The costs of reproduction in plants: a novel approach to study irregular bearing of fruit crops

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• Irregular bearing \(\rightarrow\) productivity limitation

\[\text{Year N}\]

Carbohydrates, hormones
(Monselise and Goldschmidt, 1982)

Gaaliche et al., 2011
Dambreville et al., 2013

\[\text{Year N + 1}\]

Lauri and Trottier, 2004
Normand et al., 2009
• Objective of the study:

- To investigate the effects of reproduction on vegetative growth for two irregular mango cultivars

- The costs of reproduction: a novel approach to study irregular bearing
Materials and Methods

• Two mango cultivars:
  – Kensington Pride
  – Cogshall

• 2 to 4 year-old

• 5 trees/cv: 2 thinned; 3 unthinned

• 2 growing cycles

(from Dambreville et al., 2013)
• Three levels:
  
  whole tree

Materials and Methods

scaffold branch

terminal growth unit
Materials and Methods

- Fruit load assessment (cycle n)
  - Number of fruits and fruit weight recorded at the scaffold branch level
  - Aggregated at the tree level
  - Fate of each terminal growth unit
    - Vegetative (V)
    - Flowering (F)
    - Fruiting (FR)
Materials and Methods

• Vegetative growth assessment (cycle n+1)
  - at the terminal growth unit level
  - measurement of basal diameter of each new branch
  - leaf area, dry biomass
  - aggregated at the scaffold branch level
  - aggregated at the tree level
Results

- At the tree level

1- Negative effect of fruit load on vegetative growth during the following cycle
2- Slope higher for Kensington Pride (x 2.5)
Results

- At the scaffold branch level

1- Significant but weak negative relationships
2- Slope higher for Kensington Pride (x 2)
• At the terminal growth unit level

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Fate of the terminal growth unit</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>V</td>
<td>F</td>
</tr>
<tr>
<td>Cogshall</td>
<td>3.03 a</td>
<td>1.90 b</td>
</tr>
<tr>
<td>Kensington Pride</td>
<td>5.42 a</td>
<td>2.29 b</td>
</tr>
</tbody>
</table>

1- The larger the reproductive effort, the smaller the vegetative growth during the following cycle
Discussion

• Negative effect of reproduction at different levels

• Kensington Pride more affected than Cogshall

• Consequences of reduced vegetative growth?
  – less potential flowering points
  – reduced C assimilation
  – reduced flowering/fruiting rates (Normand et al., 2009)
• The costs of reproduction (Obeso, 2002; Reekie and Bazzaz, 2005)

= loss in the potential future reproductive success caused by current investments in reproduction (Jönsson, 2000).

• Hypothesis

Vegetative growth

Resources

Defense

Reproduction

to maximize the reproductive success during the whole life span of the plant
• Relevancy for studies on irregular bearing

- life history traits to comply with the hypothesis
- relationships between life history traits and fruit production over years
- offers
  - theoretical framework
  - practical methods
  - examples on wild species
- relationships ➔ hypotheses on underlying mechanisms
- comprehensive way to study irregular bearing
• A point of discussion for fruit trees

- fruit tree cultivars are not wild genotypes
- but they derive from wild genotypes
- selection targets improved reproductive traits
  - larger costs of reproduction
  - more easily identifiable and quantifiable
Conclusion

• Negative relationships between reproduction and subsequent vegetative growth at different levels in the mango tree

• Cultivar effect on the relationships

• The concept of the costs of reproduction appears as a novel approach to study irregular bearing
Thank you for your attention