

# Wet or dry years? When do trees escape?

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UCT

In savannas, growth of saplings to trees is not continuous but rare and episodic



1958 numbi feb3y



1965 feb 3y numbi

14/02/02  
N.W.

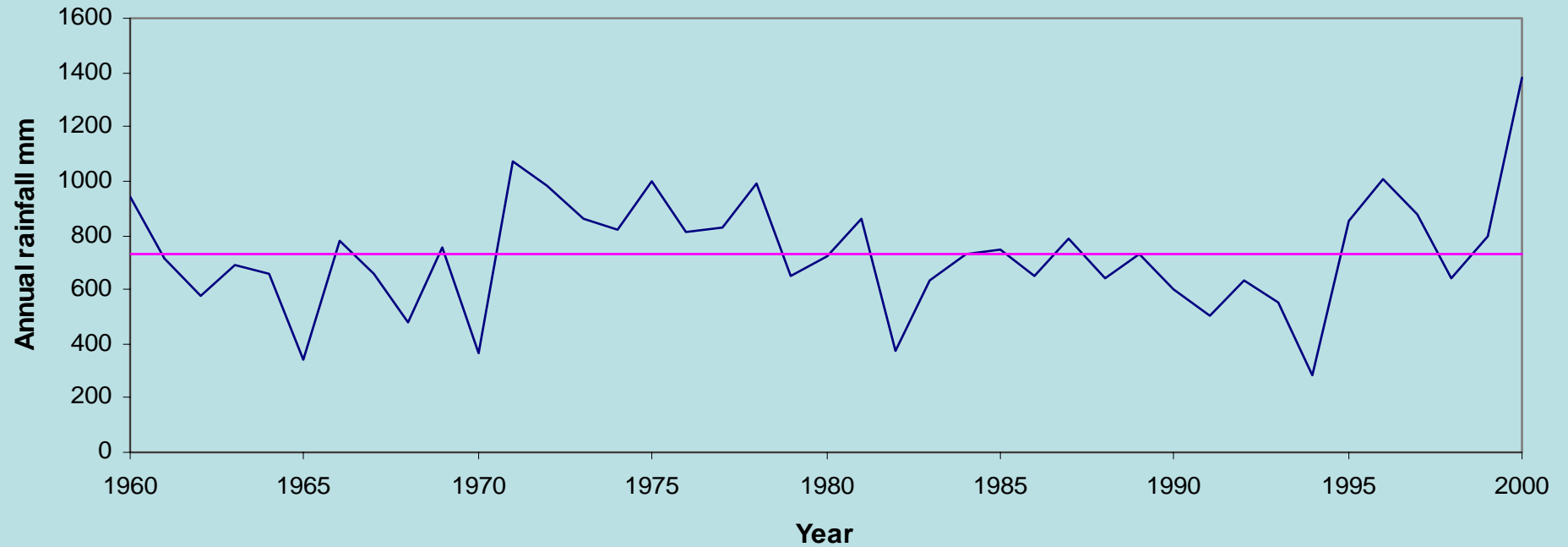


2002

Inter-annual rainfall is highly variable in savannas

When are suppressed saplings ('gullivers') most likely to escape?

**Pretoriuskop Rainfall**



# When do saplings escape?

- From the Walter hypothesis
  - Less rain = shallow infiltration, grasses favoured
  - More rain = deeper infiltration, trees favoured
- But if saplings and grasses both compete in the same root zone
  - Outcome depends on relative water uptake of trees vs. grass

# EXPERIMENTAL EXCLOSURES

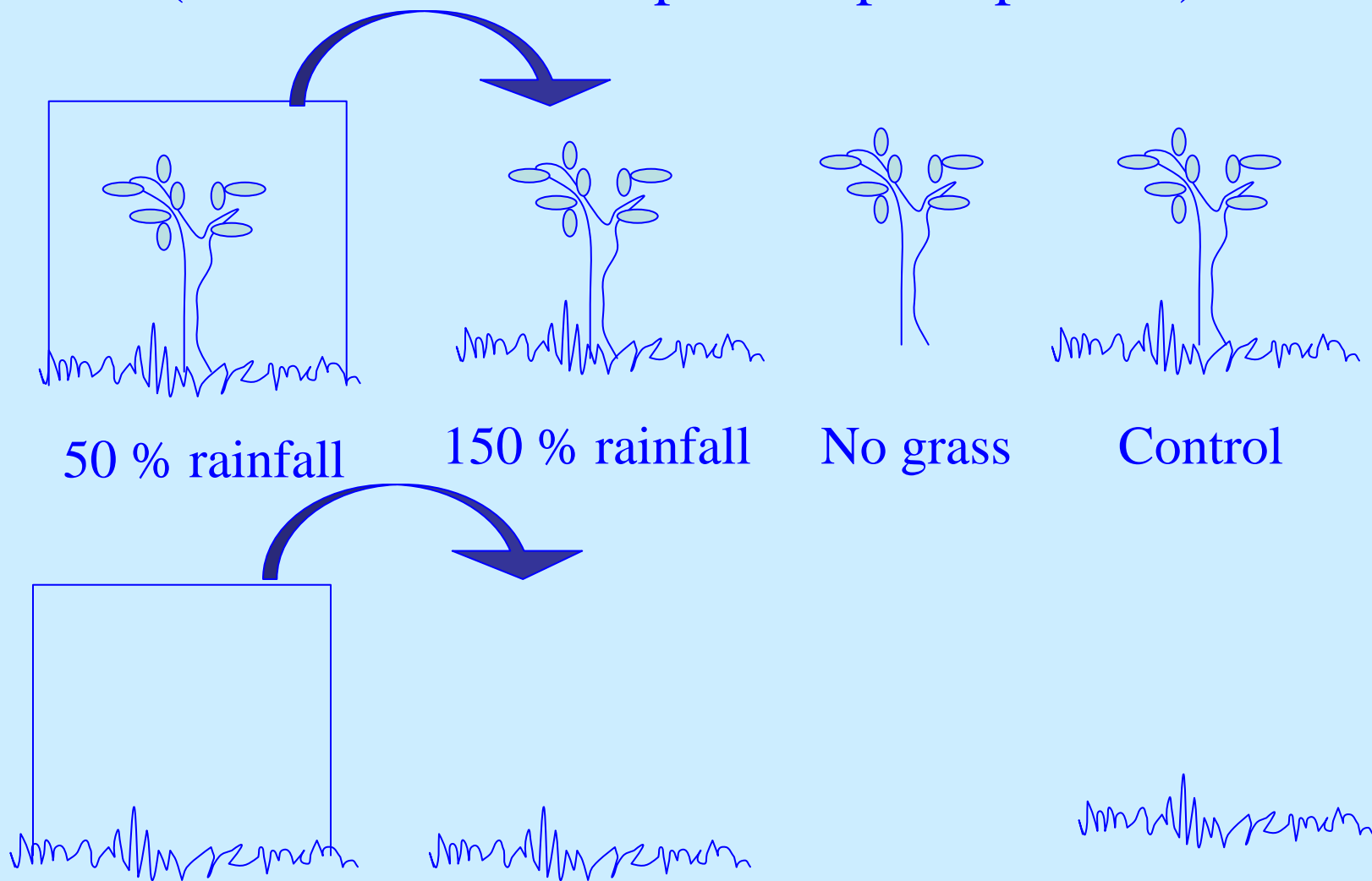
- Two exclosure sites:  
PRETORIUSKOP: 750mm pa, sandy soil (*Terminalia sericea*, *Hyperthelia dissoluta*)  
SATARA: 500mmpa, basalt clay soil (*Acacia nigrescens*, *Bothriochloa radicans*)
- Treatments: compare affect of rainfall and competition on tree/grass growth

# Dry versus wet years



# Experimental design

(8 treatments x 6 reps = 48 plots per site)



# Woody growth

- Basal diameter of coppice shoots – September 2003
- Height and canopy
- Phenology
- LAI - calibrated



# Grass biomass



# Below ground monitoring of soil moisture

- Capacitance probe
  - Moment in time
  - 1 access tube per treatment
  - 2 readings per month
- TDR nests
  - 2 per site: logs hourly
  - AWS

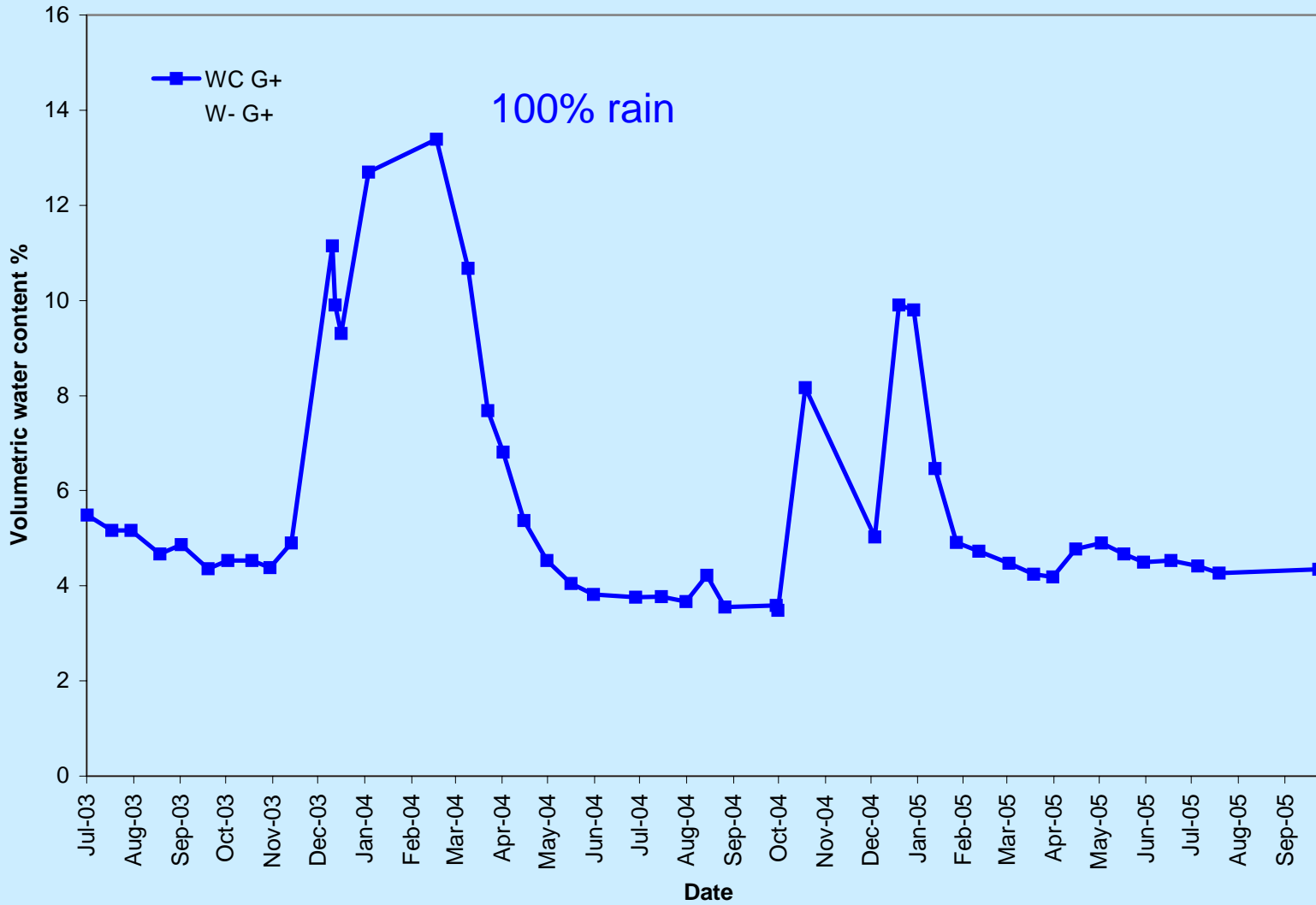


# Soil water

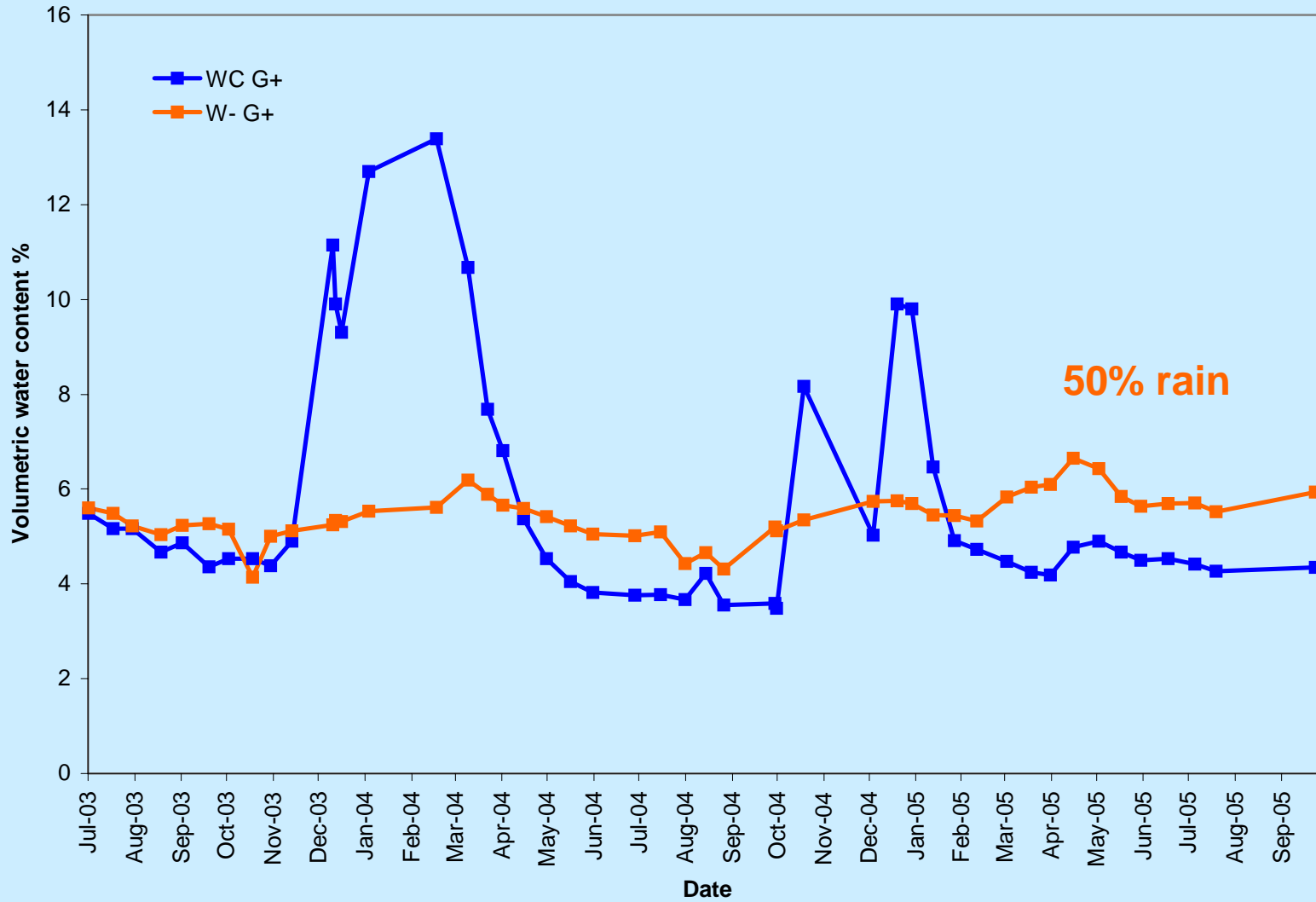
- Is infiltration of rainfall less in dry years than in wet years? Compare 50%, 100%, 150% rain treatments in deeper layers (80cm)

# Water content at 80cm soil depth

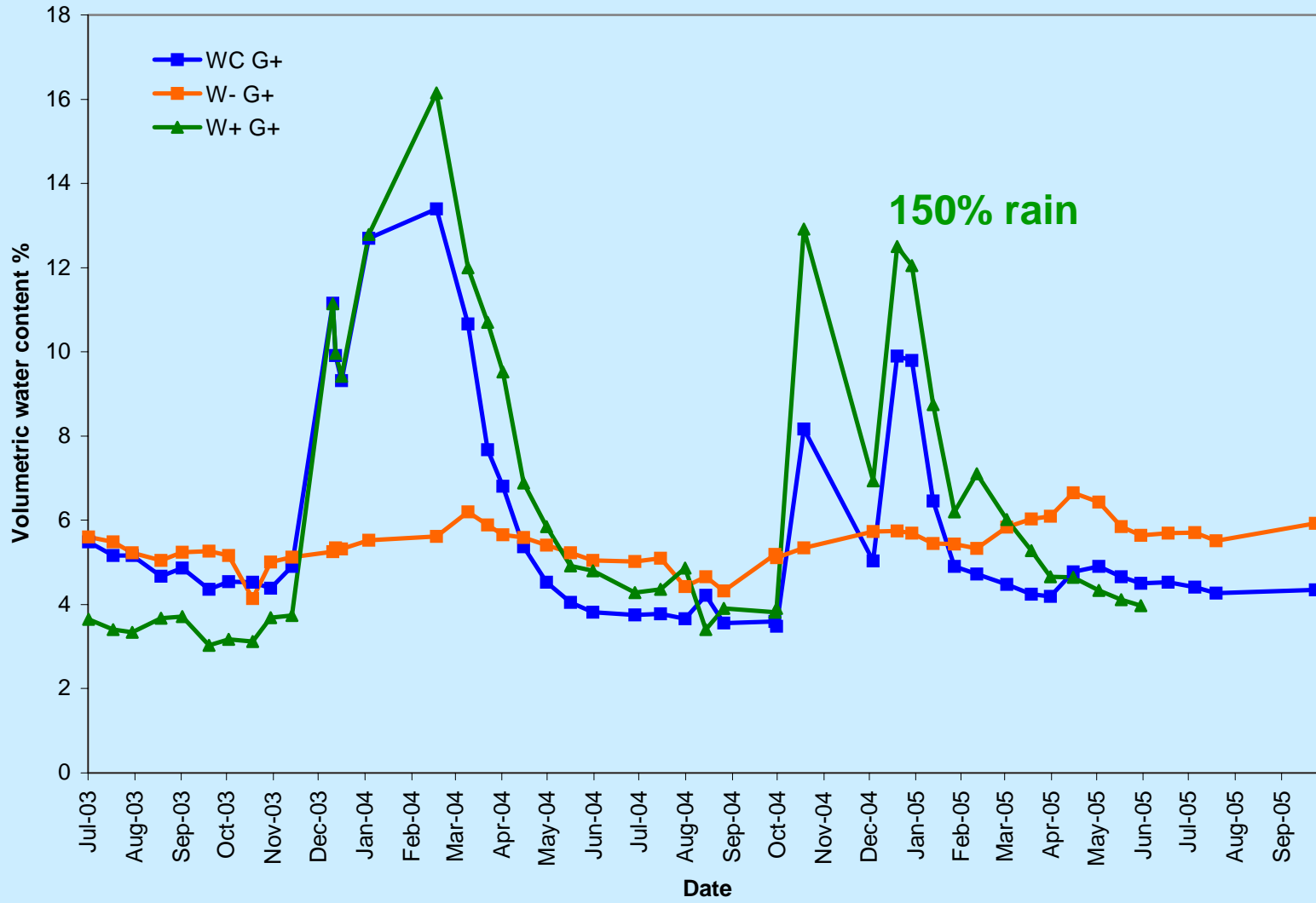
Pretoriuskop



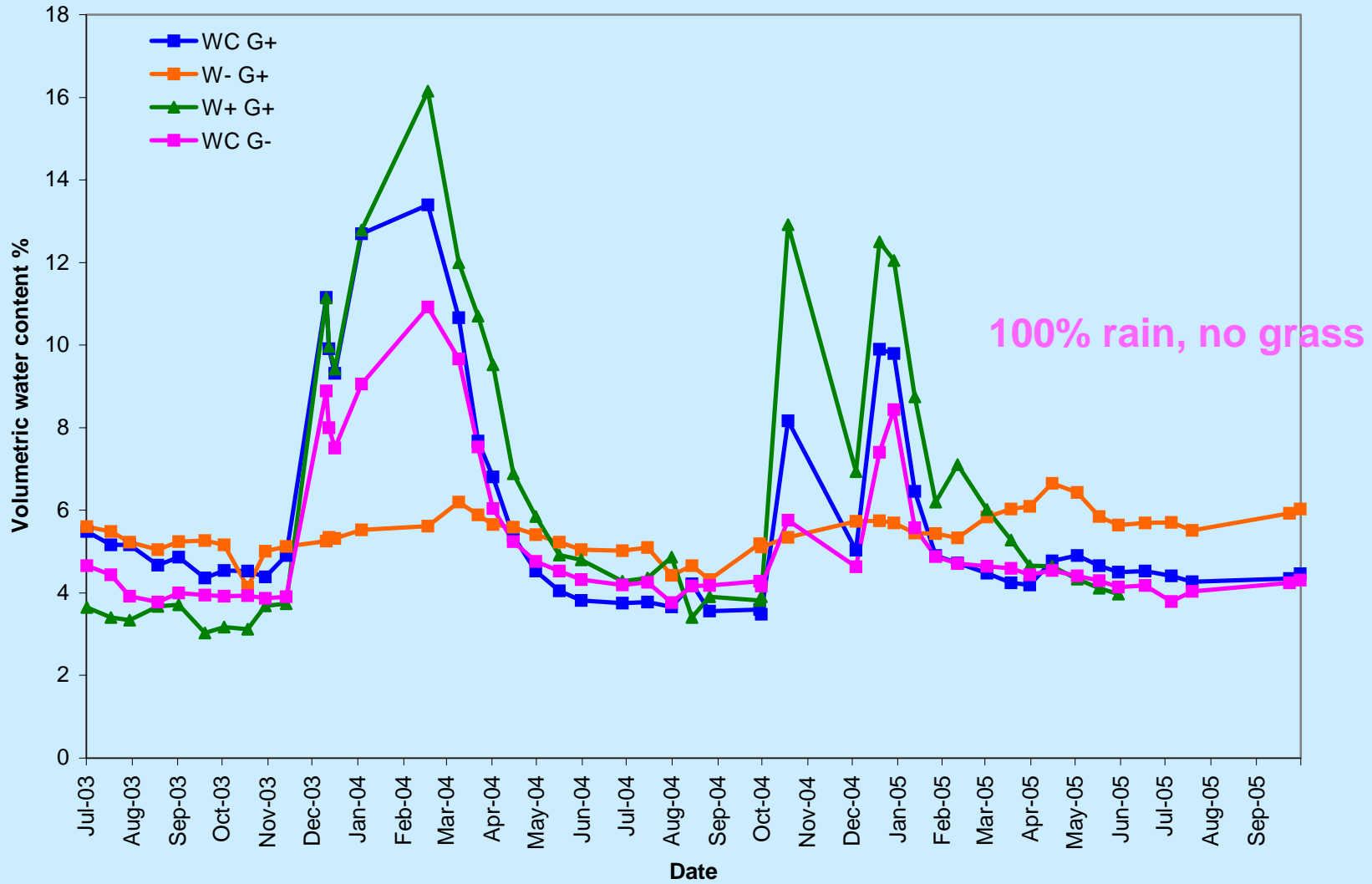
# Pretoriuskop



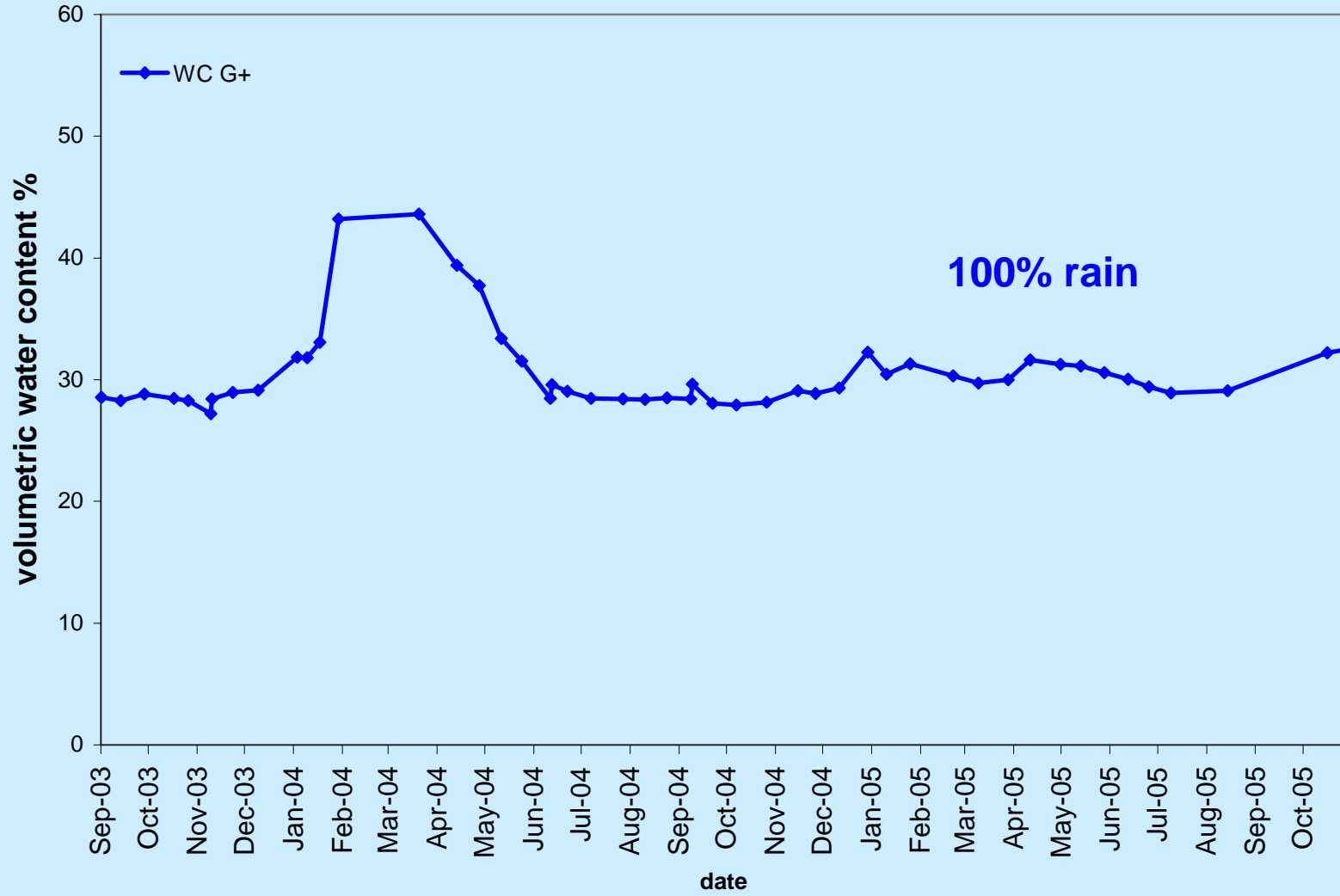
# Pretoriuskop



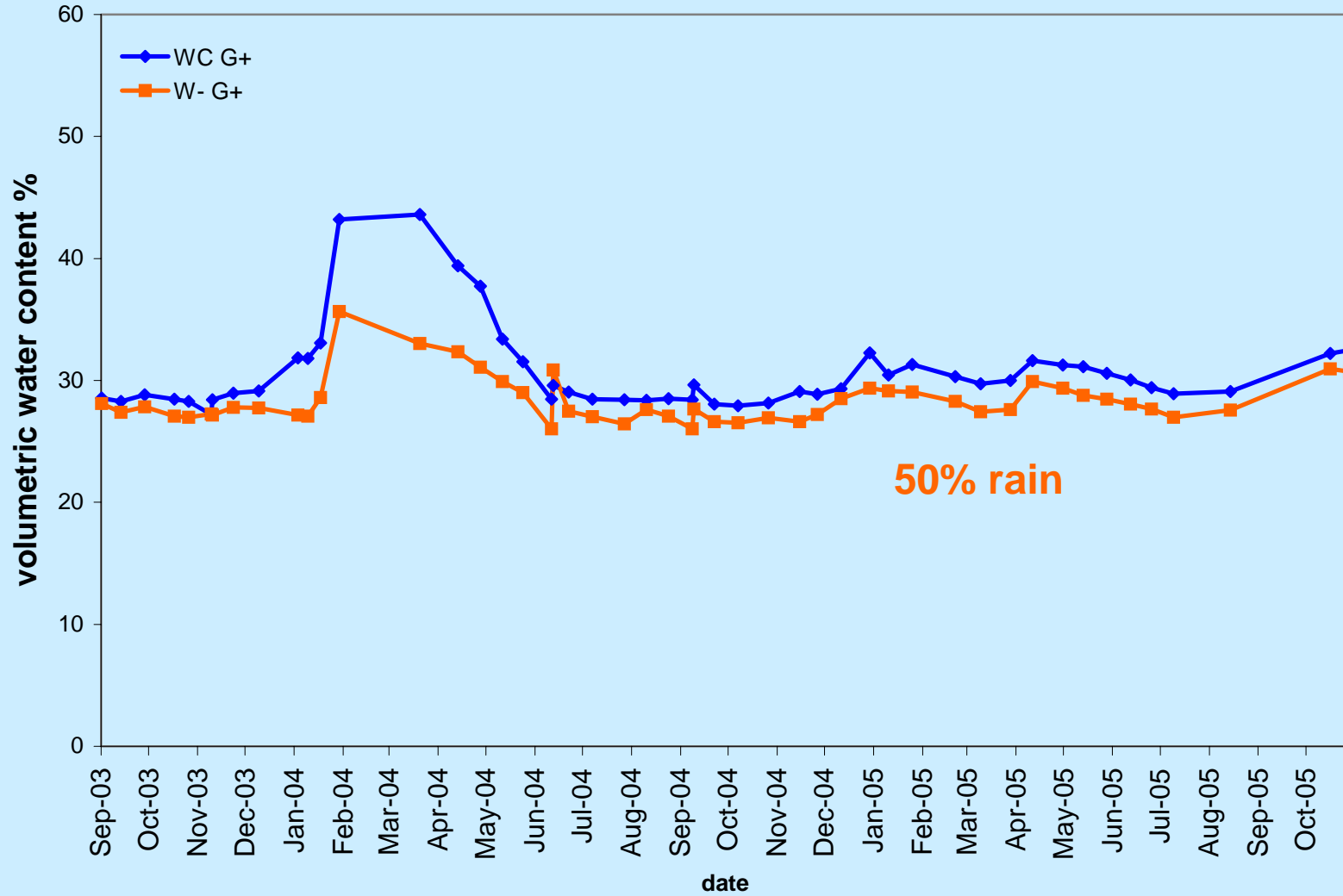
# Pretoriuskop



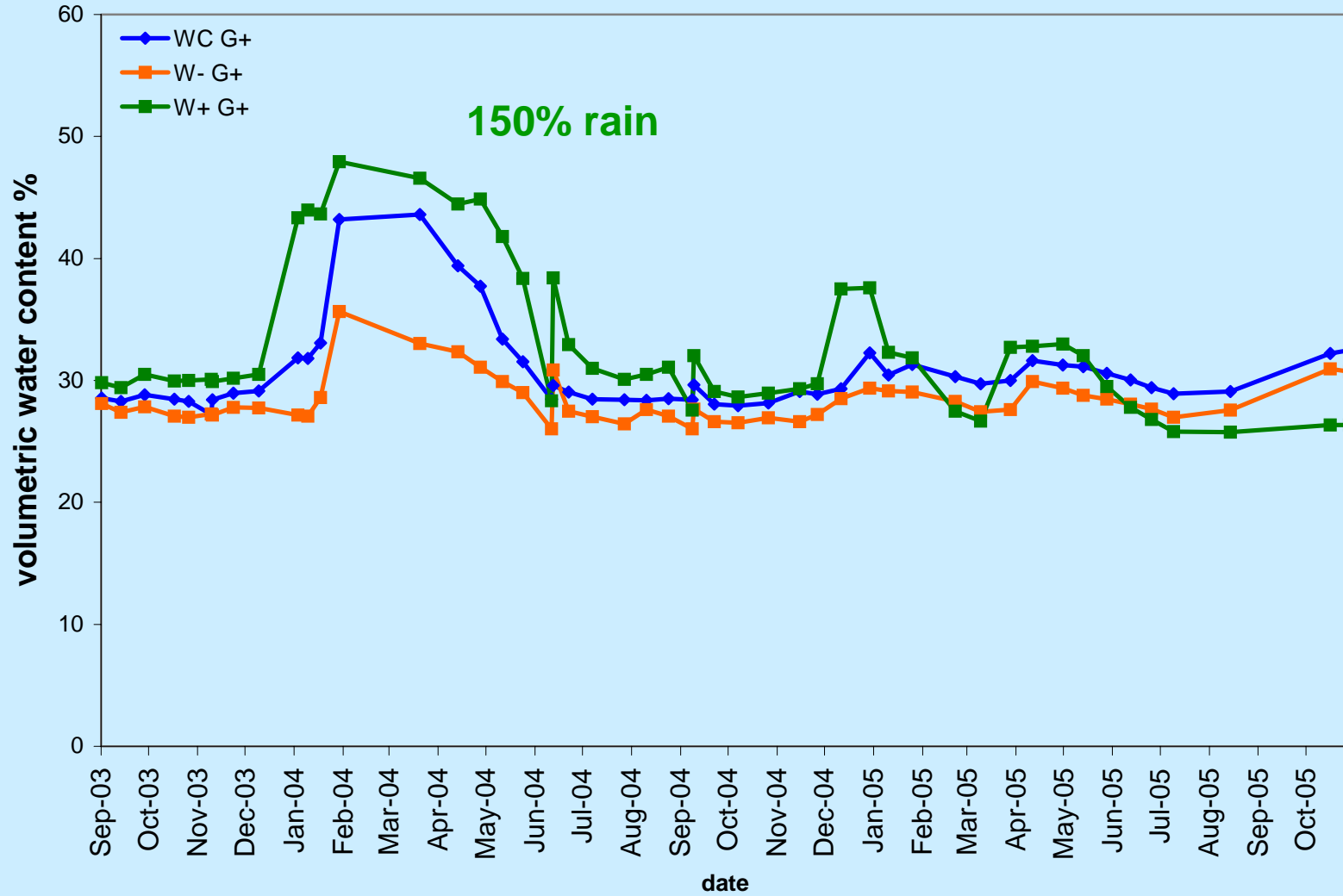
# Satara 80cm



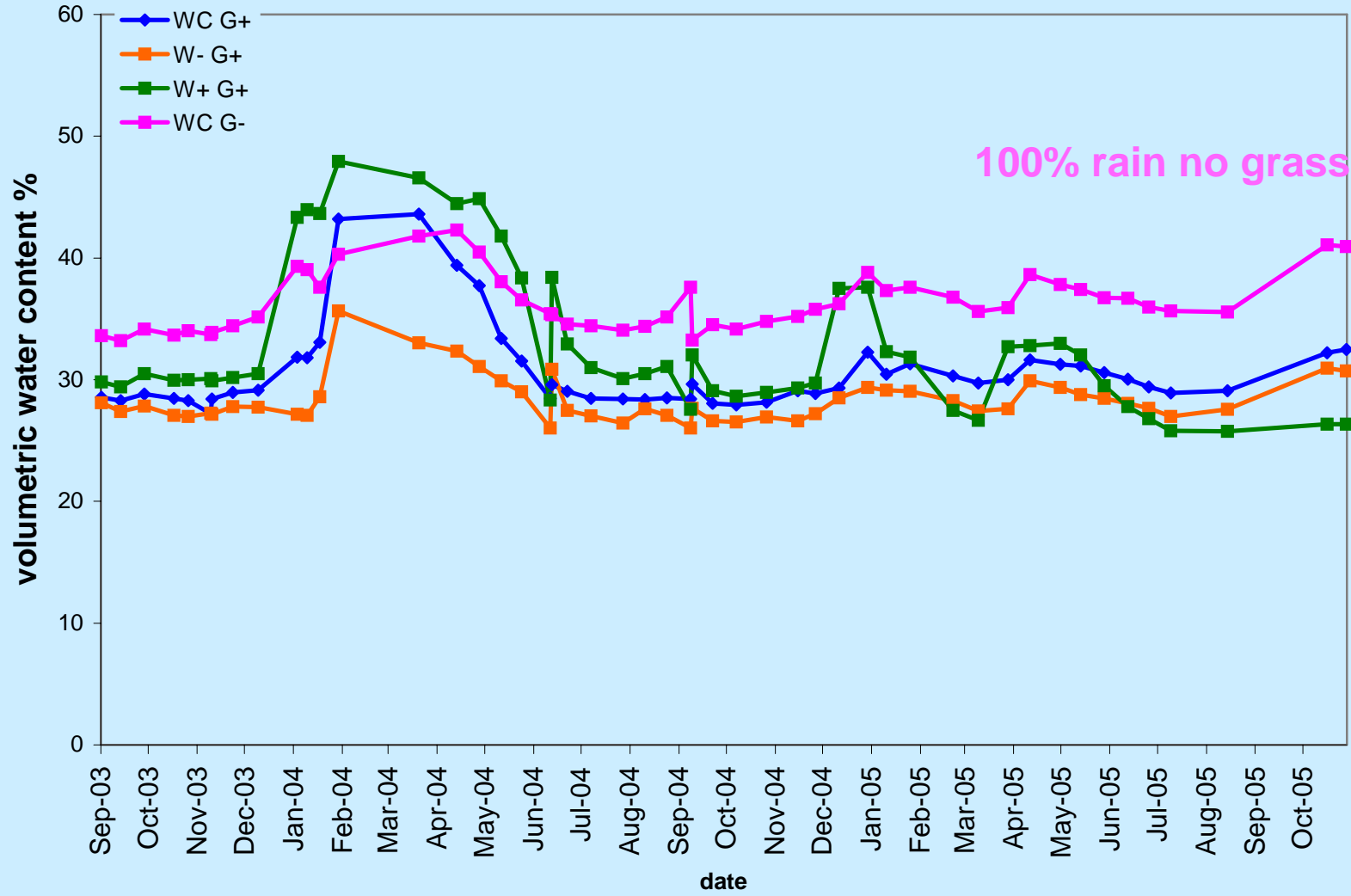
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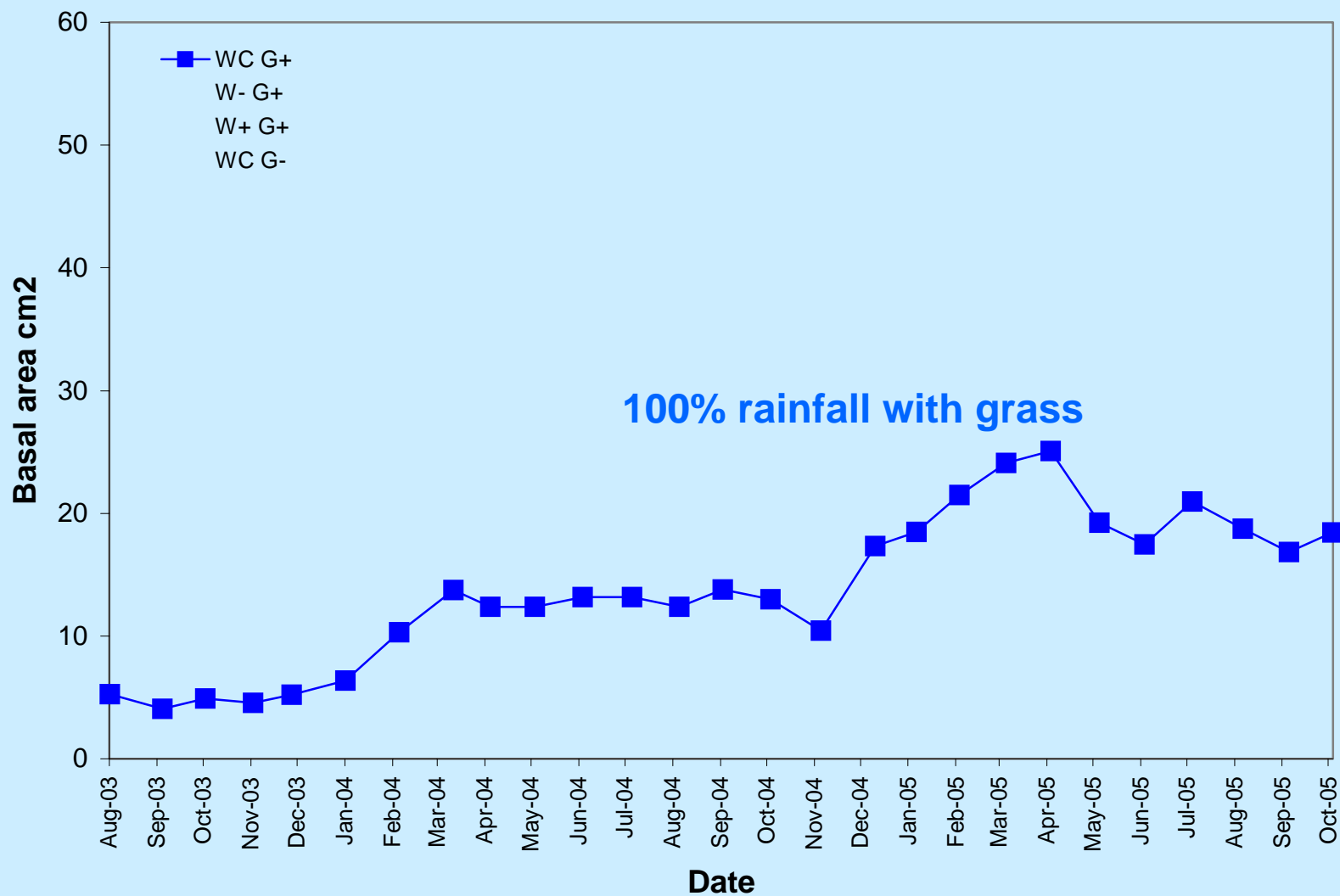
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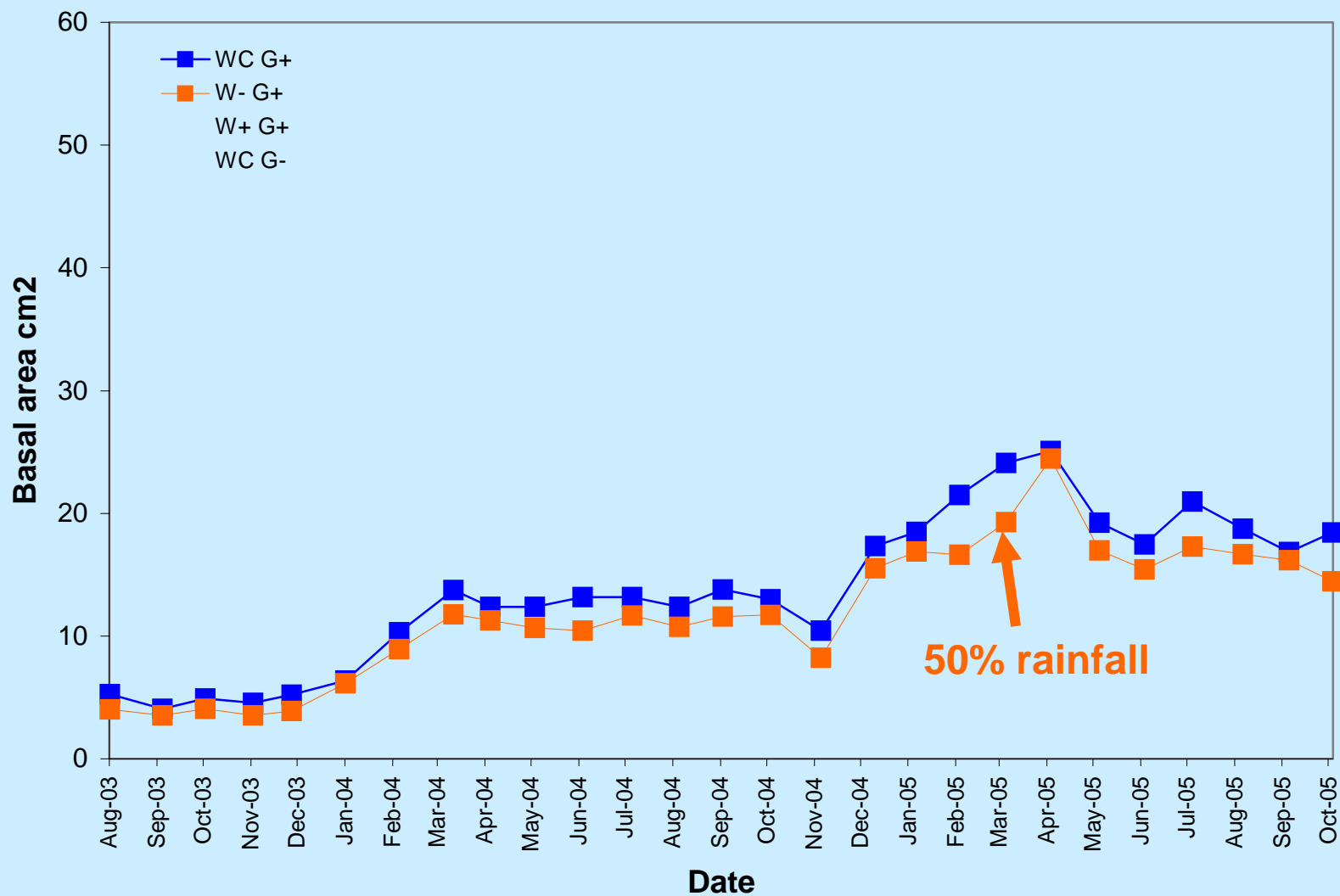
# Rain treatments fit expectations

- In the growing season
  - Less water to deep layers in 50% rain
  - More water to deep layers in 150% rain
  - Therefore saplings should do worse in 50%, better in 150% because they have deeper root systems
  - OR DO THEY?

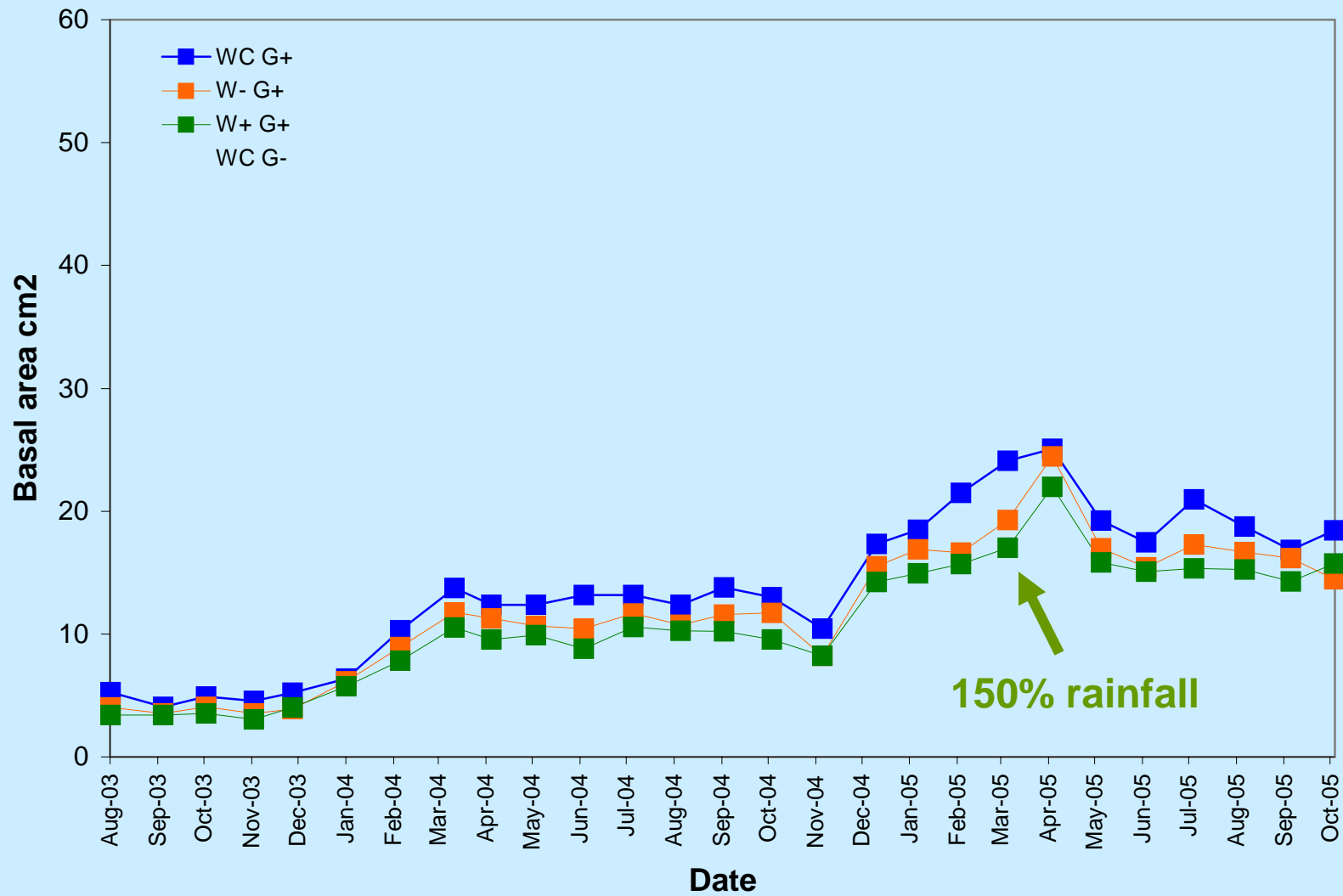
## Terminalia sericea sum basal area cm2



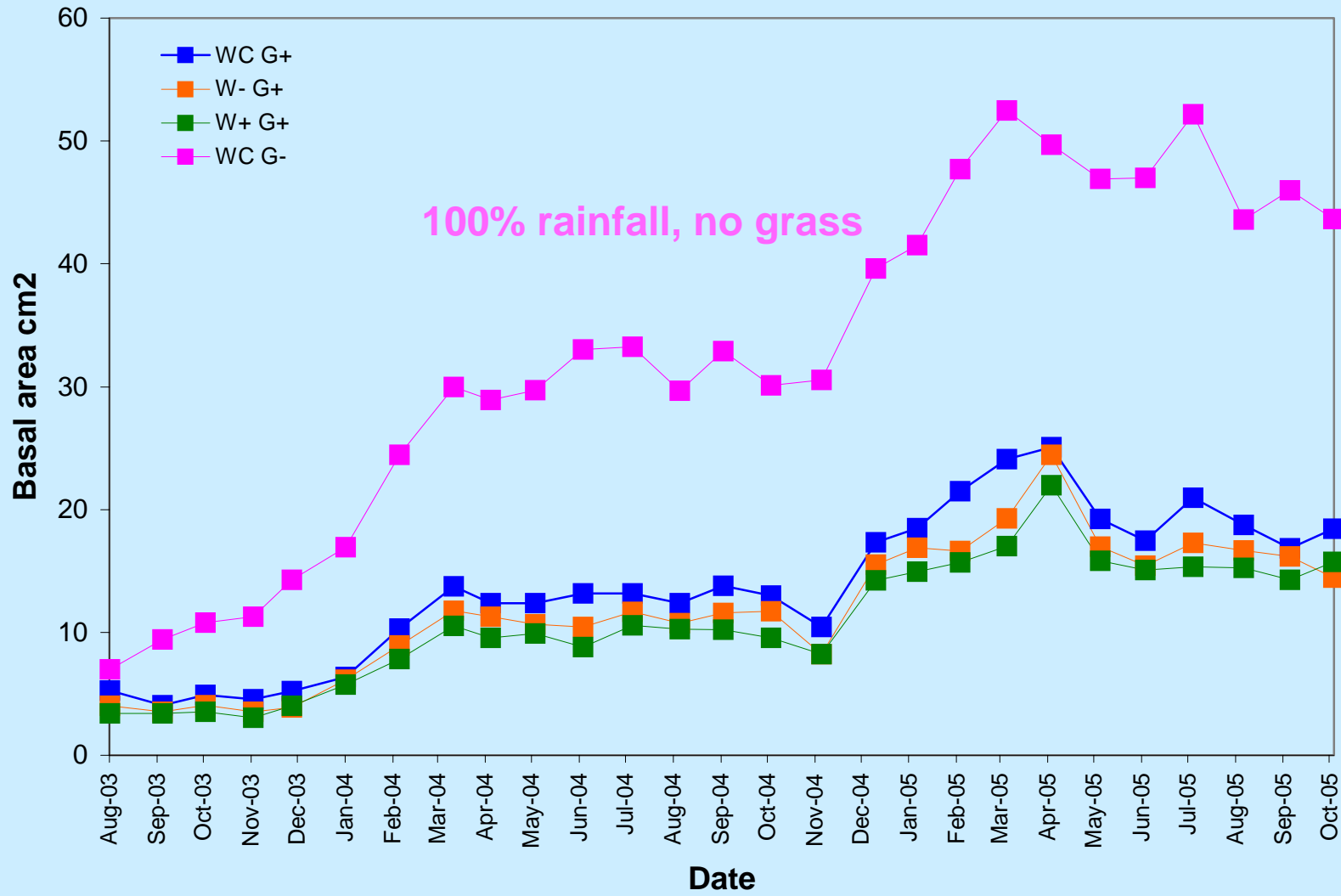
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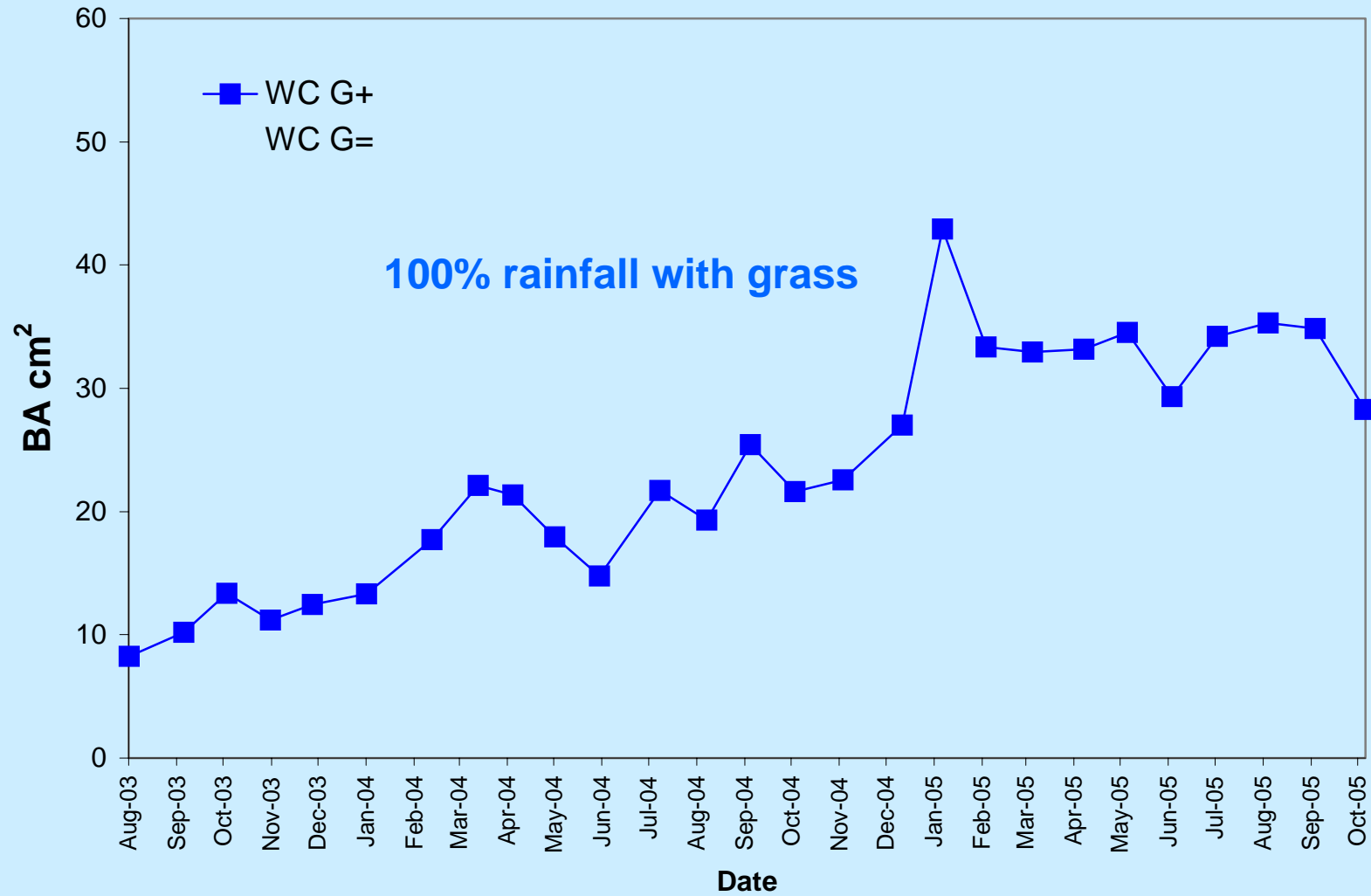
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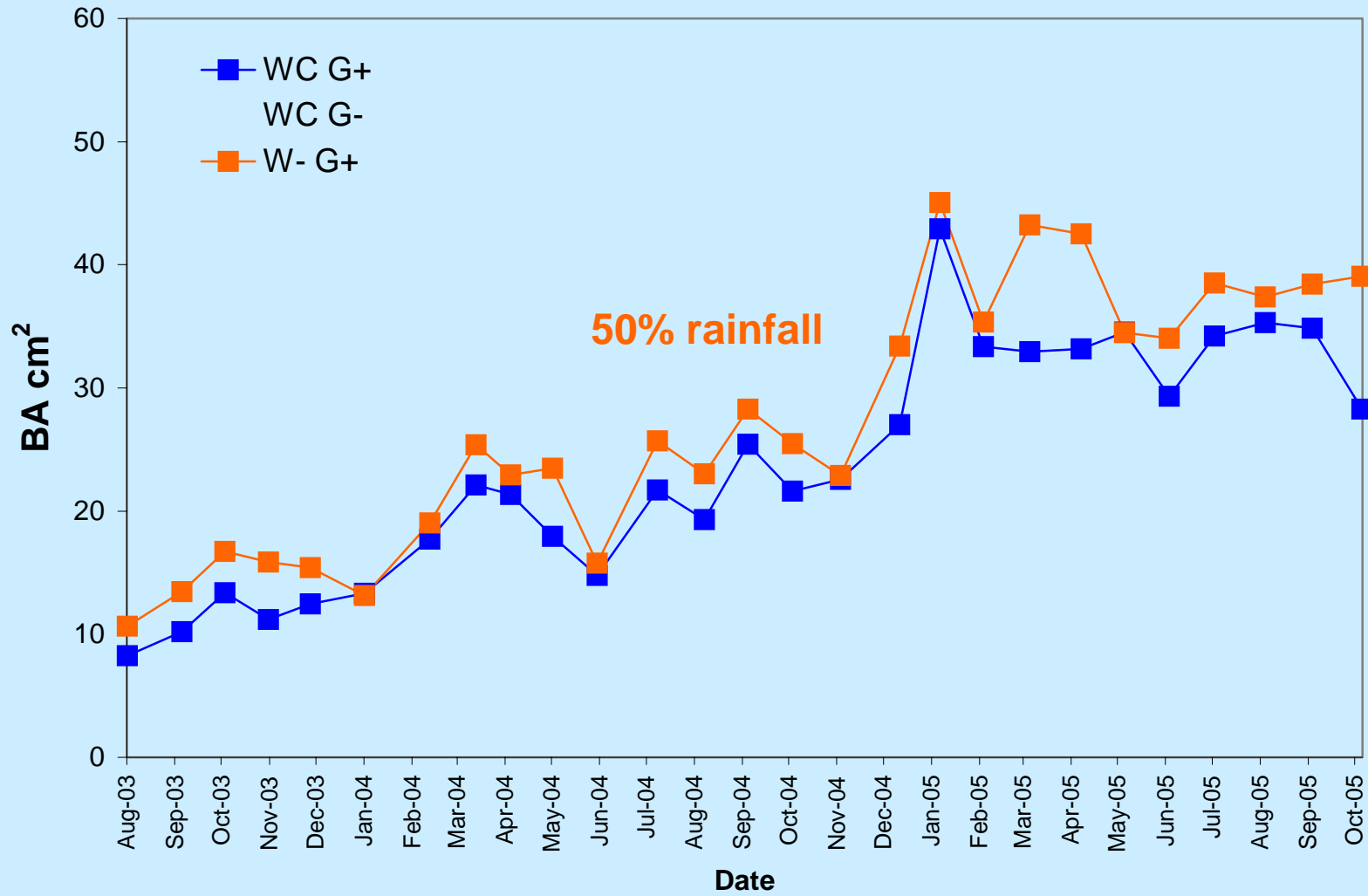
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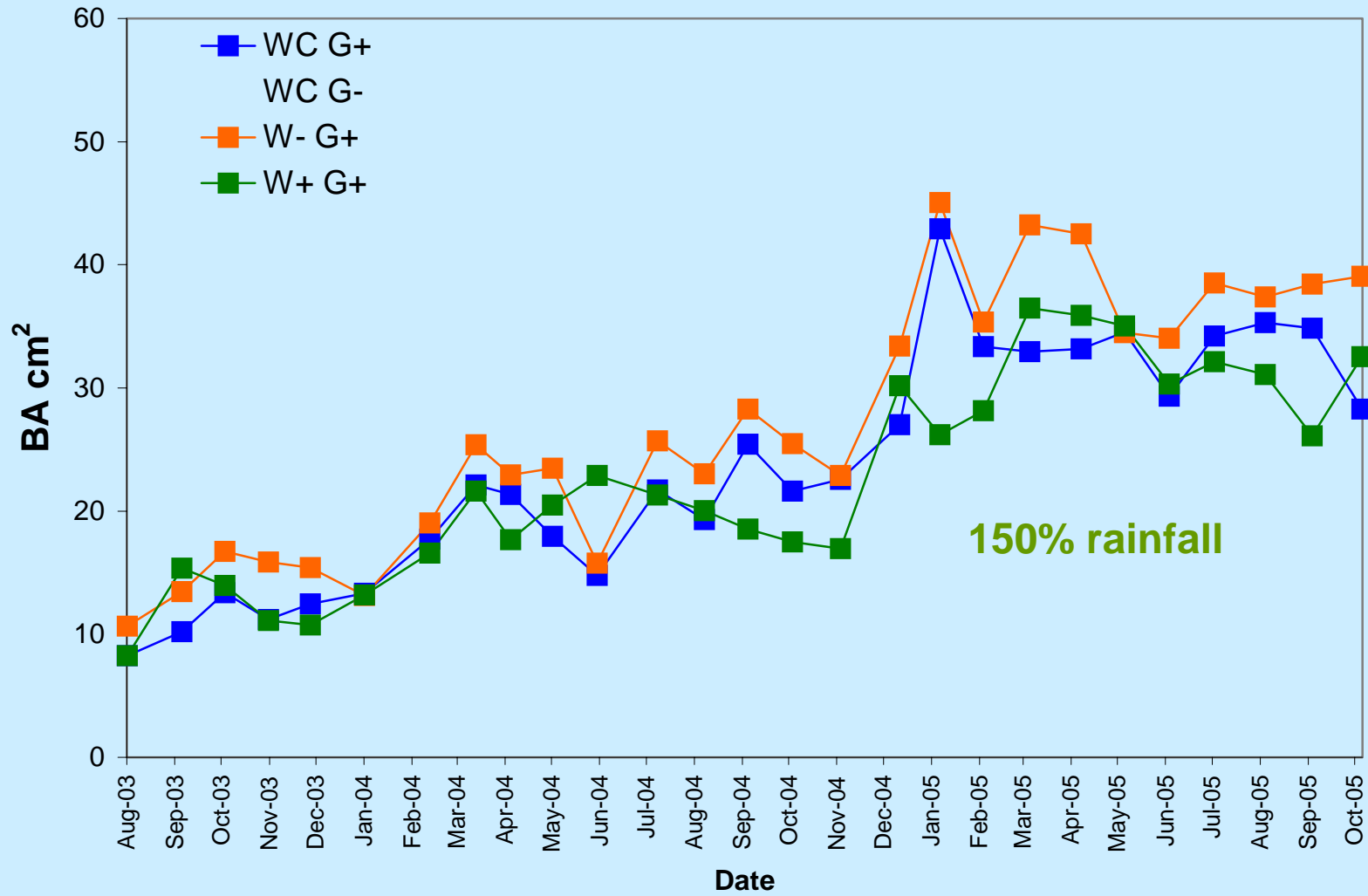
*Acacia nigrescens* **Sum basal area cm<sup>2</sup>**



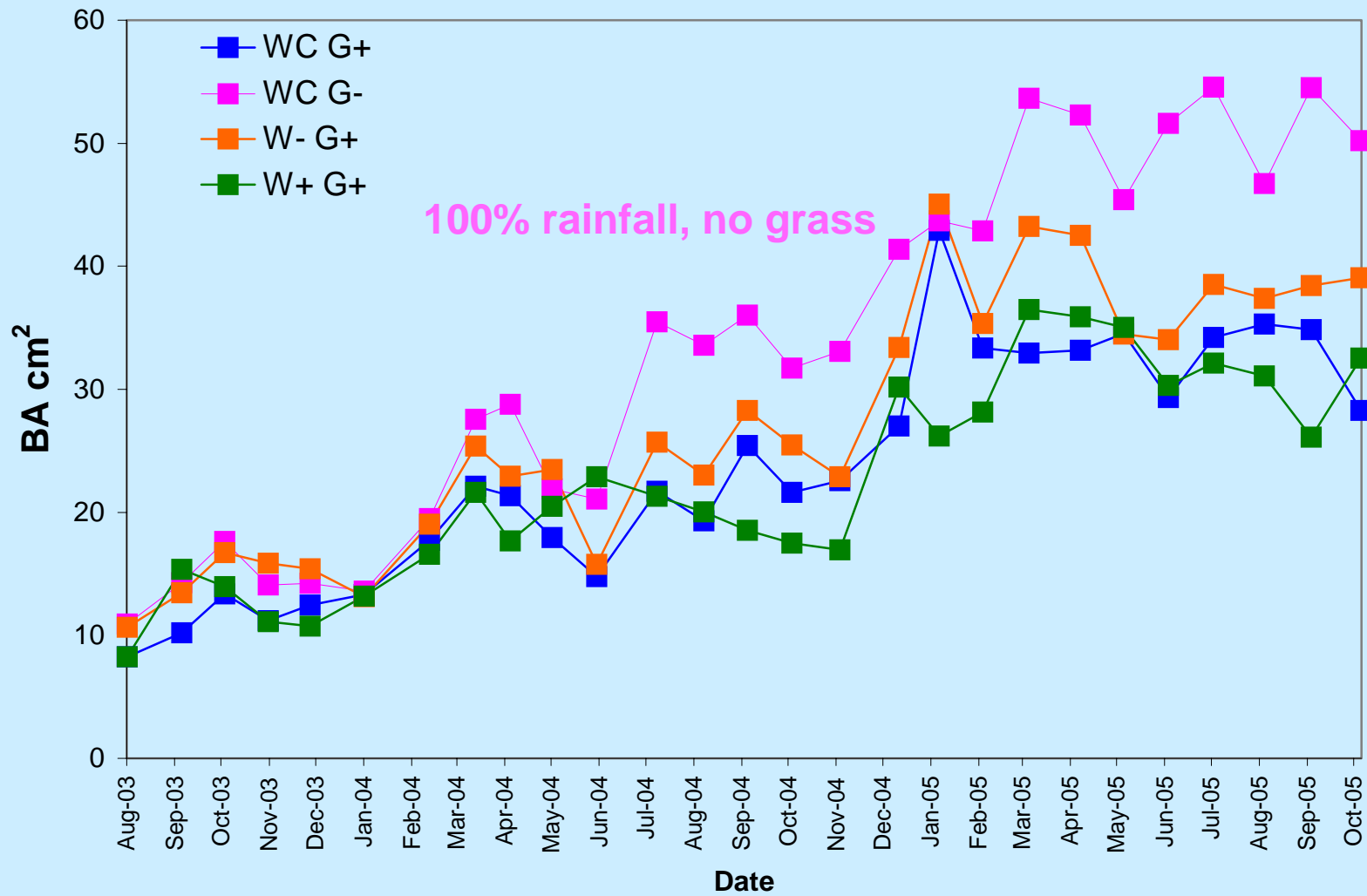
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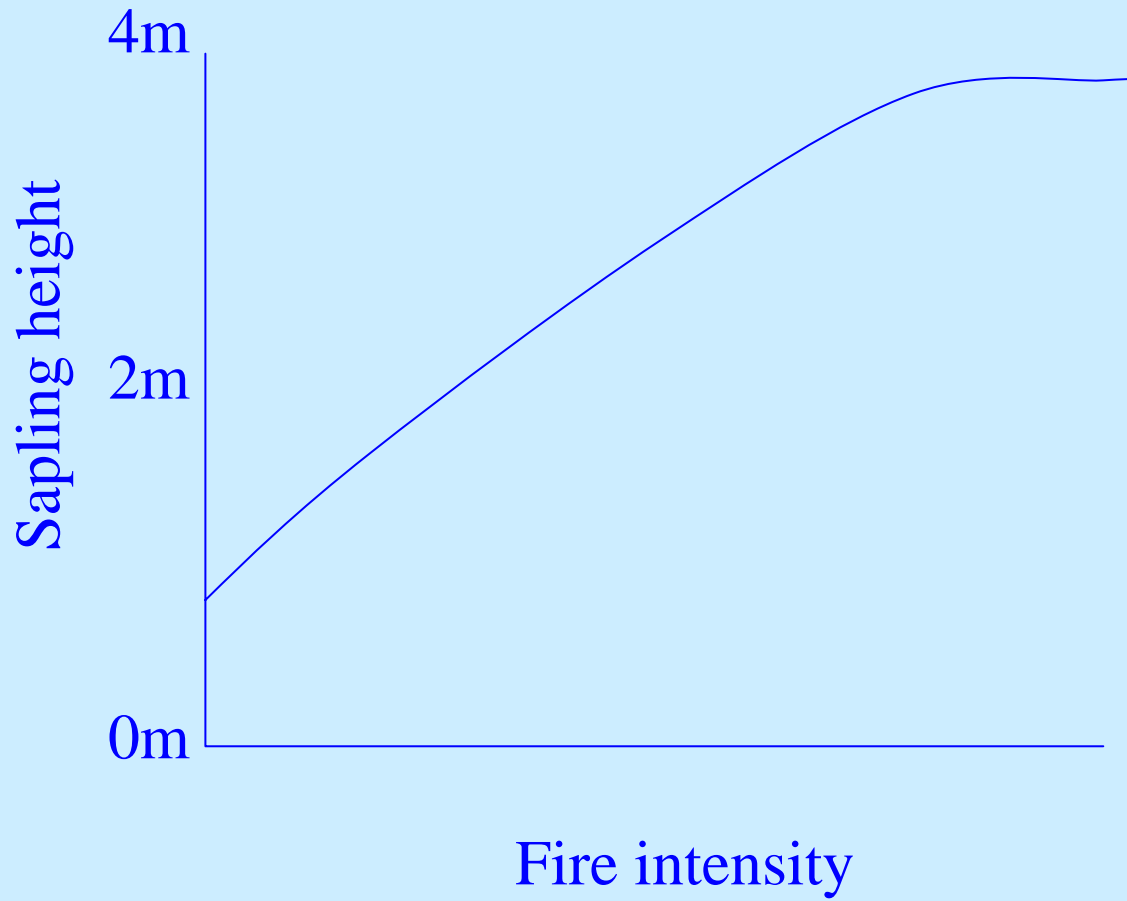


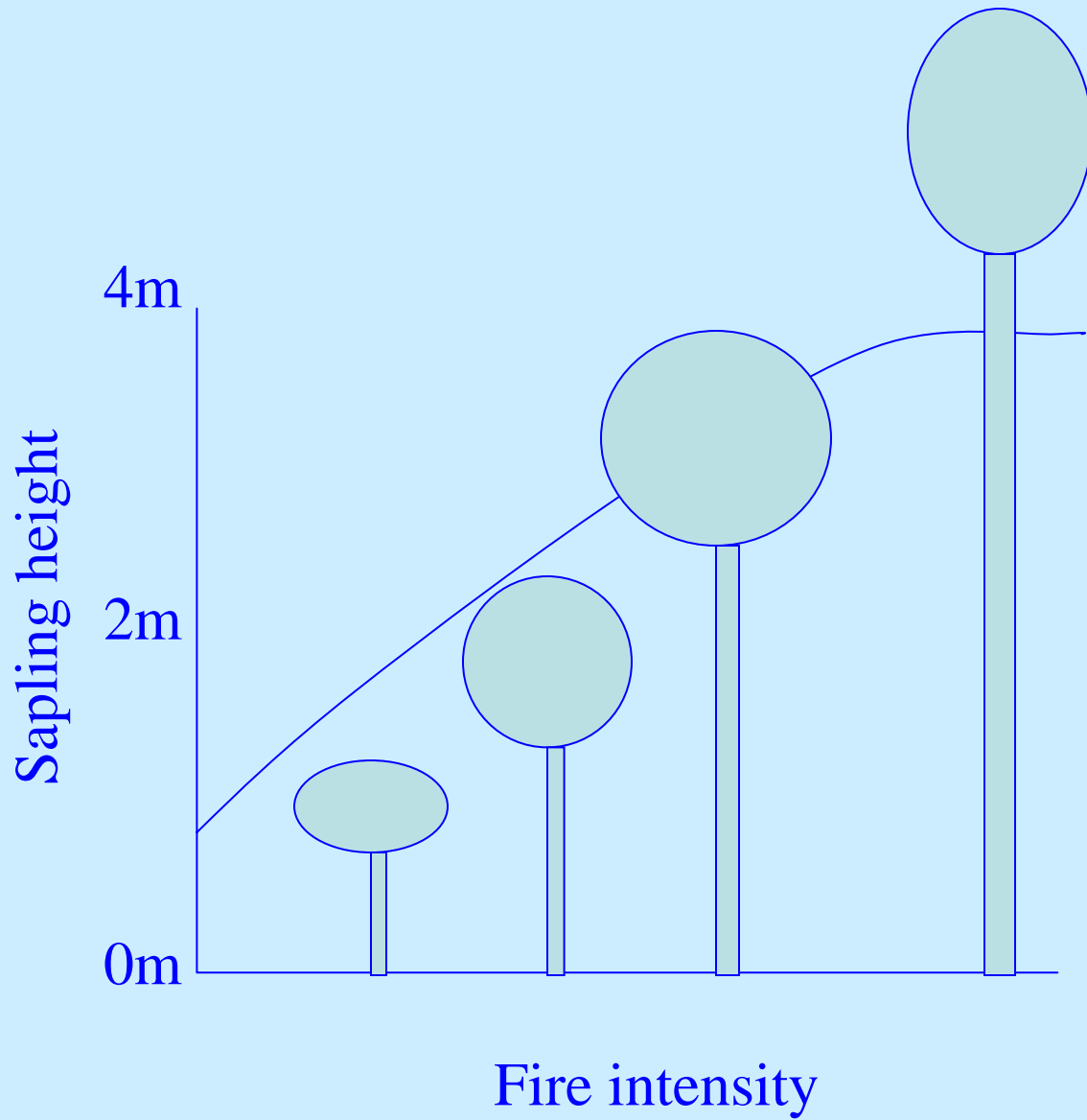
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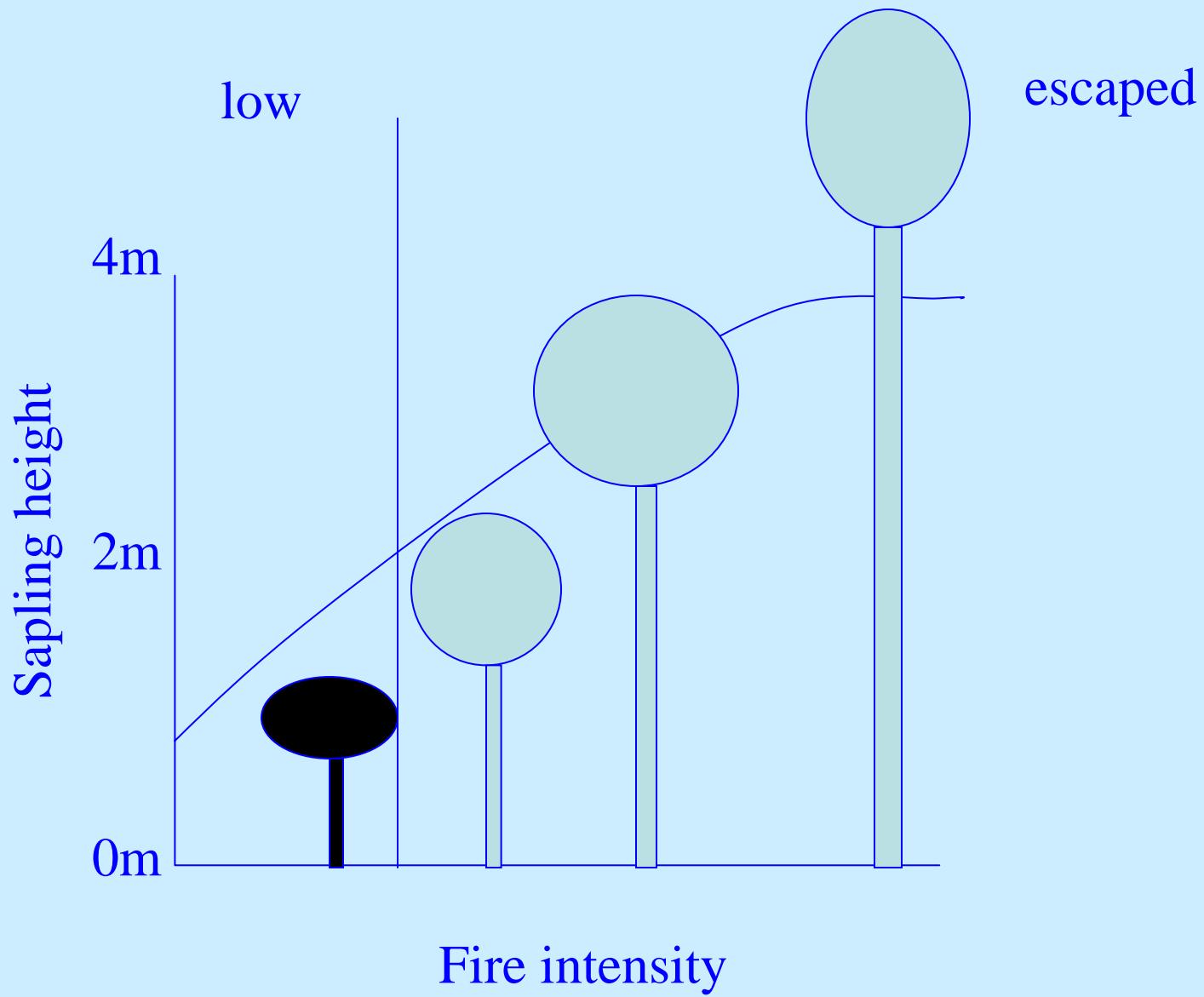


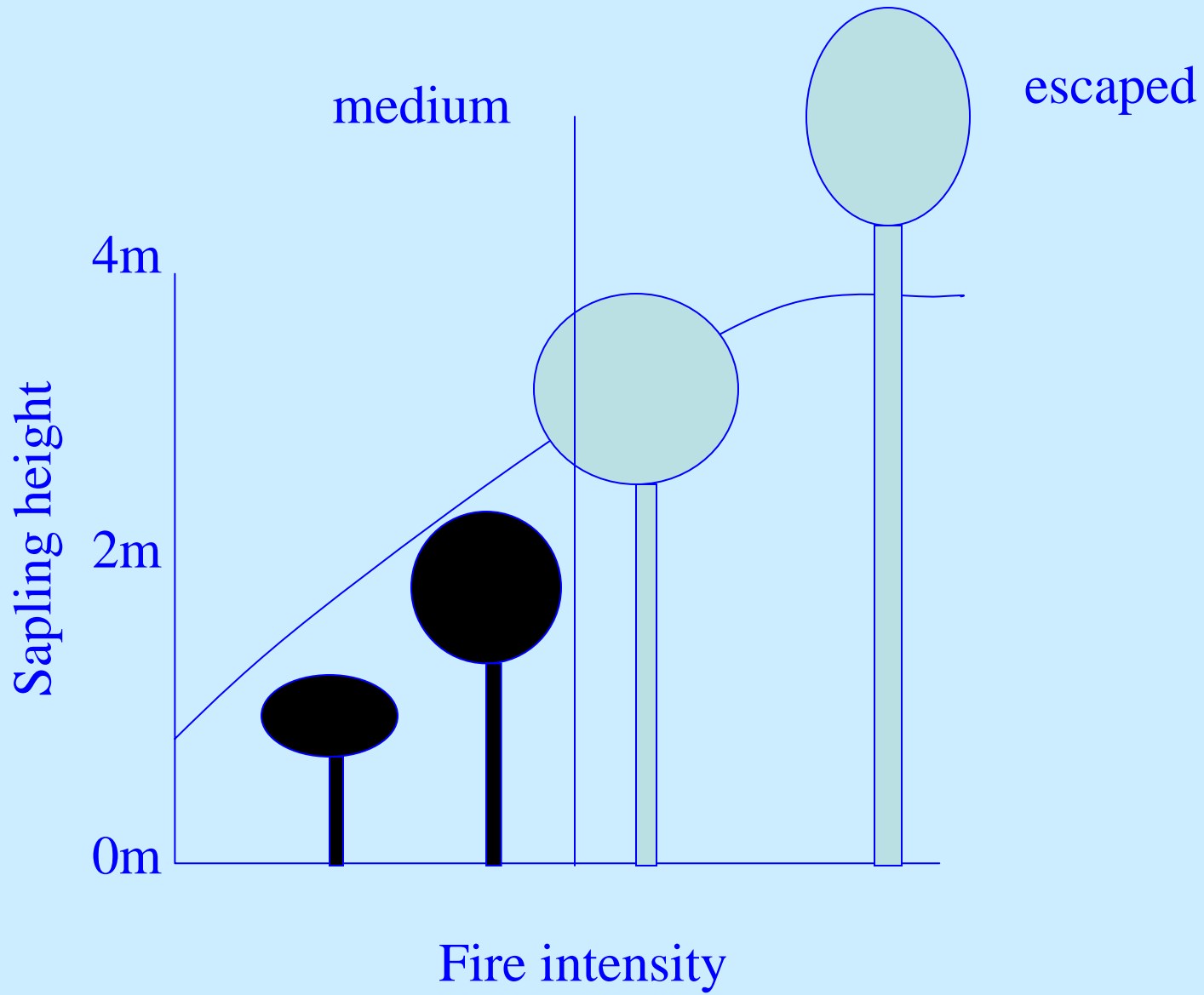
# What really matters....

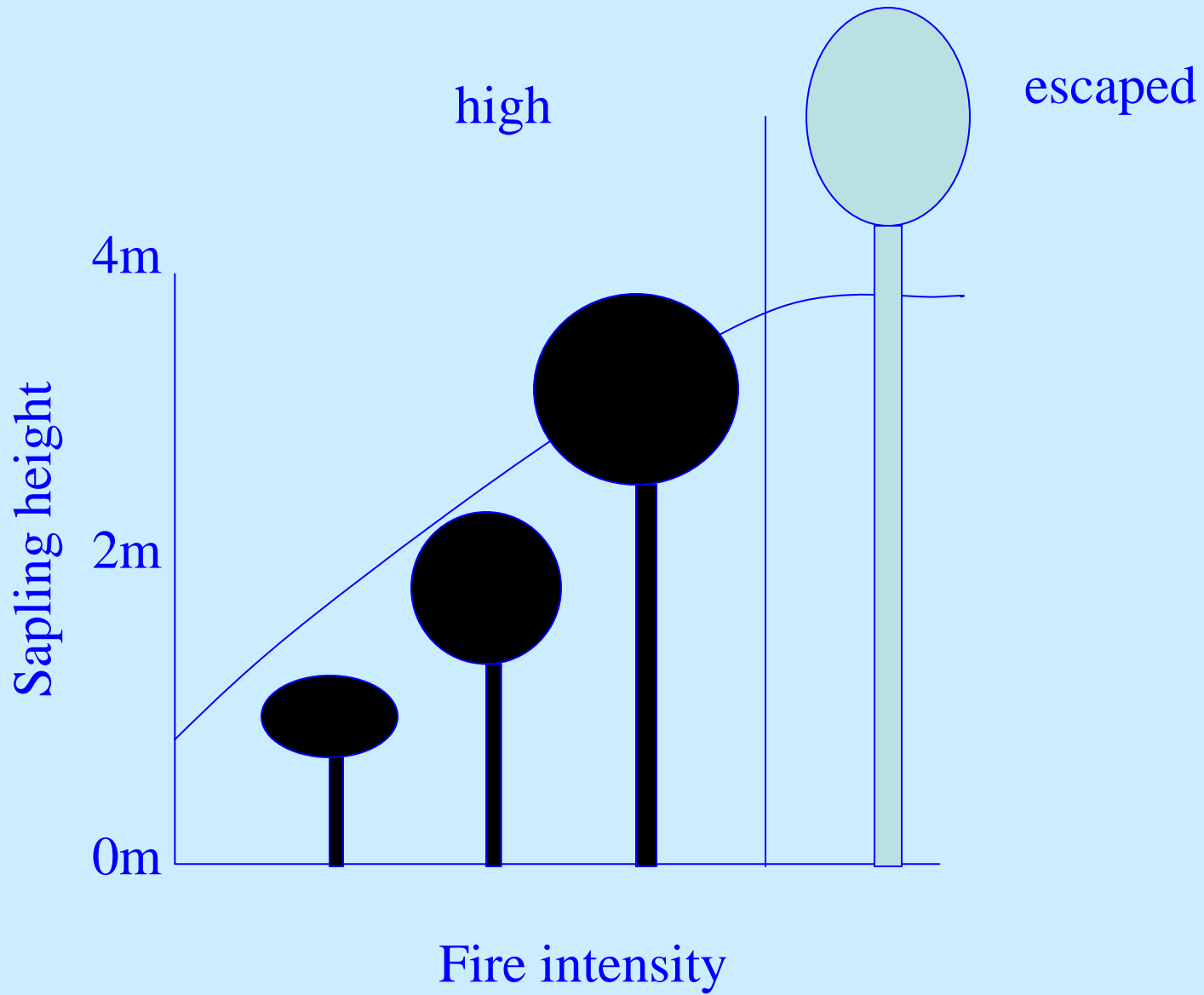
- Saplings must escape the fire/browse trap





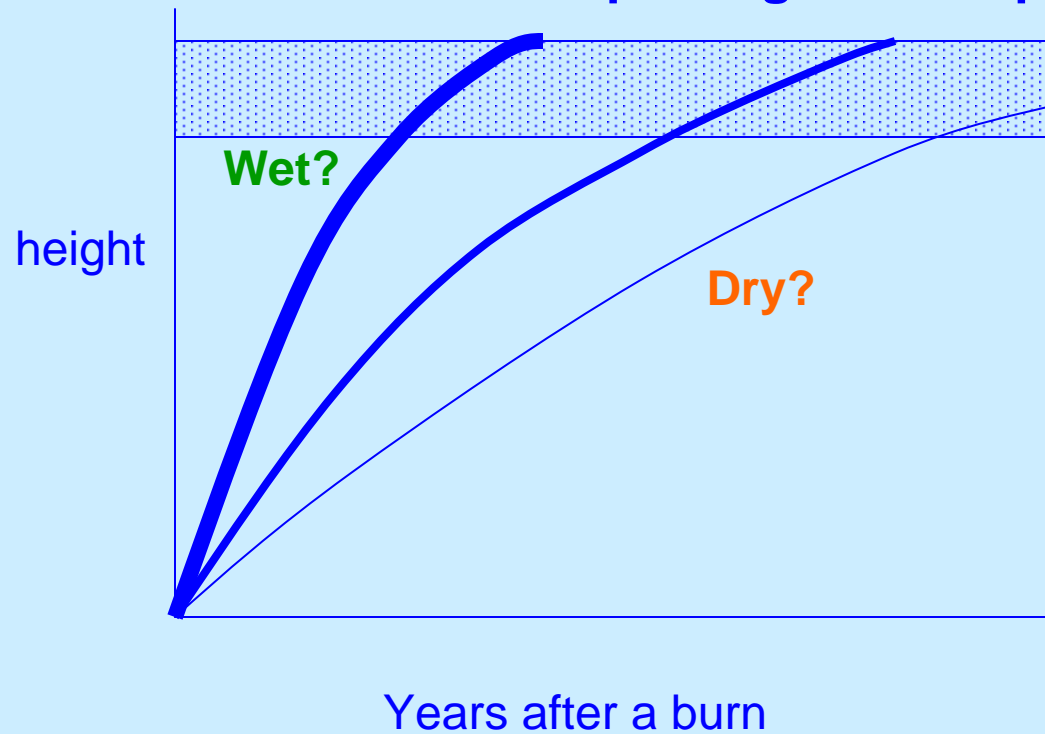




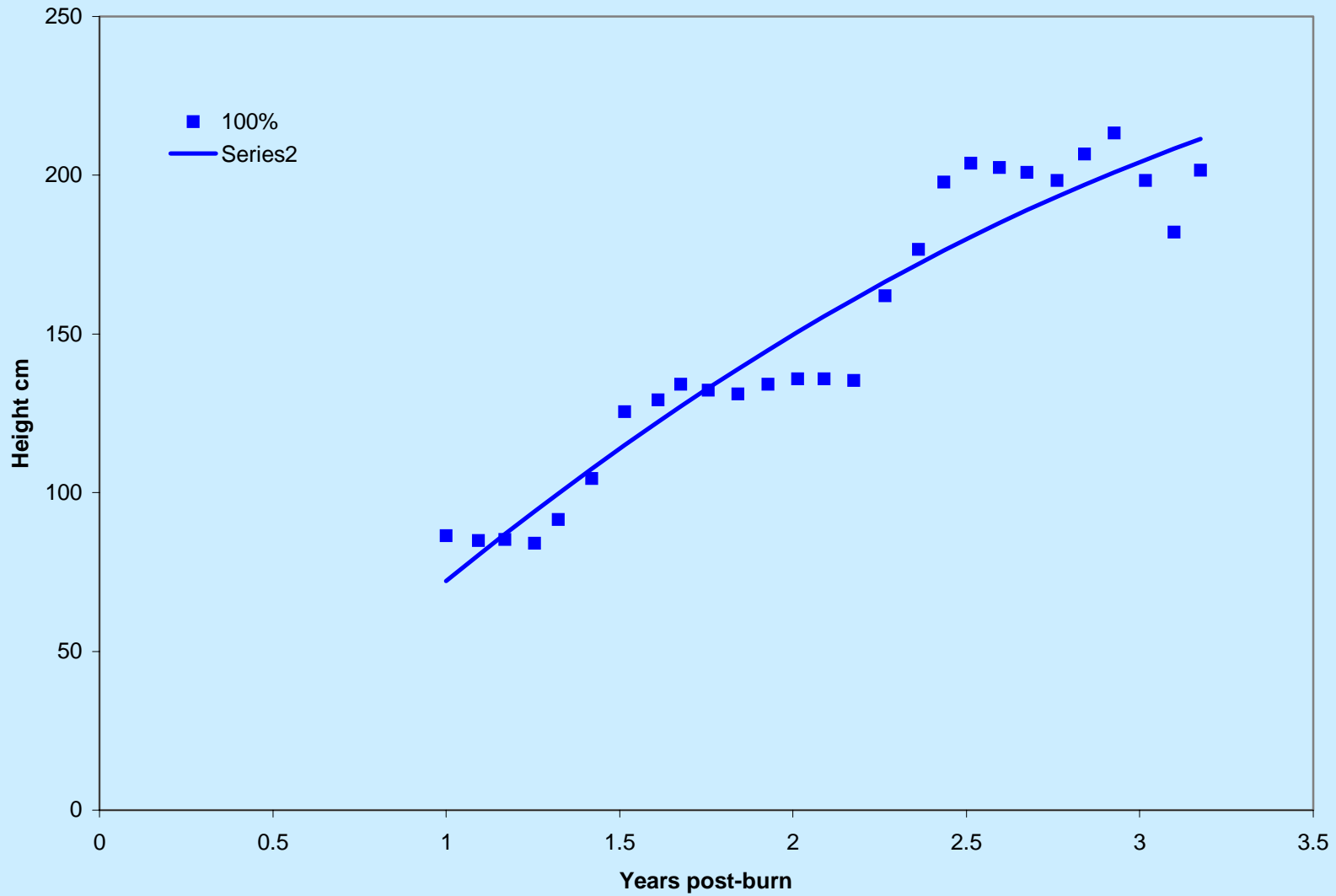


# The plant factor: How frequently do we need to trollope plants?

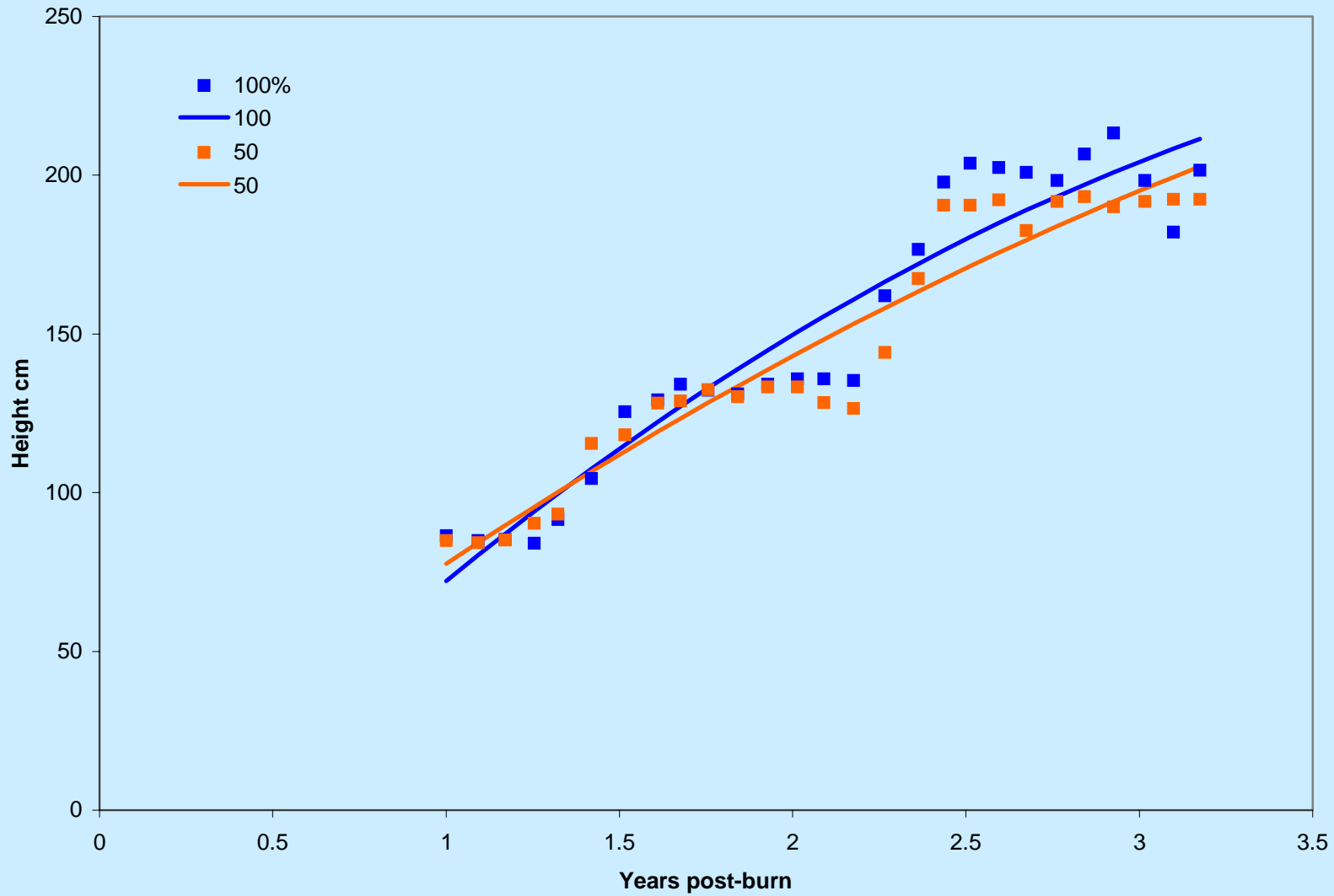
Growth rates to escape height are important but poorly known



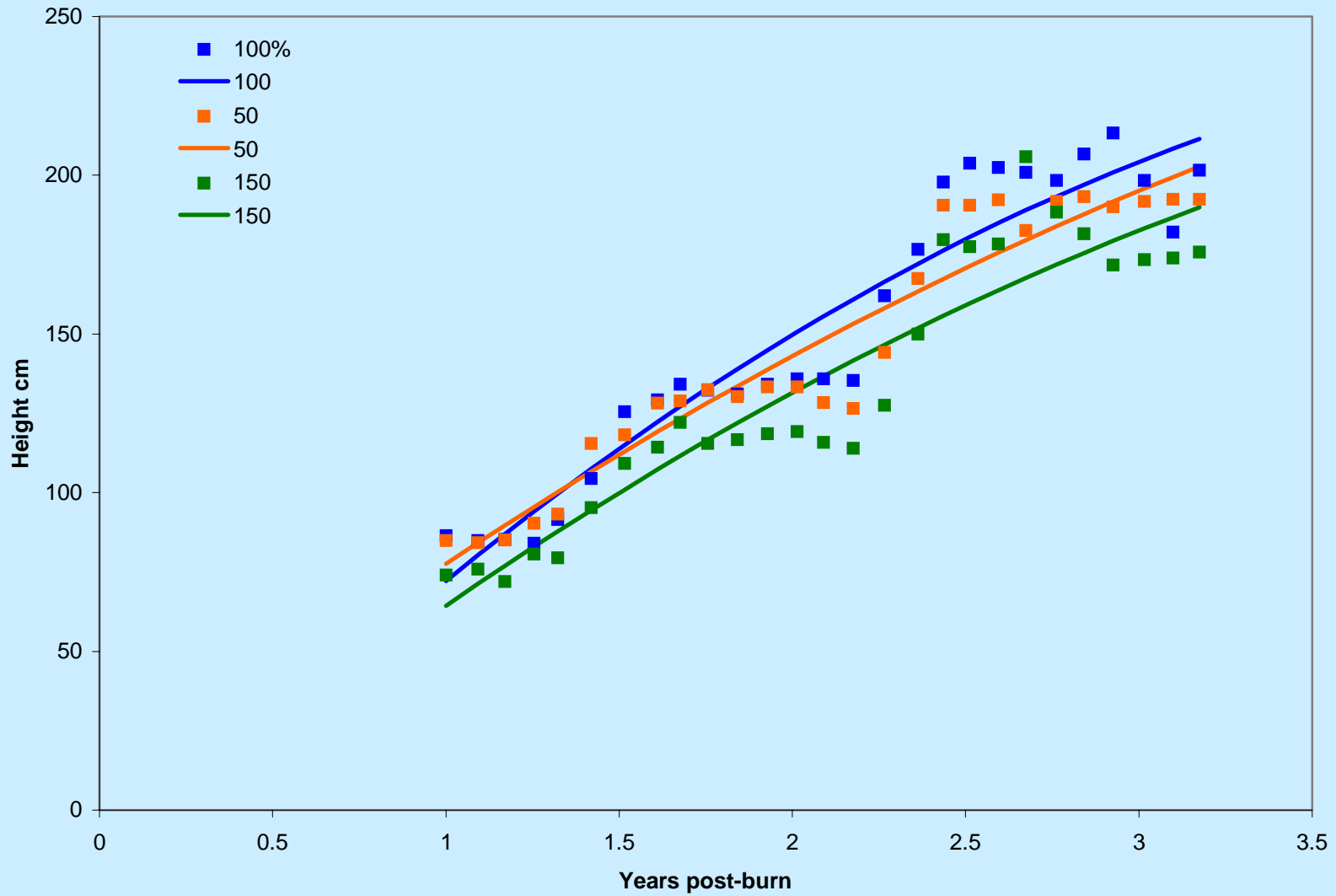
### Terminalia sericea: post burn height growth



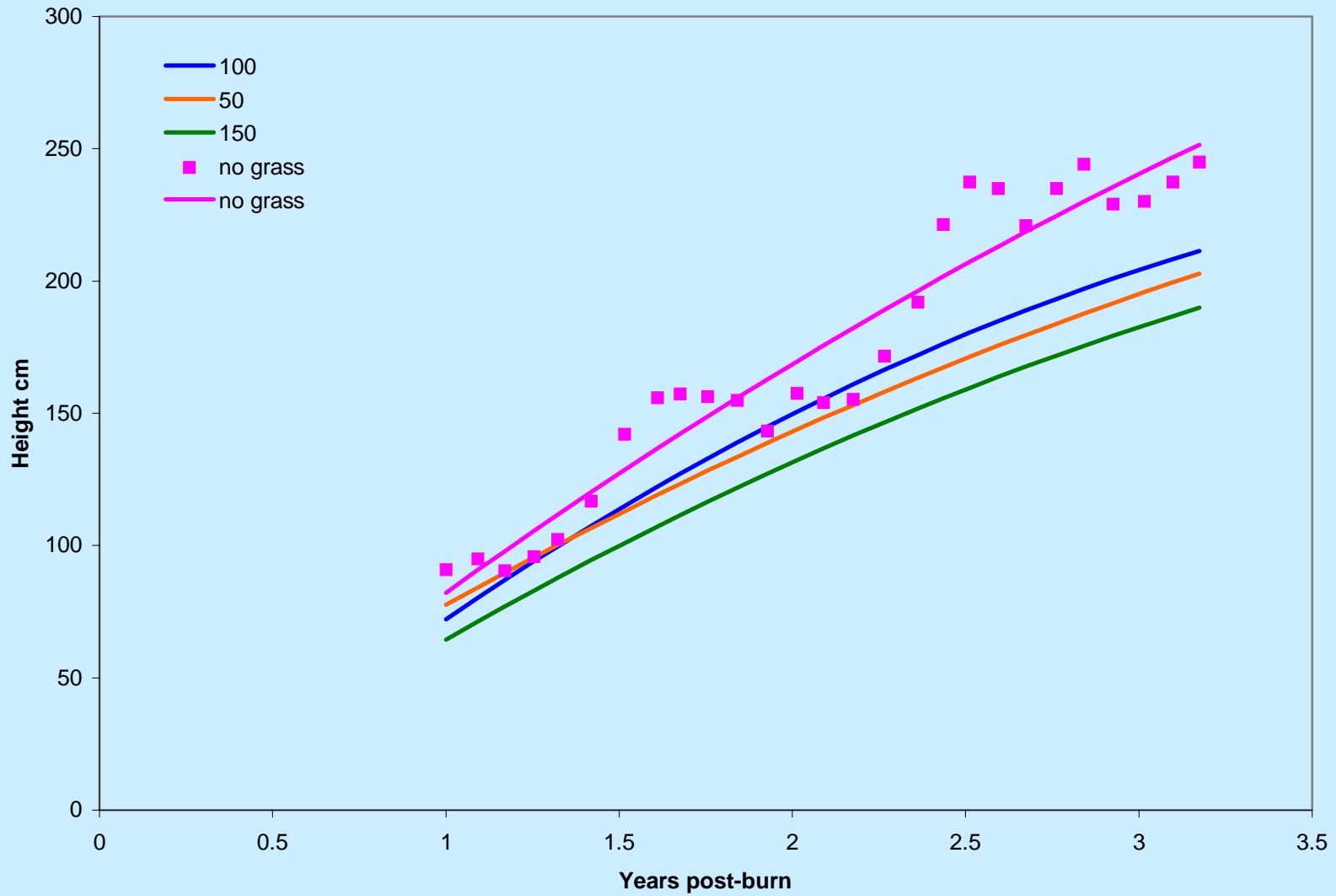
### Terminalia sericea: post burn height growth



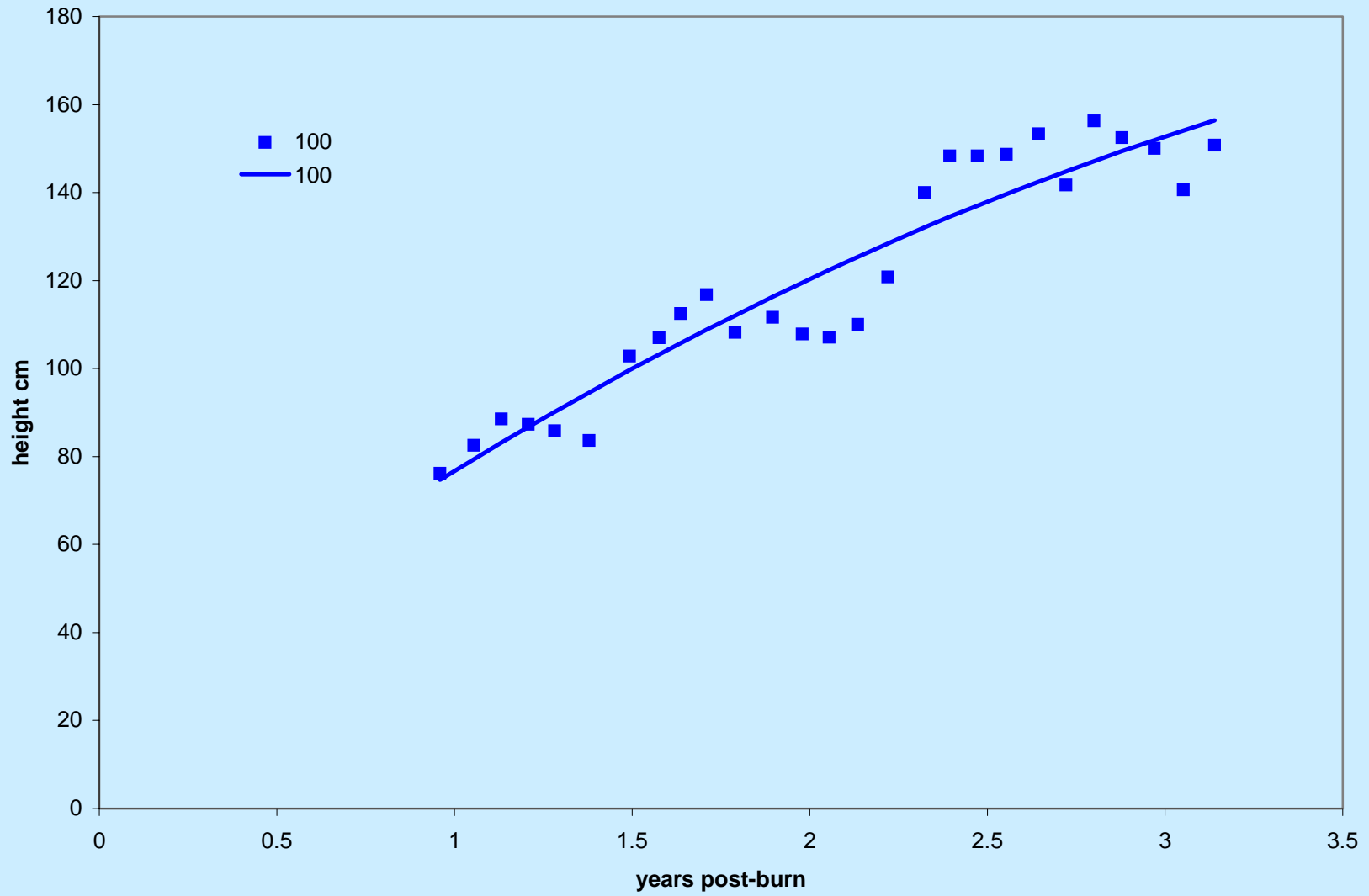
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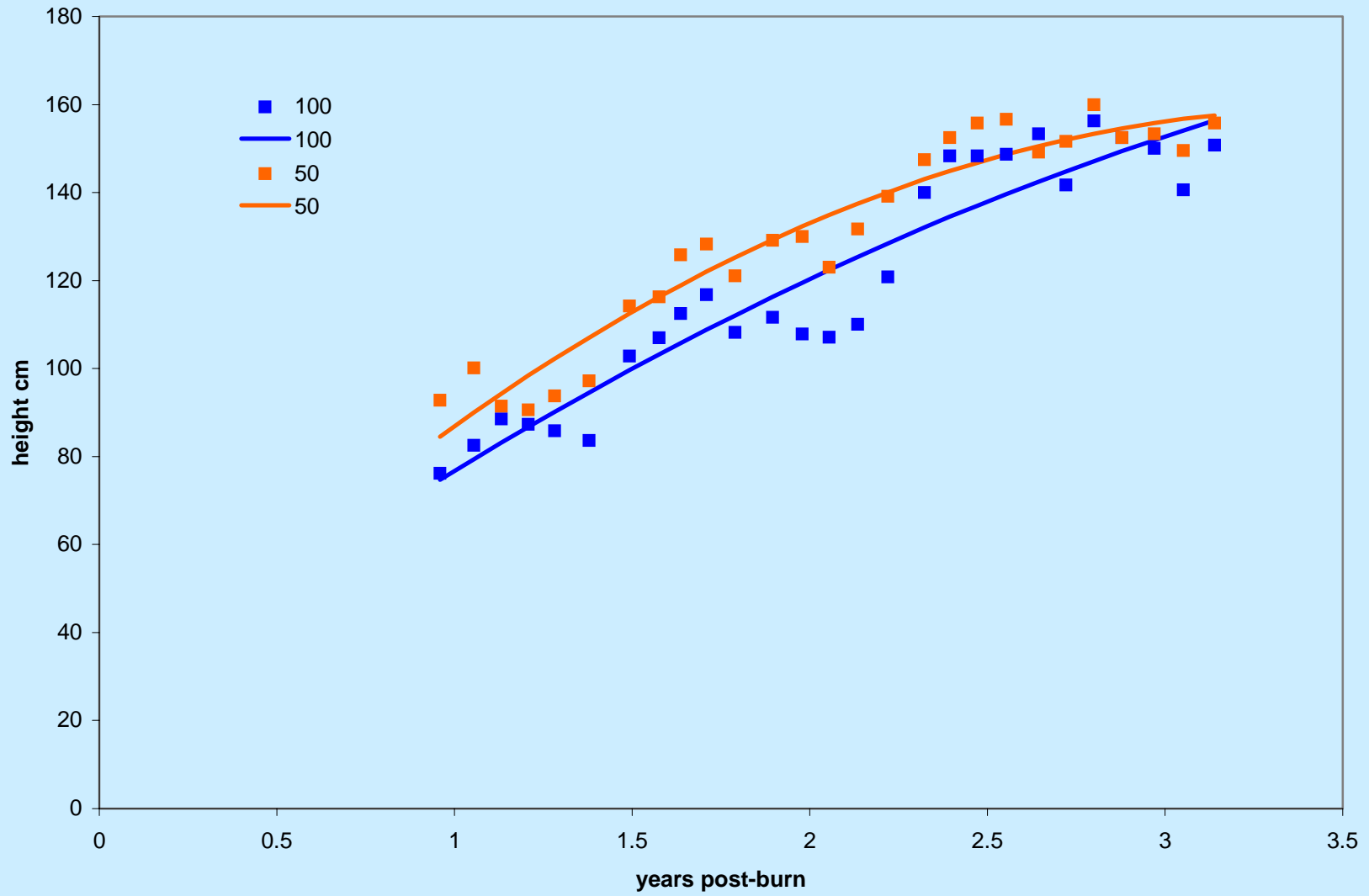
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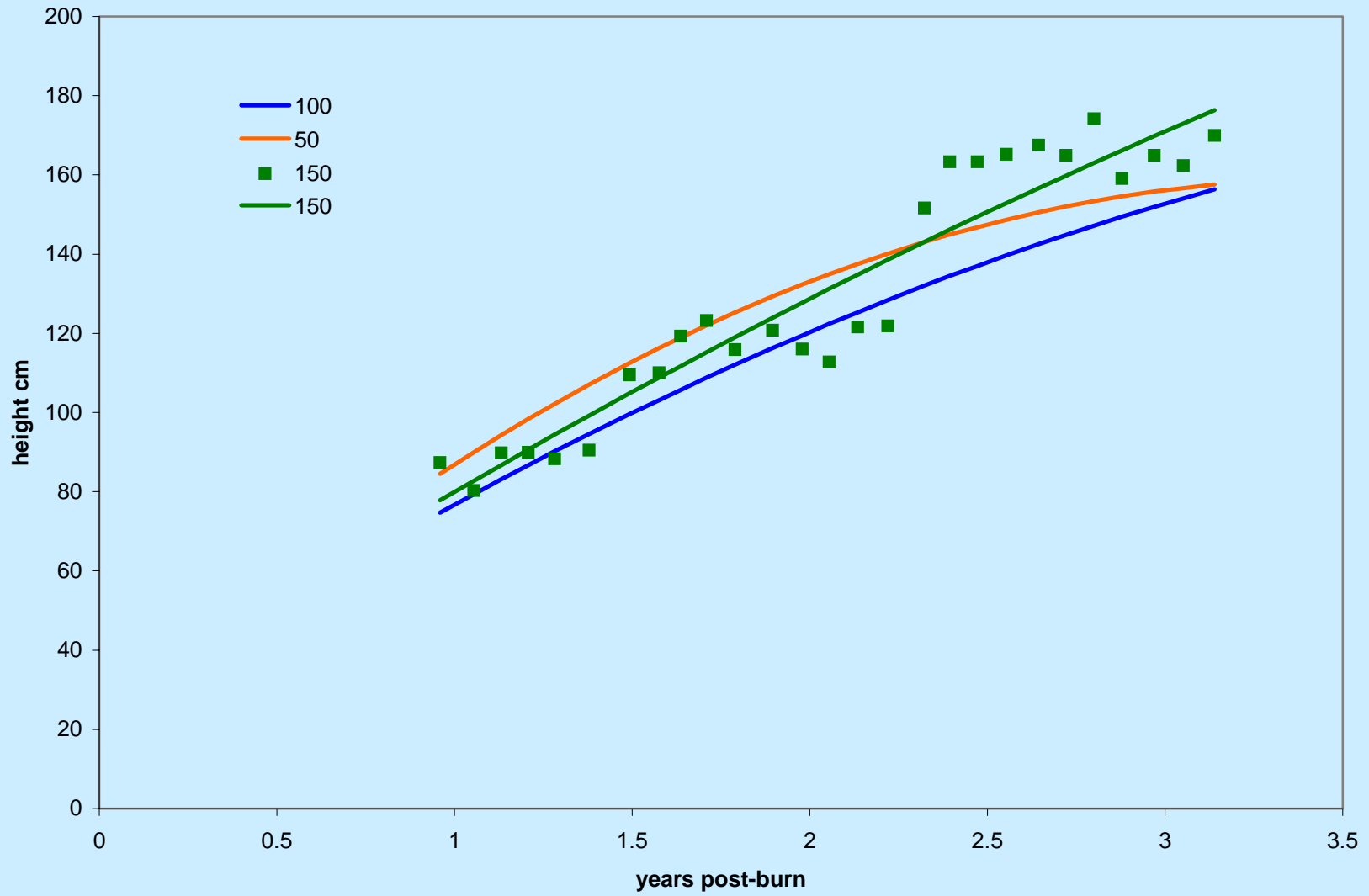
### Acacia nigrescens height growth



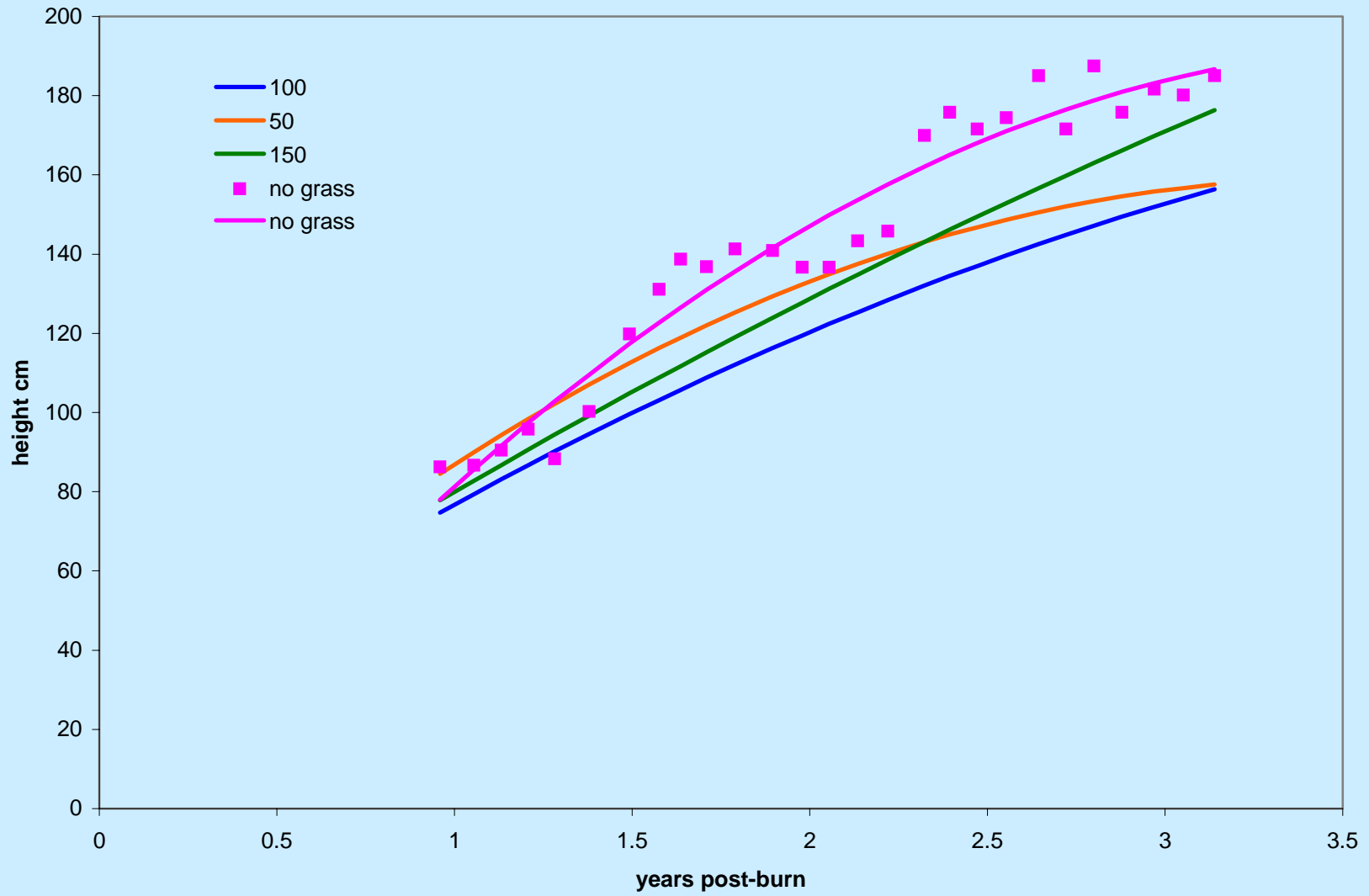
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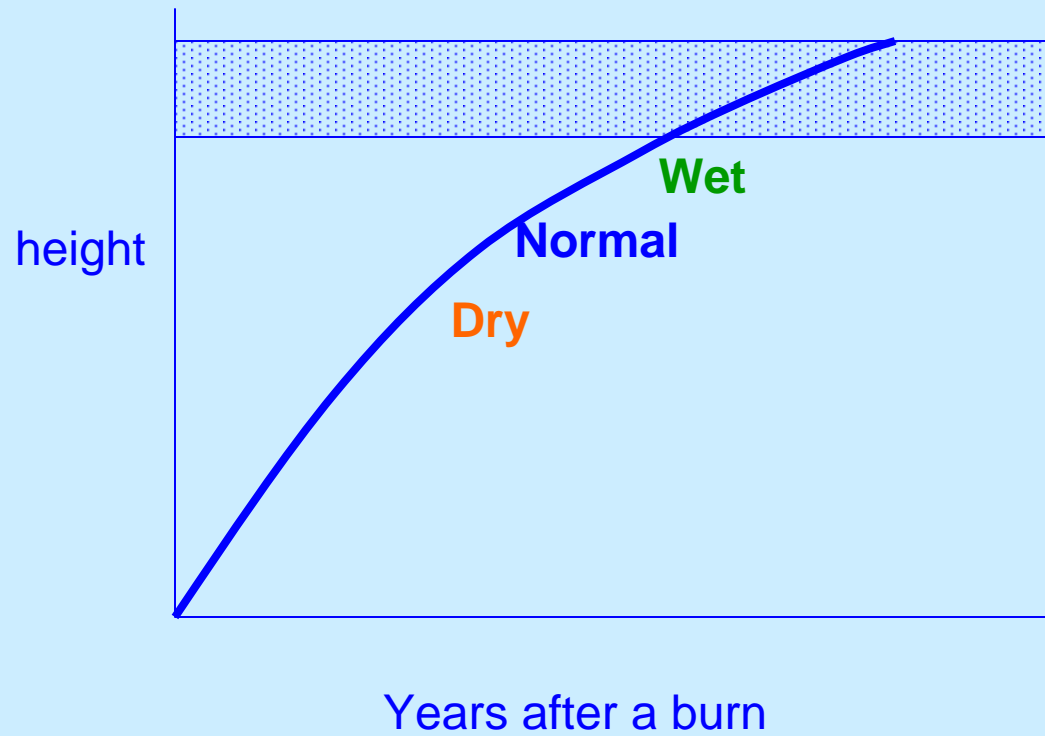
### Acacia nigrescens height growth



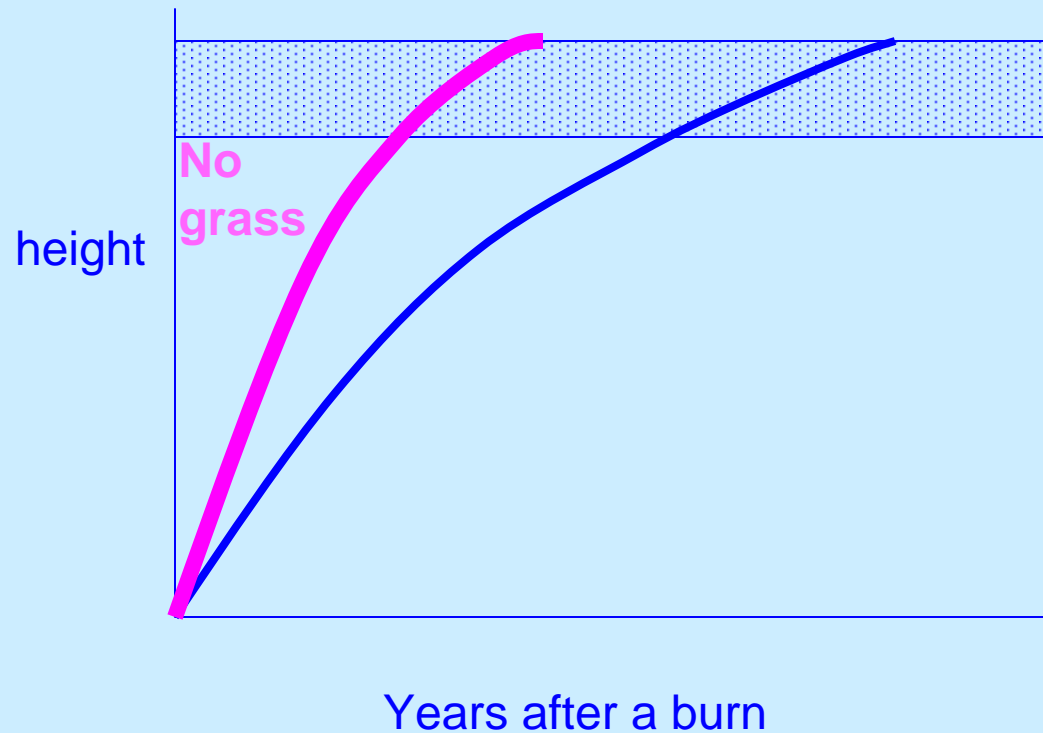
### Acacia nigrescens height growth



# Saplings grow at much the same rate in dry, medium or wet rain treatments



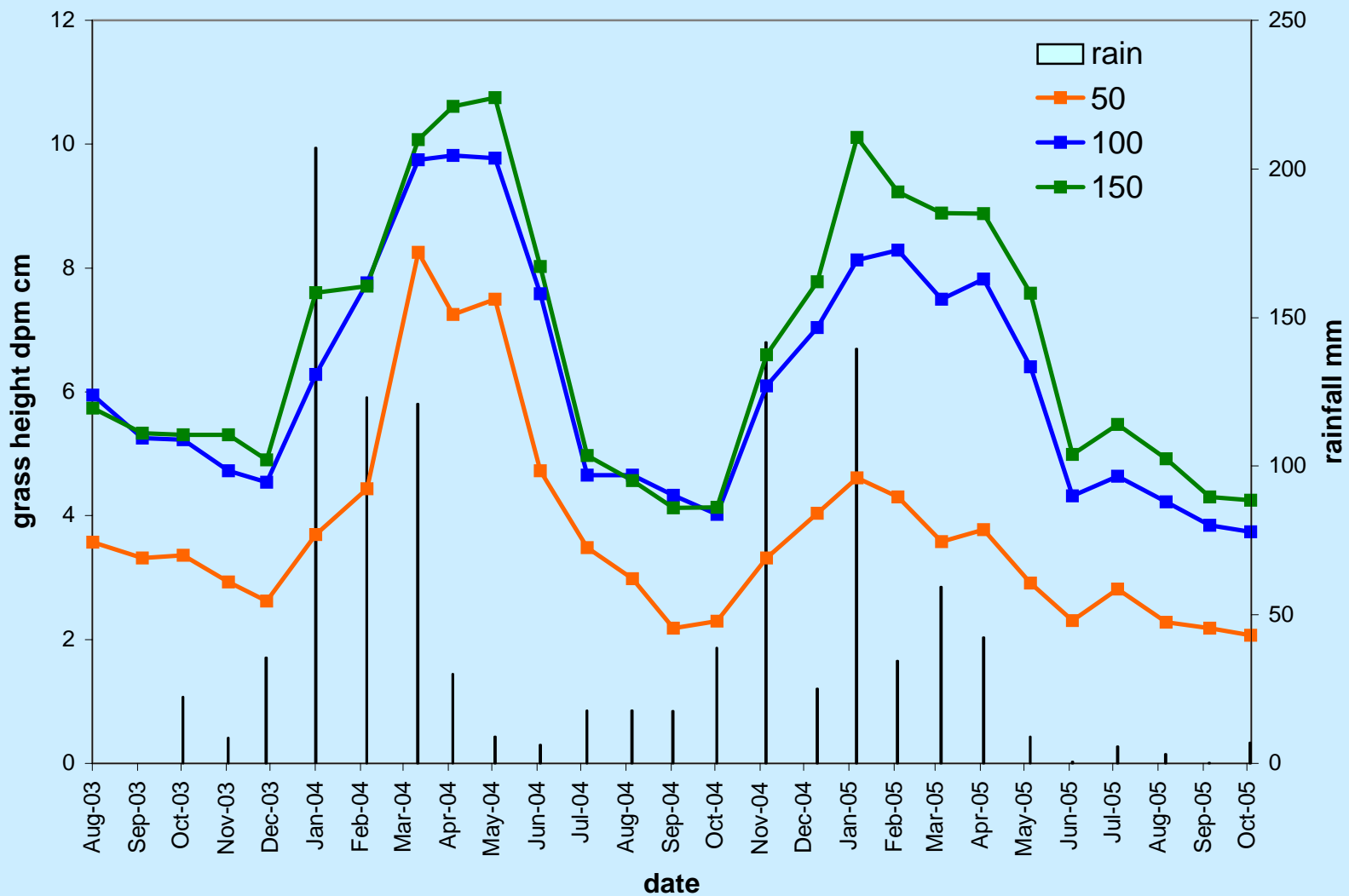
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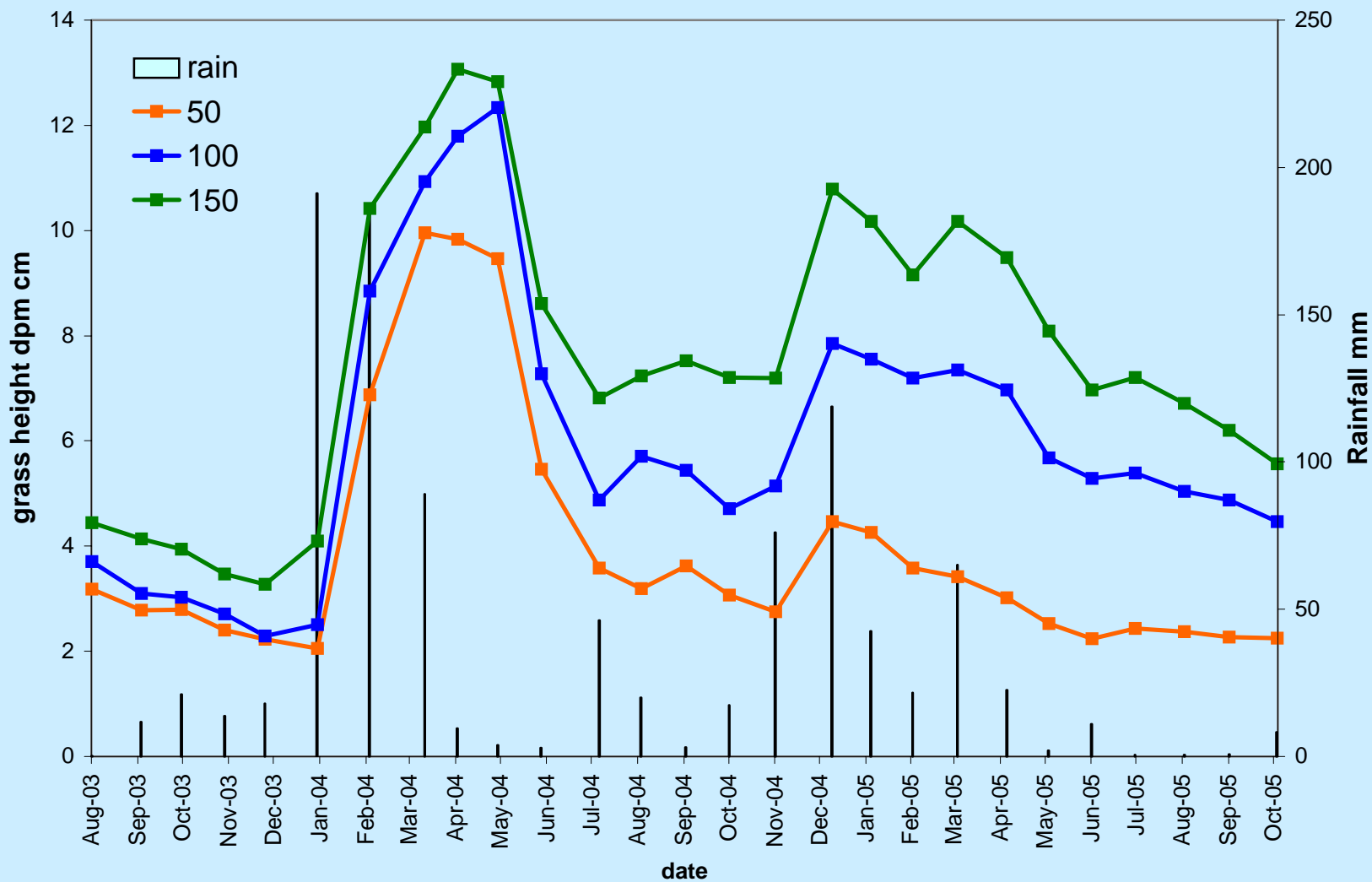
Largest growth response to no grass at all  
Root niche differences?  
No. Grasses/Saplings compete!!

What about the grasses?

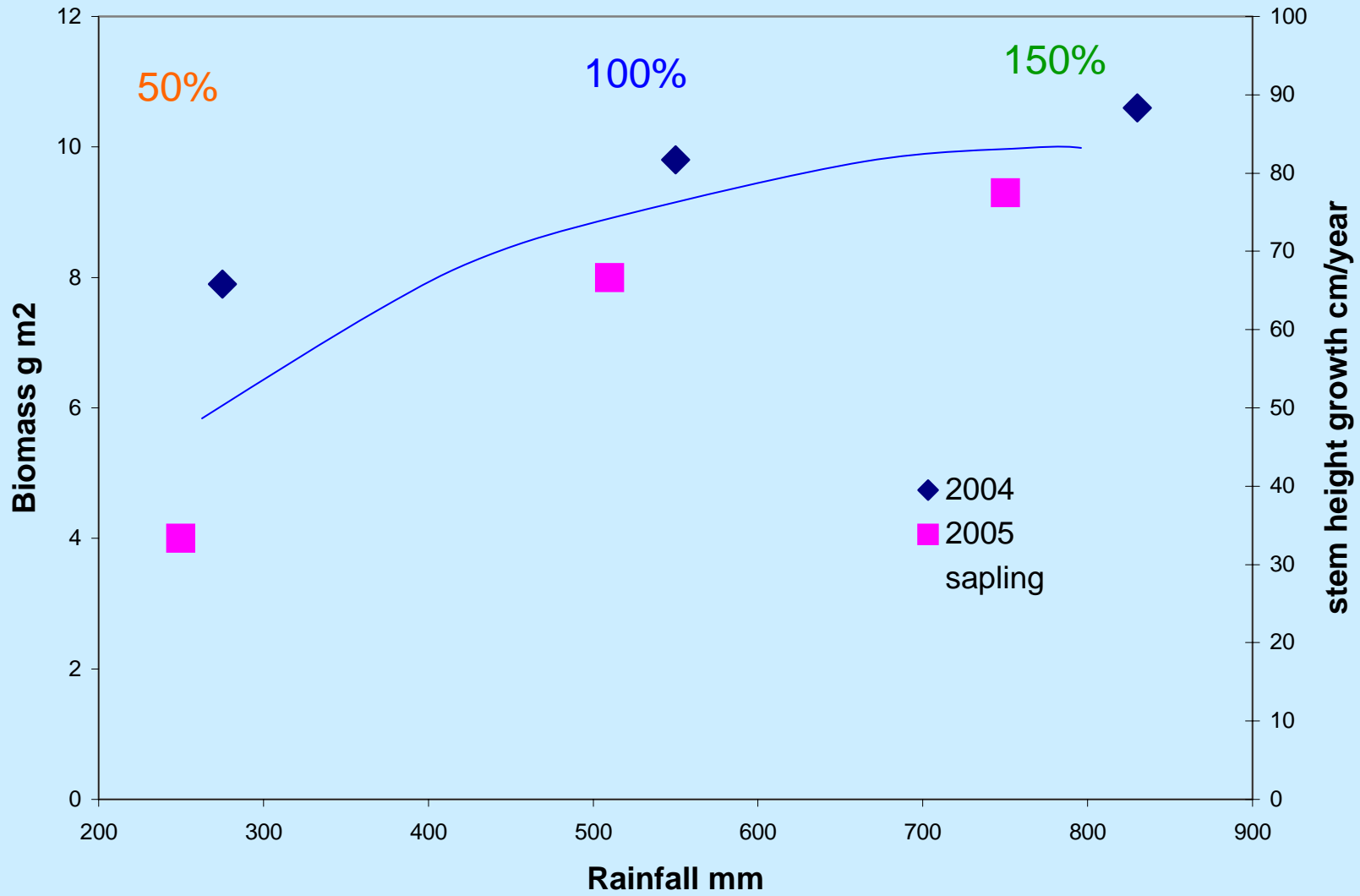
# Grass growth pretoriuskop



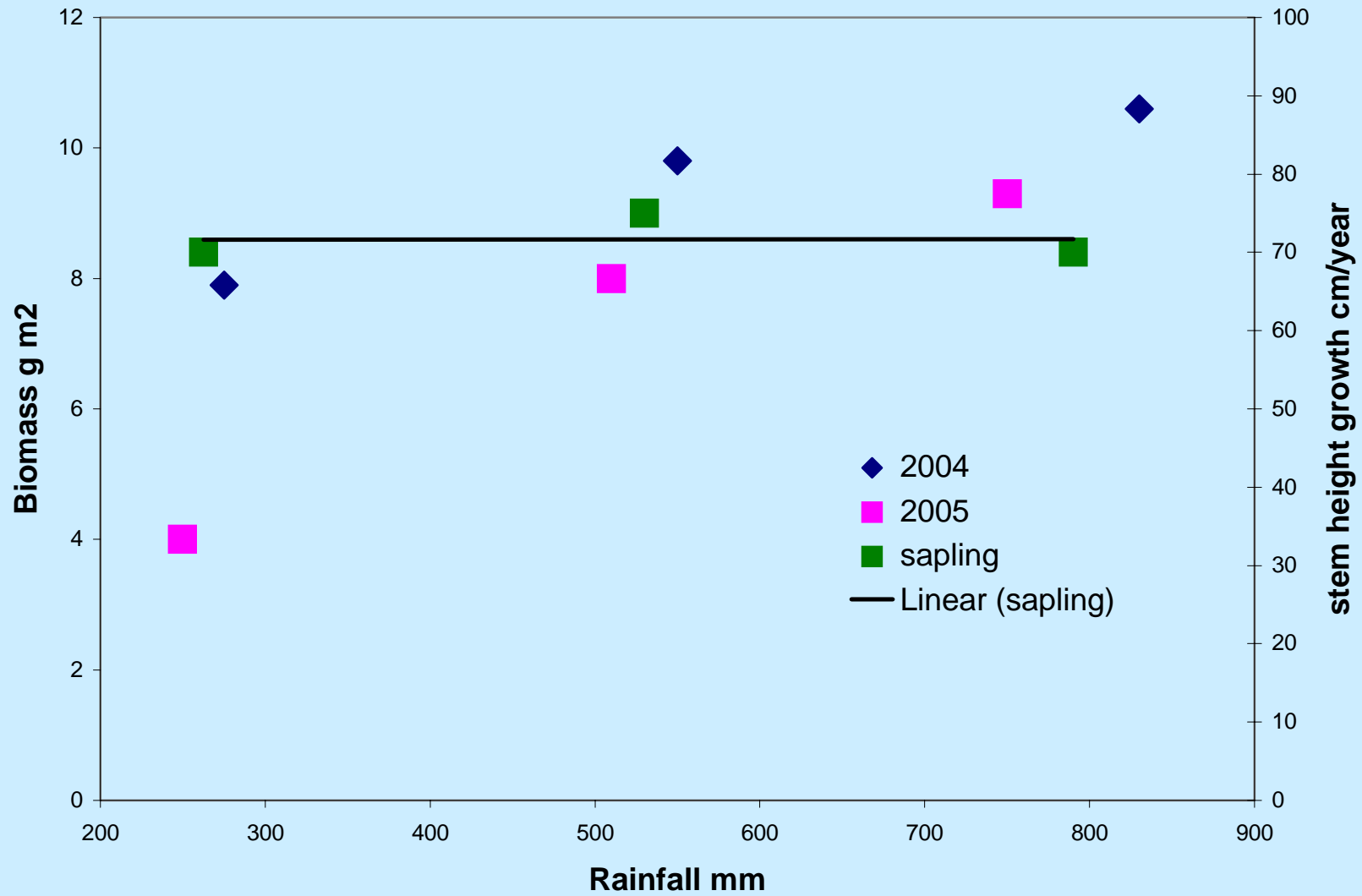
# Satara grass growth



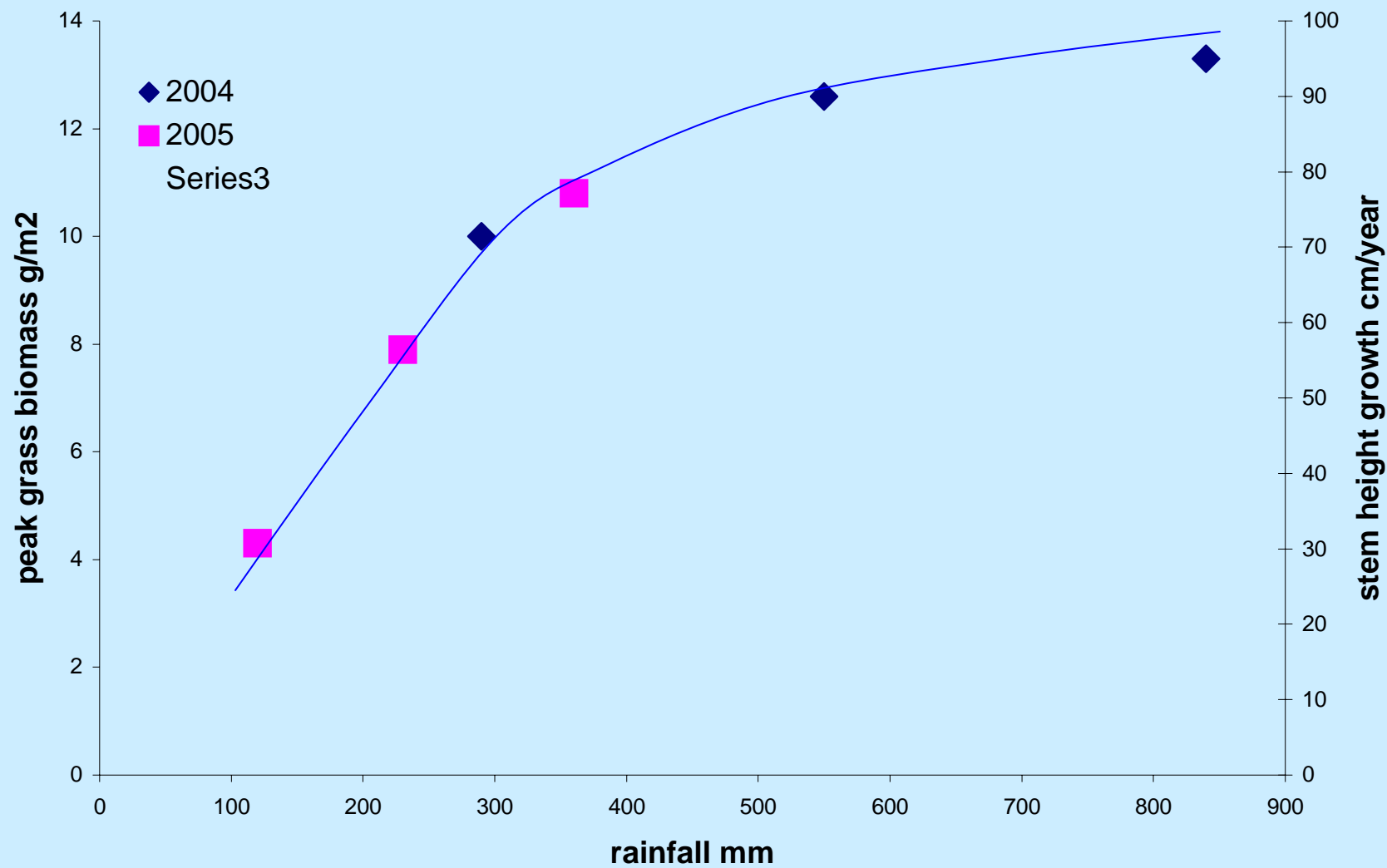
# Pkop relative rainfall response



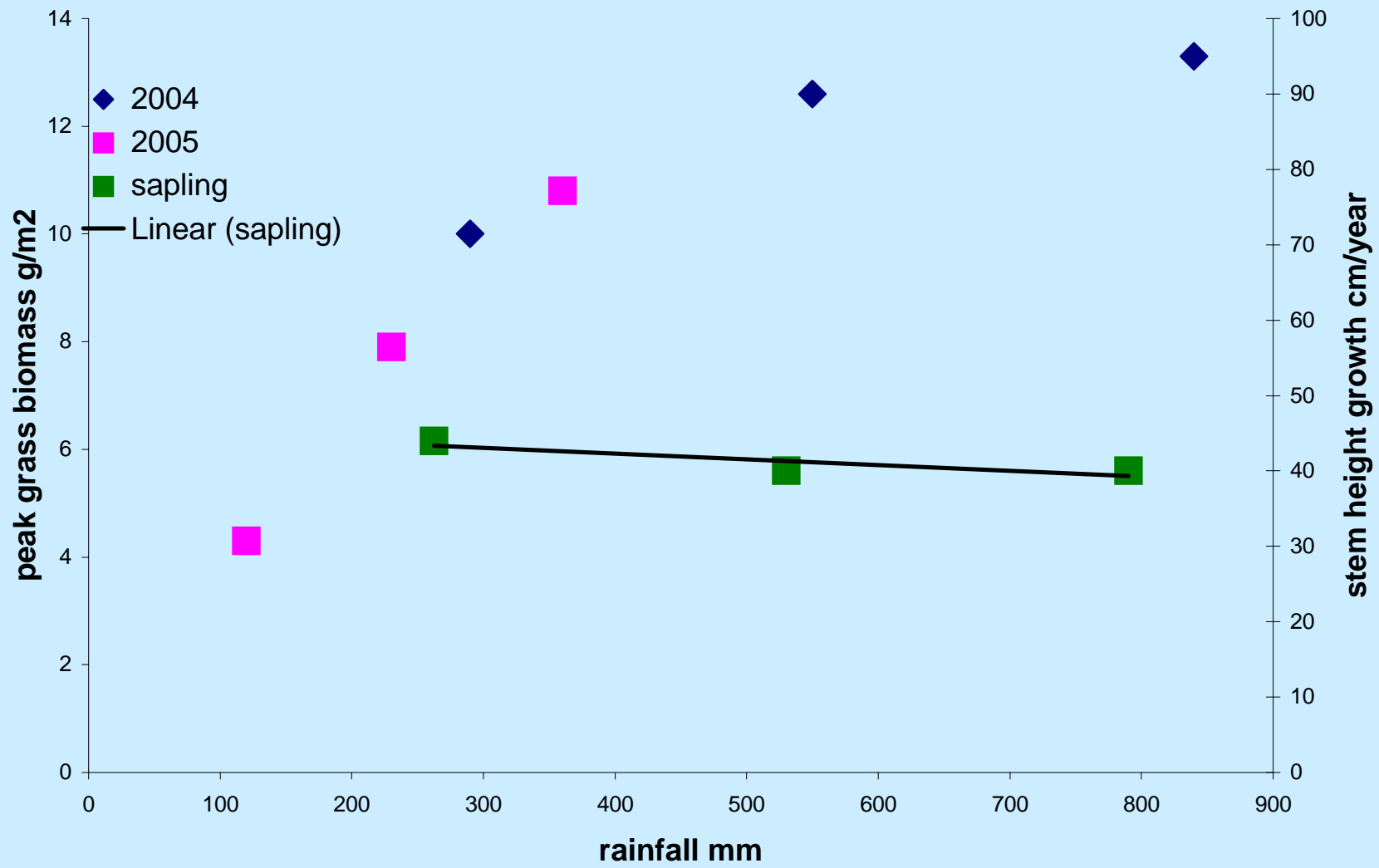
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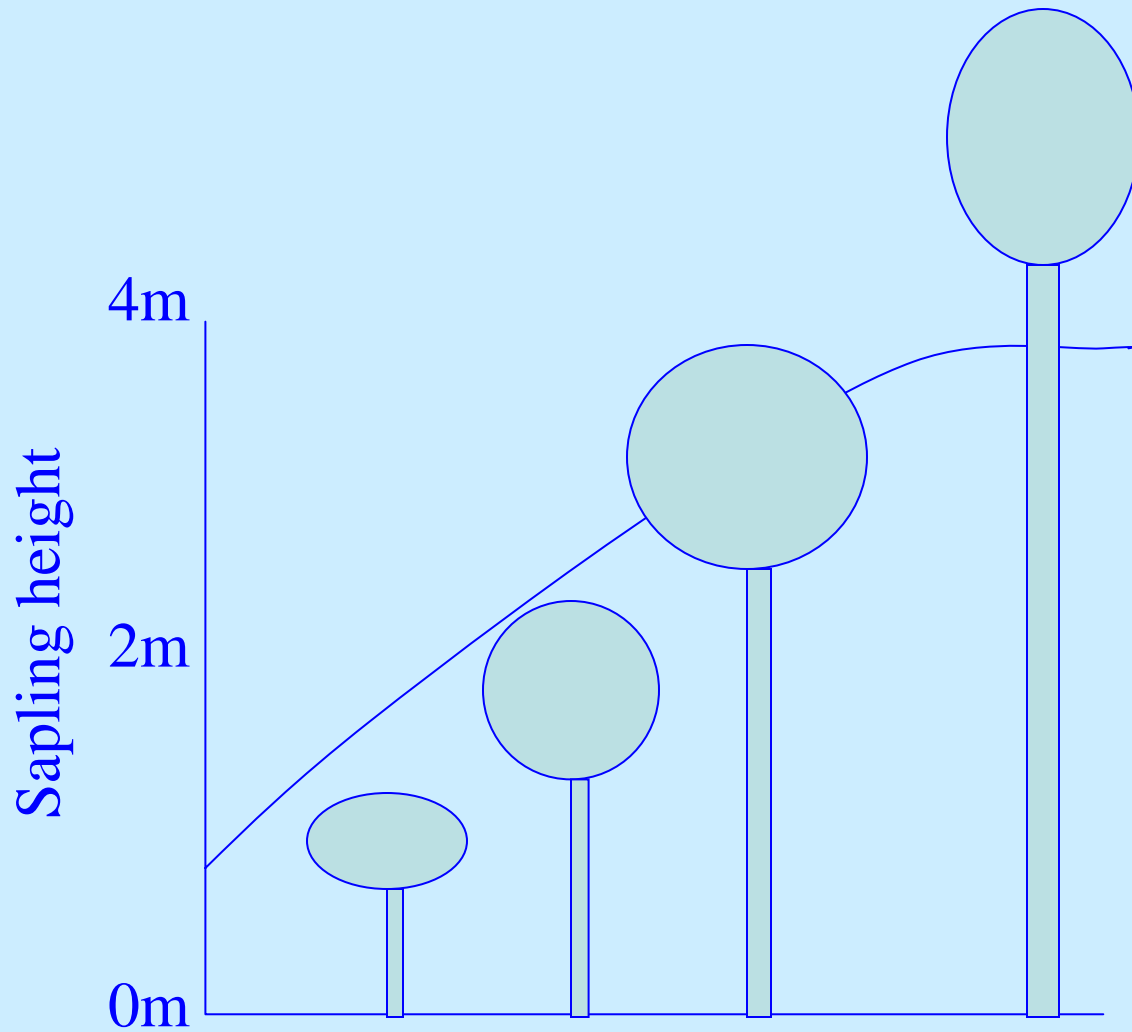


### Satara relative growth vs rain



### Satara relative growth vs rain





Fire intensity  
Increases with increasing grass biomass ('fuel load')  
So Greatest FI in wet years  
Least, or no fires at all, in dry years

# Summary of wet vs. dry treatment effects

- TREES:
  - Gulliver growth rates show low sensitivity to rainfall variation
  - Fastest growth rates with no grass (post drought?)
- GRASSES
  - Grass production very sensitive to rainfall variation
  - Low fuel loads in drought years → low intensity burns

# Conclusion

- Saplings have the greatest probability of escaping fire/browse trap in
  - DROUGHT YEARS and immediate aftermath
  - IN WET CYCLES, high grass productivity leads to high fuel loads, intense burns and no compensating growth boost to saplings

## Conclusion 2

- During juvenile stages, trees access resources in same rooting zone as grasses
- EBP treatment differences in sapling/adult transitions due to differences in fire intensity and topkill
- NOT sapling growth rates



**Thanks TGP team!!!!**





# Peak grass biomass vs rainfall Satara

