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How different pruning intensities and severities affect vegetative growth processes in “Cogshall” mango trees

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Pruning = an important management of trees:

control the size of the tree

(Davenport, 2006)



**improve light
Interception**

(Menzel and Le Lagadec, 2016)

improve yield and fruit quality

(Reddy and Kurian 2011)



Aims of the study

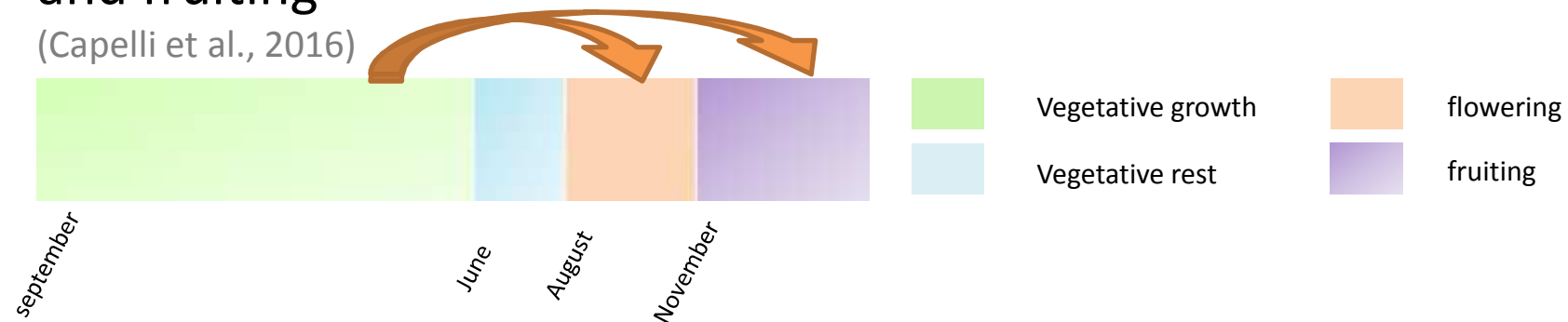


Pruning leads to a strong regrowth of the canopy



Vegetative growth affects flowering and fruiting

(Capelli et al., 2016)



Characterize the direct effect of pruning on vegetative growth to better understand the indirect impact on the yield

Characterize the effects of pruning on vegetative growth

- How pruning stimulates vegetative growth? More GUs? More burst GUs?
- Where and when vegetative growth is stimulated?



To decompose vegetative growth in elementary processes

Characterize the pruning

- At the tree scale: amount of removed fresh matter
- At the axis scale: depth of pruning



Decouple the 2 factors

Mango tree = succession of growth units

Growth Unit (GU): portion of the axis developed during an uninterrupted period of growth (Hallé and Martin, 1968)

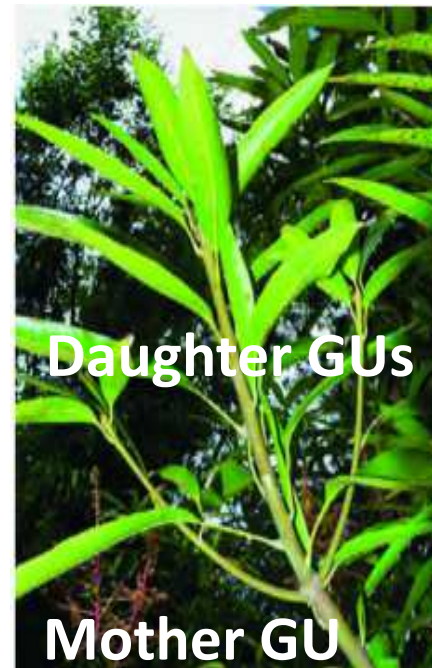
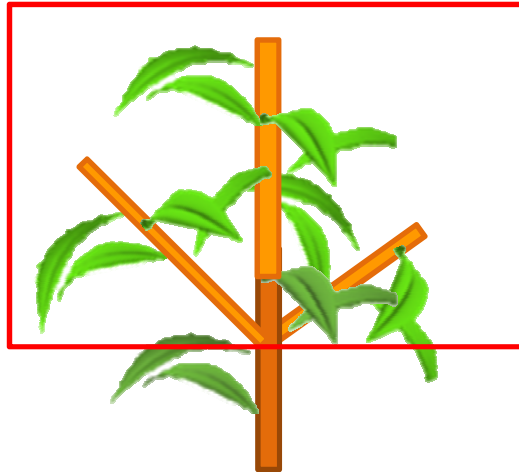
It exists kinship links between GUs:

- mother GUs produce one or several daughter GUs
- Growth level: GUs at the same distance from the tip

Growth level

Daughter GUs

Mother GU



Characteristics of the trees of the experiment



Cultivar: 'Cogshall'

Location: Reunion island – southern hemisphere



introduction

Material and methods

results

discussion

Characteristics of the trees of the experiment



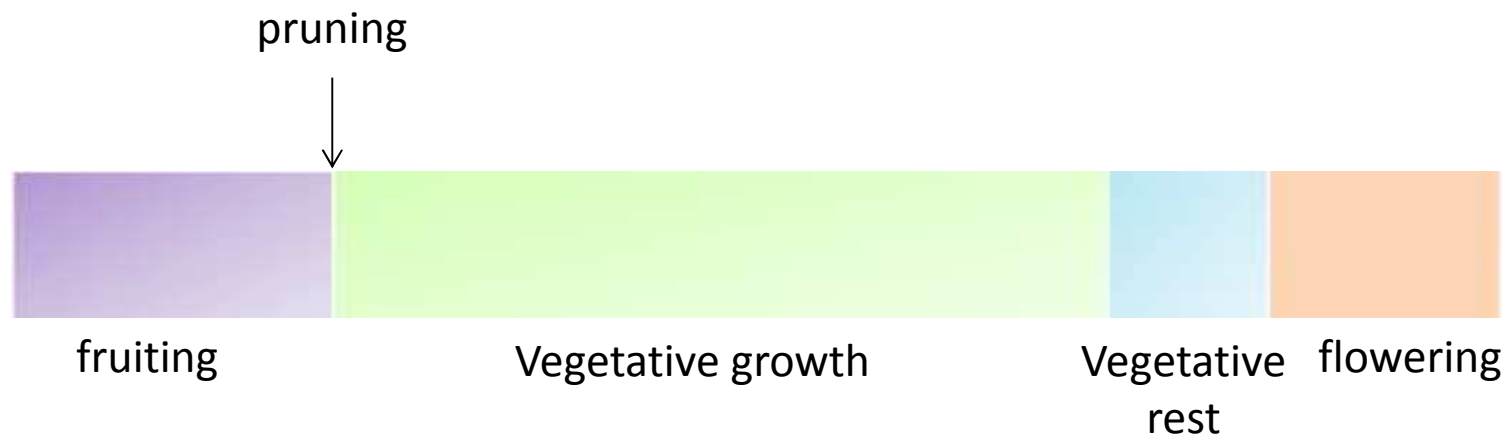
Cultivar: 'Cogshall'

Location: Reunion island – southern hemisphere

Age of trees: 13 years

Date of pruning: after the harvest

Non-productive trees in the previous cycle



introduction

Material and methods

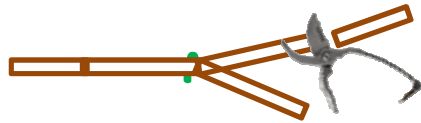
results

discussion

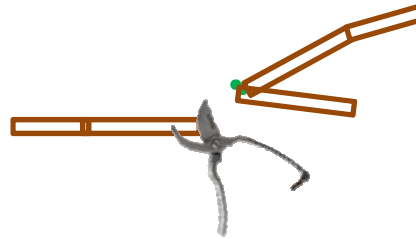
Studied factors



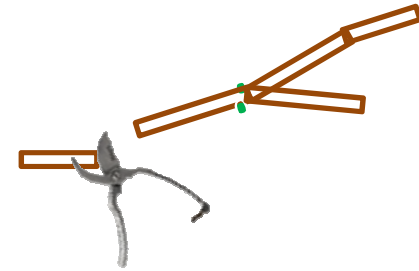
Axis scale = pruning severity: pruning depth in term of number of growth levels pruned



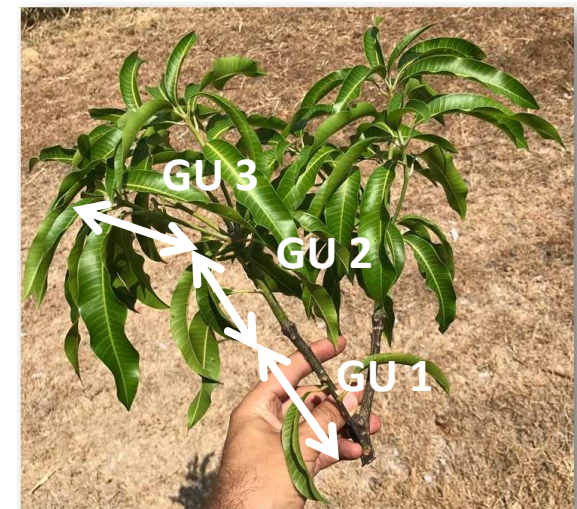
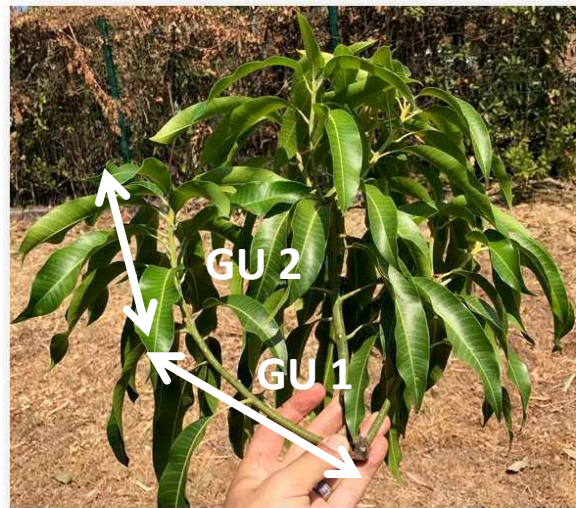
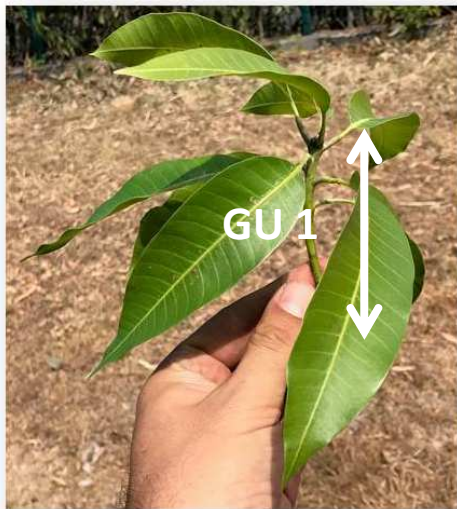
n1: one growth level removed



n2: two growth levels removed



n3: three growth levels removed

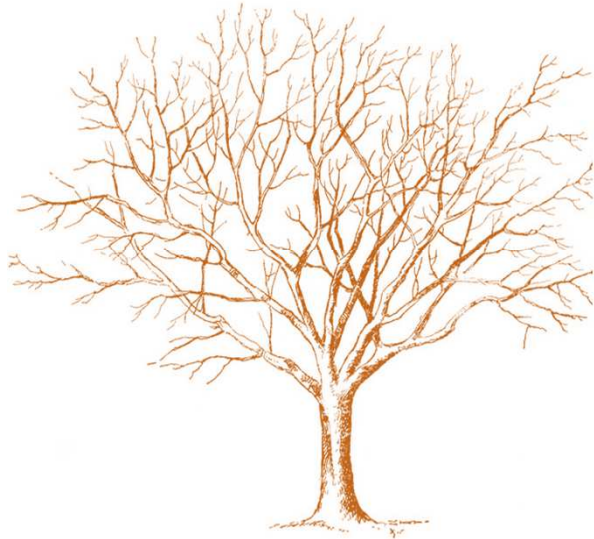


Studied factors

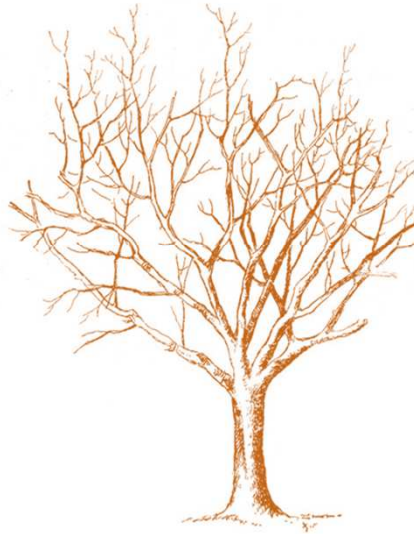


Tree scale = pruning intensity: amount of removed fresh matter

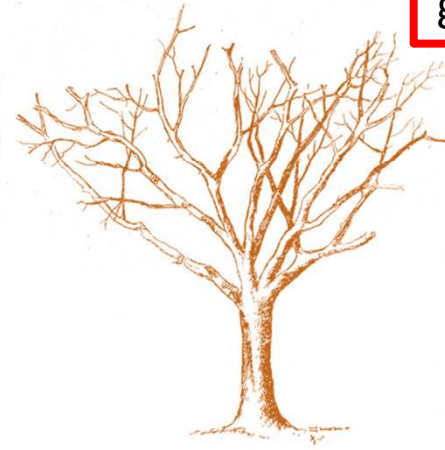
Corresponds to
growers' pruning



Control trees
(unpruned):T0



light pruning
T1



Moderate pruning
T2



Intense pruning
T3

Removed fresh matter (kg/m ³)	0.00±0.00	0.14±0.03	0.30±0.06	0.51±0.06
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0 n1
0 n2
0 n3

30 n1
30 n2
30 n3

130 n1
130 n2
130 n3

240 n1
240 n2
240 n3

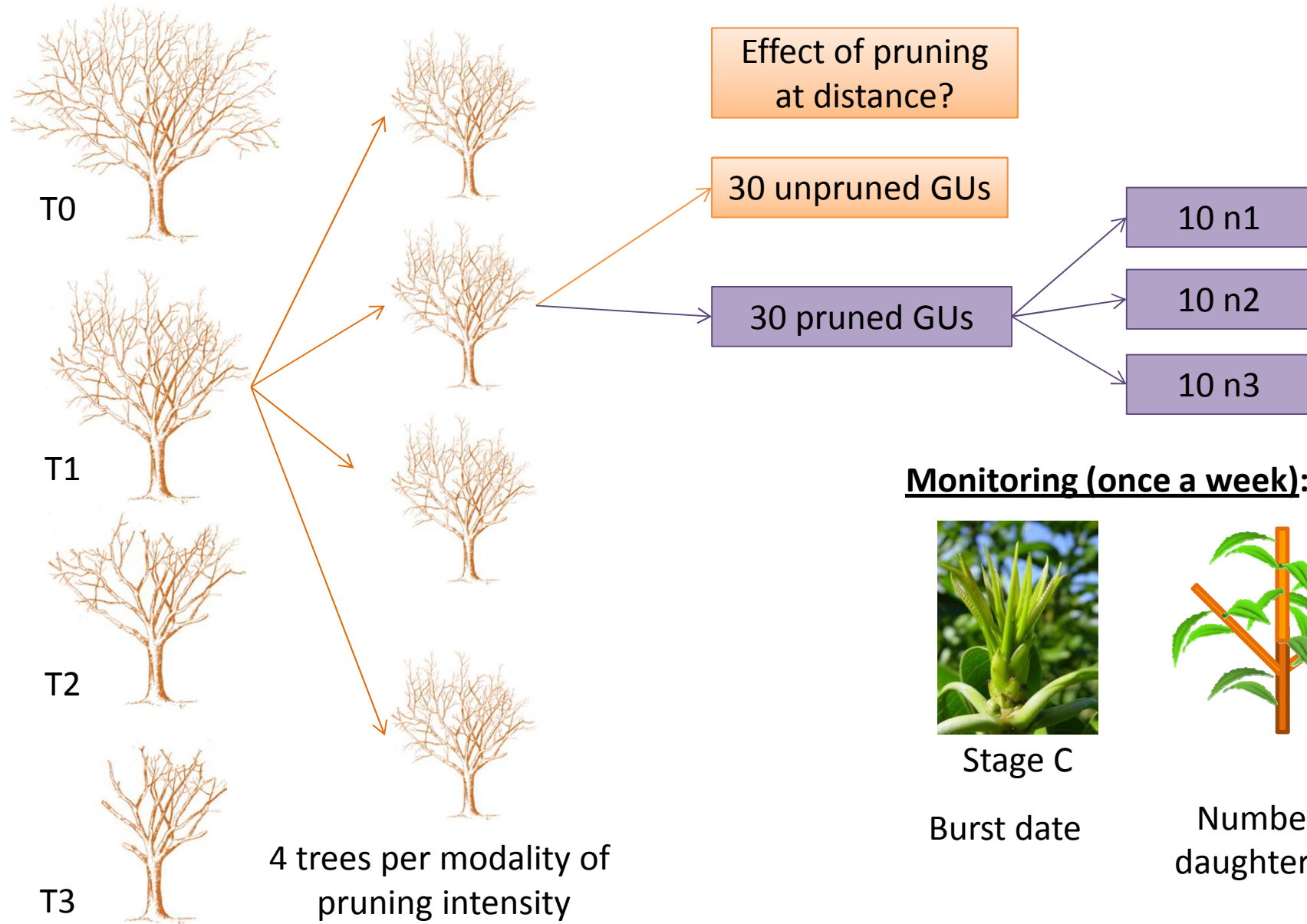
introduction

Material and methods

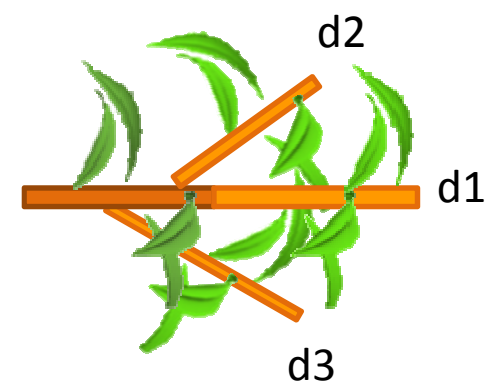
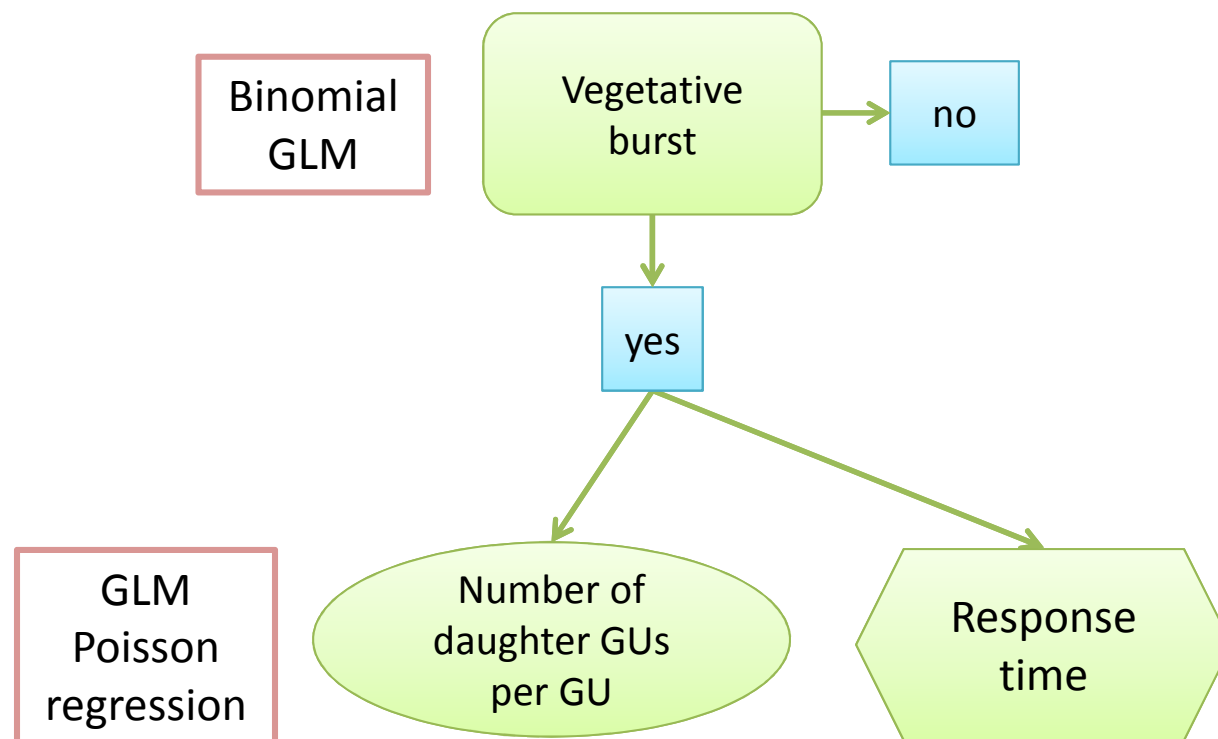
results

discussion

Data acquisition



At GU scale:



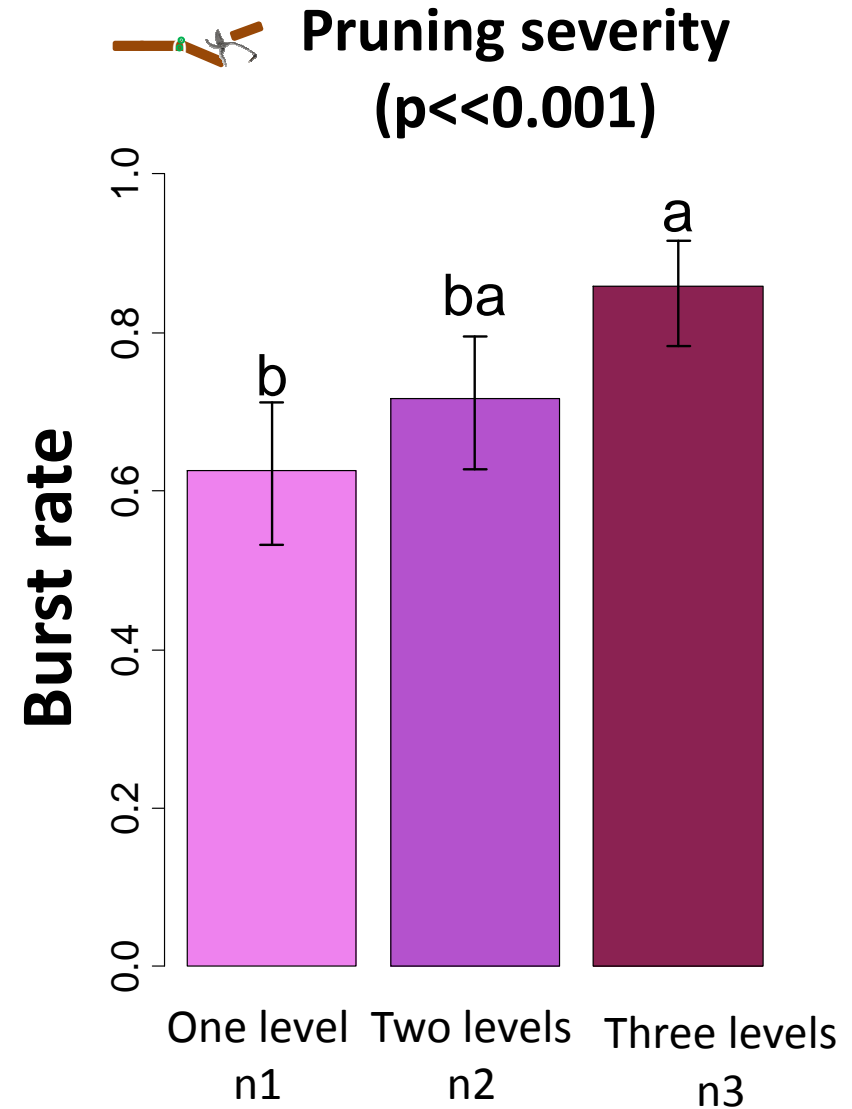
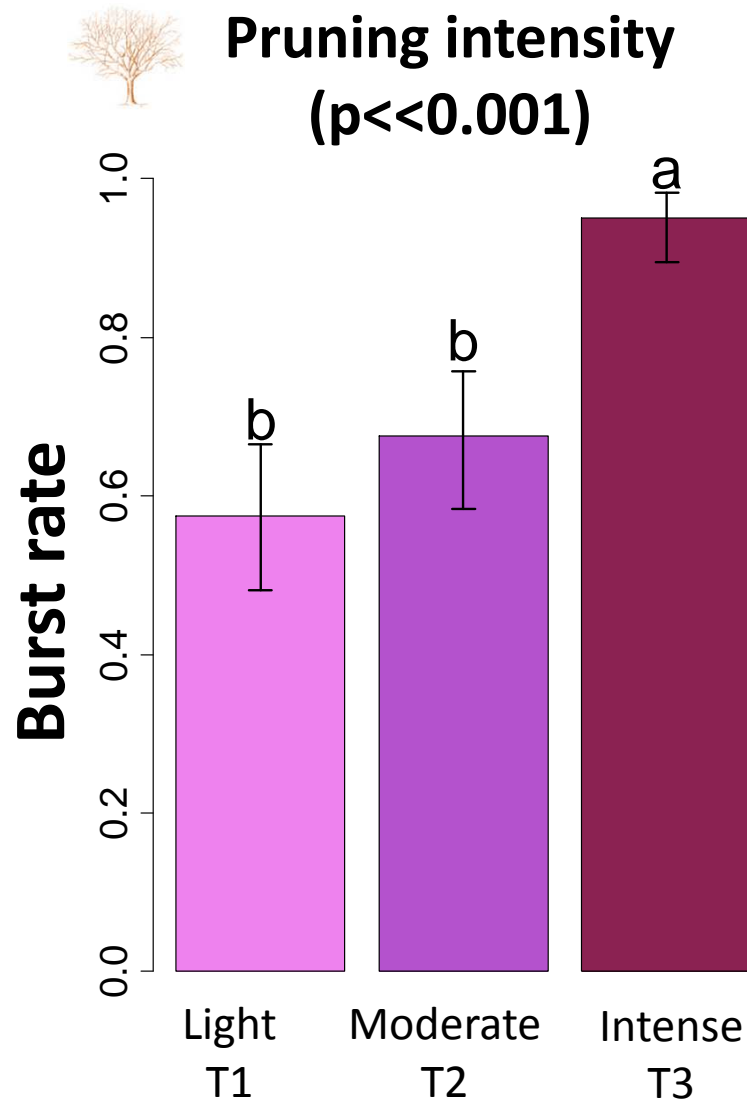
Mixture of Poisson distribution
(Leisch, 2004)

Threshold probability: 0.01

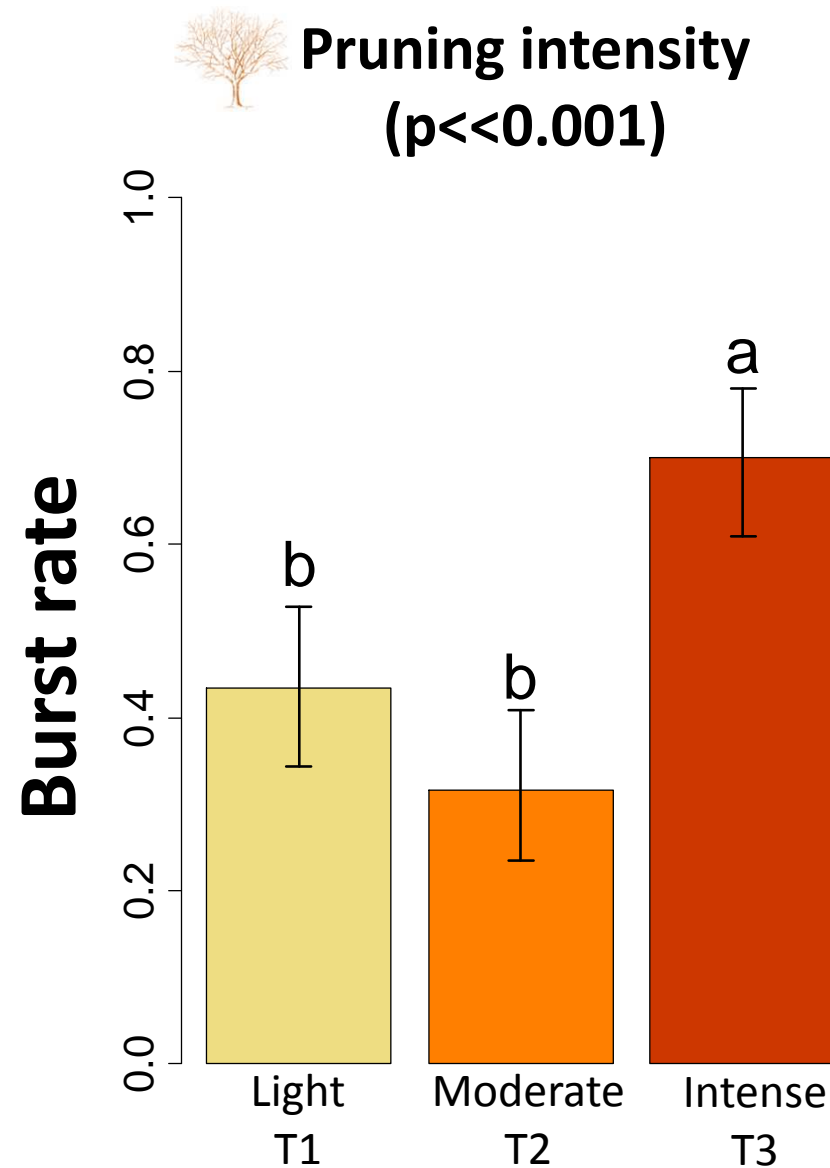
Effect of pruning on burst rate



Pruned GUs



Effect of pruning on burst rate

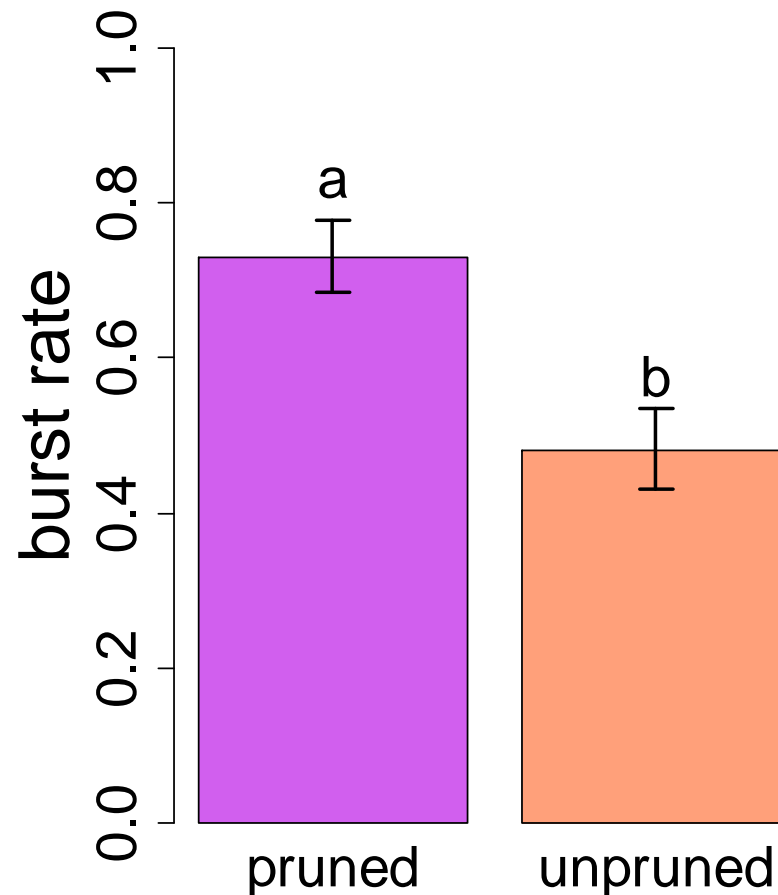


unpruned GUs

Effect of pruning on burst rate

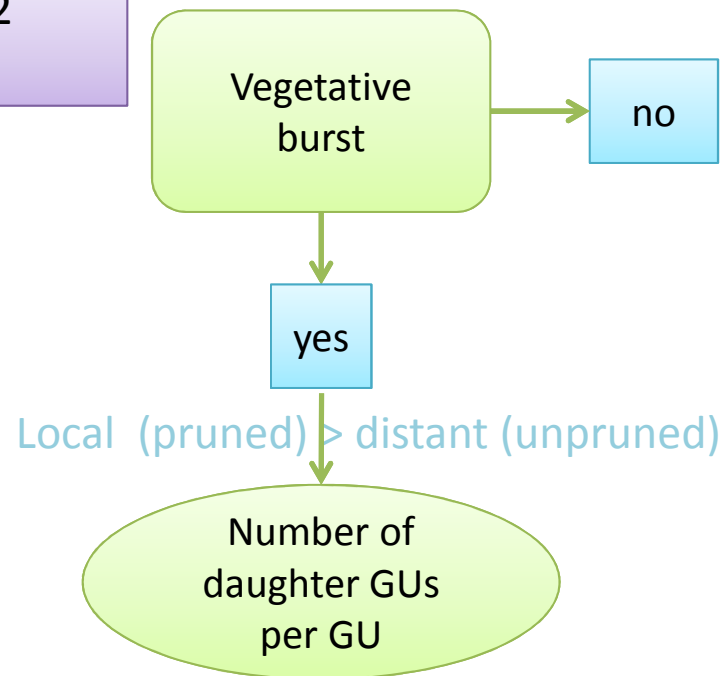


Comparison between pruned and unpruned GUs
($p < 0.001$)



Local effect (pruned GUs):

- Intensity: $T3 > T1, T2$
- Severity: $n3 > n1$



distant effect (unpruned GUs):

- Intensity: $T3 > T1, T2$

Effect of pruning on number of daughter GUs

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Pruning intensity
P=0.23



Pruning severity
($p < 0.001$)

No effect of pruning intensity

Pruned GUs

Intensity	Number of daughter GUs per GU
T1	3.4
T2	3.1
T3	3.4

Severity	Number of daughter GUs per GU
n1	2.9 b
n2	2.7 b
n3	4.1 a



Pruning intensity
P=0.02

No effect of pruning intensity

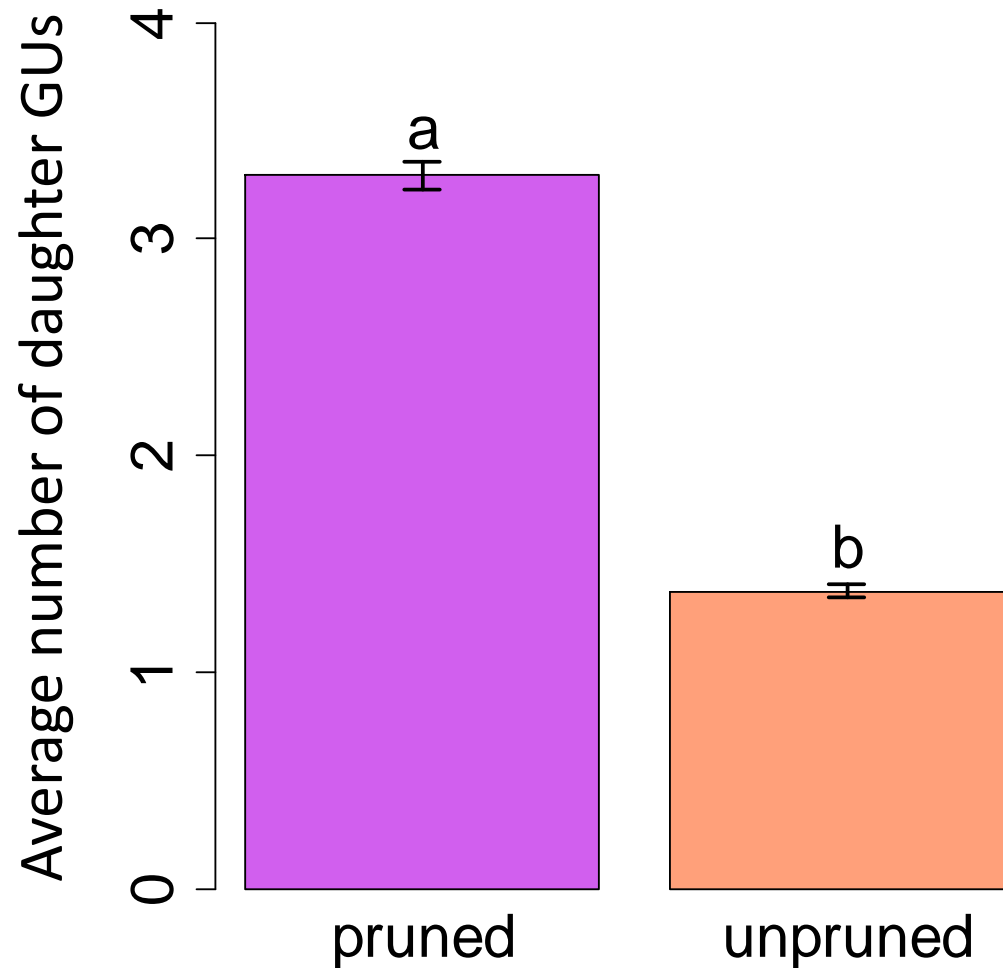
Intensity	Number of daughter GUs per GU
T1	1.6
T2	1.2
T3	1.3

unpruned GUs

Effect of pruning on number of daughter GUs

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Comparison between pruned and unpruned GUs
($p < 0.001$)



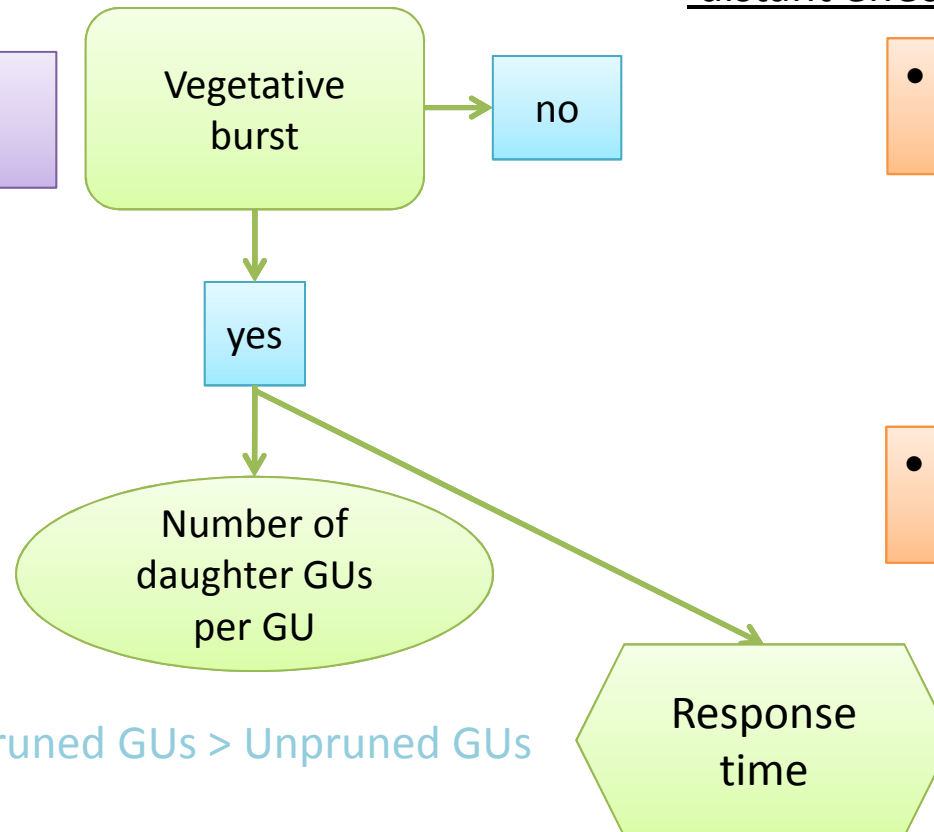
Effect of pruning on number of daughter GUs

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Local effect (pruned GUs):

- Intensity: $T3 > T1, T2$
- Severity: $n3 > n1$

- Intensity: no effect
- Severity: $n3 > n2, n1$



distant effect (unpruned GUs):

- Intensity: $T3 > T1, T2$

- Intensity: no effect

Effect of pruning on vegetative growth timing

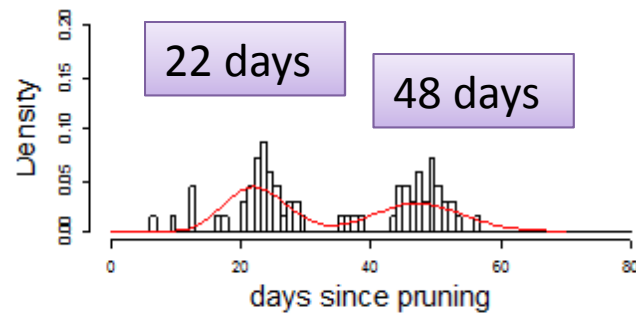
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Pruned GUS

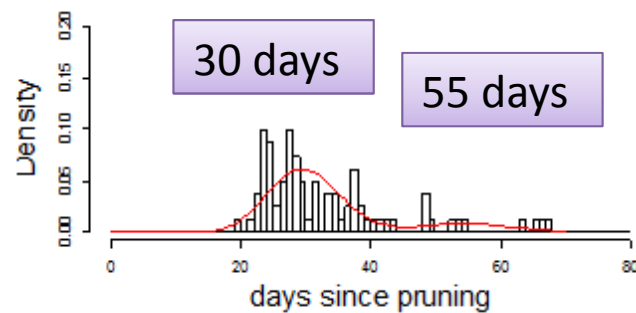


Pruning intensity

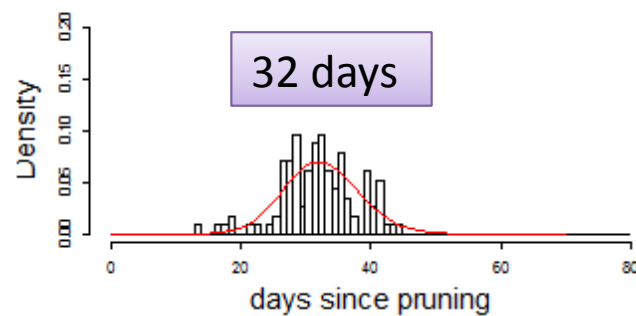
Light pruning
T1



Moderate pruning
T2



Intense pruning
T3



Effect of pruning on vegetative growth timing

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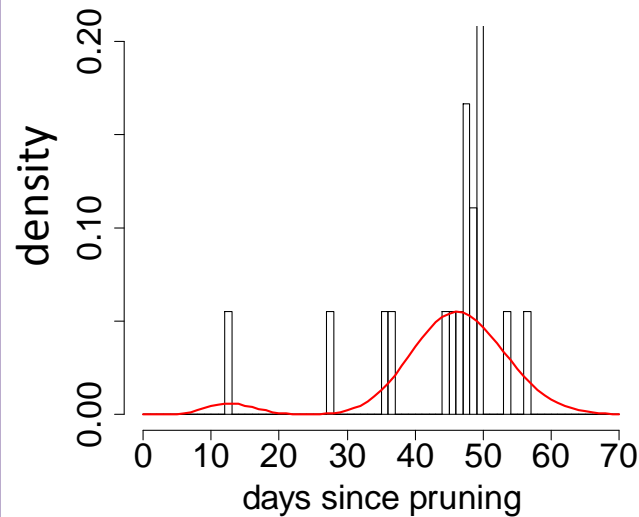
Light pruning
T1



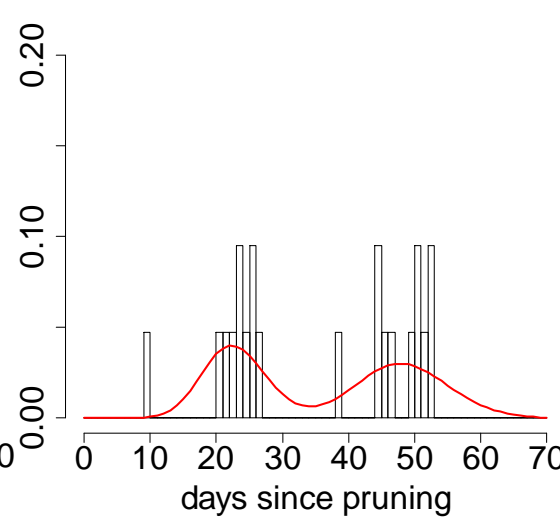
Pruning severity

Pruned GUs

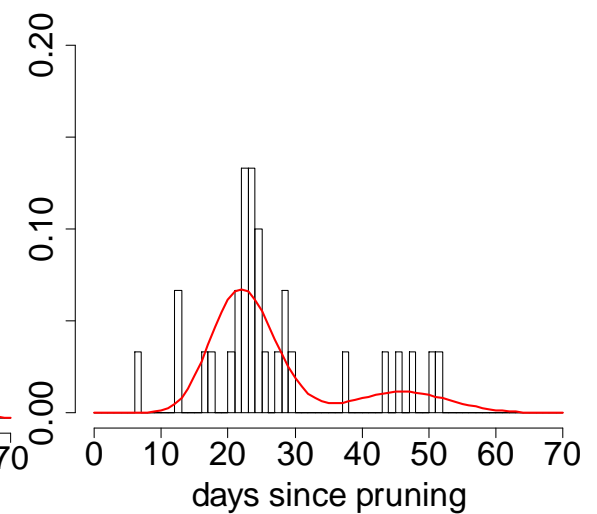
One growth level
removed: n1



Two growth levels
removed: n2



Three growth
levels removed: n3



Effect of pruning on vegetative growth timing

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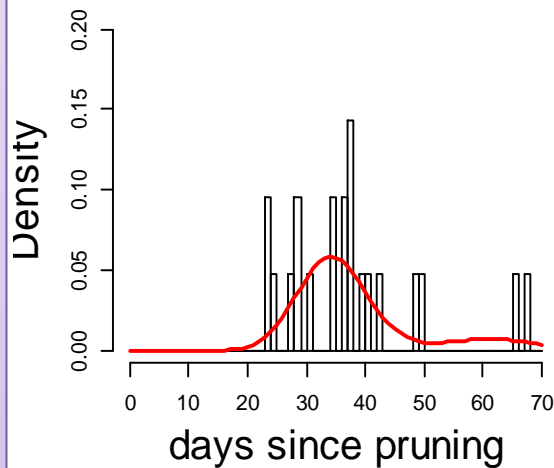
Moderate pruning
T2



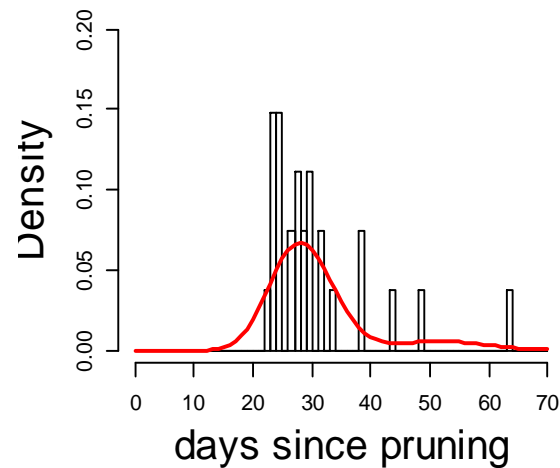
Pruning severity

Pruned GUs

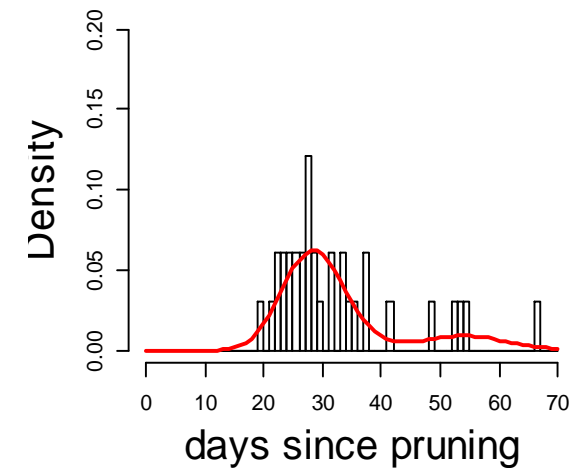
One growth level
removed: n1



Two growth levels
removed: n2



Three growth levels
removed: n3



Effect of pruning on vegetative growth timing

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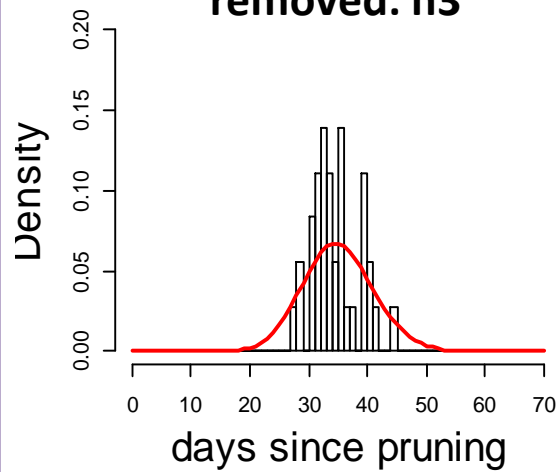
Intense pruning
T3



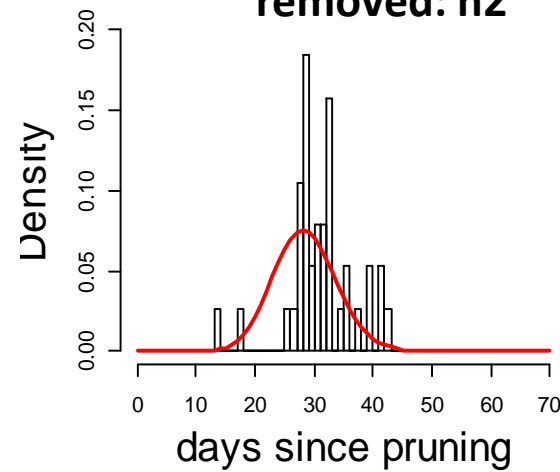
Pruning severity

Pruned GUs

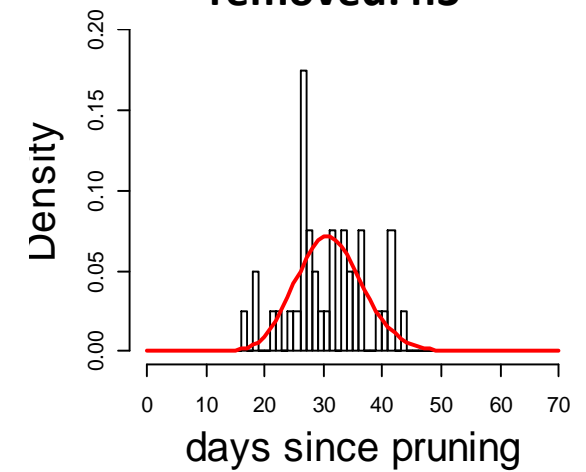
One growth level
removed: n3



Two growth levels
removed: n2



Three growth levels
removed: n3



Effect of pruning on vegetative growth timing

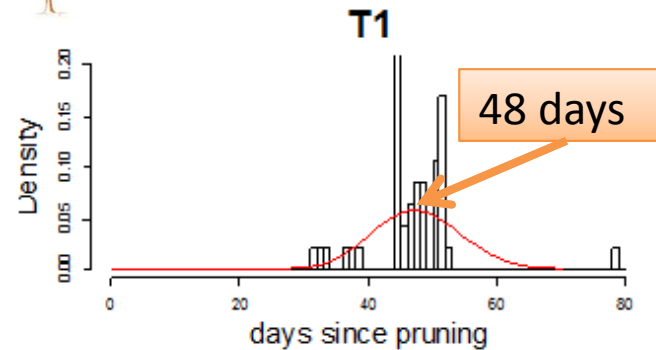
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unpruned GUs

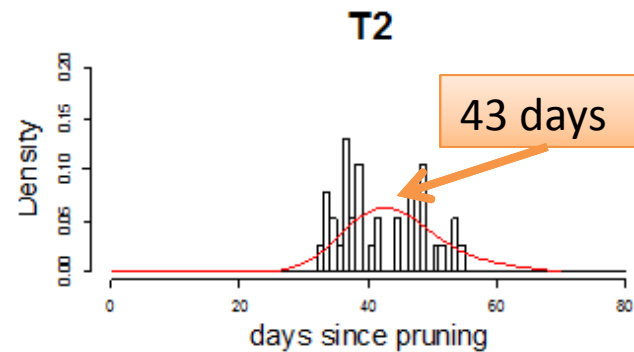


Pruning intensity

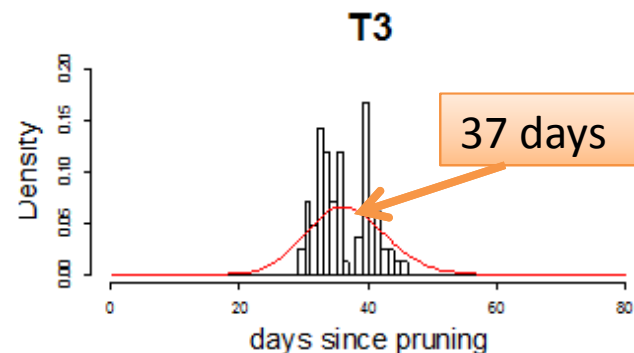
Light pruning
T1



Moderate pruning
T2



Intense pruning
T3

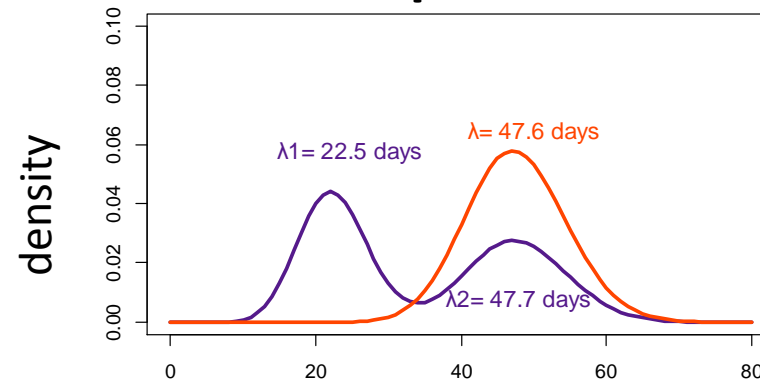


Effect of pruning on vegetative growth timing

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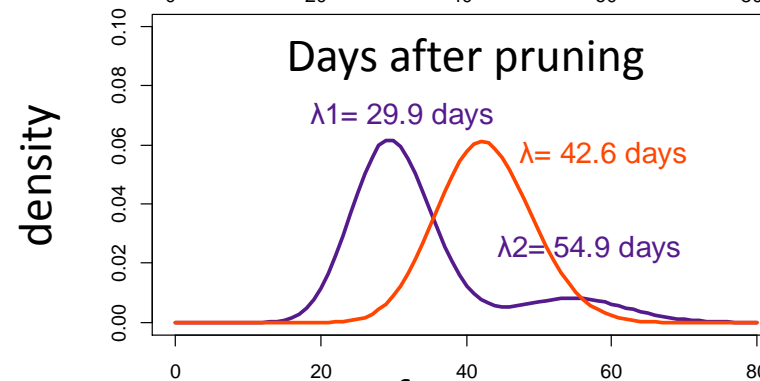
Comparison between pruned and unpruned GUs

Light pruning
T1

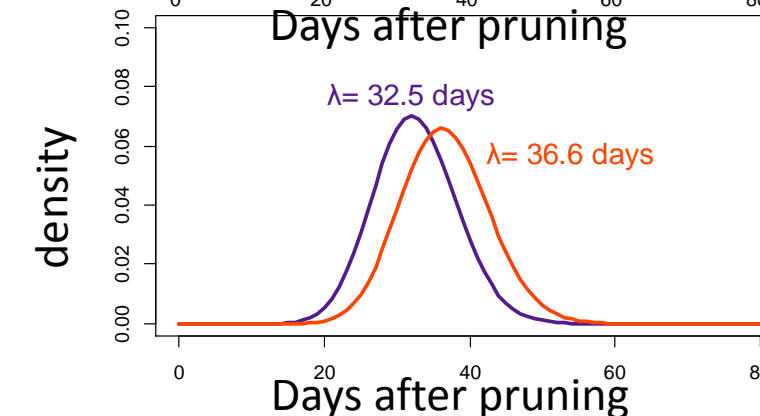


— Pruned GUs
— Unpruned GUs

Moderate pruning
T2



intense pruning
T3



Effect of pruning on vegetative growth timing

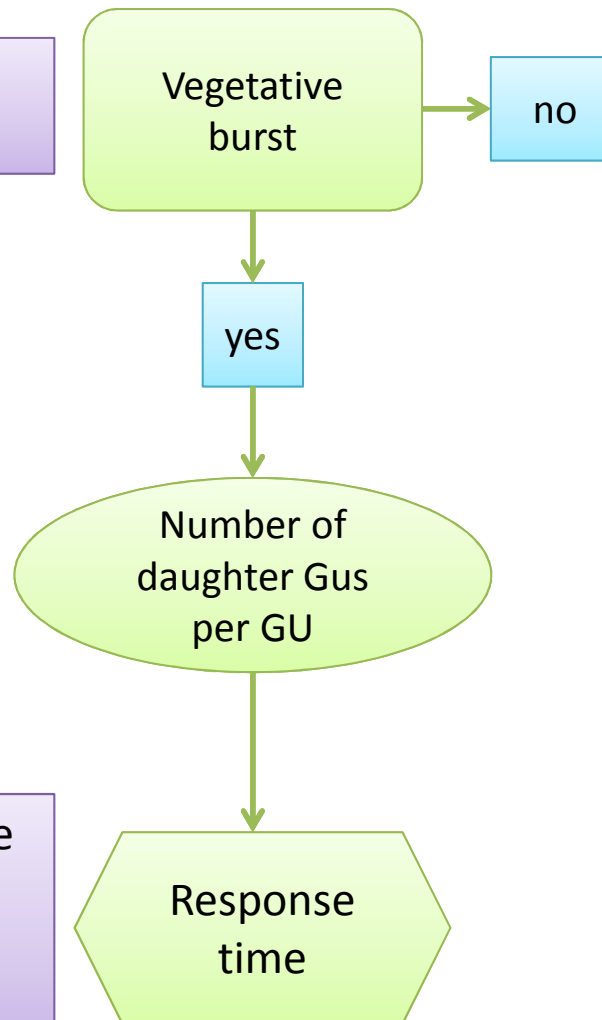
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Local effect (pruned GUs):

- Intensity: $T3 > T1, T2$
- Severity: $n3 > n1$

- Intensity: no effect
- Severity: $n3 > n2, n1$

- Intensity: number/date of flushes
Severity: number/date of flushes for T1



distant effect (unpruned GUs):

- Intensity: $T3 > T1, T2$

- Intensity: no effect

- Intensity: date of flush advanced

How pruning stimulates vegetative growth

Increase burst rate (intensity and severity pruning)

increase number of daughter GUs (severity pruning)

Where vegetative growth is stimulated?

Pruning stimulates vegetative growth locally and at distance (Fumey et al., 2011)

When vegetative growth is stimulated?

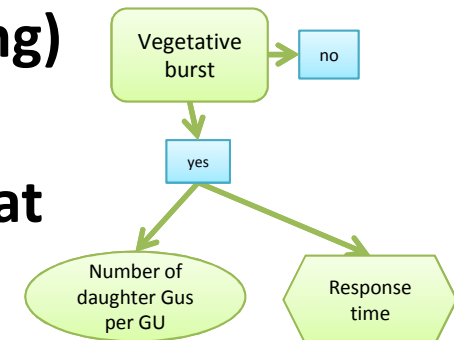
Synchronization of vegetative growth

perspectives:

Study the impact of vegetative growth on flowering and yield

positive relationship between yield and leaf area per tree (Davie and Stassen, 1997)

An important regrowth can delay or prevent flowering (Menzel and Lagadec, 2016)



Model of growth and development of mango tree

(Boudon et al., 2016)

Possibility to simulate an unpruned tree during several cycles of production

- To Integrate all the knowledges
- To make predictions

Integration of the effect of pruning



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Thank you for your attention

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