Concluding two years of energy efficient blackberry trials

A future-proof blackberry cultivation

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Worldwide Expertise for Food & Flowers

Aim project

- Future-proof blackberry greenhouse cultivation

- Learning goals:
  - Implement HNT → towards fossil free
  - Insights in light stress, water stress & photosynthesis
  - Cultivation concept with small DIF and high RH

→ Learning goals to fine-tune cultivation towards a future proof concept

KAS ALS ENERGIEBRON

Ministerie van Landbouw, Natuur en Voedselkwaliteit

Glastuinbouw Nederland

Fruit Masters.

the Greenery

svensson

Innovation Partners
collaboration as a driving force for soft fruit innovation

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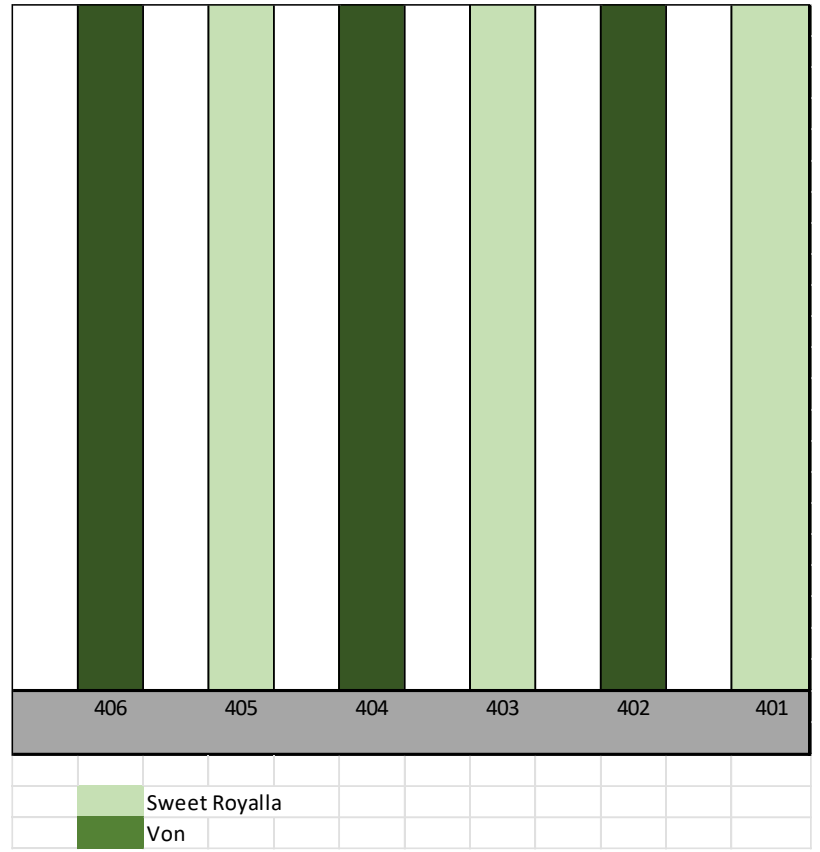
About the trial

- Two plantings: autumn and spring cultivation
- Plantdate autumn: 5 July
- Plantdate spring: 16-21 January
- Focus on flavourful varieties:
  - Sweet Royalla
  - Von
- Plant density:
  - 1 pot per 0,6m1 or 1 pot per 0,4m1
- Targets:
  - Year production 10 kg/m^2
  - Max. 5 m^3 gas/m^2
  - Minimize CO_2 inputs



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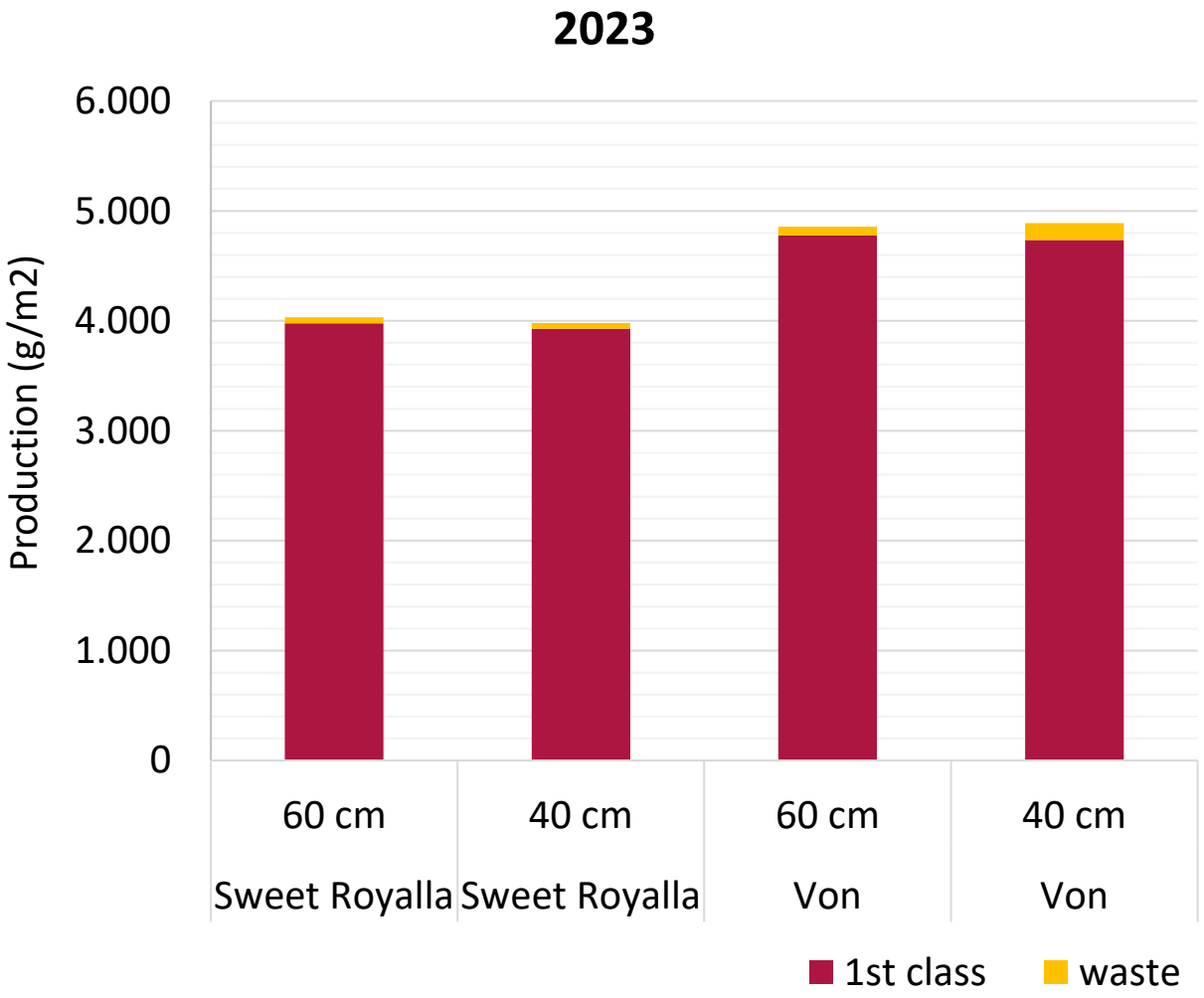
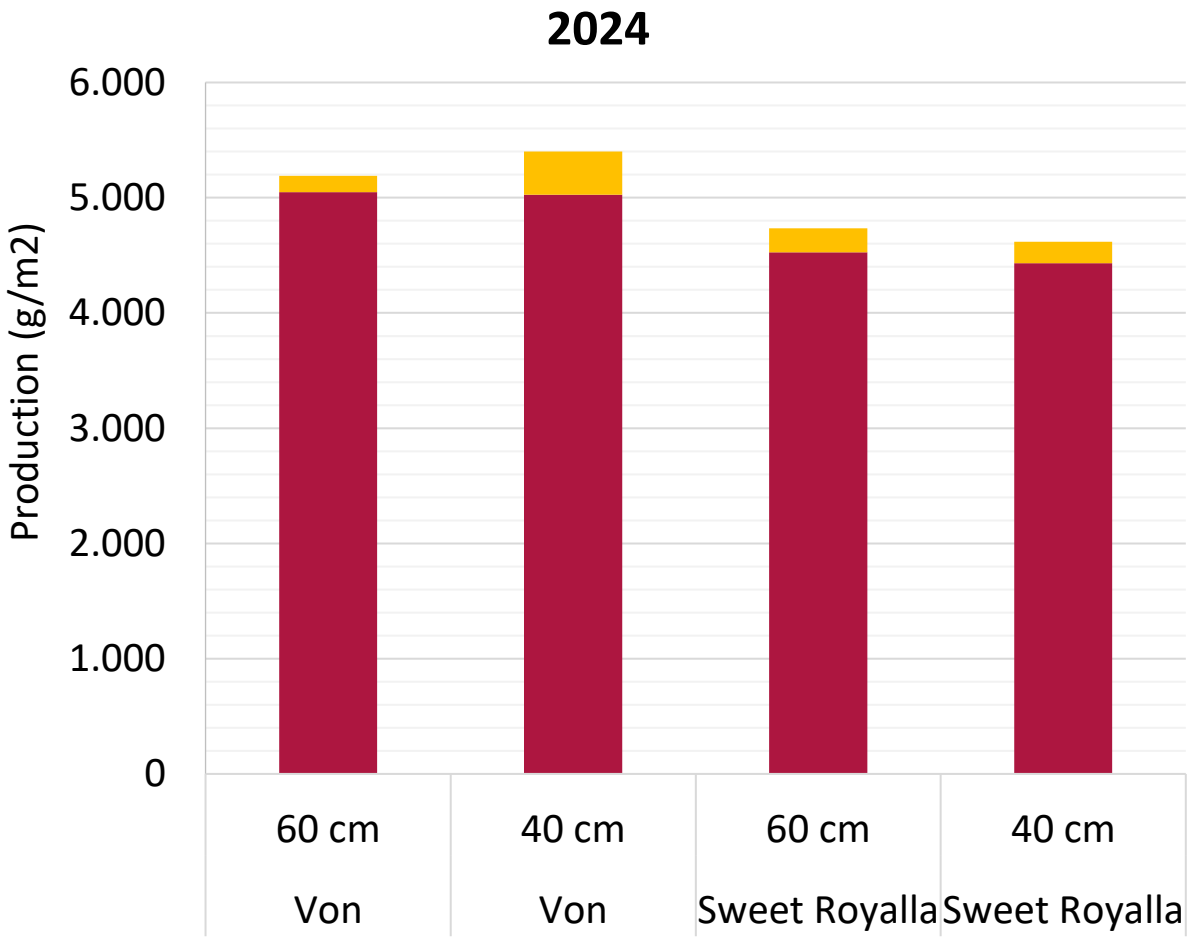
Autumn results 2023 & 2024

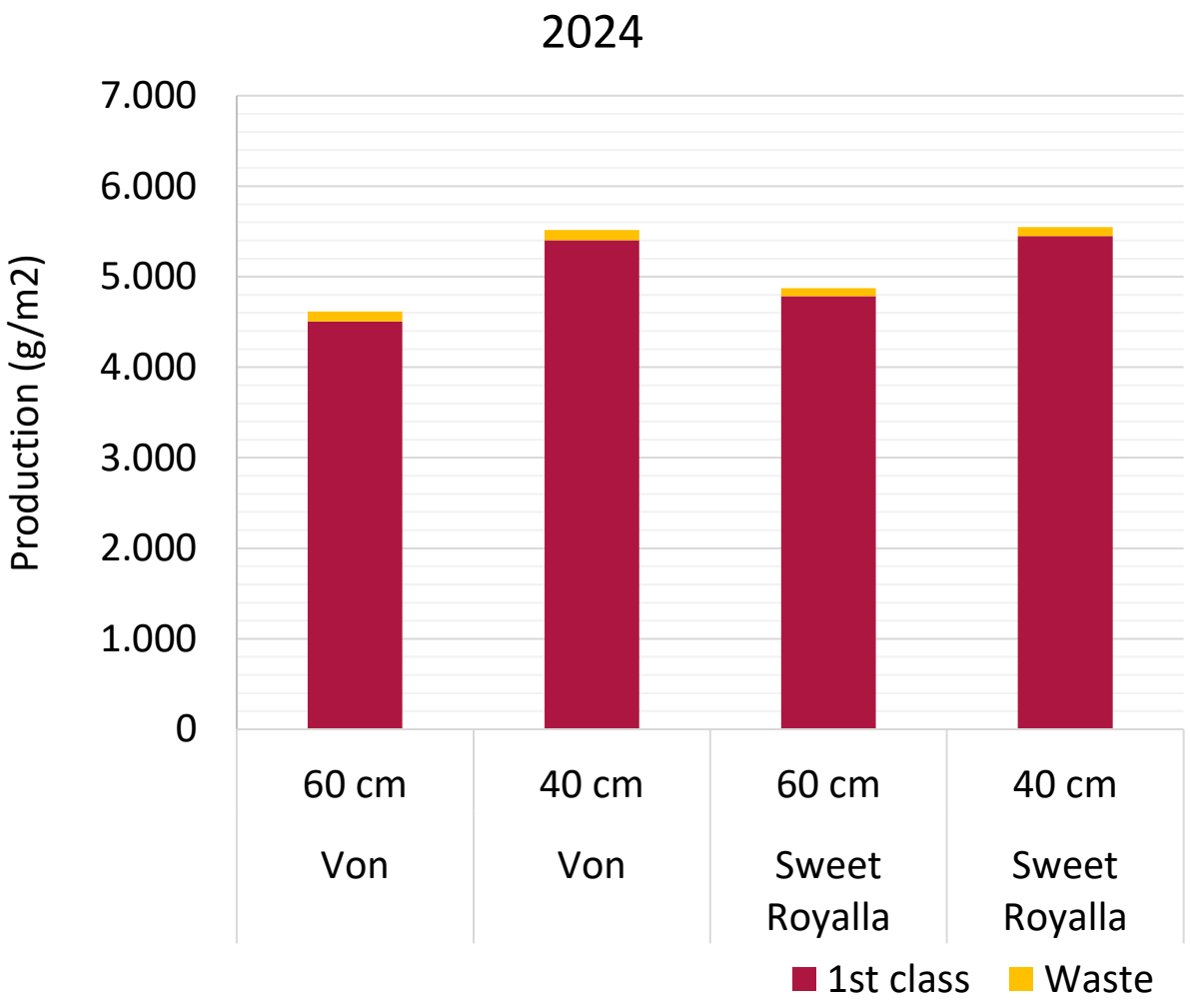


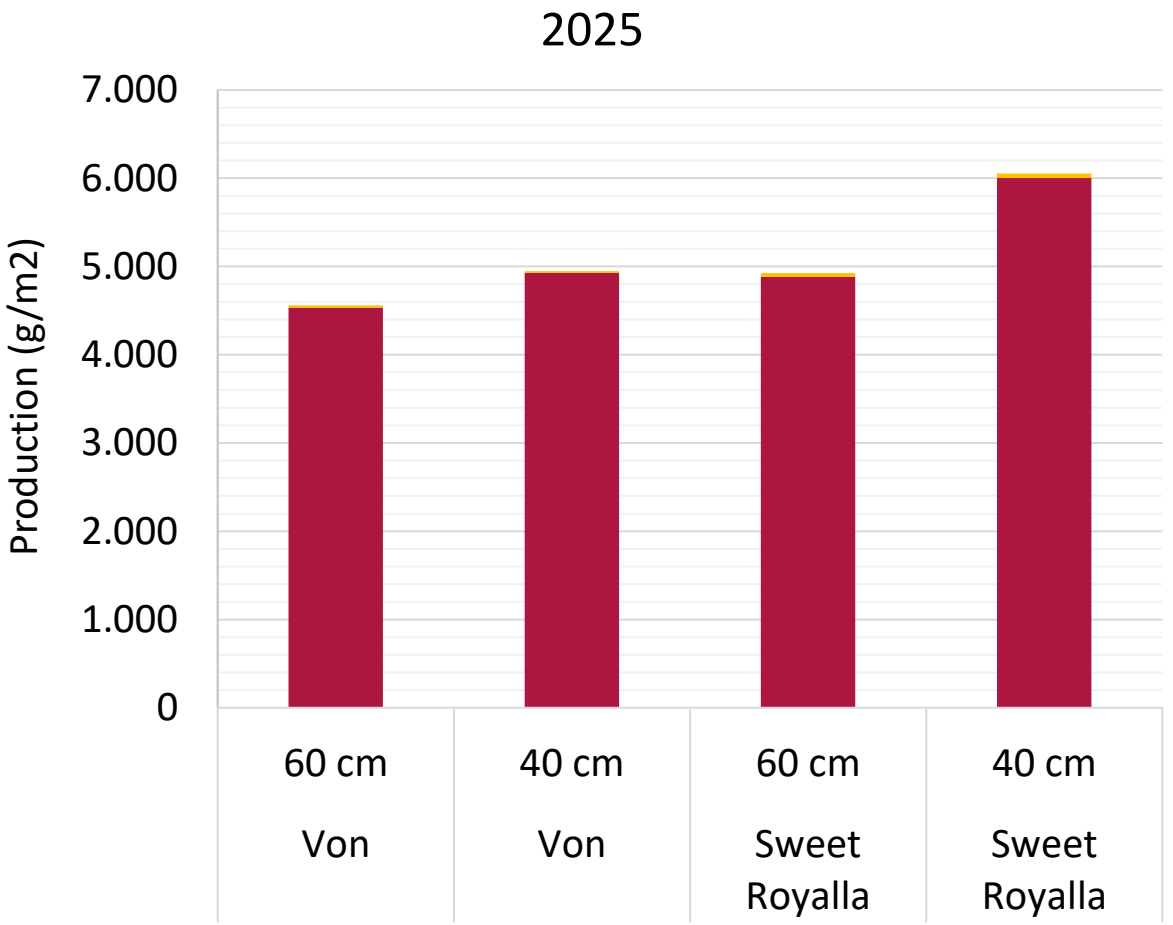


2023: 1,3 gas m^3/m^3

2024: 1,3 gas m^3/m^3

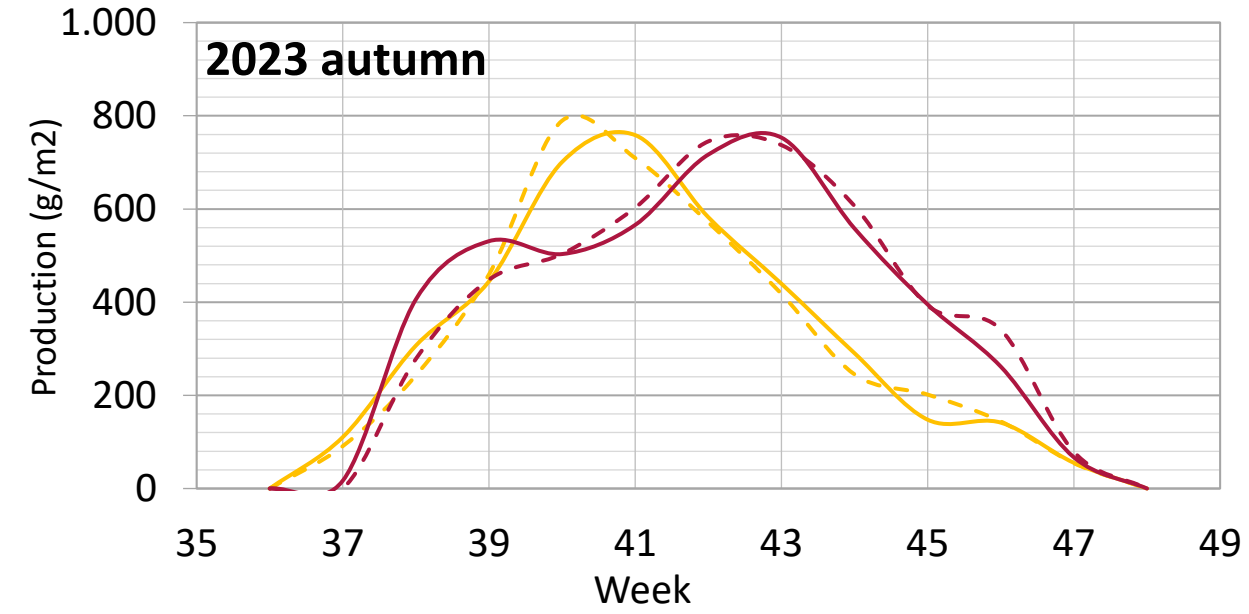
Spring production 2024-2025

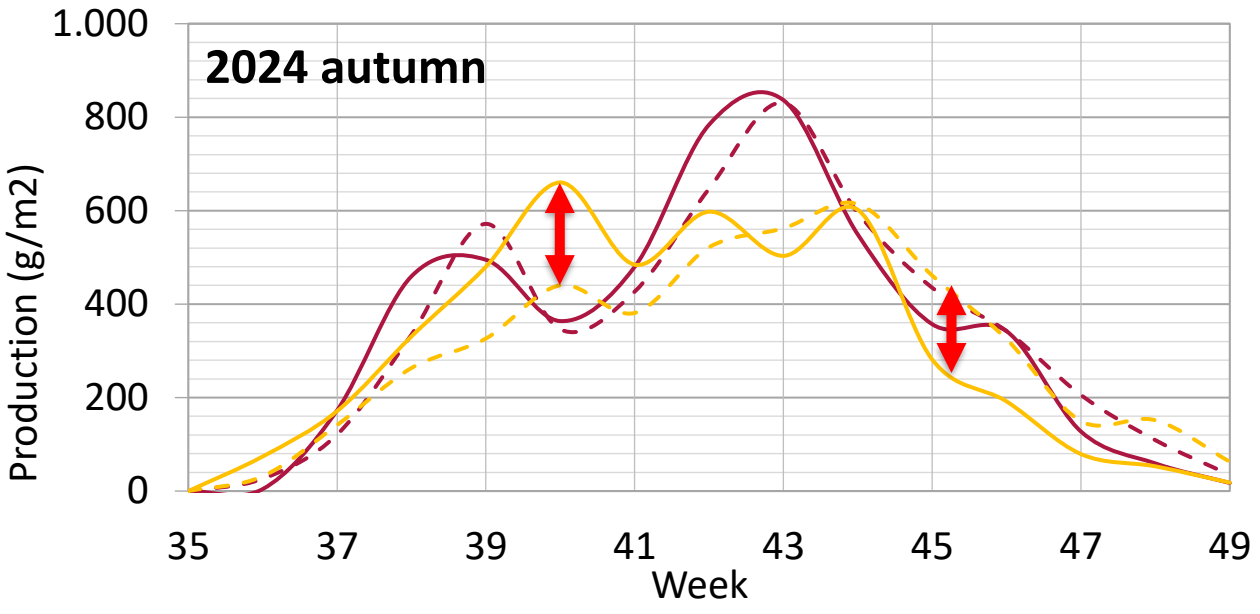




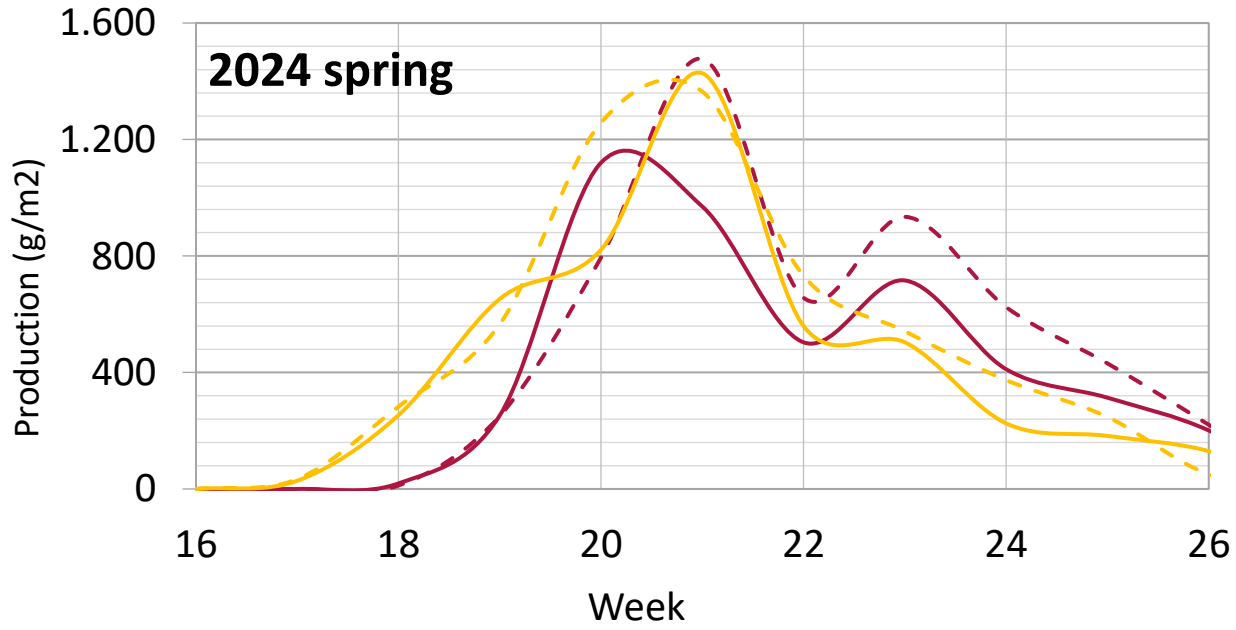
2024: 3,5 gas m^3/m^3

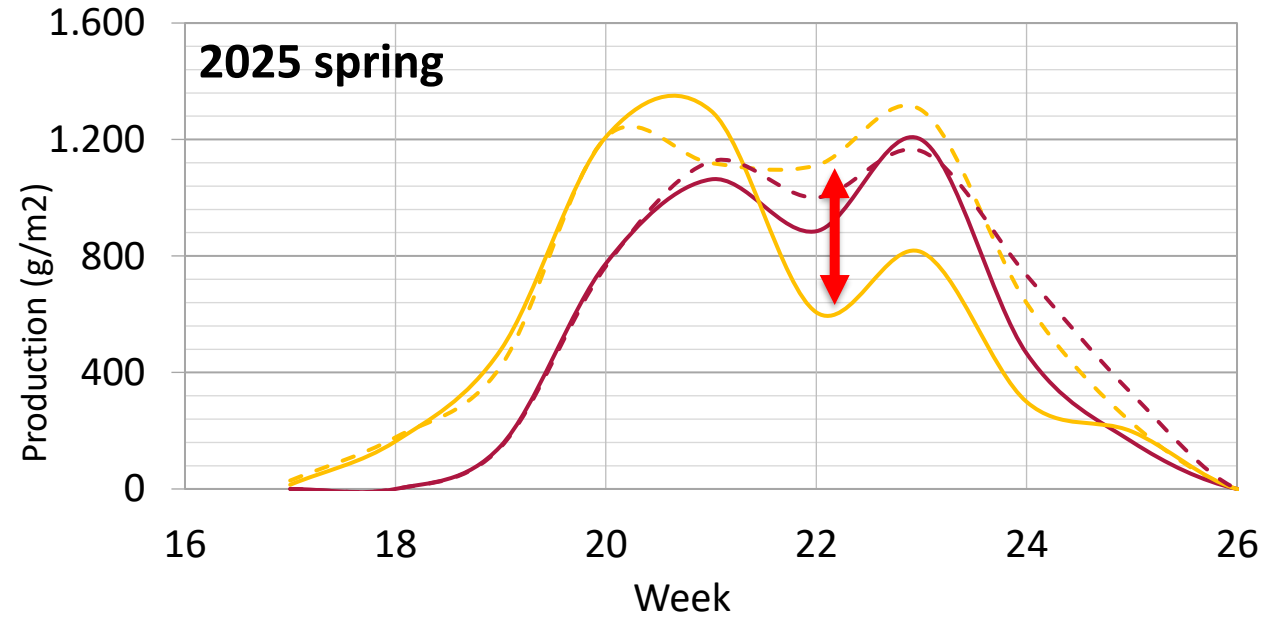
2025: 3,2 gas m^3/m^3





Von 60 cm Von 40 cm Sweet Royalla 40 cm Sweet Royalla 60 cm

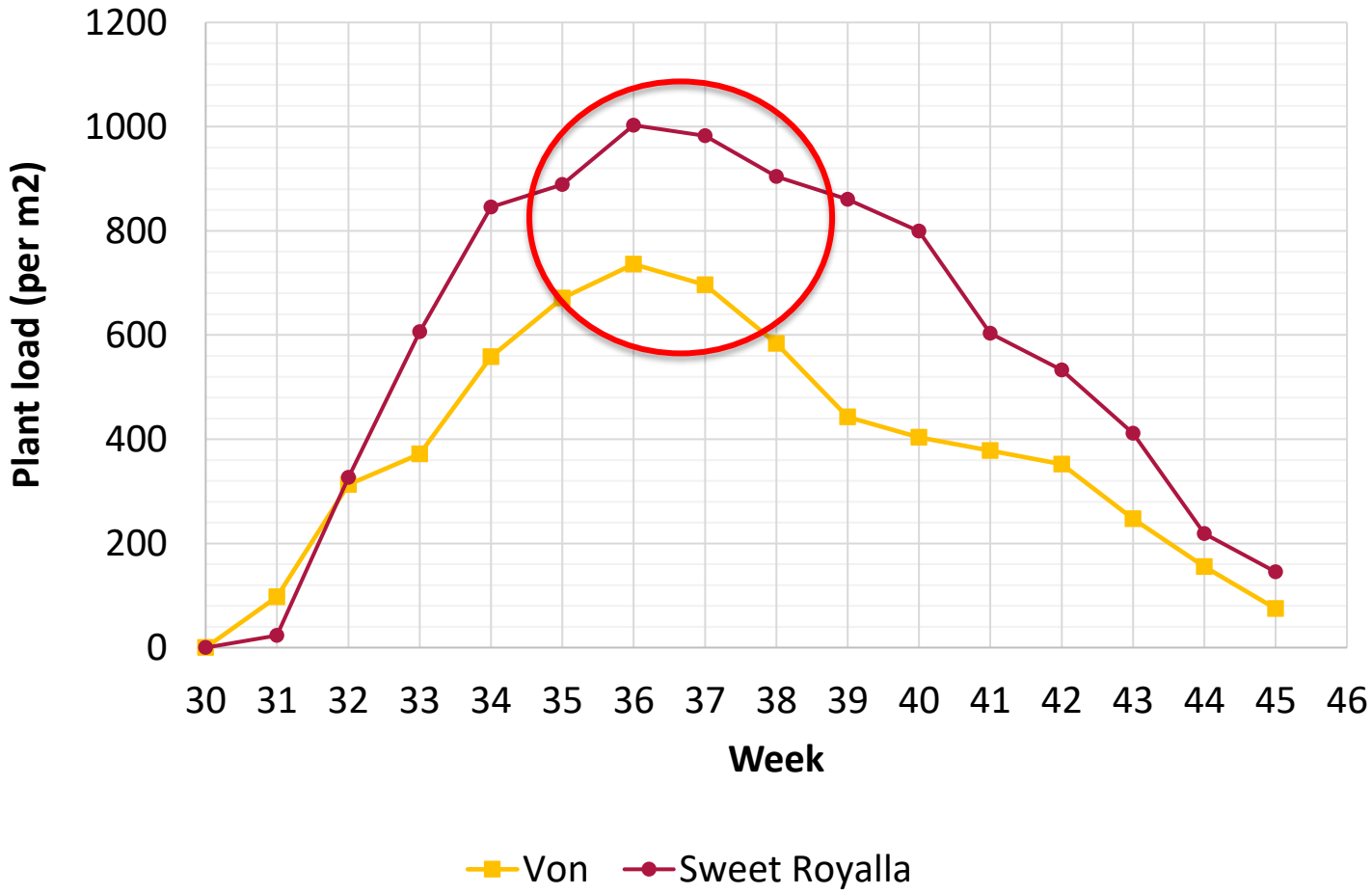




Blackberry has a huge assimilate demand

- Fruits continuously ripen from week 36 onwards
- Sugar demand is high
- While light levels are decreasing…

- Limited sugars available for latest fruit:
  - Low light levels
  - Competition
  - Crop respiration / maintenance



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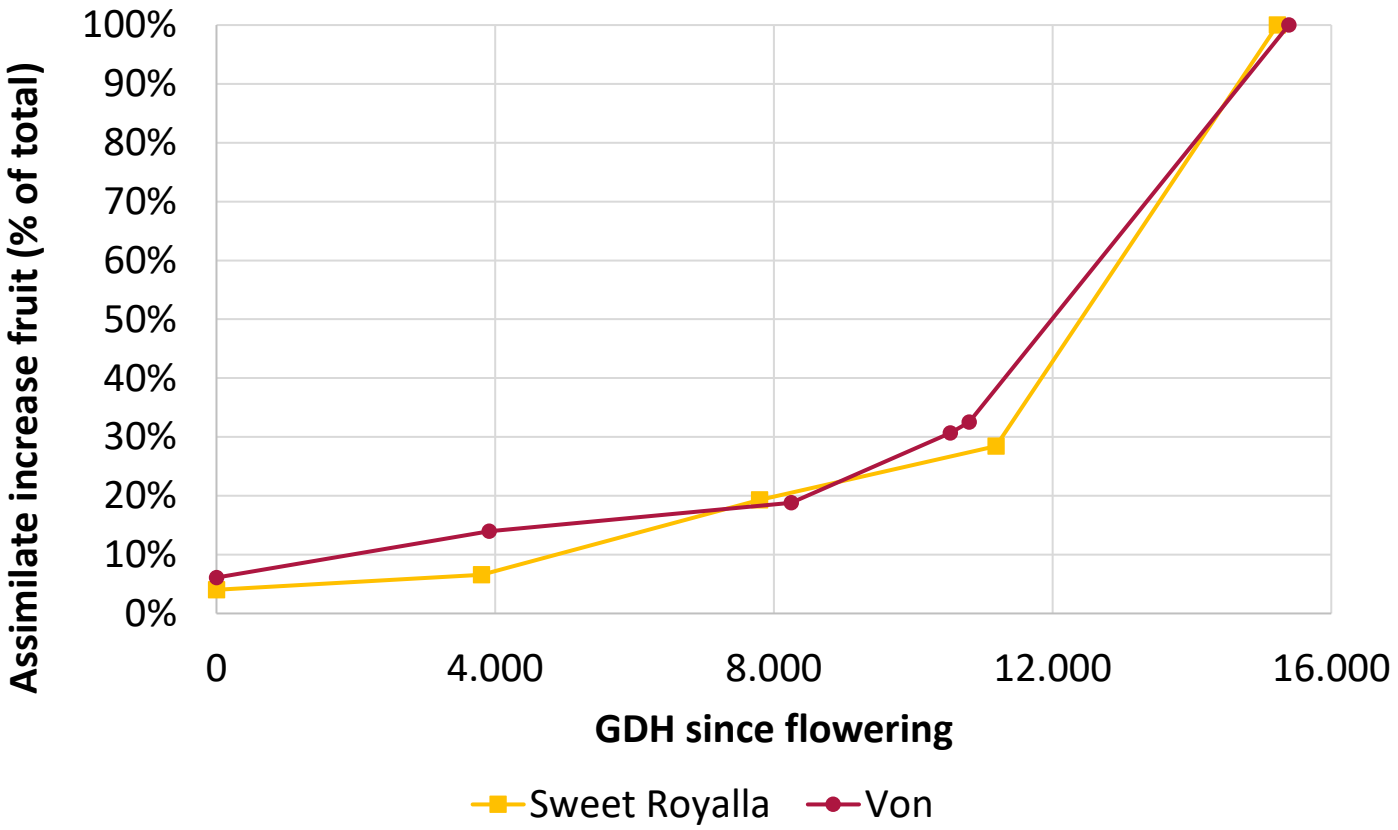
Fruit assimilate development

- Assimilate development of first top fruits
  - Fruits with limited competition
  - “ideal” ripening situation
- High assimilate increase during last ripening phase
- How does blackberry cope with this huge demand?



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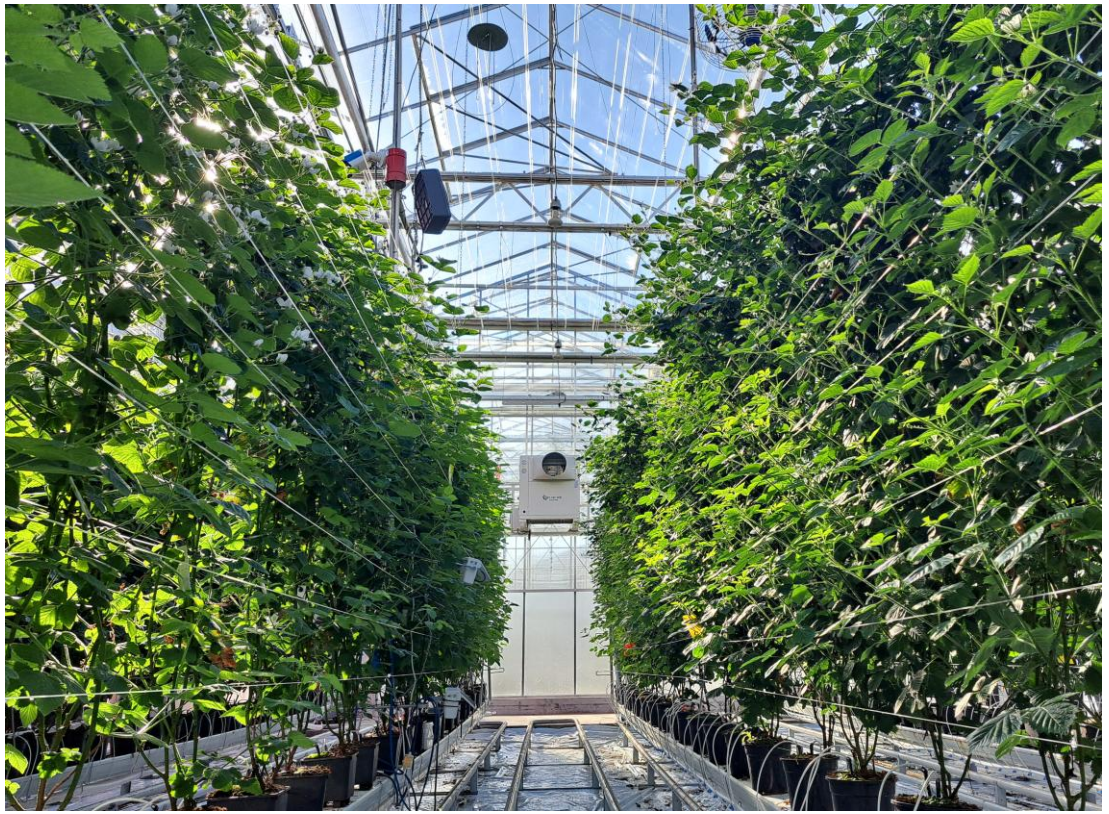
Assimilate balance calculation

- Based on crop and climate parameters an assimilate balance can be created
  - Such as leaf area, dry matter content fruits, light & CO_2 levels, temperature etc.
- This takes into account the production of assimilates by photosynthesis
- And the usage by the plant
  - Growth of leaves, branches, fruits, roots and maintenance respiration



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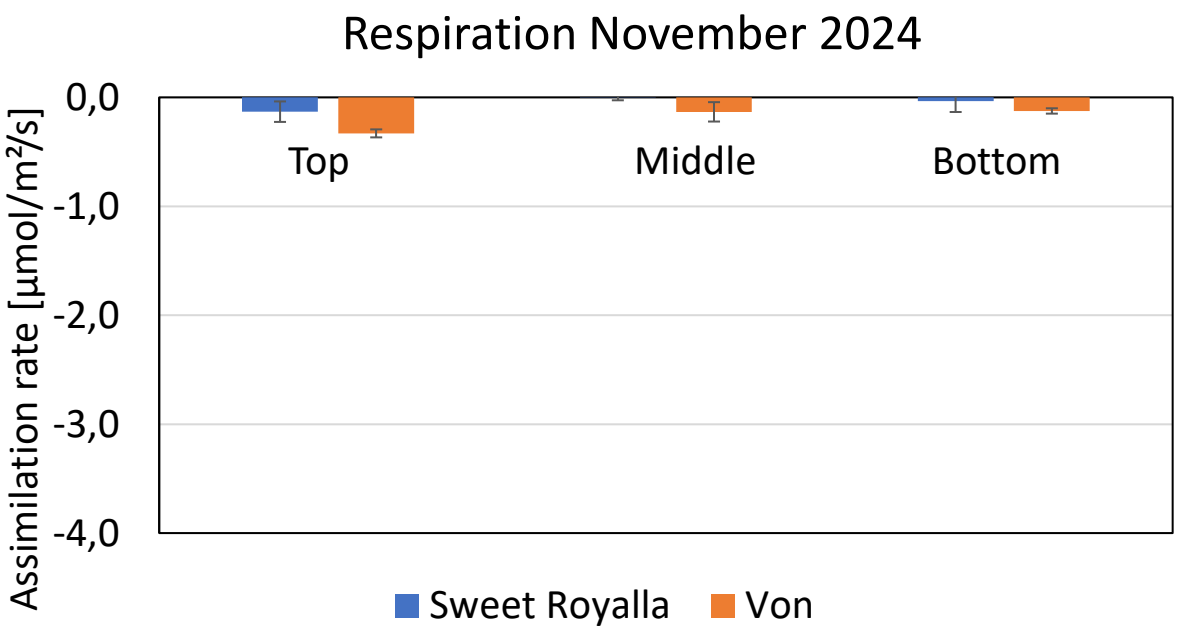
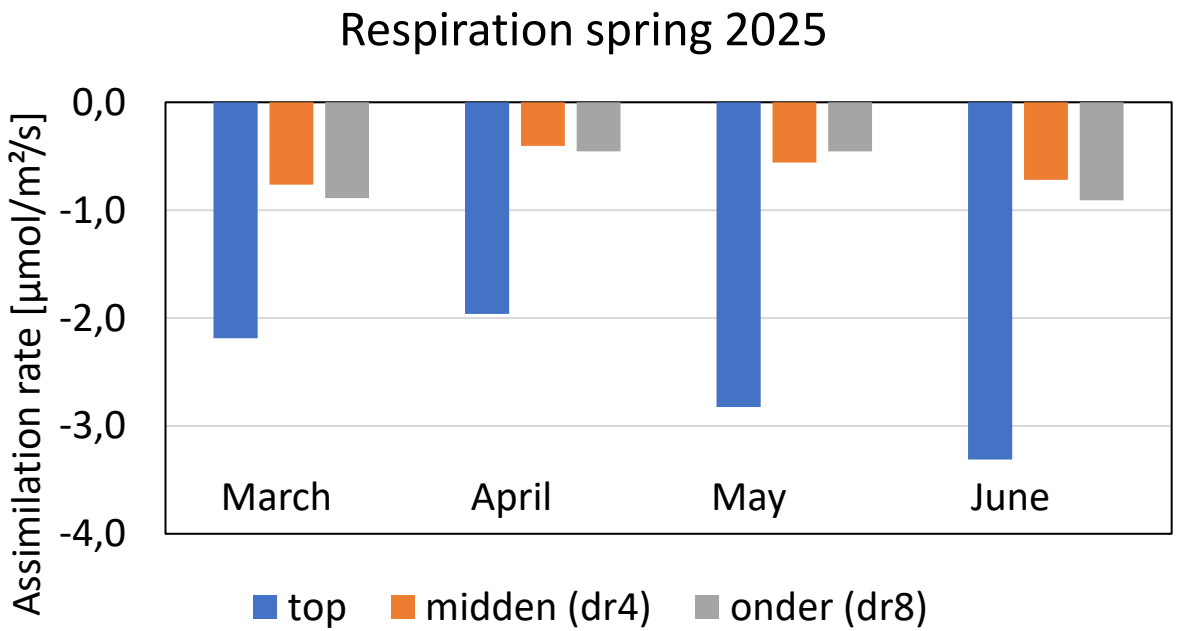
Maintenance respiration blackberry autumn and spring

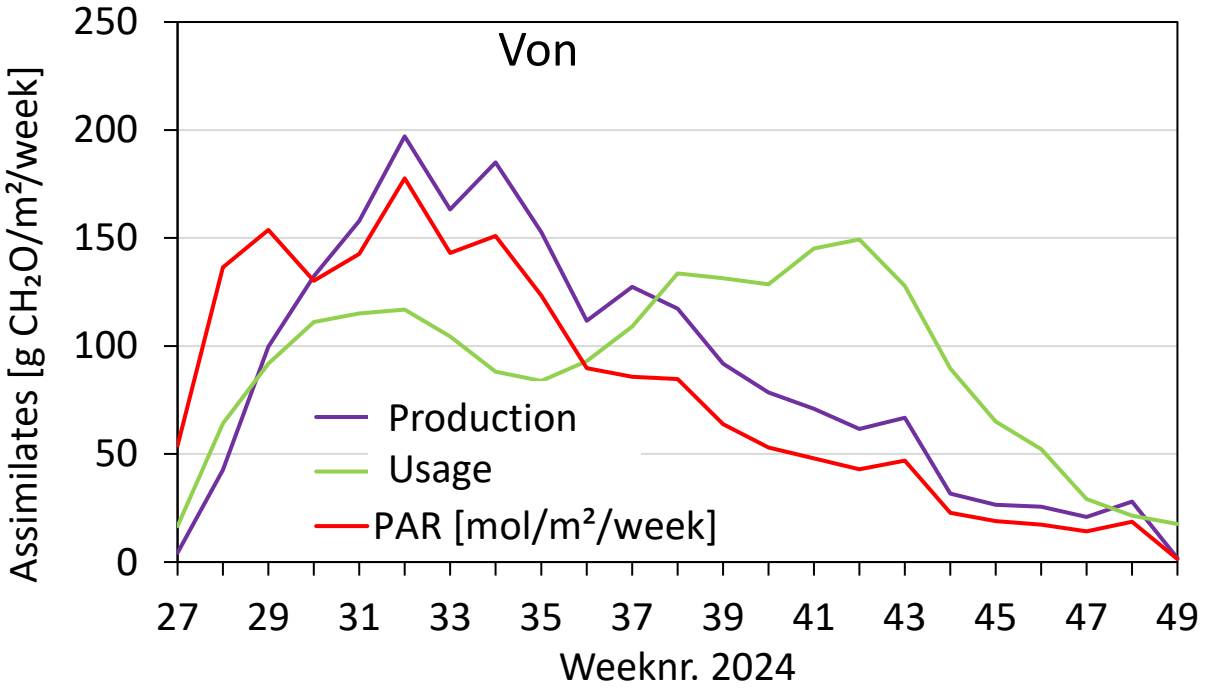
- Increasing respiration from March until June
- Much lower respiration in late autumn (November)

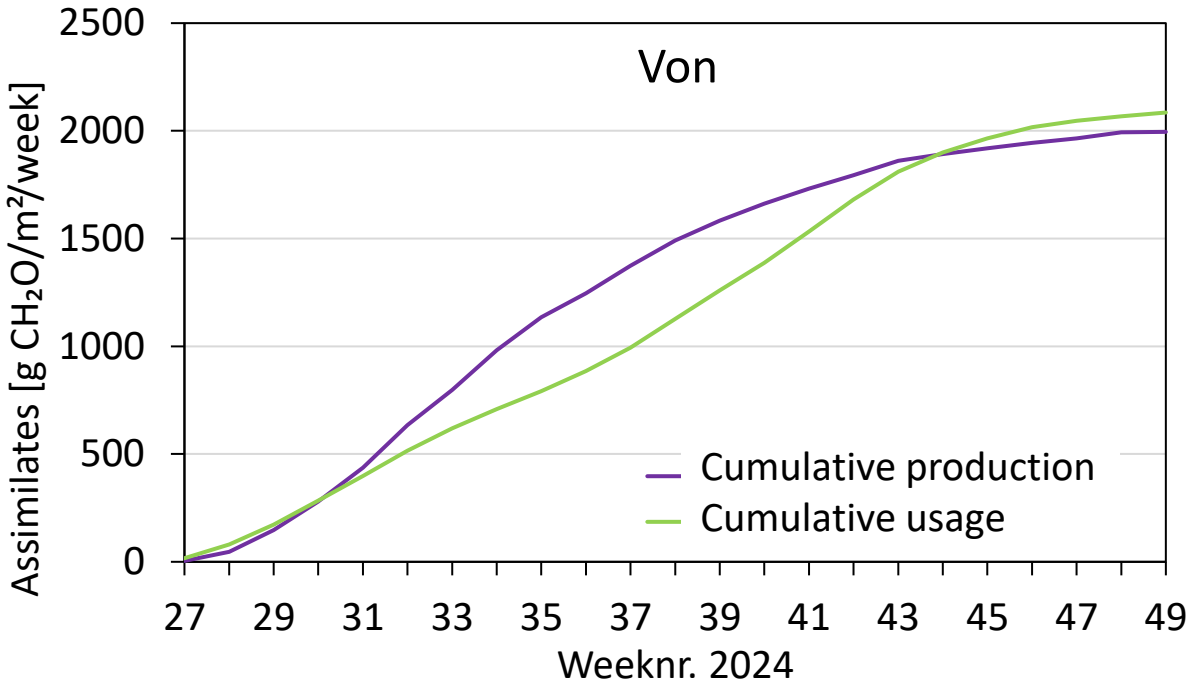
- Maintenance respiration is:
  - Temperature dependent
  - Probably also dependent on light levels: lower respiration on cloudy days compared to dark ones
  - Winter rest? (dormancy)
- **Such low respiration in autumn has a positive effect on nett assimilation**





Assimilate balance over time - autumn

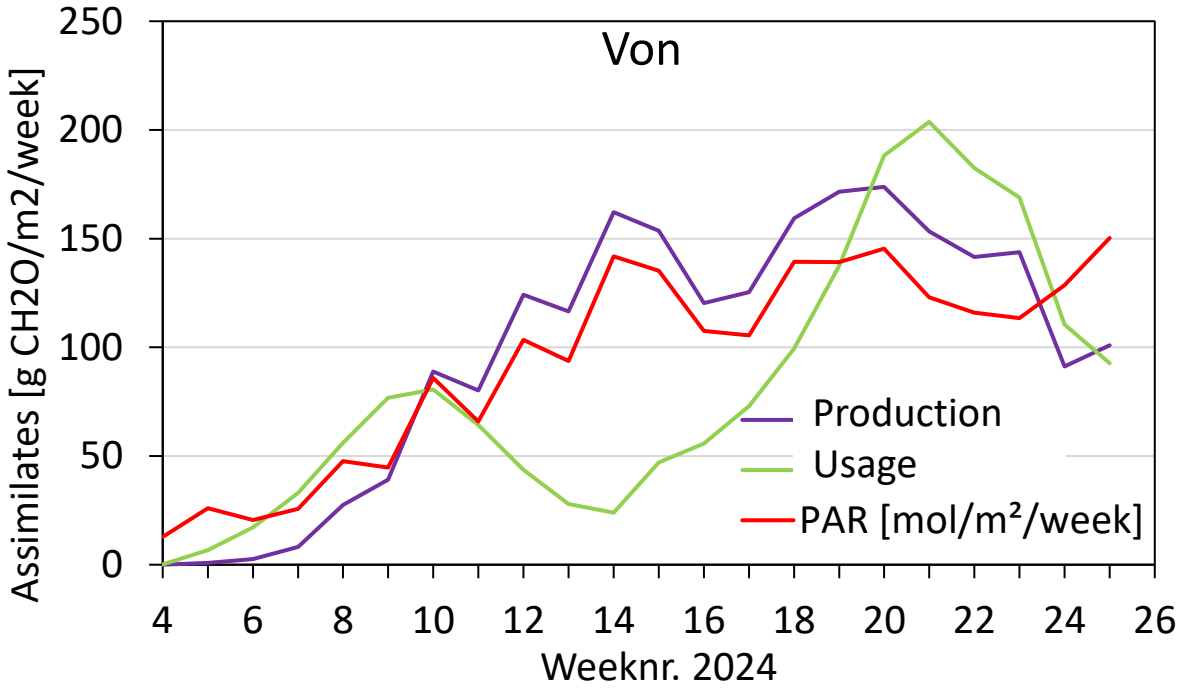


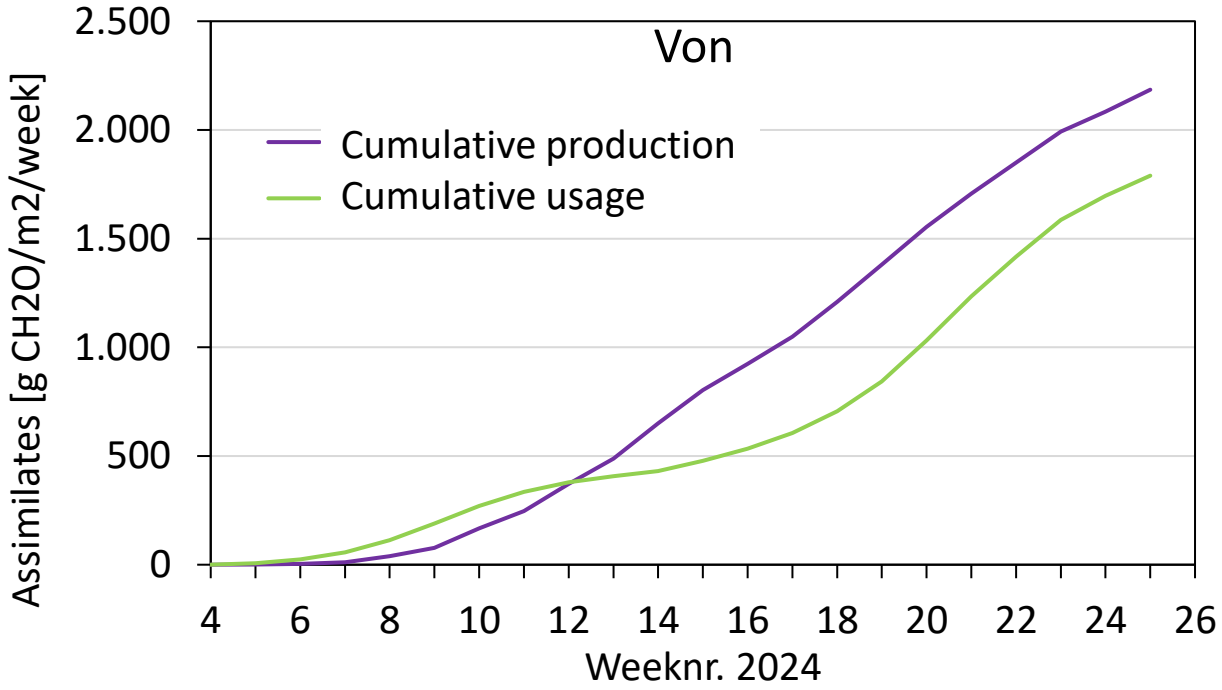


- Around week 32-38 a calculated assimilate surplus
- From week 39 onwards there is a calculated shortage of assimilates which should come from reserves
- Where are these reserves? Inside of the cane? Roots?
  - Something we could not answer yet…

Plant Lighting

Assimilate balance over time - spring





- Around week 12-19 large unused surplus *(22%)*
  - *More yield possible?*
  - Opportunity to save gas: Later planting date in combination with higher 24h temperature in this period

- From week 20-23 a *limited* shortage of assimilates which should come from reserves

How can we use this information?

- It appears that blackberry is capable of storing assimilates for later usage
  - Duration, amount, and location is still unknown
- Maintaining daily ratio of temperature and radiation (RTR) is not necessary
  - As long as there is a surplus first!
- So, RTR can more easily be used to accumulate growth degree hours

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Ratio of temperature and radiation - RTR

- Allows to plan a cultivation based on GDH
- Using 'free' energy to build up temperature
  - Test results from assimilate balance in spring

Autumn										
	Bud break & lateral outgrowth					Production				
Week	27	-	31	-	35	36	-	42	-	48
RTR	12°C + 0,3°C/mol					14°C + 3°C/mol				
GDH week	2.645		2.552		2.582	2.476		2.070		1.767
GDH Cum.	756		3.329		5.911	24.874		38.308		49.487

Spring										
	Bud break			Lateral outgrowth			Production			
	4	5	6	7	-	15	16	-	25	
RTR	12°C + 0,3°C/mol			12°C + 0,45°C/mol			14°C + 0,3°C/mol			
GDH week	1.033	1.495	1.564	1.785		2.733	2.727		2.971	
GDH Cum.	1.044	2.539	4.103	5.888		24.064	26.791		52.909	

Flowering: 12.500 GDH Start pick: 27.000 GDH End cultivation: 47.000 GDH

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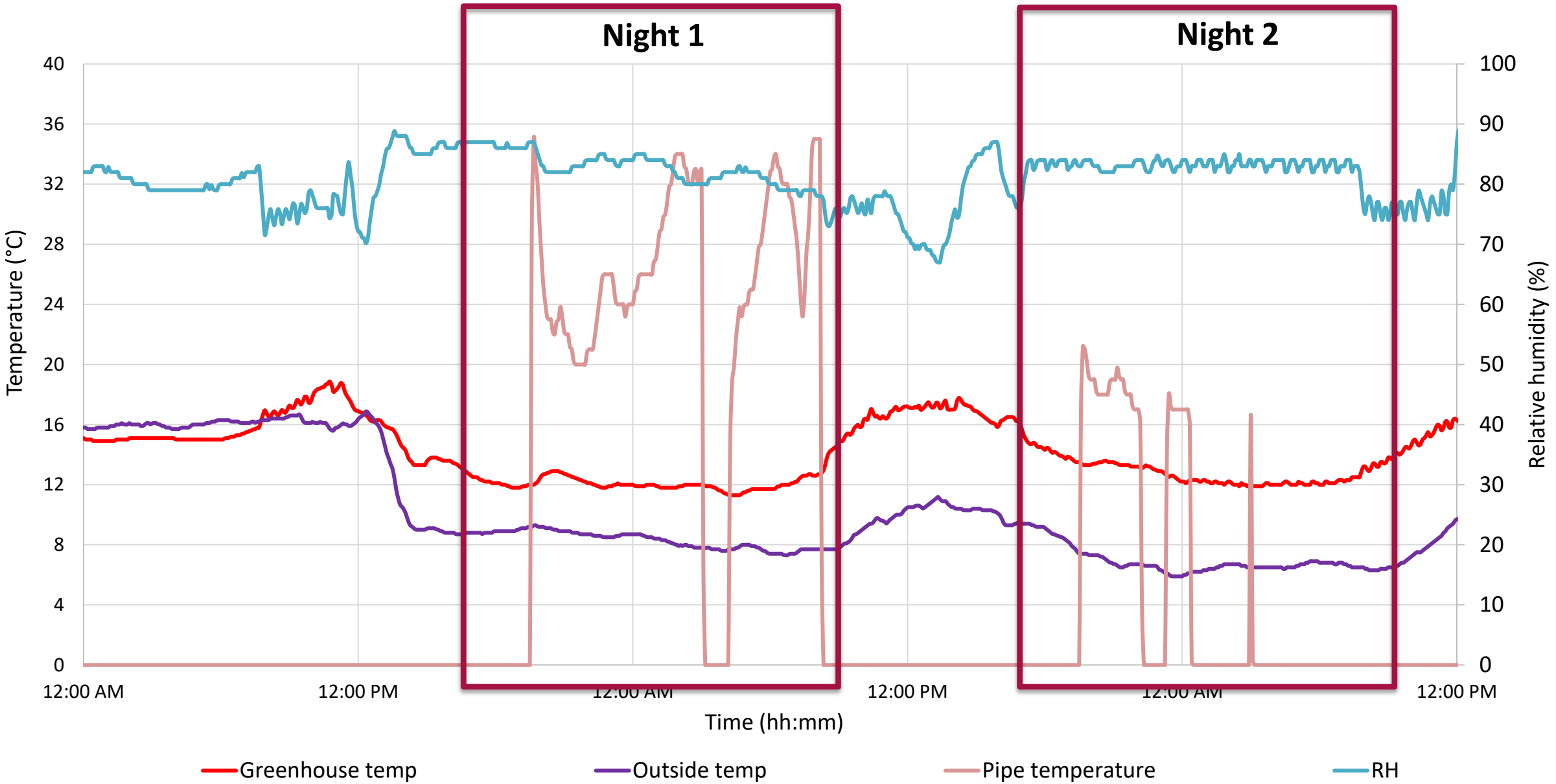
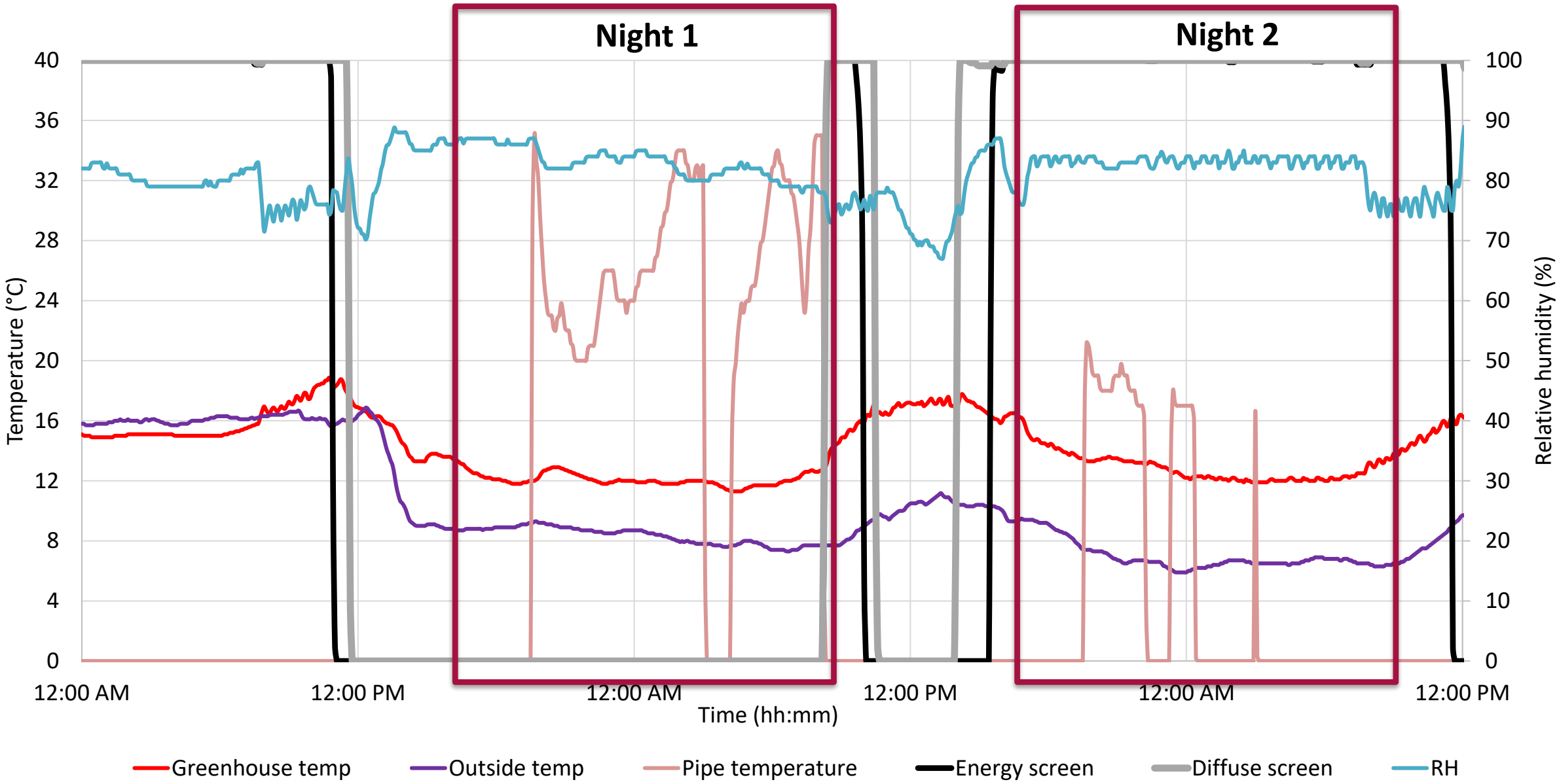
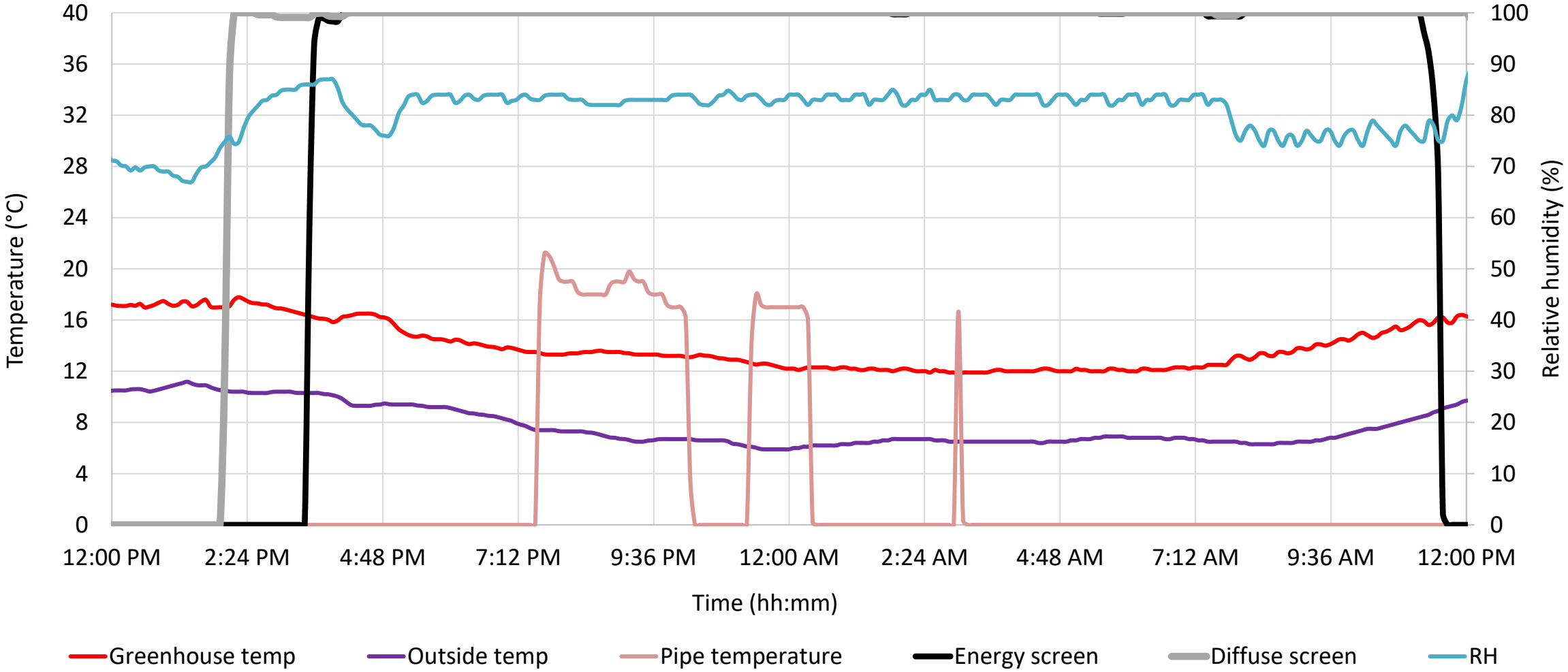
Two screens - insulation



Two screens – insulation



Night 2: insulation + dehumidification



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Conclusions

- **Climate control:**
- Maintaining active climate difficult during dark days, however necessary for quality!

- **Production summary**
- Plant distance:
  - Spring 1,37 plants/m^2
  - Autumn 0,92 plants/m^2
- 10 kg/m^2 achievable

- **Energy saving:**
- RTR good method to plan cultivation of blackberry
- Two screens improve insulation
- Dehumidification reduces energy losses + more control

A future proof concept is very much possible in blackberry!

Thank you for your attention!

Feel free to contact me for questions

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