, 5 and 29/20°C



The effects of both high and low RZTs on growth and shoot / root ratio (pooled data for bud-burst plants)



Summary Point N°3

- Low and high RZTs affect both plant growth and the distribution of dry matter between roots, stems and leaves

Do RZTs affect shoot and leaf colour ?



Effect of RZT on leaf size and colour

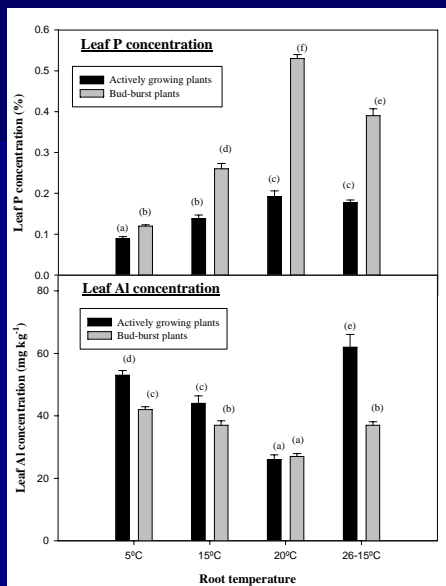


Effects of sub-optimal RZT on mineral nutrition

- At low RZTs plants showed deficiency symptoms



Effects of RZT on leaf concentrations of P and Al in both actively growing and bud-burst GLN peach plants

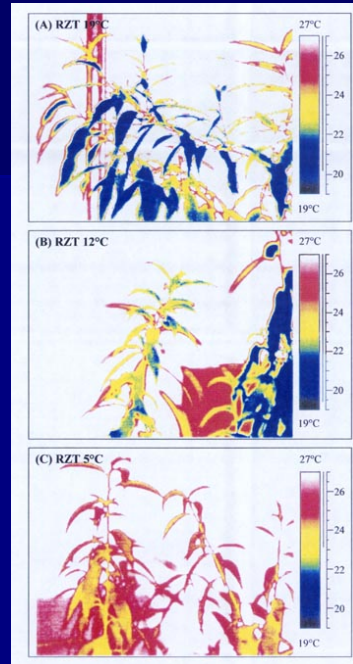


Summary Point N°4

- Root temperatures significantly affect leaf mineral concentrations and leaf colour in stone fruit

Do RZTs influence leaf physiology and temperatures?

Effects of RZT
on transpiration
and therefore
leaf
temperature

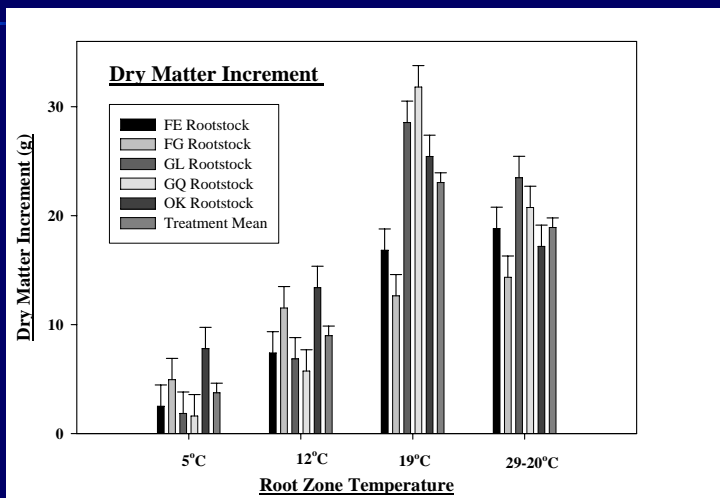


Summary Point N°5

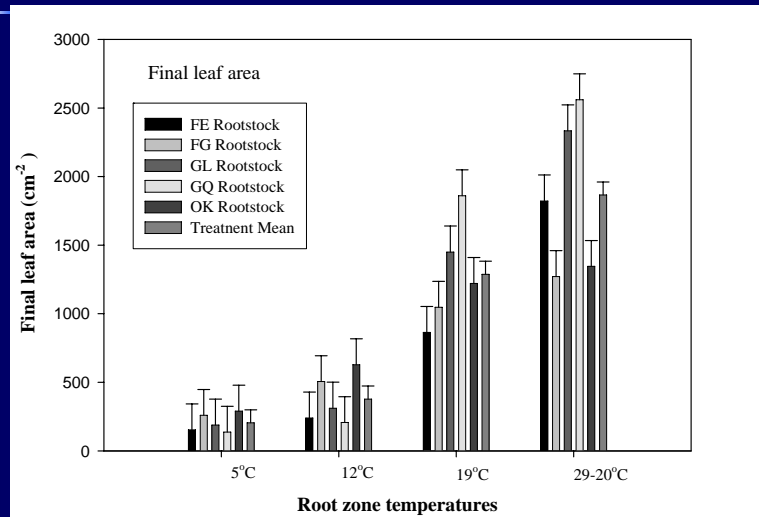
- RZTs, independently of air temperatures, can influence plant physiological processes e.g. transpiration etc.
- RZTs, independently of air temperatures, can influence foliage temperatures (significance for the incidence of pests and diseases ?)

- Do individual rootstocks vary in their response to root temperatures?

Comparative growth responses of rootstock varieties to RZTs



Comparative leaf development responses of rootstock varieties to RZTs



Summary Point N°6

- Rootstocks do differ in their responses to RZT

In summary

- RZTs, independently of shoot temperatures, affect growth, dry matter distribution, leaf morphology, mineral nutrition and leaf temperatures
 - Some plant responses to RZTs are influenced by the seasonal growth cycle (phenology)
- Implications for stone fruit development modelling, mineral nutrition, future rootstock development.
- Selection of rootstocks based on plant RZT responses and on site specific soil temps??

In conclusion

Special thanks to all those
(numerous) people who
have helped me with these
trials

And lastly,

A special 'Thank You' to all of
you here today for your
time and attention

**Some of the differing
responses of peach
rootstocks to root
temperatures**

by

^{1,2} P.Malcolm, ¹ P.Holford, ¹W.B.McGlasson.

¹CHAPS, University of Western Sydney, Australia.

²NSW DPI, Richmond, Australia