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

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- Irregular bearing → productivity limitation

Year N

carbohydrates, hormones
(Monselise and Goldschmidt, 1982)

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

Lauri and Trottier, 2004
Normand et al., 2009

Year N + 1

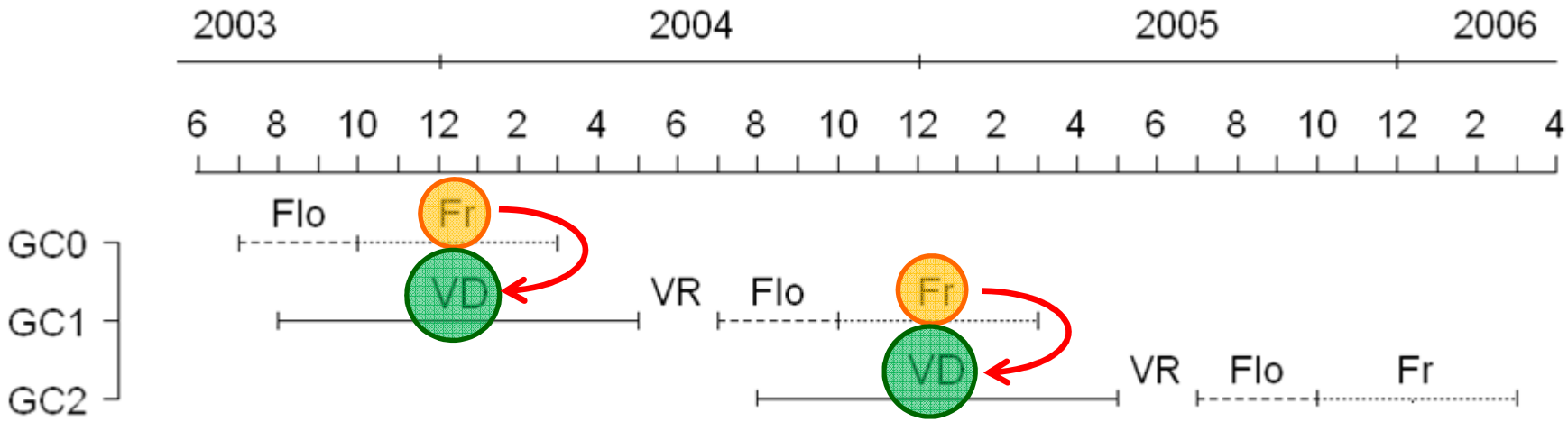
- Objective of the study :

  - 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)

Materials and Methods

- Three levels:

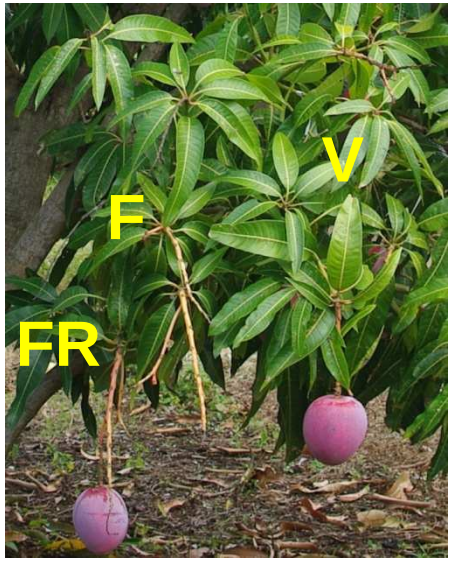
whole tree

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)



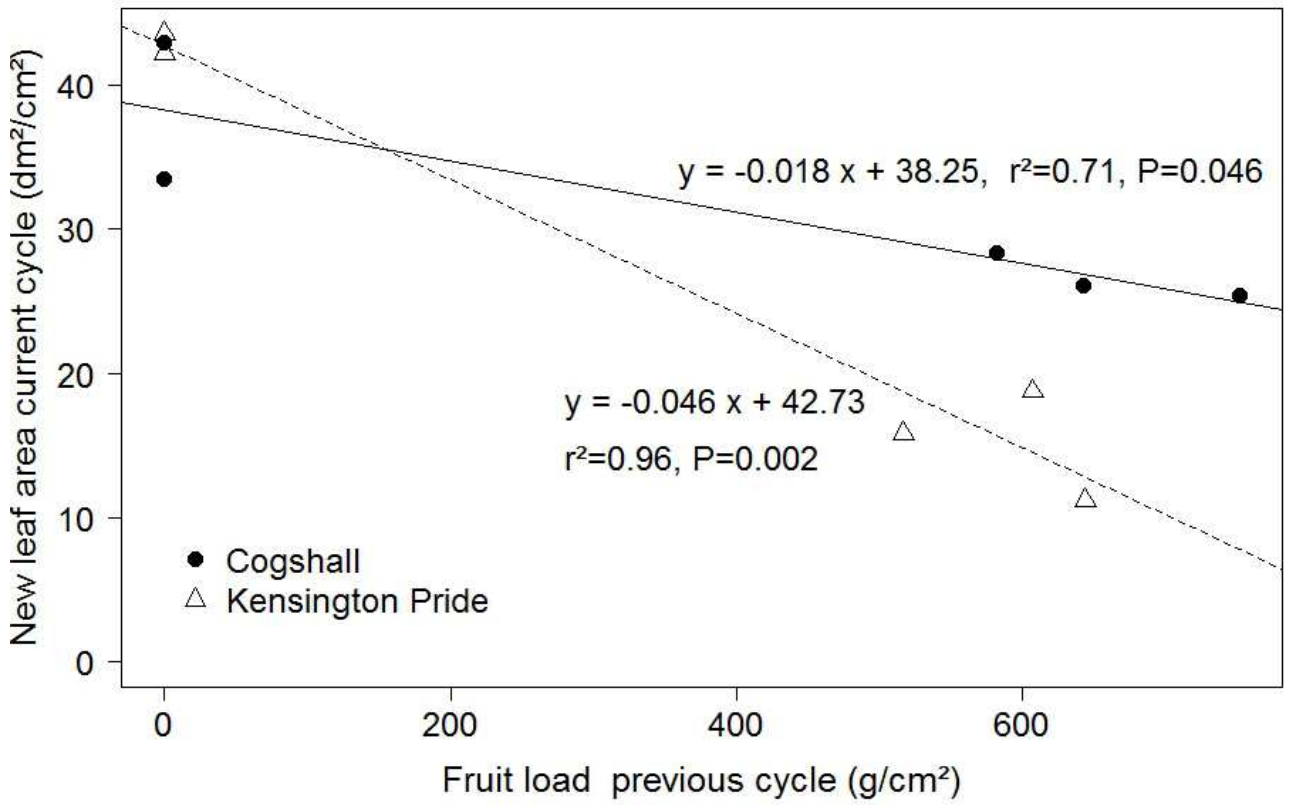
Materials and Methods

- 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

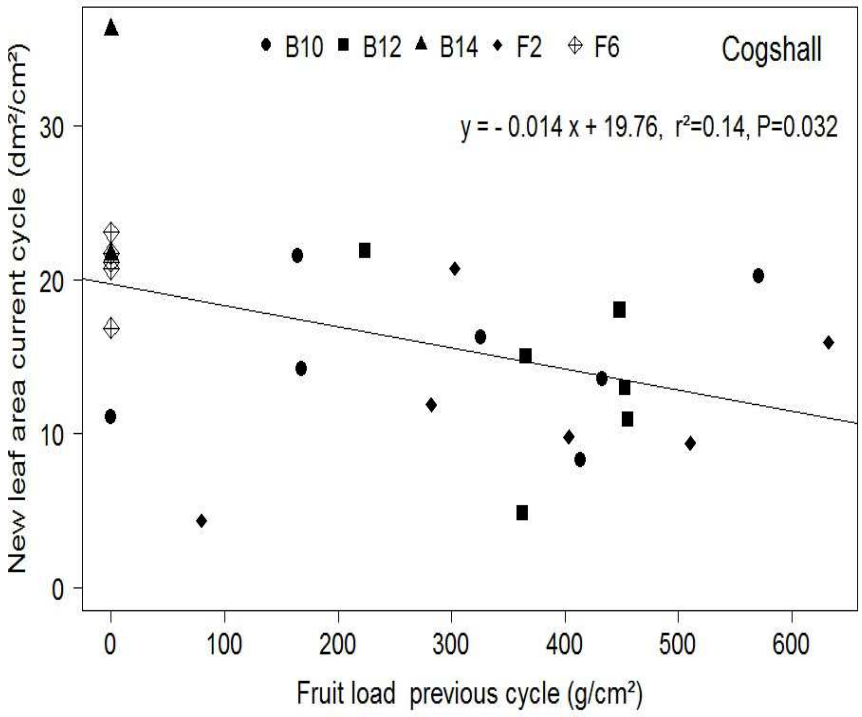


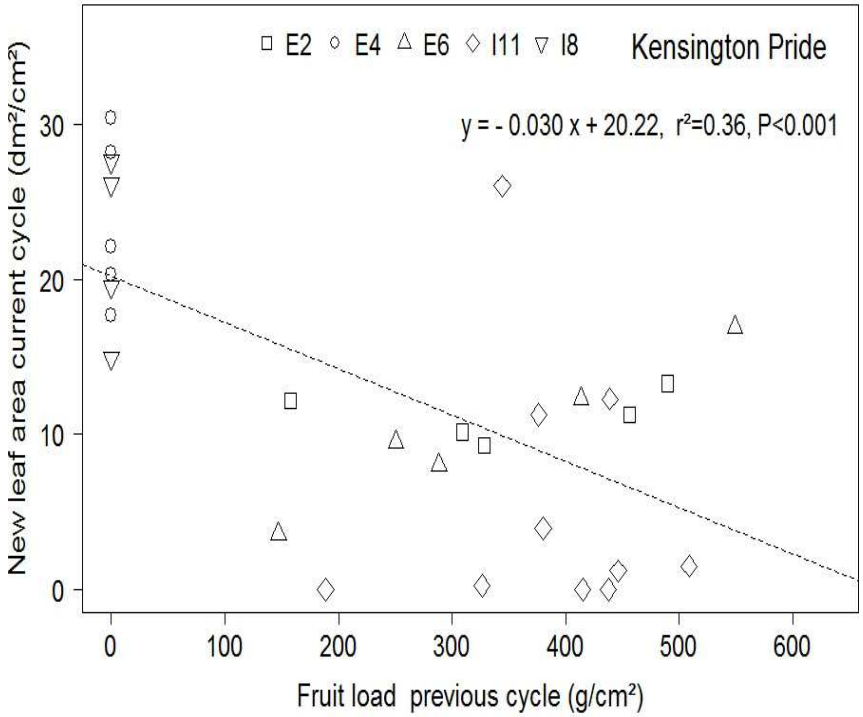
1- Negative effect of fruit load on vegetative growth during the following cycle

2- Slope higher for Kensington Pride (x 2.5)

Results

- At the scaffold branch level





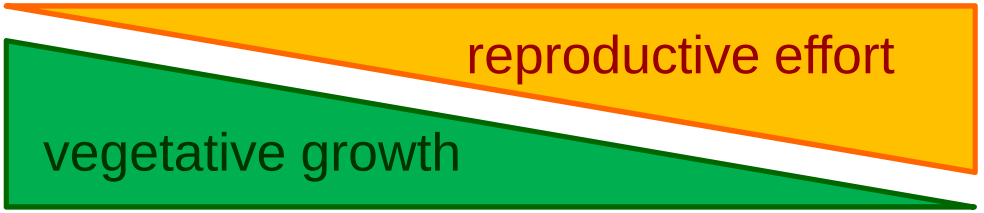
1- Significant but weak negative relationships

2- Slope higher for Kensington Pride (x 2)

Results

- At the terminal growth unit level

Cultivar	Fate of the terminal growth unit		
	V	F	FR
Cogshall	3.03 [a]	1.90 [b]	1.73 [c]
Kensington Pride	5.42 [a]	2.29 [b]	1.53 [c]



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

Discussion

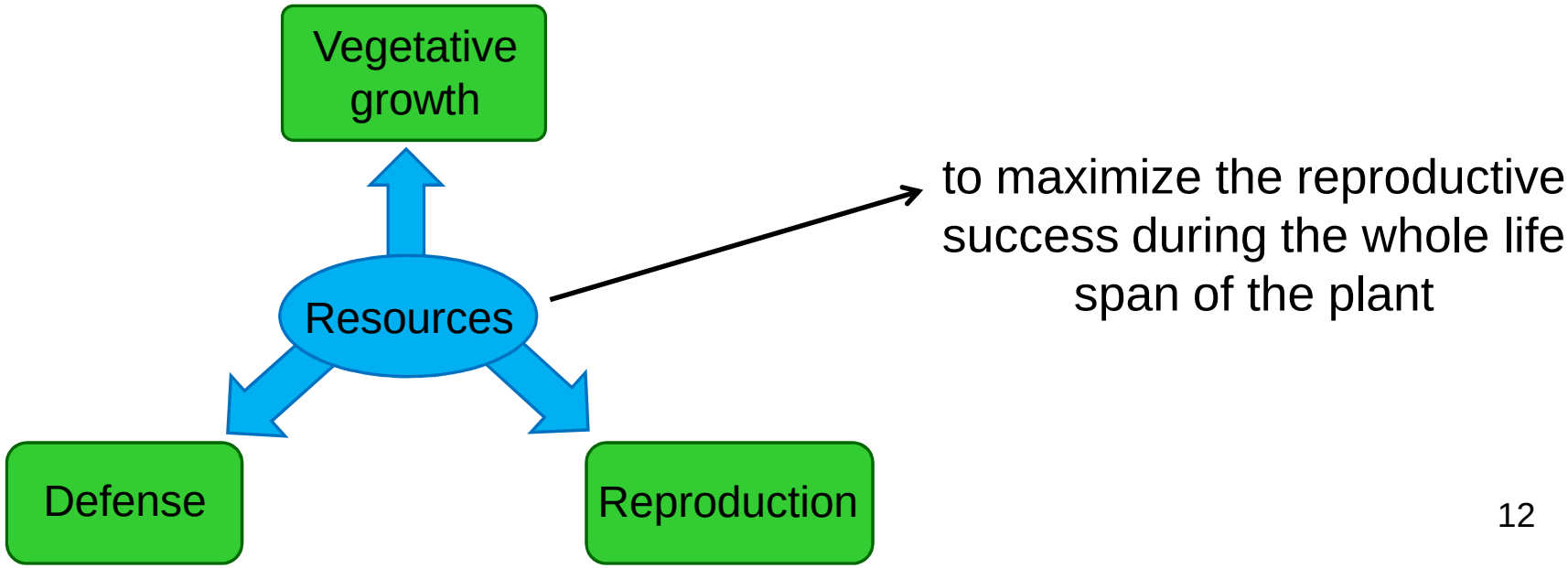
- Negative effect of reproduction at different levels
- Kensington Pride more affected than Cogshall
- Consequences of reduced vegetative growth ?
  - less potential flowering points
  - reduced C assimilation
  - reduced flowering/fruiting rates (Normand et al., 2009)

Discussion

- 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



Discussion

- 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

Discussion

- 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