Floral Initiation in Mango Literature Review

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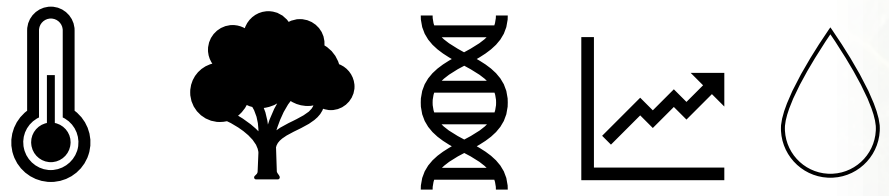
SAMOA

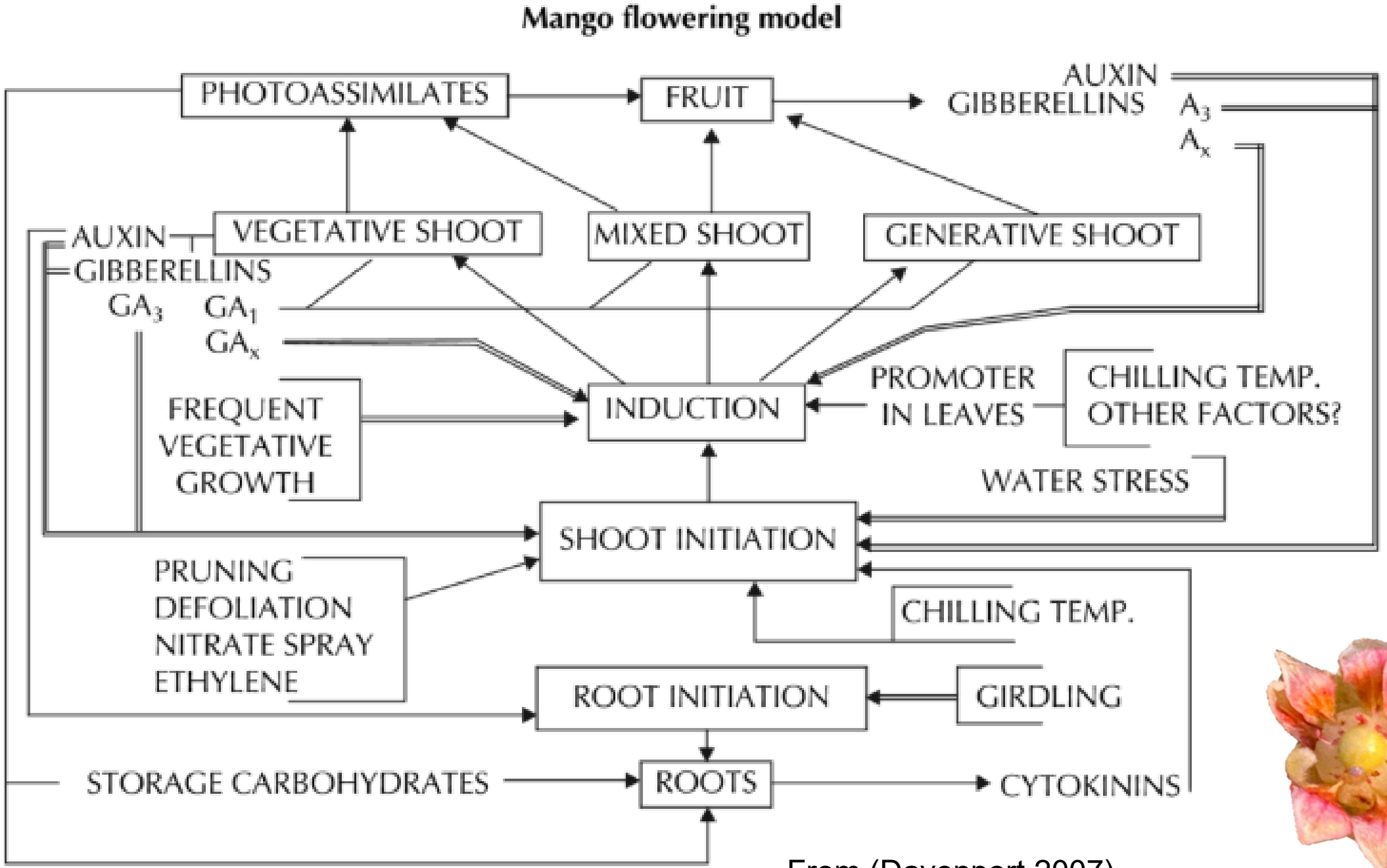
Floral Initiation

Temporary commitment for buds to form generative or mixed shoots

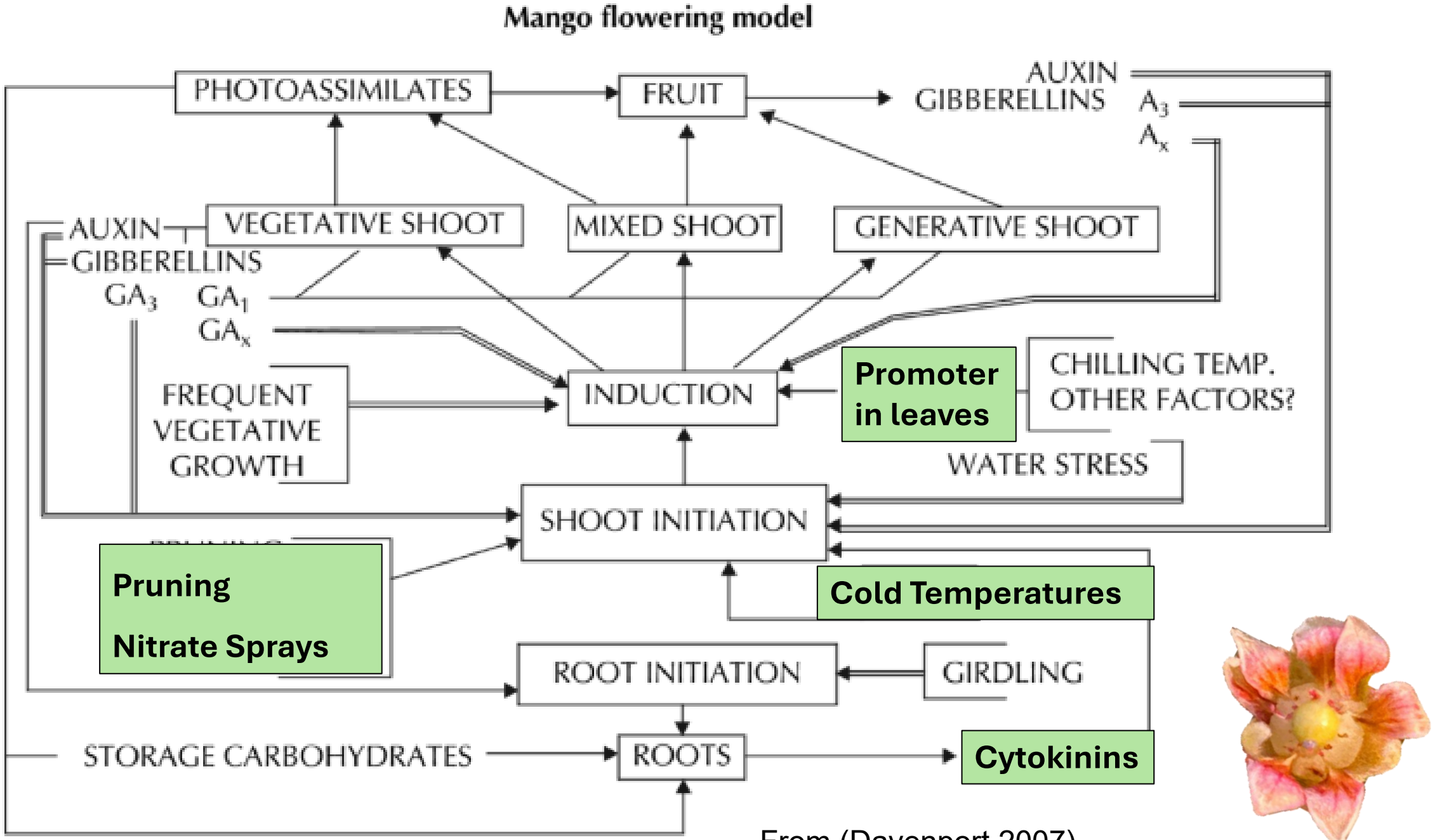
Key Factors:

1. Low Temperatures
2. Synchronization of Vegetative Growth





From (Davenport 2007)



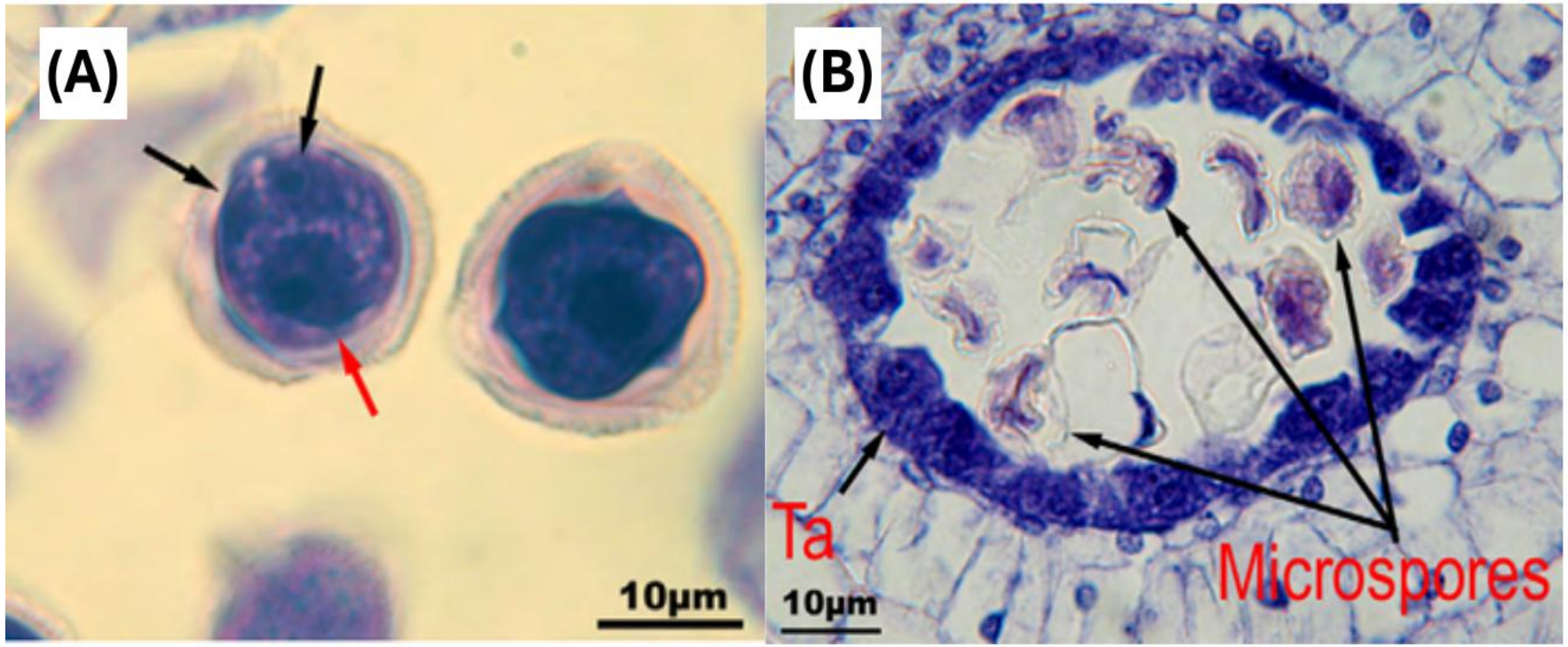
From (Davenport 2007)

Temperature

- Temps below 20°C = floral initiation
- Minimum exposure period required
- Cultivar dependent
- Cultivars differ up to 10 °C
- Persisting low temperatures – negative effects
- Low temperatures = more flowers
- 5°C – stops floral development

Temperature

- Pollen development sensitive to low temperatures
- Pollen abnormalities can be observed - diurnal temperatures <20°C
- Meiosis to pre-vacuolate stage most sensitive
- Cultivar dependent effect



Adapted from (Huang, Ma, et al. 2010)

Phytohormones

- Changes in levels – floral initiation
- Specific role unclear
- Relationship between hormones observed
- Increases and decrease coincide with reproductive phases
- Temperature effects levels

Phytohormones - Changes

Cytokinins

Abscisic Acid

Chlorophyll

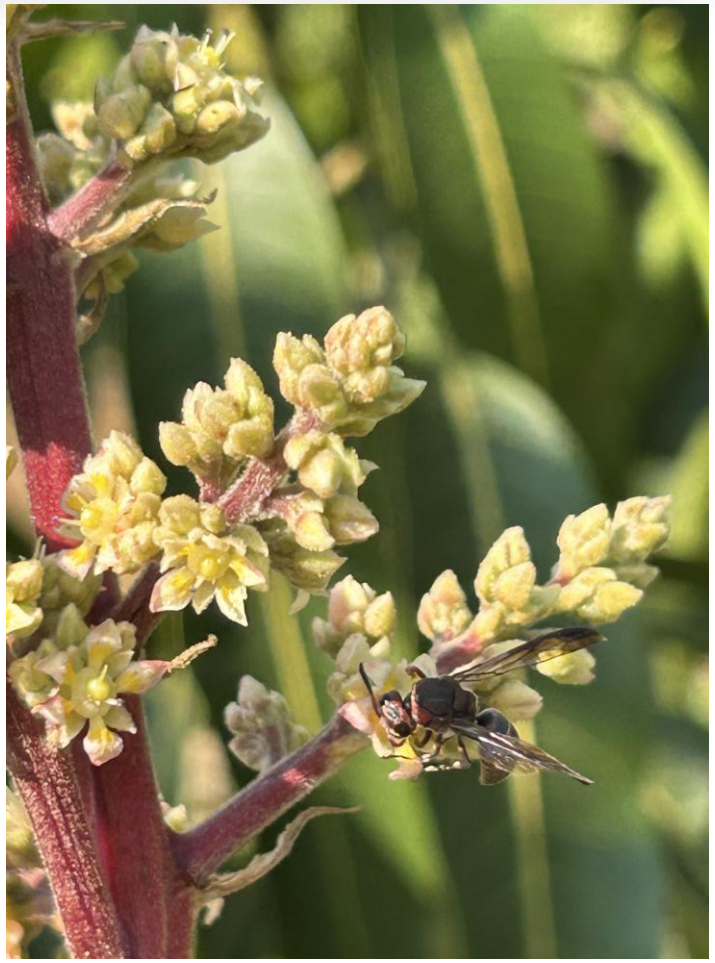
Gibberellic Acid (GA)

Auxins

Carbohydrates and Sugars

- Favorable environment: synthesis and actions
- Provided through photo assimilates
- High Total non-structural carbohydrates (TNC) = flower formation
- TNC and starch > in swelling floral buds
- Heavy fruit loads ↓↓ starch accumulation and floral initiation

Carbohydrates and Sugars



- Sugars: energy source & signal
- Sucrose synthase & sucrose phosphate 1
- Flowering robustness – sugar synthesis

Main sugars:

Sucrose

Fructose

Glucose

} *Part of pollen and nectar's metabolic profile*

Sorbitol

Mannose

Ribose

Water Availability

- Water affects vegetative growth
- Water allows veg shoots to mature (accumulate starch)
- Indirect effect on flowers
- High/erratic rain = less pollinators and ↓ Fruit set
- Water stress alone ≠ floral initiation
- Advances bud break
- Optimal irrigation – transport nutrients to flowers and fruits

Floral Manipulation

Chemical Applications

Pruning

Alternative Practices

Chemical Applications

Gibberellic Acid:

- Cultivar dependent effect
- Delay flowering – 4 weeks
- High levels decrease flower numbers
- Timing determines outcome

Paclobutrazol (PBZ):

- GA synthesis suppressor
- ↑ ABA, ↓ GA and IAA
- Floral ratio
- Floral initiation
- High persistence in trees and soils

Chemical Applications

Potassium Nitrate:

- ↑ % Flowering shoots
- ↑ Number of perfect flowers
- 600ppm ethephon
- Improves fruit set
- Increases chlorophyll, carbs in trees
- Bud break

Brassinosteroids (BRs):

- ‘Nam Dok Mai’

Increased:

- inflorescence length
- Flowers/inflorescence
- Pollen viability
- Pollen germination in pistil
- 0,01µM or 0,1 µM
- Sprayed terminal bud = large bud stage

Pruning

- Uniform floral response
- Tip pruning
- Improve flowering %
- Reserve carbs and sugars
- Enhance sugar content in leaves

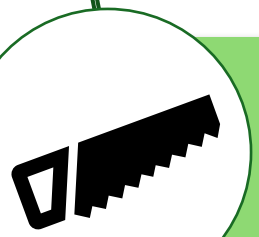
Girdling

- Sugar accumulates above girdle
- Enhance flowering response ?
- Increases ABA, SA, JA, IBA in ‘Alphonso’ and decreases GA and Cytokinins
- Improve floral ratio
- Higher production of sugar & growth inhibitors

Cultivar	Region Trials	Experimental background	Temperature	Results of Treatment	References
Sensation	Queensland Australia.	Two-year-old trees were used. Normal fertilisation was used.	1. 15°C/5°C 2. 20°C/10°C 3. 25°C/15°C 4. 30°C/20°C	1. Inflorescences failed to elongate; normal flowering did not occur. 2. Flowering occurred poorly; low pollen viability of 7,4% observed. 3. Normal Flowering, high pollen viability. 4. Normal flowering; fastest inflorescence development	(Sukhvibul, Whiley, et al. 1999)
'Keitt'	Pretoria	Two-year-old, container-grown trees were used.	10°C/15°C for 35 days.	Resulted in floral induction and complete floral development.	(Yeshitela, Robbertse, et al. 2004)
'Tommy Atkins'	-	Container-grown trees. Trees were pruned to obtain stems of the same age. Leaves which induced flowering were mature (>seven weeks).	18°C/10°C	Floral initiation occurred at this temperature regime. 28°C/22°C resulted in vegetative flushes.	(Núñez-Elisea and Davenport 1995)
'Tommy Atkins'	Pretoria	Two-year-old, container-grown trees were used.	10°C/15°C for 35 days.	Resulted in floral induction and complete floral development.	(Yeshitela, Robbertse, et al. 2004)

Recommendations

PBZ application – increase carbohydrate levels buds & leaves



Pruning – manage vegetative growth (carbohydrate reserves)

GA sprays delay flowering – optimal temperatures

Conclusions

- Flowering is complex process
- Important to know cultivar specific requirements
- Research gaps…
- Manipulation techniques – improve reproductive cycle

Acknowledgements:

References

- Davenport TL. 2007. Reproductive physiology of mango. *Brazilian Journal of Plant Physiology*, 19: 363-376
- Huang J-H, Ma W-H, Liang G-L, Zhang L-Y, Wang W-X, Cai Z-J, Wen S-X. 2010. Effects of low temperatures on sexual reproduction of ‘Tainong 1’mango (Mangifera indica). *Scientia horticulturae*, 126: 109-119.