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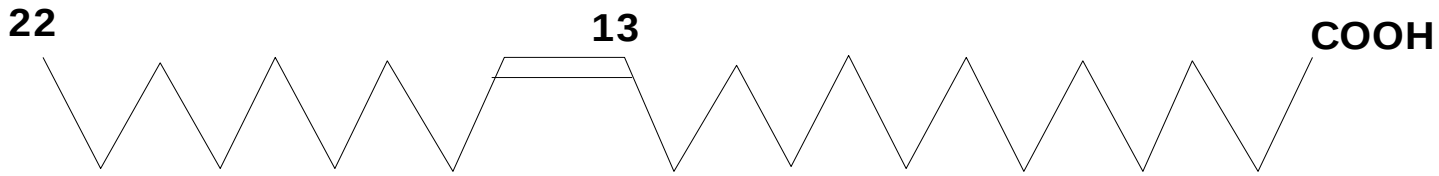
Crambe and erucic rape : interest and competition

André Merrien

CETIOM - France



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Mains uses for C22:1

- Source for behenic acid uses
- Soaps / foams
- Detergents
- Cosmetic (lip stick, cream, shampoos...)
- Erucamides for plastic industry : a slip agent for polyethylene and polypropylene films
- Lubricants for petrol industry (pipeline, extraction,..)
- Printers (ink ...)

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cream, shampoos

a slip agent for polyethylene and polypropylene films

Crops 2 Industry
"Non-food Crops-to-Industry schemes in EU27"

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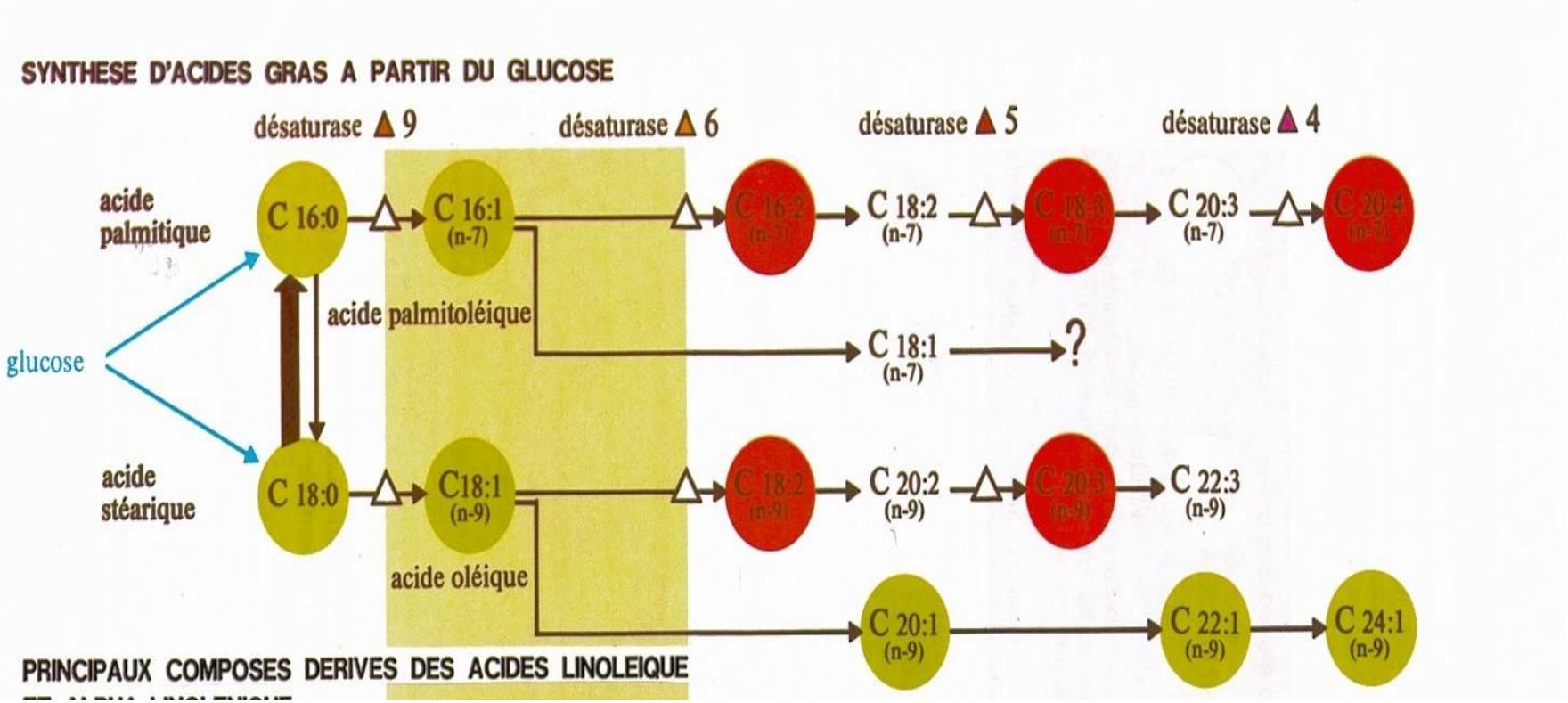
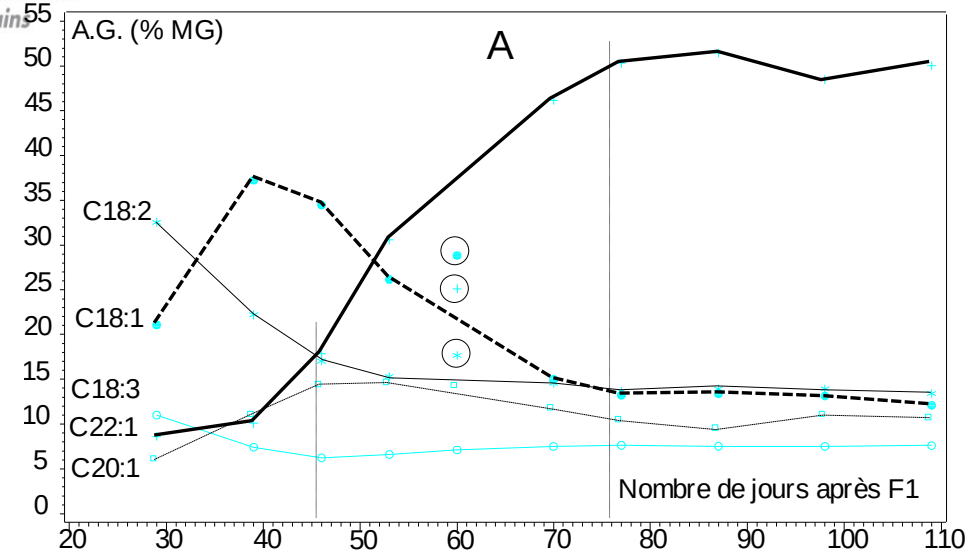
Biological pathway

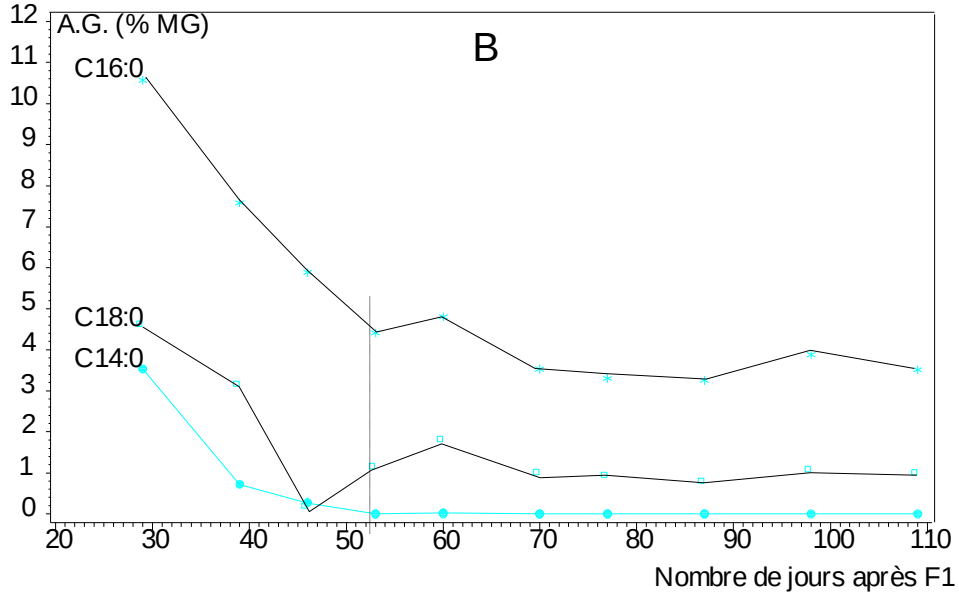
- From C18:1 → C20 :1 → C22:1
- The enzyme involve in is a specific one for the double link molecule and with a max of 18 C atoms.
- Only 2 positions (1 and 3) on the glycerol are available for erucic acid → In theory : 66.6%

C18:1 ⟶	C20:1 ⟶	C22:1
Ac. Oléique	Ac. Gadoléique	Ac. Erucique



Kinetic for FA accumulation in HEAR





C18:1 = Ac. oléique

C18:2 = Ac. linoléique

C18:3 = Ac. linolénique

C20:1 = Ac. gadoléique

C22:1 = Ac. érucique

C14:0 = Ac. myristique

C16:0 = Ac. palmitique

C18:0 = Ac. stéarique

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HEAR in Europ (Ienica)

	Acreage (ha)	Yield (t/ha)
Uk	5 000 (?)	-
France	14 000	2 t
Germany	20 000	2.1 t
Italy	1 000	1.7 t
Total	40 000 ha	

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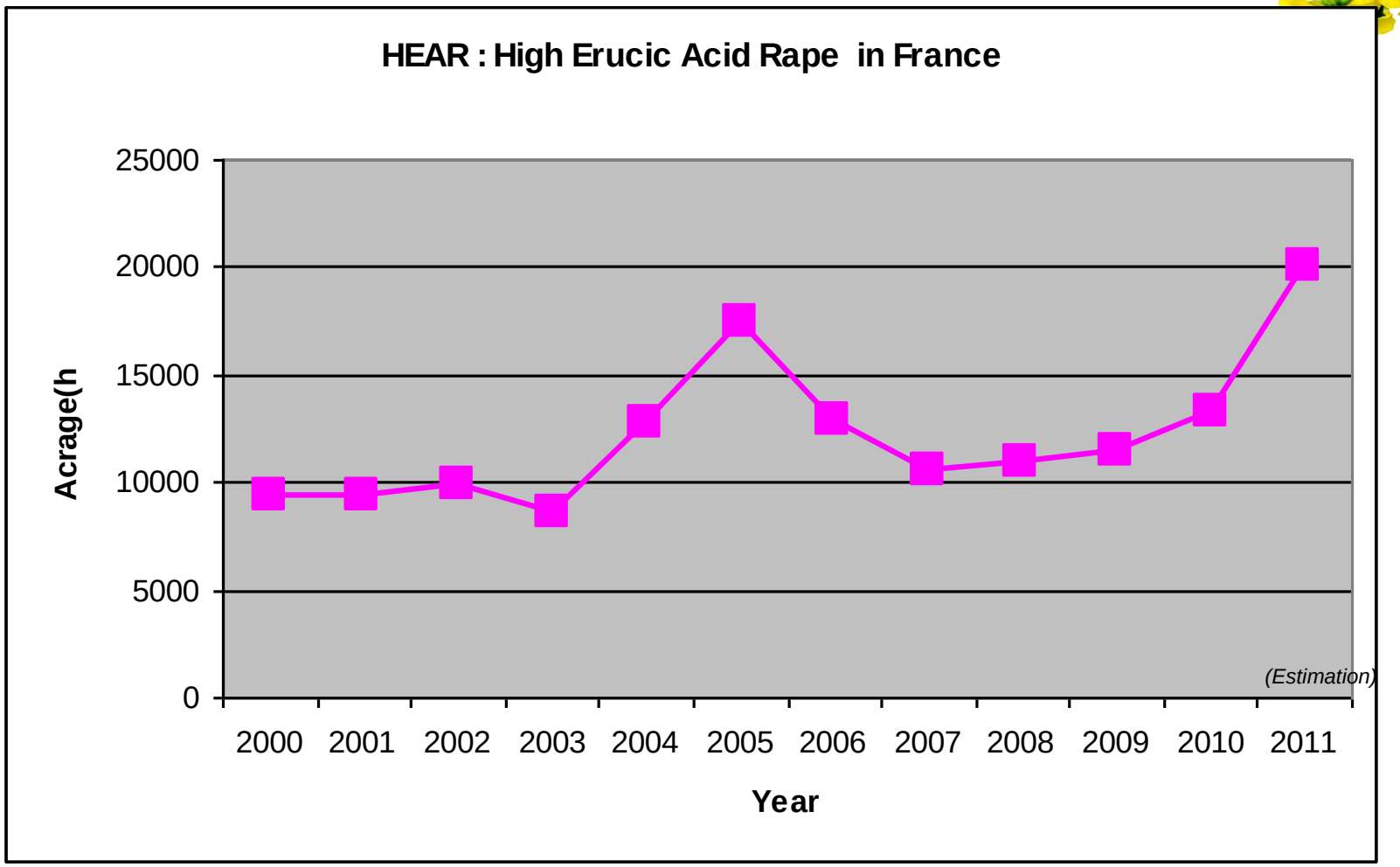

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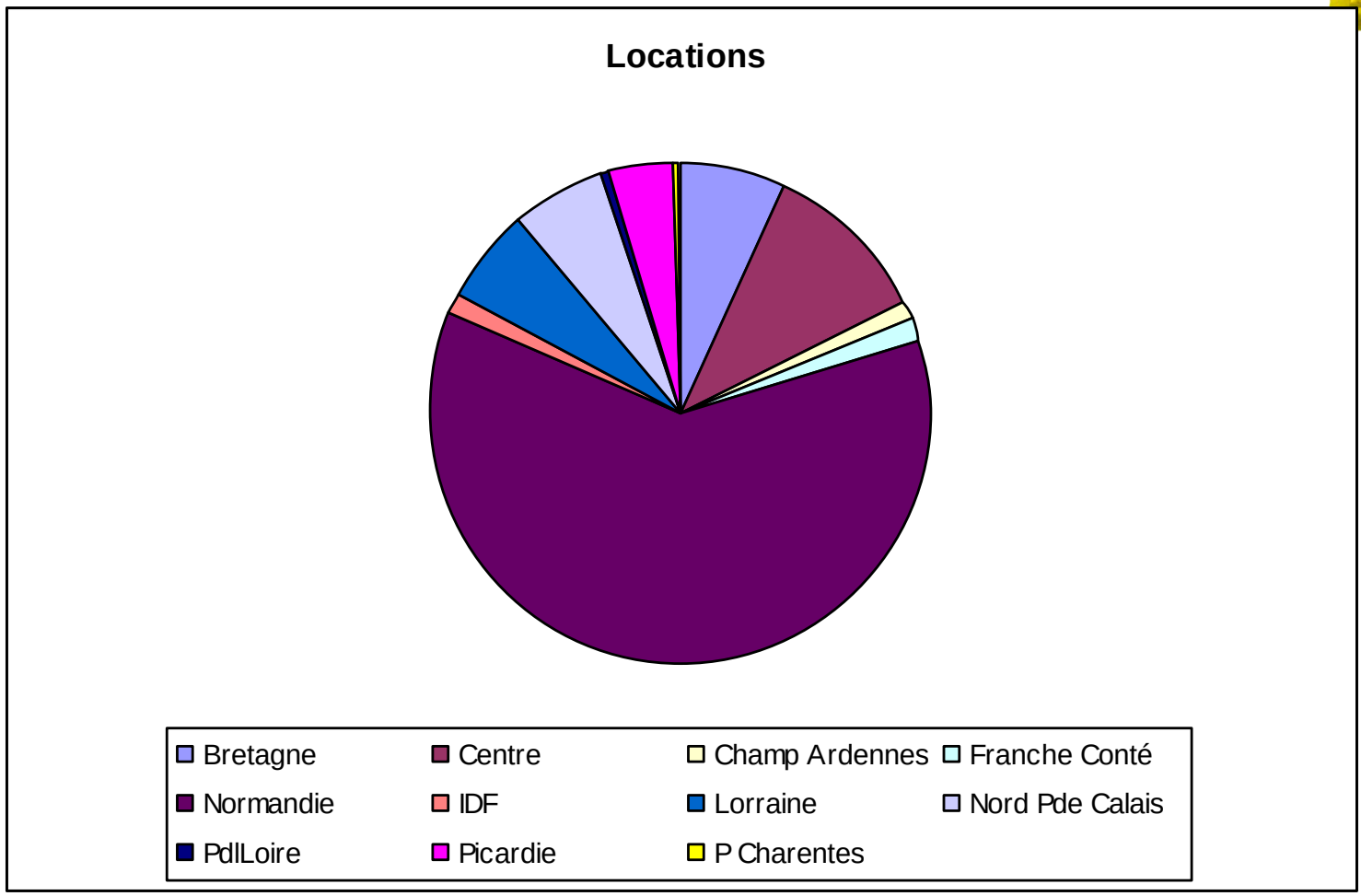
Locations
Bretagne
Centre
Champ Ardennes
Franche Conté
Normandie
IDF
Lorraine
Nord Pde Calais
PdlLoire
Picardie
P Charentes

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Average fatty acid profil for HEAR grown in France (data from 18 locations).

% of total FA	Palm.	Oléic.	Linol.	Linoln	Gadol	Eruc.
	C 16:0	C 18:1	C 18:2	C 18:3 Alpha	C 20:1	C 22:1
Average	**2,7**	**14,4**	**12,4**	**8,1**	**8,2**	**50,1**
STd	***0,2***	***1,3***	***1,1***	***0,6***	***0,5***	***1,5***

Oil : 44 % GSL : 15.1

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Résultats des variétés éruciques et témoins classiques

	Rendement graines (indice moyen / moyenne et écart-type)		**Teneur en huile aux normes (%)**	**Teneur en glucosinolates (µmol/g)**	**Teneur en protéines (%)**	**Teneur en acide érucique (%)**
Variété	9 essais		8	7	7	5
AVISO	**104,3**	6,3	42,8	13,9	21,6	-
EXAGONE	**119,1**	15,0	43,6	16,1	21,2	-
GRIZZLY	**97,6**	7,0	42,3	18,2	21,1	-
HEAVEN	**97,9**	11,9	44,4	12,5	20,9	50.6 ± 4.2
MARCANT	**90,3**	9,3	44,7	16,1	21,0	47.9 ± 3.9
ZERUCA	**91,3**	10,5	44,9	14,0	21,5	43.8 ± 5
Moyenne	**32,2**		**43,8**	**15,1**	**21,2**	**47,4**

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Common name: Crambe d'Abyssinie - Family: Brassicaceae

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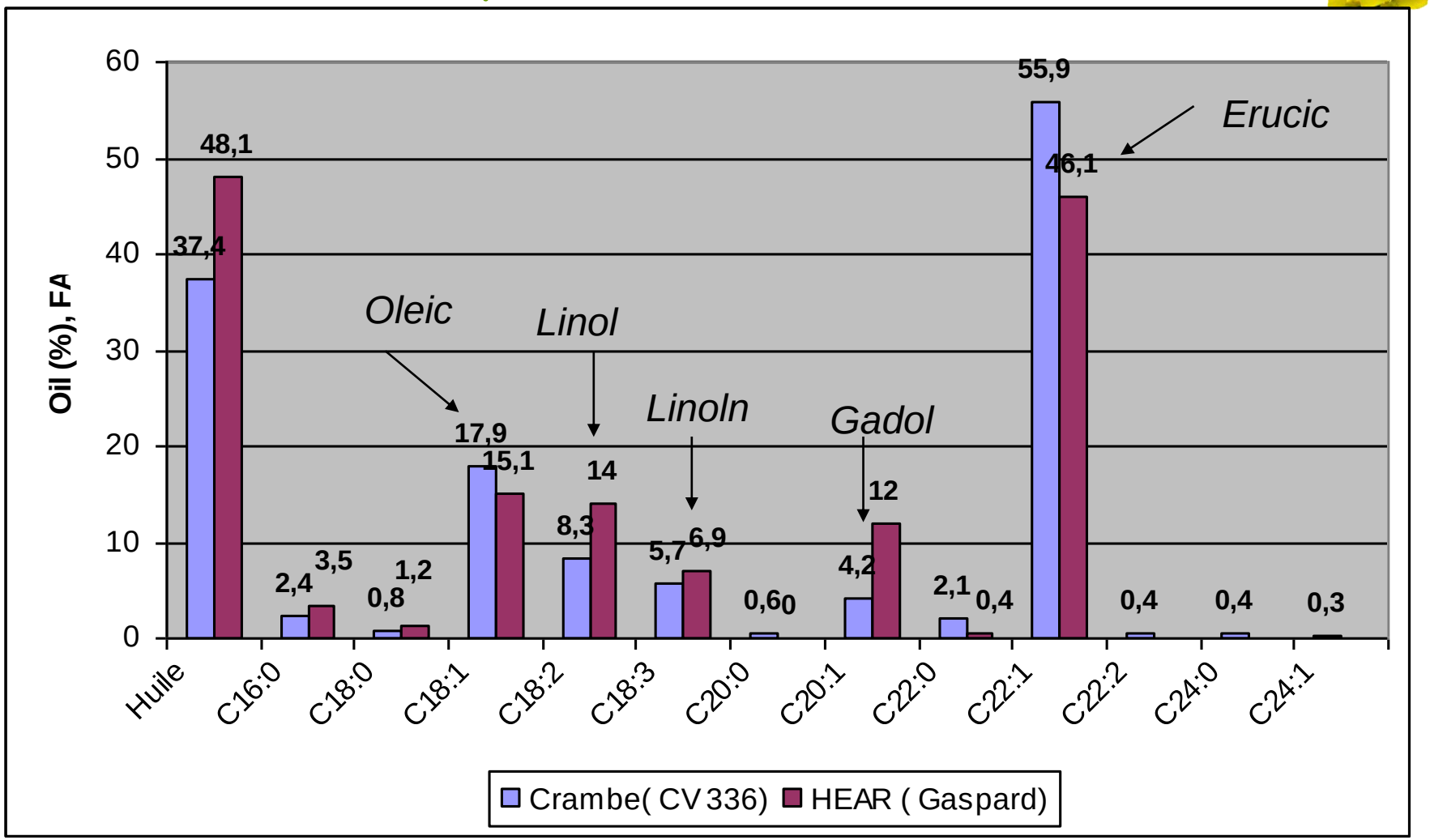
FA profiles : HEAR/Crambe



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Fatty acid profiles

Authors	CRAMBE (Abyssinian mustard) Last uptades : October 2005 [3]	AgGrow Oils LLC INFORM, Vol. 10, no.9 (september 1999) [13]	Donald L. Van Dyne, Melvin G.Blase, Kenneth D. Carlson, [6]	[19] Appelqvist and ohlson, 1972; Kramer et al., 1983; Princen and Rothfus, 1984.	[20] CETIOM, Oléoscope n°29- Septembre-Octobre 1995
Palmitic C16:0	1.8% of total		2		2.38-3.69
Stearic C18:0	0.7%				0.89-1.12
Oleic C18:1	17.2 %	16	15	17	17.88-22.21
Linoleic C18:2	8.7%	8	10	9	8.37-10.44
Linolenic C18:2	5.2%	5	7	6	6.05-6.78
Eicosanoic C20:1	3.4%		3	5	3.77-4.75
Behenic C22:0			2		1.71-2.16
Erucic C22:1	56.2% (58-66)	> 55	50-60	55	49.06-57.41
Brassidic C22:1	0.7%				
Tetracosanoic C24:0	0.7%				
Nervinic C24:1	1.6%				
Others:	2.5%				

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Some agronomics characters (1)

	Crambe	HEAR
Sowing	Spring	Winter (1/09)
Plant density (/m2)	70 - 80	35-45
Row space	12 -15 cm	17 – 45 cm
Seed weight/ha	15 - 20 kg/ha	3 kg/ha
Full Nitrogen requirements	60 kg of N/ha (6 u/q)	190kg of N/ha (6.5 u/q)
Lodging	Tolerant Max size : 85 cm	Risk (?) Max size : 150 cm
Diseases risks	Alternaria Sclerotinia	Phoma L. Sclerotinia
Harvest	- Heterogeneity in maturity of the pods - Direct combine	- Direct combine
Shattering pod	shattering losses.	No shattering with the actual cv

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Some agronomics characters (2)

	Crambe	HEAR
Cycle	100 days	310 days
Flowering time	10/6→ 1/07	01/04 → 20/04
Germination	Low rate (due to the pod wall) (50%)	90%
Seed set	Sensitivity of the pollen to high temp. (>30°c)	nc
Insects	Pollen beetle (Meligethes)	All the insects found on WOSR

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Mains characteristics for the 2 crops at harvest (Average data from CETIOM trials)

	Crambe	HEAR
Yield (t/ha)	1 – 1.2	2.8 – 3.2
Harvest index	0.45	0.40
Oil (% on dry seeds)	35 - 38	46 - 49
Yield oil (kg/ha)	400	1440
Proteins (% on meal)	26 - 28	19 - 22
1000-seed weight	5 - 8 g	3 - 5 g
Glucosinolates (umoles/g of seeds)	50 - 55	14 - 16
Erucic Acid (C22:1)	53 - 56	48 - 51

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Mains limiting factors in France for HEAR

- Only 2-3 varieties are available (Palmedor, Zeruca ..)
- GSL content .. but improve for the new varieties
- Sensitive to black leg (Phoma L.).
- Volunteers from "00" crops needs to be controlled
- Crops located in « protected » area
- Isolation from "00" fields (...but 100 m is enough..)
- Yields are still to be improve
- Max. threshold for C22:1 in the oil : 66.6 %
- C22:1 concentrations is affected by low temp.

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Mains limiting factors for Crambe

- Low genetic variability
- Very low investments in research program
- Some Industrial production are identified in USA
- Seed germination (due to the pod wall) → interest for de-hulling ?
- Weed control in early stage ? (trifluralin was usufull…)
- High GLS content in the meal
- Poor oil yield compare with HEAR