Next generation growing Blackberry

What have we learned?

Worldwide Expertise for Food & Flowers

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Aim project

- Futureproof blackberry greenhouse cultivation
- Conditions
  - Market
  - Knowledge
  - Energy
- Learning goals:
  - Implement NGG → towards fossil-free
  - Insights in light stress, water stress & photosynthesis
  - Cultivation concept with smaller DIF and high humidity

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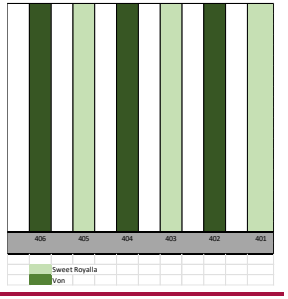
About the trial

- Two plantings: autumn and spring cultivation
- Plantdate autumn: 5 July 2023
- 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. 10 m^3 gas/m^2
  - Minimize CO_2 inputs



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Cultivation targets

- Cultivation
  - Optimising climate
    - RTR strategy
    - High pressure fogging system
  - Year production of 10kg/m^2
- Energy
  - Max. 10 m^3 gas per m2 per year:
    - Lowering peak usage
    - No minimum pipe temp.
    - Screening against outgoing radiation
  - Minimise CO_2 inputs:
    - Dosing on radiation
    - Lowering based on window opening
- Plant physiological
  - Insights in photosynthesis, light stress & water stress
  - Effect of smaller DIF

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Cultivation strategy

- Used to plan two croppings per year
- RTR driven
- PAR in greenhouse
- Steering for:
  - Max. photosynthesis
  - Opening of stomata

Week	Long-term J/cm2/dag	Long-term DLI/mol	RTR 12+3	RTR 12+4,5	RTR 14+3	Strategy	GDH week	GDH Cum.
27	1.907	27,3	**20,2**	24,3	22,2	RTR 12+3	1.505	1.505
28	1.808	25,9	**19,8**	23,6	21,8	RTR 12+3	2.563	4.069
29	1.821	26,0	**19,8**	23,7	21,8	RTR 12+3	2.572	6.641
30	1.790	25,6	19,7	**23,5**	21,7	RTR 12+4,5	3.195	9.837
31	1.780	25,5	19,6	**23,5**	21,6	RTR 12+4,5	3.184	13.021
32	1.703	24,4	19,3	**23,0**	21,3	RTR 12+4,5	3.101	16.122
33	1.609	23,0	18,9	**22,4**	20,9	RTR 12+4,5	3.000	19.122
34	1.453	20,8	18,2	**21,3**	20,2	RTR 12+4,5	2.831	21.953
35	1.320	18,9	17,7	**20,5**	19,7	RTR 12+4,5	2.688	24.640
36	1.212	17,3	17,2	19,8	**19,2**	RTR 14+3	2.469	27.110
37	1.145	16,4	16,9	19,4	**18,9**	RTR 14+3	2.421	29.531
38	1.087	15,5	16,7	19,0	**18,7**	RTR 14+3	2.379	31.910
39	921	13,2	16,0	17,9	**18,0**	RTR 14+3	2.260	34.170
40	793	11,3	15,4	17,1	**17,4**	RTR 14+3	2.167	36.338
41	716	10,2	15,1	16,6	**17,1**	RTR 14+3	2.112	38.449
42	653	9,3	14,8	16,2	**16,8**	RTR 14+3	2.066	40.516
43	527	7,5	14,3	15,4	**16,3**	RTR 14+3	1.976	42.492
44	476	6,8	14,0	15,1	**16,0**	RTR 14+3	1.939	44.431
45	381	5,4	13,6	14,4	**15,6**	RTR 14+3	1.870	46.302
46	323	4,6	13,4	14,1	**15,4**	RTR 14+3	1.829	48.131
47	264	3,8	13,1	13,7	**15,1**	RTR 14+3	1.786	49.917
48	236	3,4	13,0	13,5	**15,0**	RTR 14+3	1.766	51.683
49	206	3,0	12,9	13,3	**14,9**	RTR 14+3	1.745	53.428
50	198	2,8	12,8	13,3	**14,8**	RTR 14+3	1.739	55.166
51	180	2,6	12,8	13,2	**14,8**	RTR 14+3	1.725	56.892
52	176	2,5	12,8	13,1	**14,8**	RTR 14+3	1.723	58.615

1 mol =	46,5	J/cm2
Meteo > gh	67%	Transmission
Plant date	5-7-2023	27 3
Start flowering	31	Week
Start harvest	37	Week
End harvest	49	Week

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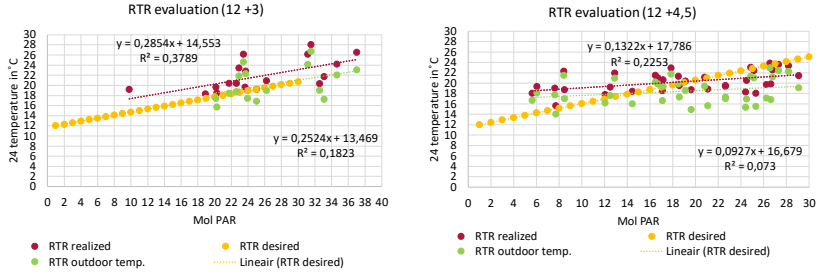
Energy: RTR evaluation



- 12+3: realised RTR too high
- 12 +4,5: desired avg. 20,5 – realised avg. 20,3 → overall, good

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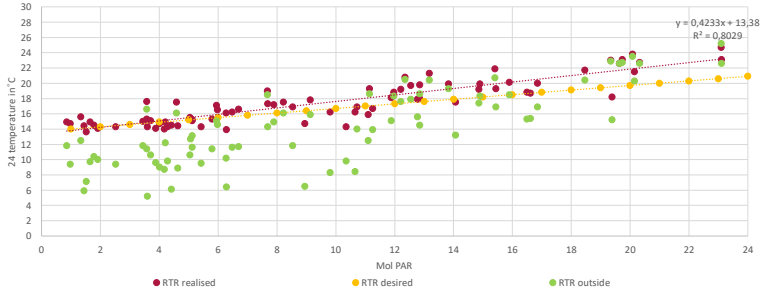
Energy: RTR evaluation 14+3



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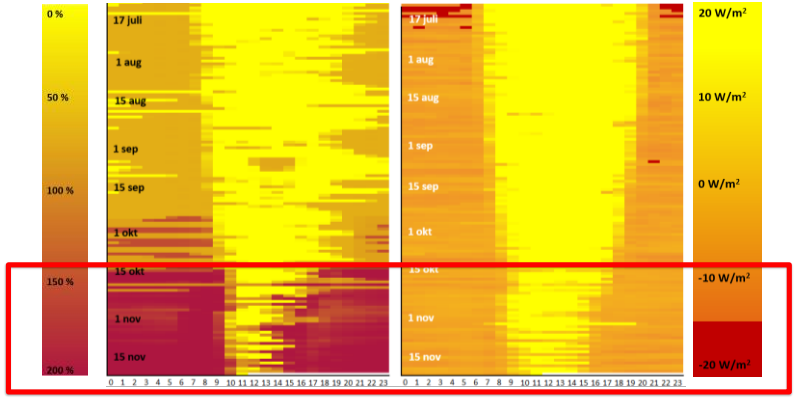
Screen closure

Nett radiation



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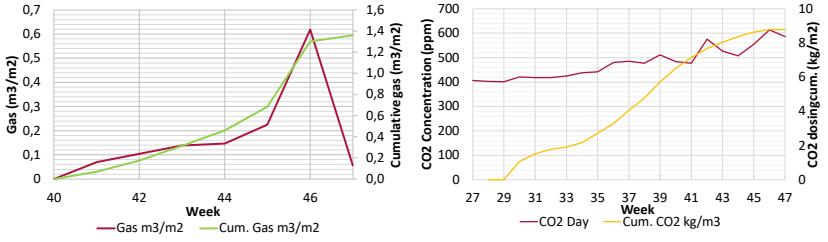
Energy: Gas and CO2 usage



- 1,4 m^3 gas/m^2, but autumn was relatively warm

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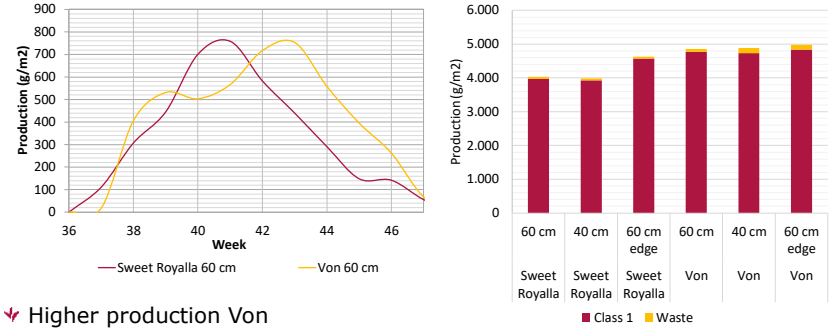
Productions



- Higher production Von
- Edge rows show higher productions! → more potential

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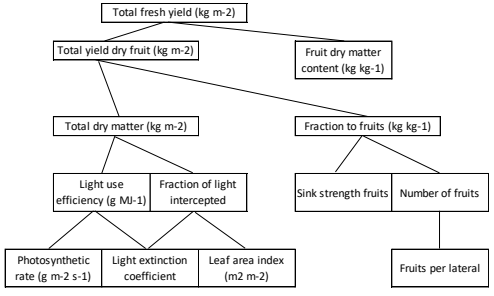
Why differences in yield?



Source: adapted from (Heuvelink et al, 1995)

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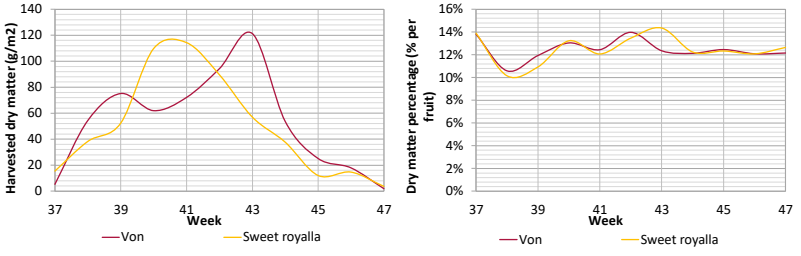
Dry matter production fruits



- Von has a greater spread in harvested dry matter
- No difference in fruit dry matter content, both 12%

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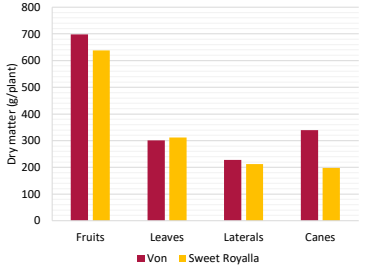
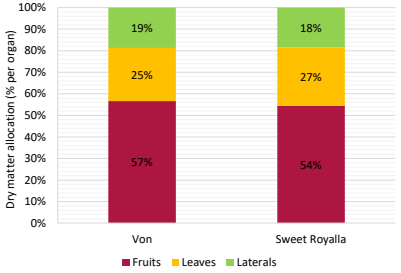
Dry matter allocation





- Higher total dry matter production for Von (excl. canes)
- Von → 3% more allocated to fruits than SR
- Von → 2% less allocated to leaves than SR

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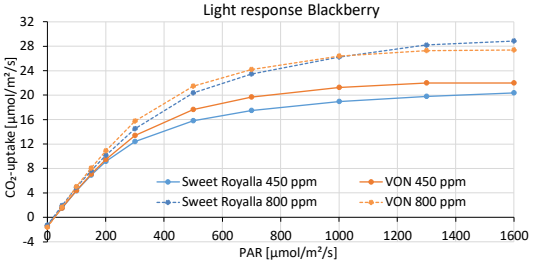
Leaf photosynthesis

- Light saturation at ±1000 µmol/m²/s
- 20-30% gain from 450 to 800 ppm
- At ambient CO_2, 8% higher CO2-uptake



Source: Plant Lighting

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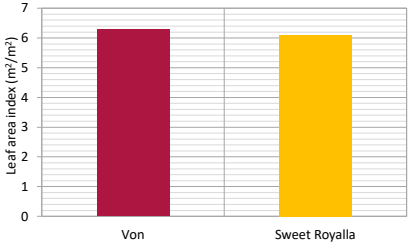
Leaf area index

- Both varieties have a high LAI
- Royalla invested more dry matter into leaves, but 3% lower leaf area

→ Thicker leaves SR



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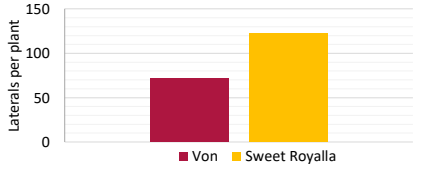
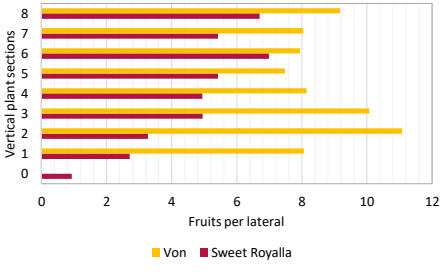
Flowering and laterals

- SR 70% more laterals
- Von higher number of fruits per lateral

High fruit number per lateral

→ Spread of peak sugar demand





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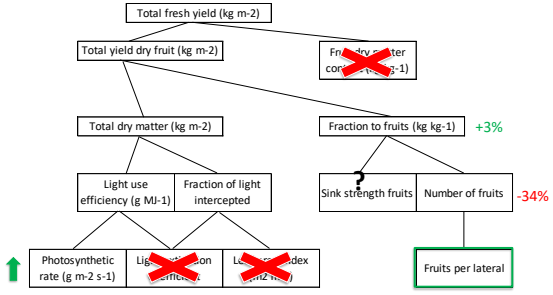
Why differences in yield?



Source: adapted from (Heuvelink et al, 1995)

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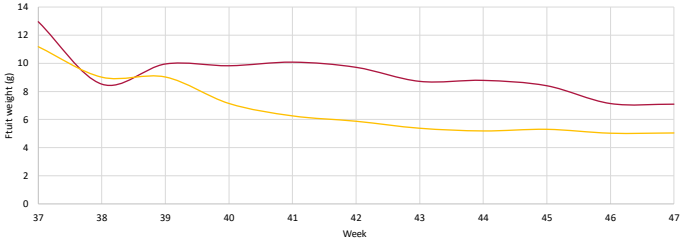
Fruit quality: average fruit weight



- Sweet Royalla decreases quickly to 6 gram
- Von long time around 9-10 gram, except last weeks

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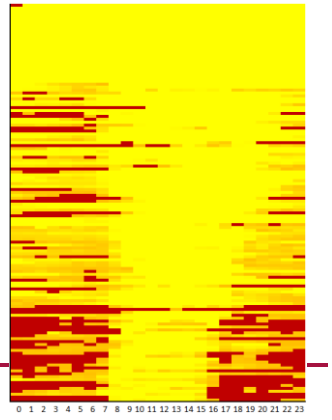
Fruit quality

- Fruit quality decreased at the end of cultivation
- High RH & low night temp caused condensation risk

→ post-harvest mould on fruits

Plant temperature – dew point temperature



Red colour is when difference is lower than 1°C →

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Conclusions

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- **Energy**
  - RTR good method to plan cultivation of blackberry
  - Two screens reduce nett heat loss effectively
  - RTR and screening reduce heating requirement
- **Productions**
  - Both varieties 4 kg/m^2
  - Edge rows higher yield → more potential
- **Fruit quality**
  - High RH and low temp → post-harvest quality decrease Von
  - Small fruits Royalla

→ **Generative plant to:**

- **Increase flowers per lateral → spread sugar demand**
- **Reduce LAI and decrease transpiration → fruit quality**

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Thank you for your attention!

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