Interreg
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BALTIC CIDER

Knowledge-driven Baltic Cider Production and Branding for Growth and Competitiveness of SMEs.

Polli Horticultural Research Centre

Estonian University of Life Sciences

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Yeast assimilable (available) nitrogen (YAN)

- **Organic nitrogen** is typically discussed as the **free amino nitrogen (FAN)** fraction of **yeast assimilable nitrogen (YAN)** YAN consists of:

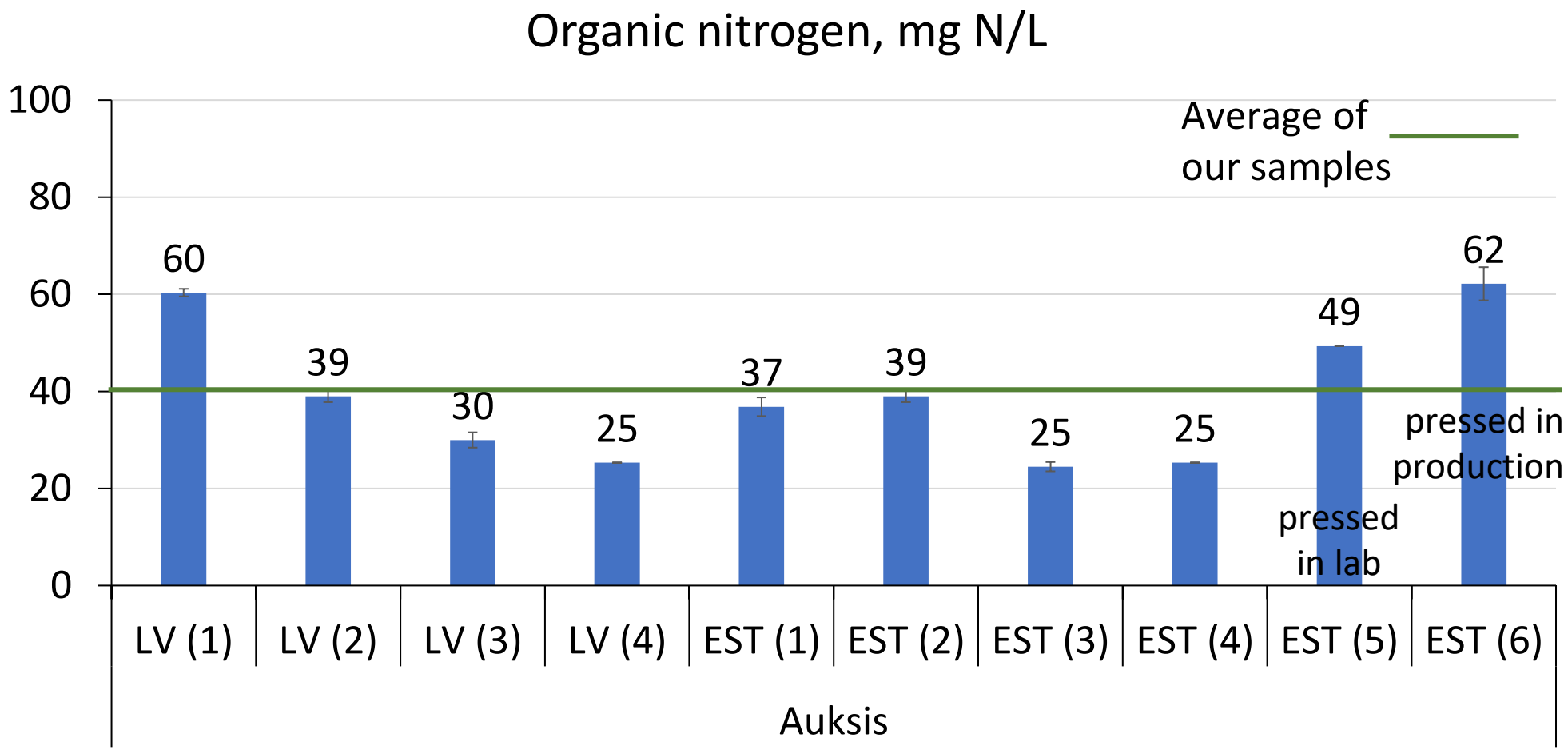
1. **Organic nitrogen:** free amino acids and small peptides (FAN)
2. **Inorganic nitrogen:** ammonium (NH_4^+)

- The organic fraction is often more important than ammonium because it directly influences yeast growth, fermentation kinetics, sulfur off-aroma formation, and aroma synthesis.

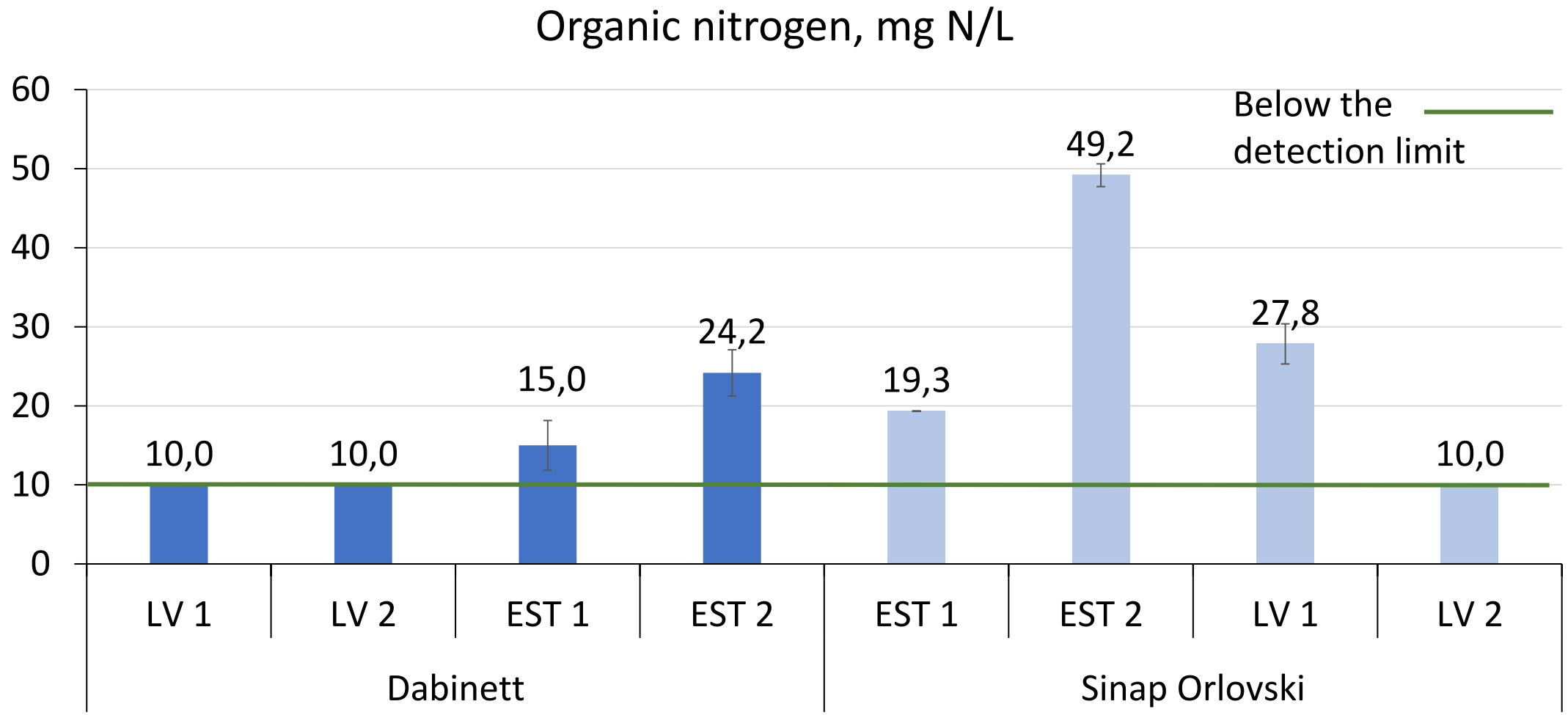
CiderLab

Portable cider/ wine analyser

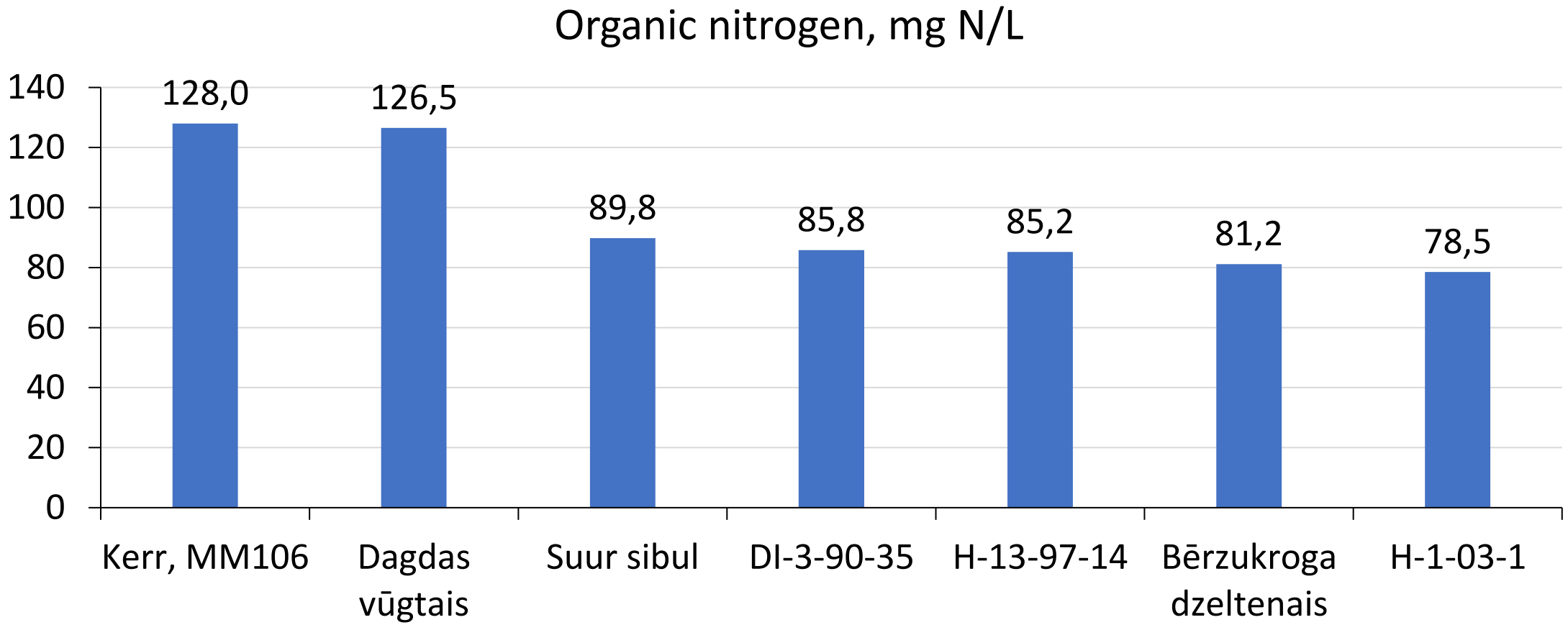
- Alcohol by Volume (ABV)
- Fermentable sugars
- **Free sulfur dioxide (SO_2)**
- **Total sulfur dioxide (SO_2)**
- **Yeast Assimilable Nitrogen (YAN)**
- Total Polyphenols Index
- Glycerol
- **Tannins**
- Total Acidity
- L-Malic acid
- L-Lactic acid
- Citric Acid
- Acetic acid
- pH



- Adjustment of YAN content before fermentation is often used in cider production to compensate for nitrogen deficiency and avoid sluggish fermentations (Rosend, 2021).



- Nitrogen-deficient apple juice frequently leads to elevated H_2S formation causing "rotten egg" aroma.



- Adjustment of YAN up to 80 mg N/L has been used for better fermentation (Rosend, 2021).

Cider analysis

Based on spectroscopy (FT-IR) analysis

Producer	Cider	Total acid	Total sugar	Alcohol
Aga Sideri, Norway	**Lagmann**	6,3	29,9	6,8
Abuls Cidery, LV	Kerr Sauss	5,0	2,9	8,9
Herbsts, LV	With nr	5,7	7,3	6,2
Lauskis winery, LV	Abolu Sidrs L	5,7	10,3	5,3
Mr. Plūme Cidery, LV	Lietuvas Pepins	8,5	4,2	8,0
Mūrbūdu Sidrs, LV	Mezabolu Rose	9,5	23,7	5,3
	Lio	6,4	2,9	5,3
Pienjāņi, SIA, LV	Biologisks Sidrs	5,4	3,1	8,3
Sabiles Sidrs , LV	KS1-24	5,6	2,7	10,8
Tālava Cider, LV	Abolu Sidrs Sausais	5,9	24,3	5,9
Tori, EST	Auksis	5,4	1,8	6,9
	Talvenauding	6,9	1,9	6,3
Jaanihanso	Auksis 2024	4,3	2,9	8,2
	Liivika 2024	3,8	20,9	6,8
Kloostrimetsa	Segu 2024	5,4	2,0	6,4

Based on American Cider Association (ACA)

Category	Residual sugar (g/L)
Dry	0–9 g/L
Semi-dry	>9–18 g/L
Semi-sweet	>18–35 g/L
Sweet	>35 g/L

Acid profile of ciders

Producer	Cider	Acetic acid, g/ L	Citric acid, g/ L	Lactic Acid, g/ L	Malic acid, g/ L	Tartaric acid, g/ L
Aga Sideri, Norway	**Lagmann**	0,4	0,3	0,8	4,0	0,8
Abuls Cidery, LV	Kerr Sauss	0,4	0,5	1,1	2,6	0,6
Herbsts, LV	With nr	0,5	0,6	2,6	1,5	0,8
Lauskis winery, LV	Abolu Sidrs L	0,7	0,6	2,4	1,1	0,9
Mr. Plūme Cidery, LV	Lietuvas Pepins	0,6	0,0	0,0	7,3	1,2
Mūrbūdu Sidrs, LV	Mezabolu Rose	0,7	0,5	0,0	7,2	1,2
	Lio	0,4	0,7	0,5	3,5	0,8
Pienjāņi, SIA, LV	Biologisks Sidrs	0,5	0,2	0,0	3,7	0,9
Sabiles Sidrs , LV	KS1-24	0,4	0,7	0,0	4,1	0,5
Tālava Cider, LV	Abolu Sidrs Sausais	0,9	0,4	4,4	0,8	0,8
Tori, EST	Auksis	0,4	0,5	2,6	0,3	1,3
	Talvenauding	0,4	0,7	1,5	3,6	0,8
Jaanihanso	Auksis 2024	0,5	0,5	3,1	0,1	0,8
	Liivika 2024	0,3	0,8	2,4	0,0	0,8
Kloostrimetsa	Segu 2024	0,9	0,3	2,7	0,8	0,6

Malolactic fermentation (MLF) status

Observation	Interpretation
High malic, low lactic	No MLF
Low malic, high lactic	MLF occurred
Intermediate values	Partial MLF

Lactic and acetic acids are often indicators of microbial transformations occurring during or after fermentation.

Sensory impact

Malic acid contributes:

- sharp acidity,
- green apple character,
- freshness.

Tartaric acid in apples is naturally very low.

What each acid primarily tells you in finished cider?

Acid	Main interpretation
Malic	Apple acidity; MLF status; cultivar characteristics
Lactic	Extent of malolactic fermentation; bacterial activity
Acetic	Fermentation quality; volatile acidity; spoilage risk
Citric	Minor natural acid; possible acidification; bacterial metabolism
Tartaric	Often indicates acid addition or non-apple inputs

Glycerol and profile of sugars

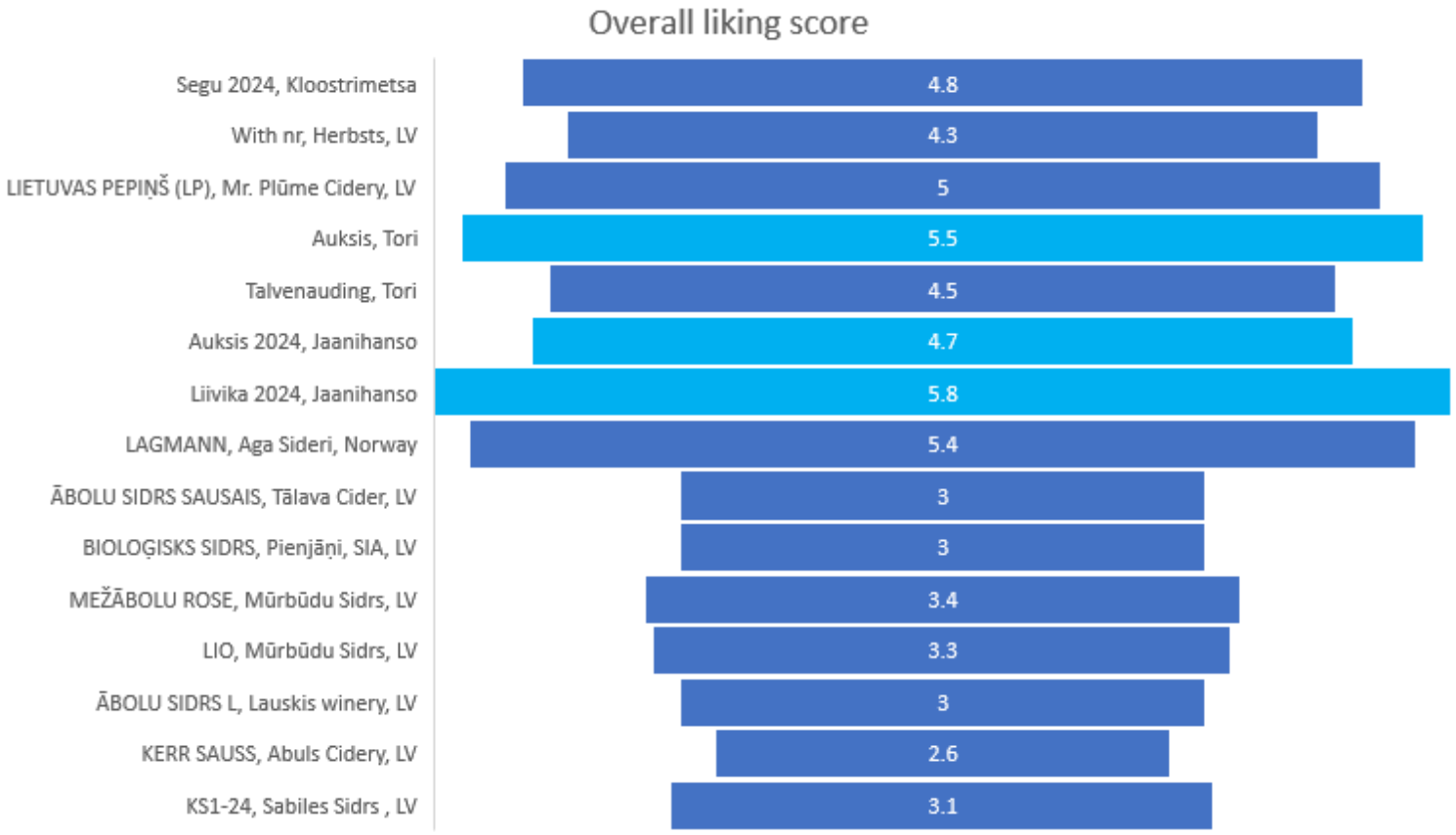
Producer	Cider	Glycerol, g/ L	Saccharose, g/ L	Fructose, g/ L	Glucose, g/ L
Aga Sideri, Norway	**Lagmann**	5,8	0,0	24,9	6,6
Abuls Cidery, LV	Kerr Sauss	5,2	0,1	1,1	1,0
Herbsts, LV	With nr	5,4	0,0	5,0	1,9
Lauskis winery, LV	Abolu Sidrs L	4,4	0,2	7,0	4,0
Mr. Plūme Cidery, LV	Lietuvas Pepins	5,6	0,0	2,6	0,6
Mūrbūdu Sidrs, LV	Mezabolu Rose	5,6	14,6	5,0	4,0
	Lio	4,0	0,1	1,5	1,3
Pienjāņi, SIA, LV	Biologisks Sidrs	4,8	0,0	0,9	1,8
Sabiles Sidrs , LV	KS1-24	5,7	0,0	1,2	1,0
Tālava Cider, LV	Abolu Sidrs Sausais	6,1	14,6	5,5	5,3
Tori, EST	Auksis	5,8	0,0	0,5	1,8
	Talvenauding	5,1	0,0	0,9	0,9
Jaanihanso	Auksis 2024	5,0	1,5	0,8	2,6
	Liivika 2024	4,6	0,3	10,6	11,3
Kloostrimetsa	Segu 2024	5,9	0,2	1,0	1,6

Glycerol affects mouthfeel and body

Glycerol contributes to
- viscosity,
- perceived smoothness,
- fullness/body.

Measurable sucrose in finished cider may indicate:
- backsweetening with sugar,
- interrupted fermentation after sugar addition,
- analytical sampling before fermentation completion.

Sensory analysis

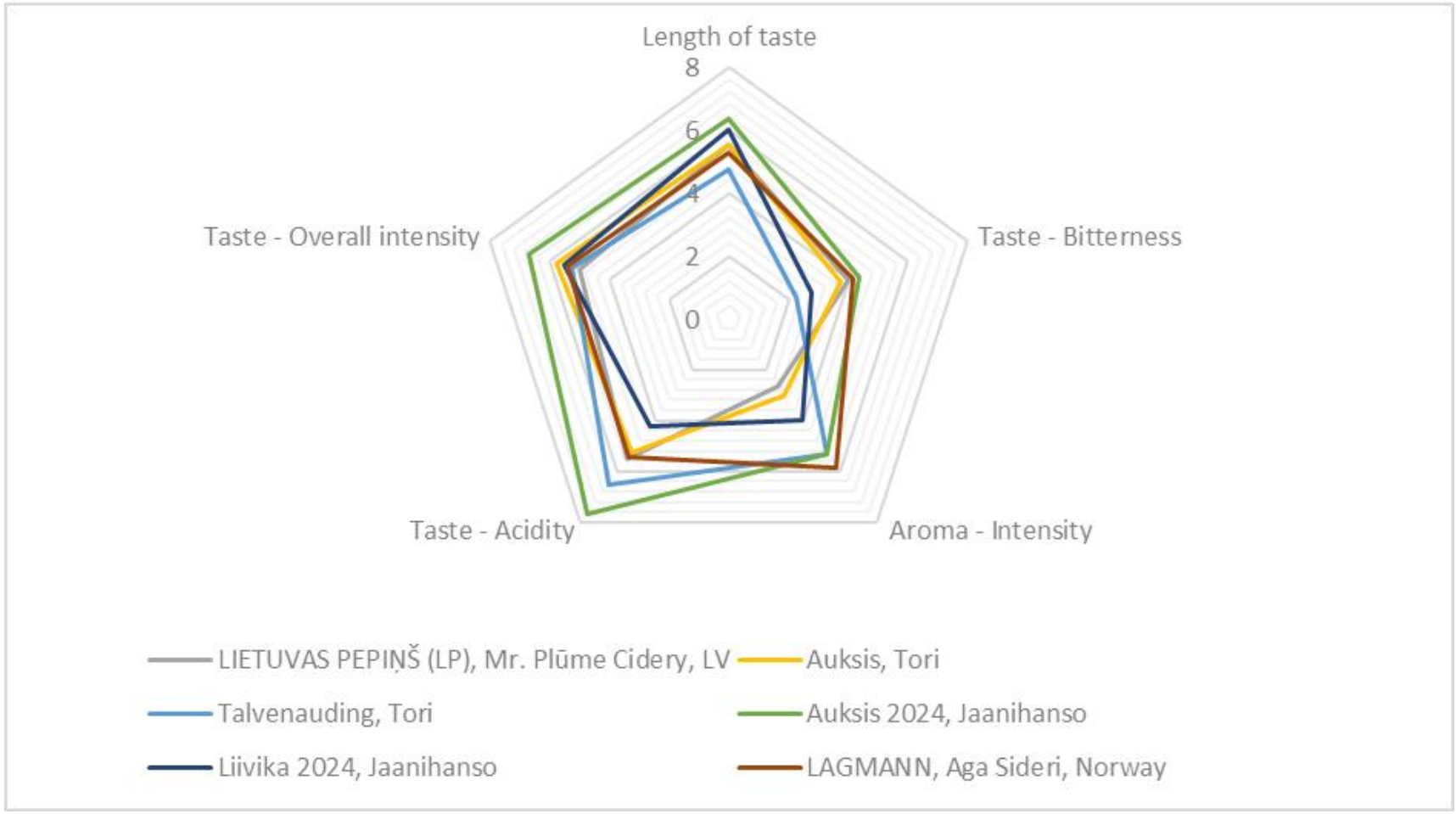


11 evaluators

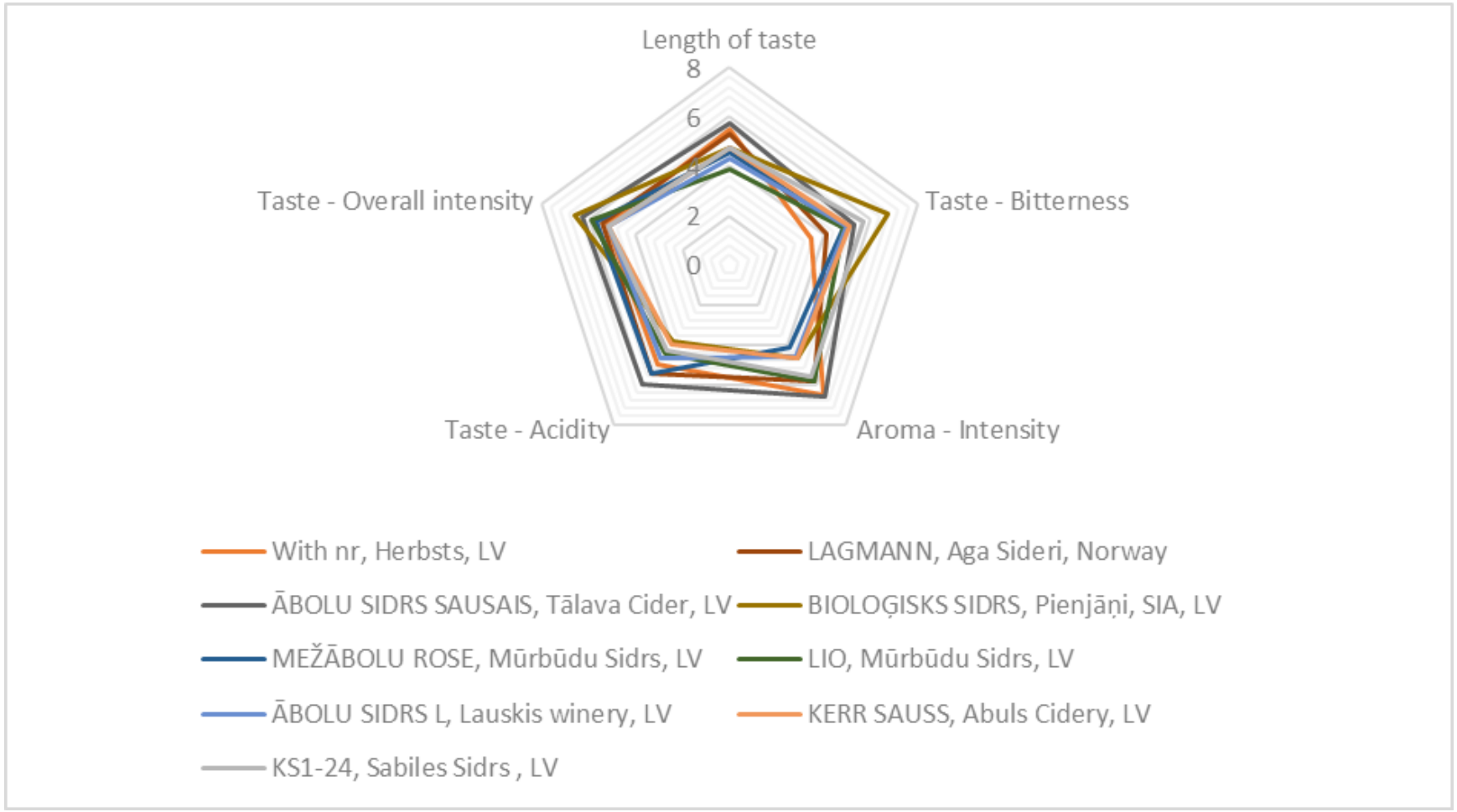
Attributes evaluated

- Appearance
- Taste
- Aroma
- Aroma components

Taste and aroma attributes (single cultivar ciders)



Taste and aroma attributes (blends)



Aroma components (CATA-check- all-that apply)

Cider	Overall liking of the product	Berry	Fresh apple	Cooked apple	Pear	Stone fruit	Floral	Nutty	Herbal	Tropical	Citrus	Moldy	Yeasty	Rotten
Segu 2024, Kloostrimetsa	4,8			2				1	2	1				
With nr, Herbsts, LV	4,3	1		2	3	1								
LIETUVAS PEPIŅŠ (LP), Mr. Plūme Cidery, LV	5,0		1				3		1			1		
Auksis, Tori	5,5		2				3		2					
Talvenauding, Tori	4,5		1		1	1	2							
Auksis 2024, Jaanihanso	4,7				2	1		1	1	1		1	1	
Liivika 2024, Jaanihanso	5,8			2			1	1	1	1		1		
LAGMANN, Aga Sideri, Norway	5,4		3	1							1	1	2	
ĀBOLU SIDRS SAUSAIS, Tālava Cider, LV	3,0			1					2		1	1		3
BIOLOĢISKS SIDRS, Pienjāņi, SIA, LV	3,0	2						1			2	1		2
MEŽĀBOLU ROSE, Mūrbūdu Sidrs, LV	3,4		3		1	1			1		1			
LIO, Mūrbūdu Sidrs, LV	3,3			1		2			2			1		2
ĀBOLU SIDRS L, Lauskis winery, LV	3,0	1	1	1	1				1		1		2	
KERR SAUSS, Abuls Cidery, LV	2,6	1	2			1		1		1		1	1	
KS1-24, Sabiles Sidrs , LV	3,1				2	1			2	1				2

Materials used

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