

FATTY ACID CHARACTERIZATION OF SUNFLOWER BREEDING MATERIALS AT THE IFVC

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Introduction

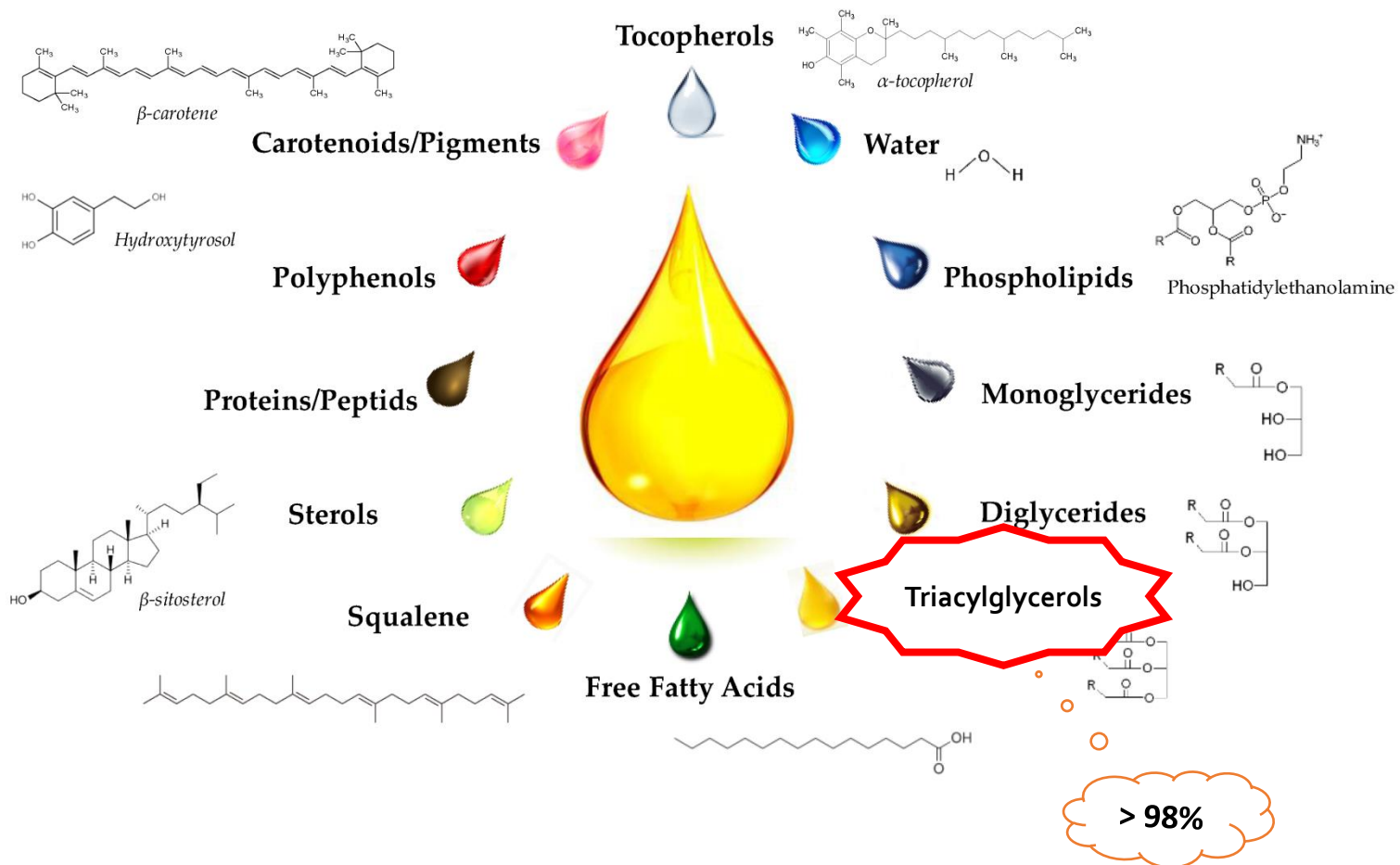
Kernel and seed component content (%)	Whole seed	Kernel
Oil	16-55	36-65
Proteins	10-27	20-40
Carbohydrates	18-26	4-18
Palmitic acid (C16:0)	-	5-7
Stearic acid (C18:0)	-	2-6
Oleic acid (C18:1n9)	-	15-37
Linoleic acid (C18:2n6)	-	51-73
Linolenic acid (C18:3n3)	-	< 0,3
Chlorogenic acid	1,1-4,5	0,5-2,8
Caffeic acid	-	0,05-0,29
Tocopherols	-	0,07
Cellulose	38-60	38-55
Carotenoides	-	0,01-0,02
Total minerals	2-4	3-4

Benefit of Lipids

Lipids

- 1 Energy role (1g fat ~ 40 kJ)
- 2 Building role (phospholipids)
- 3 Liposoluble vitamin carriers
- 4 Carriers of taste and texture food

Seed lipids, general composition of sunflower oil



❖ The most represented fatty acid in sunflower oil

❖ Saturated (SFA)

❖ *Palmitic acid (C16:0)*

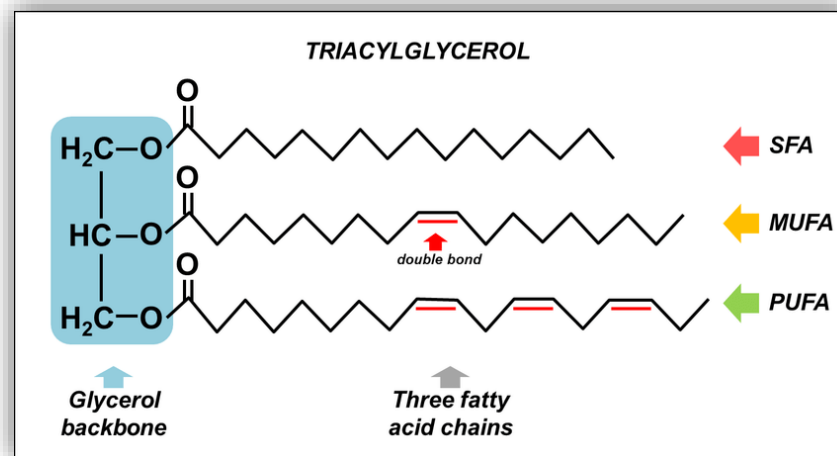
❖ *Stearic acid (C18:0)*

❖ Monounsaturated (MUFA)

❖ *Oleic acid (C18:1n9)*

❖ Polyunsaturated (PUFA)

❖ *Linoleic acid (C18:2n6)*



Aim of this study



- *Identification*
- *Quantification*
- *Comparison*

SUNFLOWER SEED

Inbred line from breeding materials
Institute of Field and Vegetable Crops, Novi Sad

21 samples

Material and methods

Preparation of samples

Sunflower seed



Pressed (hydraulic press, Sirio, 10 tons strength, cc 400 bars)

10 μ L sunflower oil + 190 μ L TMSH (trimethylsulfonium hydroxide)

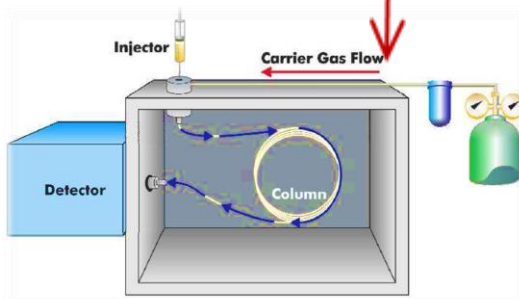


GC analysis of methyl esters of fatty acids



GC operating conditions

Gas chromatography system: **KONIK**
HRGC 4000
Analytical Column: **Omegawax capillary column**
Detection: *Flame ionisation detector (FID)*
Detector temperature: **250°C**
Injection temperature: **250°C**
Carrier gas: **Helium 6.0**
Flow rate: **2.0 mL/min**
Injection volume: **2 μ L** (split 70:1)



Statistical analysis

- Three measurements
- Multivariate Exploratory tech., Cluster Analysis (Joining -tree clustering)
- Amalgamation rule: Unweighted pair-group average
- Distance measure: Euclidean distances

Results

Samples	Fatty acids content in %				Oil content (%)
	Palmitic acid	Stearic acid	Oleic acid	Linoleic acid	
LIP-MAR-F ₁ _28B/9	4.45	2.66	90.92	1.97	38.98
LIP-MAR-F ₁ _21B/6	3.78	3.02	90.91	2.29	40.27
LIP-MAR-F ₁ _12B_5	5.31	2.57	90.55	1.57	35.60
LIP-MAR-F ₁ _11B_5	5.25	2.96	89.78	2.00	41.82
LIP-MAR-F ₁ _10B_2	4.71	2.91	89.68	2.70	31.53
LIP-MAR-F ₁ _25B/7	4.62	2.31	89.07	4.00	31.70
LIP-MAR-F ₁ _3B_9	4.45	2.44	87.17	5.95	34.21
LIP-MAR-F ₁ _8B_2	4.30	2.44	81.84	11.42	44.77
LIP-MAR-F ₁ _23B/3	4.24	2.28	78.92	14.55	36.61
LIP-MAR-F ₁ _27B	5.49	2.61	73.42	18.48	35.80
LIP-MAR-F ₁ _1B_2	6.12	4.62	47.81	41.46	36.10
LIP-MAR-F ₁ _7B_3	5.10	3.80	45.13	45.97	40.59
LIP-MAR-F ₁ _20B	4.83	3.06	44.87	47.25	30.26
LIP-MAR-F ₁ _17B	6.38	4.30	44.17	45.16	27.13
LIP-MAR-F ₁ _6B_8	6.07	4.84	43.56	45.54	34.53
LIP-MAR-F ₁ _15B/8	6.86	3.91	43.35	45.89	40.72
LIP-MAR-F ₁ _22B/3	6.10	3.33	40.92	49.65	32.55
LIP-MAR-F ₁ _2B_5	5.92	4.40	38.42	51.26	35.84
LIP-MAR-F ₁ _26B/1	5.94	3.07	32.84	58.15	33.10
LIP-MAR-F ₁ _18B/4	5.89	4.67	29.51	59.93	27.96
LIP-MAR-F ₁ _14B_7	6.97	1.94	22.39	68.70	39.27

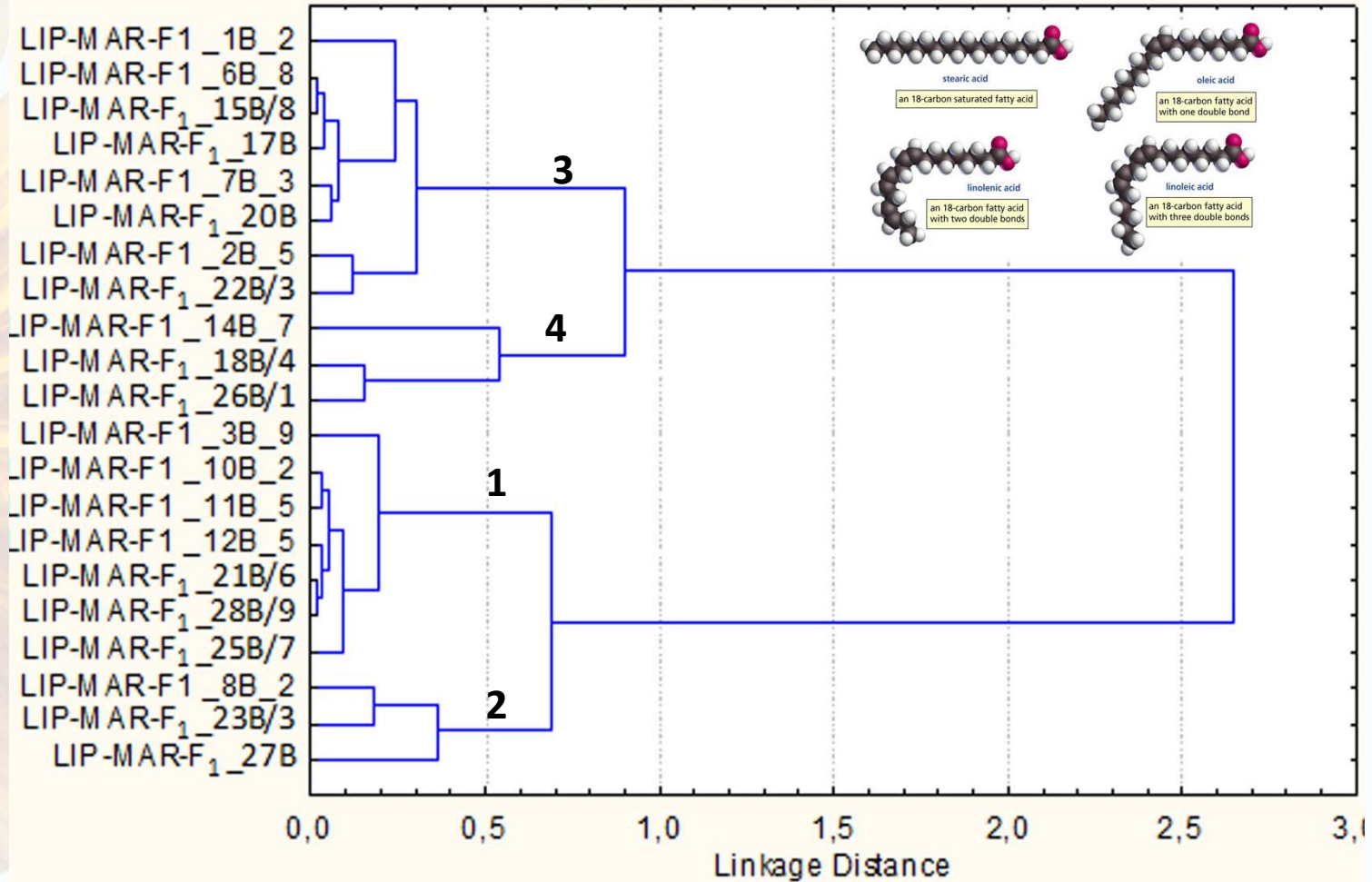
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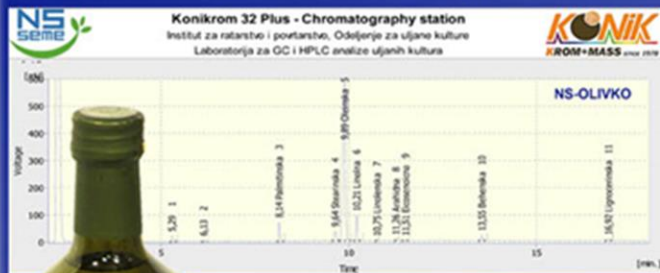
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Tree Diagram for 21 Cases
Unweighted pair-group average
Euclidean distances



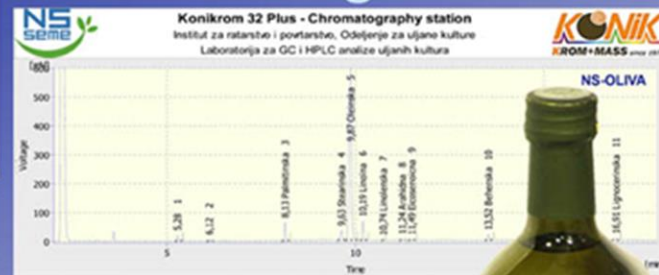
OLIVKO and OLIVA, one of the first domestic commercial hybrids in the NS selection from the "High-oleic" class



Reten. Time [min]	Response	Amount [µl]	Amount [%]	Peak Type	Compound Name
8,140	157,360	0,035	3,8	Order	Palmitinska
9,640	136,480	0,034	3,7	Order	Stearinska
9,890	2973,805	0,771	82,7	Order	Oleinska
10,210	230,823	0,057	6,1	Order	Linolna
10,753	3,097	0,001	0,1	Order	Linolnska
11,260	13,525	0,004	0,4	Order	Arahidna
11,513	7,613	0,002	0,2	Order	Ekcosenoicna
13,547	71,615	0,021	2,2	Order	Behenska
16,920	25,425	0,007	0,8	Order	Lignocerinska
Total		0,932	100,0		

OLIVKO

- Medium early high oleic hybrid
- Plant height 145 -165 cm
- Oil content 48 to 50%
- Oleic acid in oil above 80%,
- Seed yield up to 4 t / ha
- Resistance to rust and sunflower moth
- Set of 50,000 to 55,000 plants per hectare
- Intolerant to Phomopsis



Result Table (ESTD - F:Konikrom Plus\FAME, ogled, suncokret)\Provere, Kvalitet iz proizvodnje\10_Oliva_02_01

Reten. Time [min]	Response	Amount [µl]	Amount [%]	Peak Type	Compound Name	
3	8,133	142,755	0,032	3,7	Order	Palmitinska
4	9,630	126,034	0,031	3,6	Order	Stearinska
5	9,873	2899,600	0,729	84,3	Order	Oleinska
6	10,193	360,434	0,039	4,5	Order	Linolna
7	10,737	1,464	0,000	0,0	Order	Linolnska
8	11,243	11,212	0,003	0,3	Order	Arahidna
9	11,493	7,728	0,002	0,2	Order	Ekcosenoicna
10	13,523	65,760	0,019	2,2	Order	Behenska
11	16,910	26,987	0,008	1,0	Order	Lignocerinska
Total			0,964	100,0		

OLIVA

- High oleic and early hybrid
- Plant height 150-170 cm
- Seed yield up to 4 t / ha
- Oil content 48-50%
- Oleic acids in oil over 80%
- Resistance: all races of Plasmopara helianthi, on rust and sunflower moth
- Attractive for pollinators
- Well tolerates stressful conditions,
- Set of 50,000-55,000 plants per hectare



Conclusions

- This study shows that the wide range in fatty acid composition of inbred lines allows the selection of appropriate inbred lines which will give sunflower hybrid with the desired oil quality.
- The tested inbred lines are sufficiently divergent because they enable the production of hybrids with a high content of oleic acid, as well as hybrids with a balanced content of PUFA, ie oils that will have the desired ratio of omega 3 and omega 6 fatty acids.
- Total content of saturated acid was from 6% to 10%.
- Total content of unsaturated acid was from 89% to 93%.

Thank you for your attention

