

D3.1

Delivery of standard operating procedure for all analytical approaches with respect to fruit quality and composition and sensory parameters (P1, P3, P10, P14, P15).



EUBERRY: Grant agreement no. EU FP7 KBBE - 2010 - 4 265942

Variation of Volatile Patterns and Sensory Traits of Raspberries (*Rubus idaeus* L.) as Influenced by Cultivar, Harvest Date and Cultivation Technique

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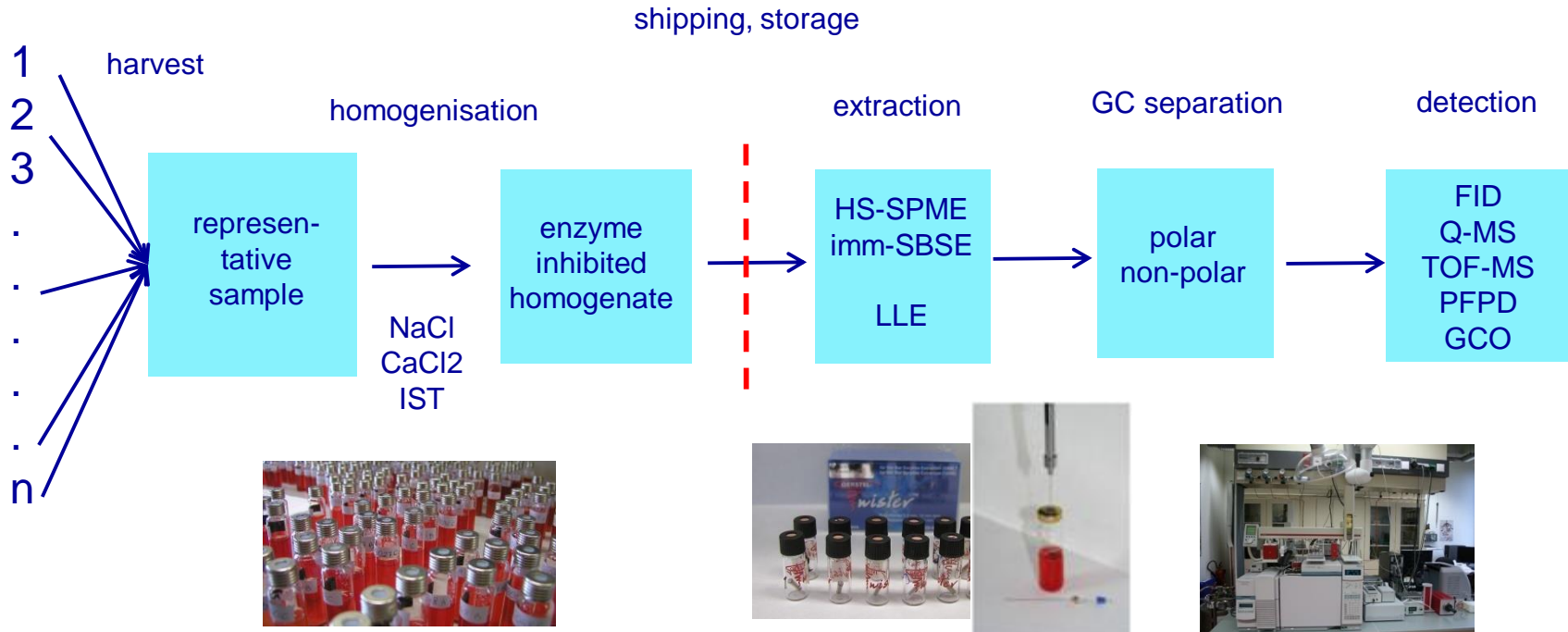
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Semiquantification of VOCs in berries



Data processing: **non-targeted** approach using the software CHROMStat 2.6 by Analyt (Müllheim, Germany)

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Raspberry - Sensory Evaluation

Judge:
Date:

Sample no:

091

	low							high
raspberry odour	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	low ¹			5				high ⁹
untypical odour	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	low ¹			5				high ⁹
sweet taste	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	low ¹			5				high ⁹
sour taste	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	low ¹			5				high ⁹
harmonic taste	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	low ¹			5				high ⁹
raspberry aroma	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	low ¹			5				high ⁹
green/grassy aroma	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	low ¹			5				high ⁹
other fruity aroma	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	low ¹			5				high ⁹
untypical aroma	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	low ¹			5				high ⁹
juiciness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	low ¹			5				high ⁹
firmness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1			5				9
acceptance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1	2	3	4	5	6	7	8

Comments:

Methods

Sensory evaluation of raspberries

smell (pronasal)

taste

aroma (retronasal)

flavour

mouth feeling

acceptance (hedonic)

- Scientific aim:

Study of influence of protected cultivation on aroma patterns using different plastic material



Photo: University Geisenheim

-Material and methods:

Location: Experimental field at University Geisenheim, Germany

Cultivars: Glen Ample and Tulameen

Testing facility: Long-cane plants cultivated in containers.

Treatments: i) open field (control), ii) UV-B blocking plastic, iii) UV-B window plastic

Experimental design:

2 cultivars x 3 treatments x 2 harvest dates x 3 agronomical repetitions x 2 analytical repetitions

-Material and methods:

Analysis of raspberry volatiles (VOCs) by Headspace-SPME-GC-FID and -MS

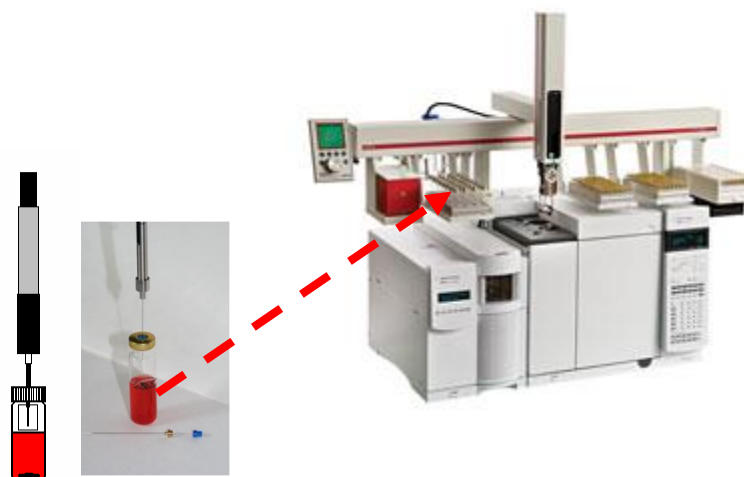
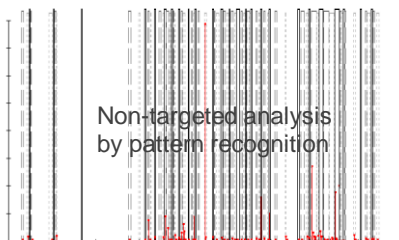
10 mL enzyme inhibited strawberry juice in 20 mL headspace vials
100 μ m PDMS SPME fiber (Supelco 57300-U)

MPS2 autosampler

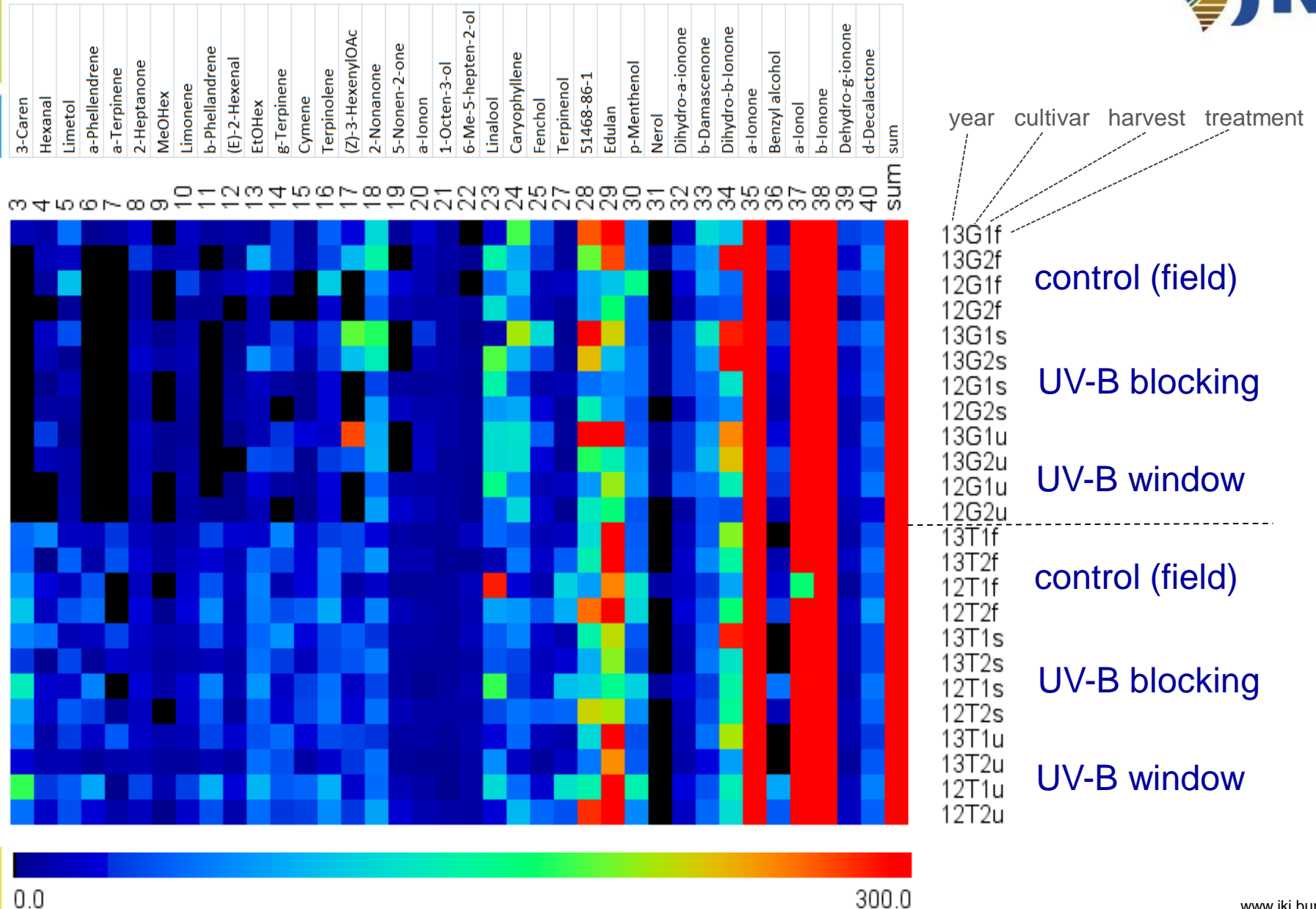
Agilent 6890N GC with FID for semi-quantification

Agilent 6890N GC with 5975B qMS and Agilent 7890A GC with Waters TOFMS Premier for substance identification

Data processing with CHROMStat2.6



Heat map of 38 VOCs in dependence of year & cultivar & harvest & treatment



ANOVA separately for two harvest years

Factors: cultivar & harvest & treatment



Influence of cultivation factor on metabolite patterns:

- 2012: cultivar > harvest > treatment (significant differences in VOC concentrations: 30 > 24 > 11)
- 2013: cultivar > harvest > treatment (significant differences in VOC concentrations: 30 > 21 > 14)

Influence of cultivation factor on single metabolites:

- Cultivar: Tulameen shows higher concentrations especially of monoterpenoids like
 - 3-Carene sweet citrus
 - α -Phellandrene citrus, terpenic
 - α -Terpinene terpenic, citrus
 - β -Phellandrene mint, terpenic
 - Unknown (Benzopyran) floral, rose-like, passion fruit (GCO)
- Cover treatment: No uniform trend on 38 VOCs between open field and covered cultivation
 - Higher at UV-B window plastic:
 - Unknown (Benzopyran) floral, rose-like, passion fruit (GCO)

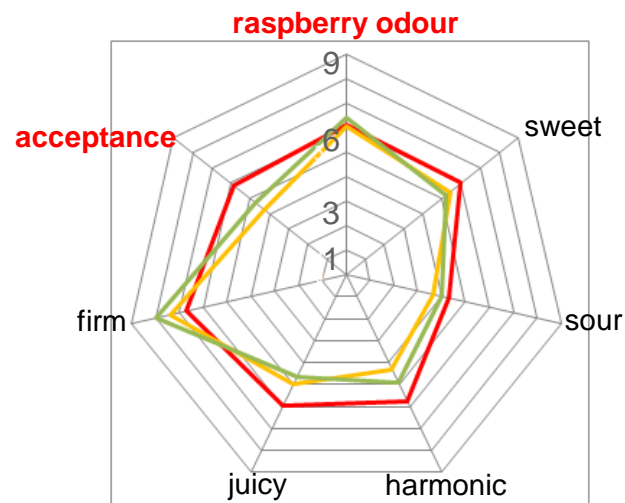
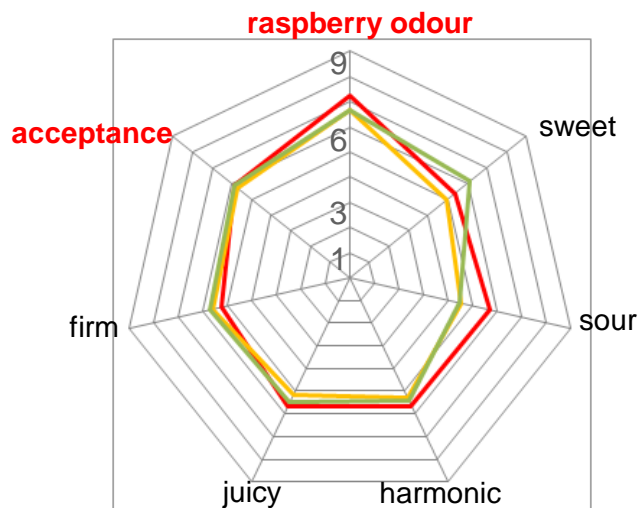
Sensory analysis – influence of cover material



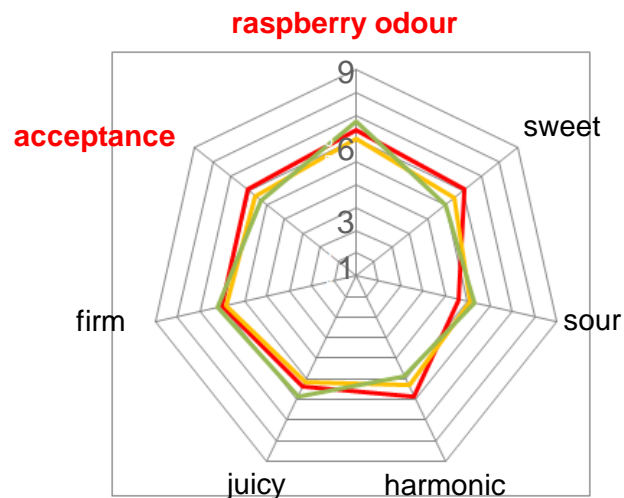
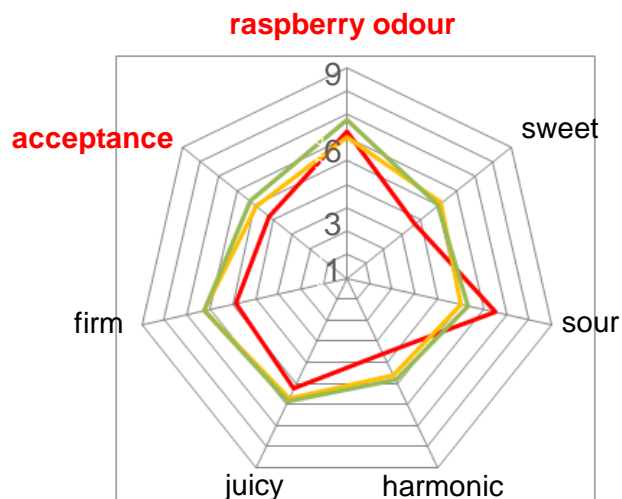
harvest begin

harvest end

Glen Ample



Tulameen



— open field

— UV-B blocking

— UV-B window

Harvest year 2012, trained sensory panel, 9-point scale, samples N = 12

Correlation analysis for the harvest year 2012 using Statistica7.1
Red labelled Pearson coefficients are significant for $p < 0.05$, $N = 12$

	odor	sweet	sour	harmonic	juicy	firm	acceptance
odor	1.00						
sweet	0.12	1.00					
sour	0.20	-0.67	1.00				
harmonic	0.40	0.84	-0.37	1.00			
juicy	0.11	0.03	0.36	0.13	1.00		
firm	-0.34	0.26	-0.77	-0.03	-0.32	1.00	
acceptance	0.45	0.72	-0.14	0.95	0.28	-0.31	1.00
Limetol	0.64						0.42
1-Octen-3-ol	-0.68						-0.09
β -Damascenone	0.80						0.44
α -Ionol	0.65						0.47
Dehydro- γ -ionone	0.85						0.53

Conclusions

- Headspace-SPME-GC is suitable for semi-quantification of raspberry VOC patterns.
- The investigated parameters cultivar , harvest and cover treatment influence the VOC pattern in the rank:
cultivar > harvest date > treatment
- **Plastic cover influences the sensory quality of the berries. Plastic cover influences raspberry odour but not the acceptance .**
- The differences between UV-B blocking and UV-B window material are marginal.
- A so far unidentified compound (benzopyran?) with floral, rose-like and passion fruit-like odour is enhanced by the covered cultivation.

